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Director
Zoological Survey of India

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

RECORDS
OF THE
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A NEW SPECIES OF *BACTROCERA* MACQUART (DIPTERA : TEPHRITIDAE : DACINAE) FROM SOUTHERN INDIA.

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INTRODUCTION

Drew (1989) has revised the generic and subgeneric classification of the tribe Dacini of the subfamily Dacinae. All the species of Dacini with free abdominal terga are placed under the genus *Bactrocera* Macquart. The genus is divided into 4 groups of subgenera viz., *Bactrocera, Melanodacus, Queenslandacus* and *Zeugodacus* each of which in turn accommodates various subgenera. The new species presently described here is an aberrant one belonging to the subgenus *Bactrocera* Macquart of the Bactrocera group of subgenera (previously called the Strumeta group). The species does not possess anterior supraalar and prescutellar bristles though the subgenus is usually characterised by the presence of these bristles.

Drew (1989) while dealing with the tropical fruit flies of the Australasian and Oceanic Regions stated that some of the species placed in the subgenus *Bactrocera* show variation in the presence of prescutellar bristles and that the South Pacific species *B. decurtans* (May) and *B. murrayi* (Perkins) are possibly aberrant *Bactrocera* species in which prescutellar and supraalar bristles are absent. Absence of anterior supraalar and prescutellar bristles is also reported in *Bactrocera (Bactrocera) cocciniae* (Premlata & Singh) described from Chandigarh, India (Premlata & Singh, 1987).

Bactrocera (Bactrocera) digressa sp. nov.

(Figs. 1-5)

Diagnosis : This species can be readily differentiated from all known *Bactrocera* by the bifid apex of its ovipositor and the absence of anterior supraalar and prescutellar bristles.

Female : *Head* : (Fig. 1) Yellow, tinged with rufous ; compound eyes brown ; ocellar triangle black ; frons with indistinct brown spots at bases of bristles and brown discolouration medially ; 2 inferior fronto-orbital bristles (frontal setae), 1 superior fronto-orbital bristle (orbital seta) ; facial spots oval, polished black ; antennal segments (scape, pedicel, first flagellomere) yellow, tinged with brown, arista brown.

Thorax : (Fig. 2) Mesonotum (Scutum) rufous, pale pubescent and with two straight sided lateral post sutural yellow vittae which extend to inner postalar bristles (intraalar setae) ; anterior supraalar bristles (anterior supraalar setae) and prescutellar bristles (prescutellar acrostichal setae) absent ; mesopleural yellow stripe narrow and yellow mark on upper sternopleuron small.

Scutellum pale pubescent, entirely yellow except for a narrow band of brown at base. Legs rufous to yellow ; coxae and trochanters rufous ; femora rufous but yellow more or less along basal one third of fore and mid and basal half of hind ones ; tibiae rufous, tarsi pale yellow tinged with rufous. Wings (Fig. 3) largely hyaline with narrow yellow-fumose costal band extending from subcostal cell through apex of cell R_1 to upper apical 1/3 of cell R_5 ; the costal band not extending into cell R_1 except at its apex ; cubital streak narrow. Halteres pale yellow.

Abdomen : (Fig. 4) Predominantly rufous and covered with pale pubescence ; second tergum pale yellow along posterior margin and with narrow black vitta confined to basal half medially ; third tergum with narrow black basal band and narrow black median vitta which extends posteriorly over apex of fifth tergum ; tergal glands dark brown ; basal segment of ovipositor rufous ; piercer (Fig. 5) bifid at apex.

Length : Body excluding ovipositor 7.3mm., basal segment of ovipositor 1.15mm., inversion membrane 0.5mm., piercer 1.1mm., wing 7mm.

Male : Unknown

Holotype : Female, India : Tamil Nadu, Salem District, Shevroy Hills, Semmanatham, 28-xii-1989, Coll : C. Radhakrishnan ; *Paratype* : 1 Female, India : Tamil Nadu, North Arcot District, Jawadi Hills, Yelagiri, 7-xii-1992, Coll : K. R. Rao.

The type specimens are in the collections of the Zoological Survey of India, Calicut.

Etymology : The specific epithet is from the Latin *digressus* meaning "Departure" or "deviation" and it refers to this species being aberrant from other *Bactrocera.*

SUMMARY

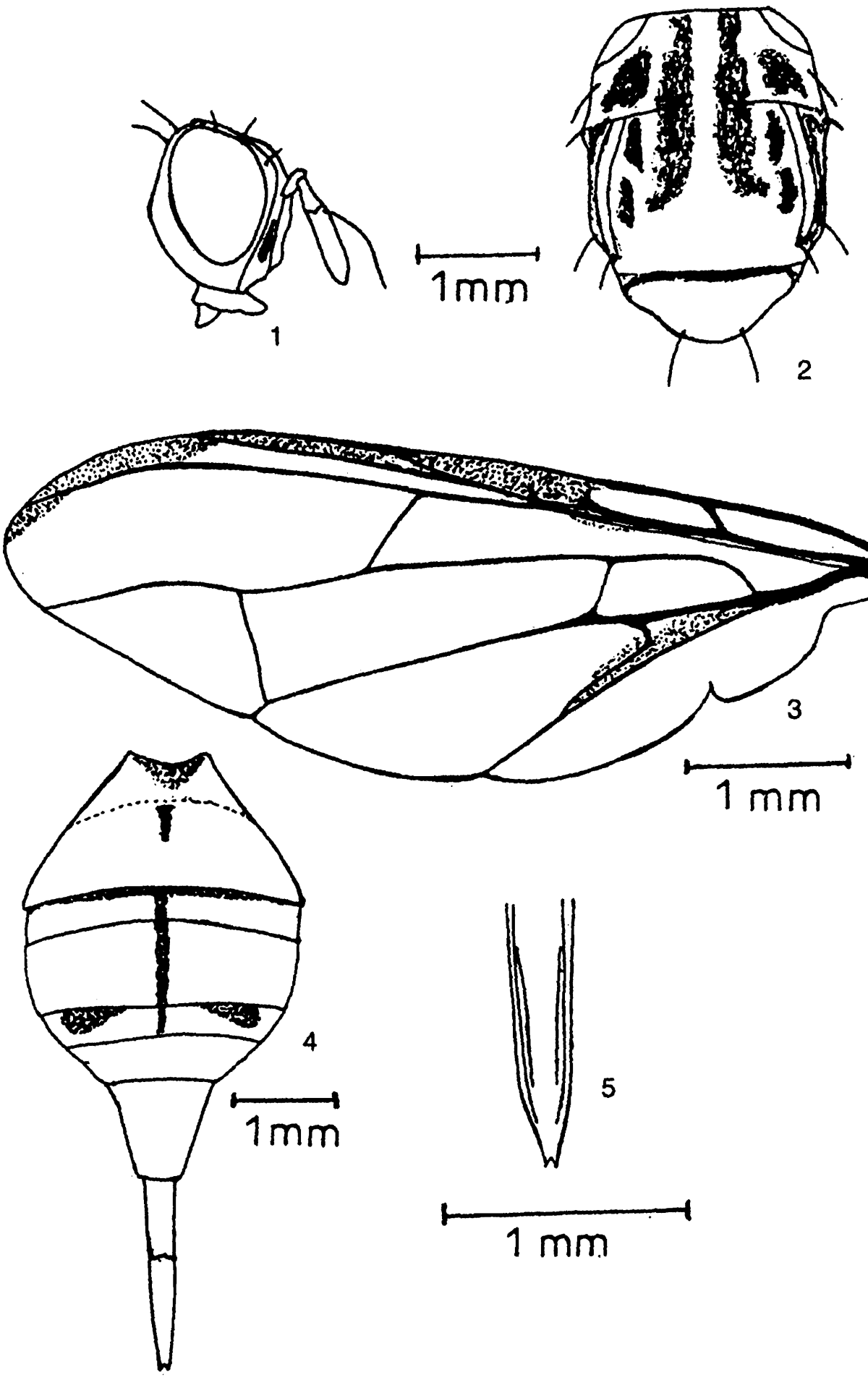
Bactrocera (Bactrocera) digressa sp. nov. keys near *B. (B). andamanensis* (Kapoor) from Andamans, India (Kapoor, 1971) and *B. (B). holtmanni* (Hardy) from the Philippines (Hardy, 1974) in possessing an apically bifid piercer ; it differs in the absence of anterior supraalar and prescutellar bristles which are however, present in *andamanensis* and *holtmanni.* Besides, in *digressa* the costal band is narrow and does not extend along the upper margin of cell R_1 except at its apex unlike in *holtmanni* in which it extends along the upper margin of cell R_1 throughout its length. In addition it is not expanded into an apical spot in the new species unlike in *andamnensis* in which it is expanded into an apical spot nearly covering the apical part of cell R_5.

ABSTRACT

An aberrant new species, *Bactrocera (Bactrocera) digressa* is described.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Calcutta for facilities and encouragement.



Figs. 1-5. *Bactrocera (Bactrocera) digressa* sp. nov., female : 1, head-lateral view ; 2, thorax-dorsal view ; 3, wing ; 4, abdomen-dorsal view ; 5, apex of piercer.

REFERENCES

Drew, R. A. I. 1989. The tropical fruit flies (Diptera : Tephritidae : Dacinae) of the Australasian and Oceanic Regions. *Mem. queensland, Mus.*, **26** : 1-521.

Hardy, D. E. 1974. The fruit flies of the Philippines (Diptera : Tehpritidae). *Pacif. Ins. Monogr.* **32** : 1-266.

Kapoor, V. C. 1971. Four new species of fruit flies (Tephritidae) from India. *oriental Insects.* **5** (4) : 477-482.

Premlata & A. Singh. 1987. A new species of genus *Dacus* Fabricius (Tephritidae : Diptera) from India. *Journal, Bombay Natural Hist. Society.* **84** (2) : 401- 404.

Rec. zool. Surv. India : **97** (Part-4) : 5-22, 1999

STUDIES ON THE CARCINOLOGICAL FAUNA OF GOPALPUR COAST, BAY OF BENGAL. 1. NON-BRACHYRHYNCHAN (DECAPODA : BRACHYURA)

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INTRODUCTION

The Brachyura (true crabs) constitute the largest and specialized group not only on Marine Decapoda but also class Crustacea. These Carcinological fauna of Gopalpur Coast has received very little attention. Sporadic records of Brachyura have been reported from South Orissa as well as whole Orissa Coast. From early expeditions particularly by the Indian marine survey steamer 'H. M. Investigator' Alcock's findings (1895-1900) were recorded in his monumental publications. Although additional observations by Gravely (1927), Kemp (1915-1919), Chopra (1930-1937) and Chopra & Das (1930 and 1937), Sethuramalingan and Khan (1992) have contributed considerably on the crabs of Bay of Bengal. Orissa Coast has remained unexplored, except for Chilka Lake (Kemp, 1915 and Deb, 1995) and a few isolated specimens recorded by Alcock & Anderson (1894-95). It was, therefore, considered that a representative collection of the crabs of Orissa coasts should be studied properly to augment our knowledge of this group. The general collections were made from local faunal surveys carried out during 1990-1993 at the fish landing centres of Gopalpur-On-Sea and analysed thoroughly. The non-brachyrhynchan crabs which form an important part of Brachyura are dealt with in the present paper and other groups will follow in subsequent communication.

MATERIALS AND METHODS

The materials for the present study were collected through extensive surveys during the years 1990-1993 from the commercial fish landing centres of Gopalpur. The crab species were collected from the cast net, gill net, shore seine and drag net operated within 5 to 50 metres depth as well as from the intertidal region. The representative samples of crabs were washed under tap water and then preserved in 8% formalin. All the collected specimens were criticaly examined. The species identification were carried out following Alcock (1895-1900), Chhapgar (1957-1969), Sethuramalingam and Khan (1991) and Tirmizi & Kazmi (1988). In synonymies it is attempted to include all important references relating to taxonomy of each species, otherwise only a restricted synonymy is provided. The classification adopted here is after Tirmizi & Kazmi (1988). Representative specimens of each species were measured for male and female with slide calipers for their length and breadth in mm ranging from the smallest to largest. The abbreviations used

* For correspondence.

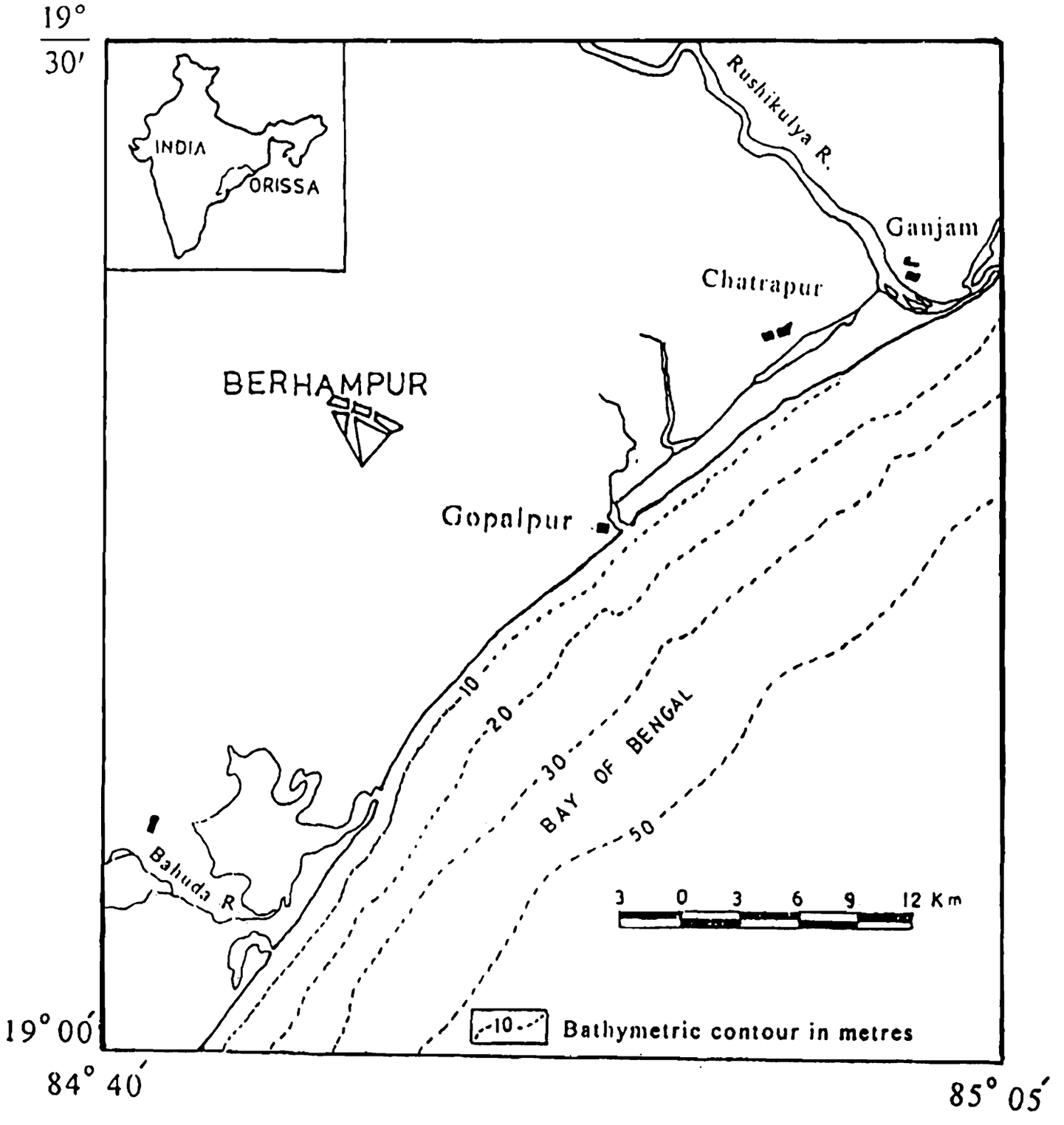

Fig. 1. Topographic features of Gopalpur Coast

throughout the text are as follows cl-Carapace Length, cb-Carapace breadth, mm-millimetre and symbols used ♂, ♀ refer to male and female, respectively. All the materials reported here in are housed in the Department of Marine Sciences, Berhampur University.

ECOLOGICAL NOTES

Gopalpur (19° 16' N, 84° 54' E) in the South Orissa Coast (Fig. 1), Bay of Bengal is a completely sandy beach having a fairly straight coastline of several kilometres running in the north-south direction. Its climate is semi-arid with an average annual rainfall of 1210 mm and nearly 80% of it is contributed by the South-West monsoon. Atmospheric temperatures on an average reach maximum of 37°C in summer and minimum of 12.7°C in winter. (India Meteorological Department, Climatological data for the years 1931-1960). During the South-West monsoon the predominant direction of wave approach is from South and South-West. Wave heights are usually greater (2.0-2.5 m) during the months May-August and in November, waves of a lesser height (1.0-1.5 m) in September-October and from December to April (Mishra, 1992). On a 20-point rating system this beach is classified as "exposed" (Rao and Pattnaik, 1986). The width of the intertidal zone varies from 25 to 50 metres depending on tides and seasons. Tides are semi-diurnal Sandy bottoms are a predominant environmental feature along this coast. The continental shelf is narrower compared to other regions of Orissa coast.

SYSTEMATIC LIST

Class : Crustacea

Order : Decapoda

Suborder : Reptantia

Infraorder : Brachyura

Section : Dromiacea de Haan, 1833

Superfamily : DROMIOIDEA DE HAAN, 1833

Family : DROMIIDAE DE HAAN, 1833

Genus : ***Conchoecetes*** Stimpson, 1858

1. ***Conchoecetes artificiosus*** (Fabricius, 1798)

Genus : ***Dromia*** Weber, 1795

2. ***Dromia dehaani*** Rathbun, 1923

Genus : ***Dromidia*** Stimpson, 1858

3. ***Dromidia unidentata*** (Rüppell, 1830)

Section : Oxystomata H. Milne Edwards, 1834

Superfamily : DORIPPOIDEA MACLEAY, 1838

Family : DORIPPIDAE MACLEAY, 1838

Subfamily : DORIPPINAE MACLEAY, 1838

Genus : ***Dorippoides*** Serène & Romimohtarto, 1969

4. ***Dorippoides facchino*** (Herbst, 1785)

Genus : ***Neodorippe*** Serène & Romimohtarto, 1969

5. ***Neodorippe callida*** (Fabricius, 1798)

Superfamily : LEUCOSIOIDEA SAMOUELLE, 1819

Family : CALAPPIDAE DE HAAN, 1833

Subfamily : CALAPPINAE DE HAAN, 1833

Genus : ***Calappa*** Weber, 1795

6. ***Calappa lophos*** (Herbst, 1782)

7. ***Calappa pustulosa*** Alcock, 1896

Subfamily : MATUTINAE DE HAAN, 1835

Genus : ***Matuta*** Weber, 1795

8. ***Matuta lunaris*** (Forskål, 1775)

9. ***Matuta planipes*** Fabricius, 1798

Family : LEUCOSIIDAE SAMOUELLE, 1819

Subfamily : ILIINAE STIMPSON, 1871

Genus : ***Arcania*** Leach, 1817

10. ***Arcania erinaceus*** (Fabricius, 1798)

11. ***Arcania septemspinosa*** (Fabricius, 1787)

12. ***Arcania undecimspinosa*** de Haan, 1841

Subfamily : LEUCOSIINAE SAMOUELLE, 1819

Genus : ***Leucosia*** Weber, 1795

13. ***Leucosia biannulata*** Tyndale-Biscoe & George, 1962

Genus : ***Philyra*** Leach, 1817

14. ***Philyra globosa*** (Fabricius, 1798)

15. ***Philyra globulosa*** H. Milne Edwards, 1837

16. ***Philyra scabriuscula*** (Fabricius, 1798)

Section : Oxyrhyncha Latreille, 1803

Superfamily : MAJOIDEA SAMOUELLE, 1819

Family : MAJIDAE SAMOUELLE, 1819

Subfamily : INACHINAE MACLEAY, 1838

Genus : ***Macropodia*** Leach, 1814

17. ***Macropodia falcifera*** (Stimpson, 1857)

Subfamily : PISINAE ALCOCK, 1895

Genus : ***Doclea*** Leach, 1814

18. ***Doclea gracilipes*** Stimpson, 1857

19. ***Doclea ovis*** (Herbst, 1788)

Superfamily : PARTHENOPOIDEA MACLEAY, 1838

Family : PARTHENOPIDAE MACLEAY, 1838

Subfamily : PARTHENOPINAE MACLEAY, 1838

Genus : ***Parthenope*** Weber, 1795

20. ***Parthenope longimana*** Linnaeus, 1764

21. ***Parthenope pransor*** (Herbst, 1796)

Subfamily : AETHRINAE DANA, 1851

Genus : ***Cryptopodia*** H. Milne Edwards, 1834

22. ***Cryptopodia angulata*** H. Milne Edwards & Lucas, 1841

SYSTEMATIC NOTES

1. *Conchoecetes artificiosus* (Fabricius, 1798)

Dromia artificiosa Fabricius, 1798. *Suppl. Ent. Syst. :* 360.

Cancer artificiosus Herbst, 1803. *Krabben* : 54, pl. 58, fig. 7.

Conchoecetes artificiosus Stimpson, 1907, *Smith. Misc. collns.*, : 180, pl. 21, fig. 5; Alcock, 1899. *Jour. Asiat. Soc. Bengal,* **68** (2) No. 3 : 151; Chopra, 1933, *Rec. Indian Mus.*, **35** (1) : 28; Chhapgar, 1969. *Jour. Bombay Nat. Hist.* Soc., **65** (3) : 608; pl. 1a ; Tirmizi & Kazmi, 1988, *Marine Fauna of Pakistan,* **4** : 15, figs. 3, 4.

Material & Measurements : 1 ♂ cb. 42 mm, cl. 39.05 mm

Habitat : It occurs from 30 to 100 metres depth (Alcock, 1899) on sandy or muddy substratum.

Distribution : Madagascar, Persian Gulf, Karachi, East coast of India. Andamans, Sri Lanka, Singapore, Thailand, China, Japan and North-East Australia.

2. *Dromia dehaani* Rathbun, 1923

Dromia rumphi de Haan, 1850, *Fauna Japonica,* **5** : 107, pl. 32; Alcock, 1899b, *Jour. Asiat. Soc. Bengal,* **68** (2) No. 3 : 137.

Dromia dromia Rathbun, 1902, *Proc. U. S. Natn. Mus.,* **26** : 32; Chhapgar, 1957. *Jour. Bombay Nat. Hist. Soc.,* **54** : 401, pl. 1, fig. a.

Dromia dehaani Rathbun, 1923, *Proc. Biol. Soc.* Washington, **36** : 68; Sakai, 1976. *Crabs of Japan and the Adjacent Seas,* **1** : 8, pl. 2, fig. 1; Tirmizi & Kazmi, 1988, *Marine Fauna of Pakistan,* **4** : 20, figs. 5, 6.

Material & Measurements : 2 ♂ cb. 48-50 mm, cl. 42.05-44.04 mm 1 ♀ cb. 70.08 mm, cl. 60.05 mm.

Habitat : It inhabits on sandy or muddy bottoms, usually found from 50 to 150 metres depth.

Distribution : South Africa, Red Sea, Maldives, Karachi, Both Coasts of India, China and Japan.

Remarks : It is commonly found along this coast.

3. *Dromidia unidentata* (Rüppell, 1830)

Dromia unidentata Rüppell, 1830. *Beschr. und Abbild.* 24 Art. *Krabben des Roth. Meer.,* **40** : 16, pl. 4; fig. 2; Alcock, 1899, *Jour. Asiat. Soc. Bengal,* **68** (2) No. 3 : 139.

Dromidia unidentata Kossmann, 1880, Reise Kust. Rot. Meer. Crust., **3** : 67; Laurie, 1906, *Ceylon Pearl oyster Fisheries Rep.* 5. London, Suppl. No. 40 : 351; Sakai, 1976. *Crabs of Japan and the adjacent Seas,* **1** : 11, pl. 2, fig. 2, text fig. 2a, b; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 28, fig. 8.

Material & Measurements : 1 ♀ cb. 29.05 mm, cl. 30.05 mm.

Habitat : It is found from infratidal Zone to a depth of 15 to 50 metres depth on sandy or rocky bottoms.

Distribution : Madagascar, Persian Gulf, Red Sea, Karachi, Coromandel Coast, Andamans, Sri Lanka and Malay Archipelago.

Remarks : It is rarely found along this coast.

4. *Dorippoides facchino* (Herbst, 1785)

Cancer facchino Herbst, 1785, *Krabben :* 190, pl. 11, fig. 68.

Dorippe facchino de Haan, 1841, *Fauna Japonica :* 123 ; Alcock, 1896, *Jour. Asiat. Soc. Bengal,* **65**(2) : 278; Ummerkutty & Deb, 1972, *Rec. Zool. Surv. India,* **66** (1-4) : 191.

Dorippe (Dorippoides) facchino Serène & Romimohtarto, 1969, *Mar. Res. Indonesia,* **9** : 4, 8, figs. 2, 6, 11, 16A, B, C, D, pl. 1C, 3D.

Dorippoides facchino Manning & Holthuis, 1981. *Smith. Contr. Zool. No. 306* : 30.

Material & Measurements : 3 ♂ cb. 22-24 mm, cl. 20.05-22 mm. 2 ♀ cb. 31.05-33 mm, cl. 28.05-30.05 mm.

Habitat : It is found on sandy or muddy substratums at a depth of 15-100 metres. Lepas are generally seen attached to its legs.

Distribution : Persian Gulf. Gulf of Oman. South and East Coast of India, Sri Lanka, Indonesia, China and Japan.

5. *Neodorippe callida* (Fabricius, 1798)

Cancer astutus Herbst, 1785. *Krabben :* 45, pl. 4, fig. 6.

Dorippe astuta Fabricius, 1798, Suppl. Ent. Syst. : 361; Alcock, 1896, *Jour. Asiat. Soc. Bengal* **65**(2) : 280; Chhapgar, 1957. *Jour. Bombay Nat. Hist. Soc.,* **54**(2) : 409, pl. 3, figs. d, e.

Neodorippe callida Manning & Holthuis, 1981. *Smith. Contr. Zool. No. 306 :* 37; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 48, figs. 14 & 15.

Material & Measurements : 1 ♂ cb. 13 mm, cl. 15 mm. 2♀ cb. 18.04-20.03 mm, cl. 19.0-22 mm.

Habitat : It is found in shallow water from 15 to 30 metres depth.

Distribution : Karachi, Both the coasts of India, Mergui Archipelago, Thailand, China and Philippines.

6. *Calappa lophos* (Herbst, 1782)

Cancer lophos Herbst, 1782. *Krabben,* **5** : 201, pl. 13, fig. 77.

Calappa lophos de Haan, 1837. *Fauna Japonica :* 72, pl. 20 fig. 1; Alcock & Anderson, 1894. *Jour, Asiat soc. Bengal,* **63**(2) No. 4 : 203; Chopra, 1933. *Rec. Indian Mus.,* **35**(1) : 28; Pillai, 1951. *Bull. Cent. Res. Inst. Travancore, :* 8; Chhapgar, 1957. *Jour. Bombay Nat Hist. Soc.,* **54** : 404, pl. 1; figs. h, ij L2(1), Ser. c.

Material & Measurements : 2 ♂ cb. 46.04-57.08 mm, cl. 37.03-39 mm. 2 ♀ cb. 50.09-77.03 mm, cl. 43.03-49.02 mm.

Habitat : It occurs from 30-70 metres depth on sandy bottom.

Distribution : Mauritus, Pakistan, India, Australia, China and Japan.

Remarks : It is commonly found along this coast.

7. *Calappa pustulosa* Alcock, 1896

Calappa pustulosa Alcock, 1896. *Jour. Asiat. Soc. Bengal,* **2** : 147, pl. 6, fig. 1; Chopra, 1933. *Rec. Indian Mus.,* **35** (1) : 29; Sakai, 1965. *The crabs of Sagami Bay,* : 57, pl. 23, fig. 2.

Material & Measurements : 1 ♀ cb. 54 mm, cl. 48 mm.

Habitat : It is found on sandy bottom at a depth of 30-70 metres.

Distribution : India, Japan.

Remarks : It is rarely found along this coast.

8. *Matuta lunaris* (Forskål, 1775)

Cancer lunaris Forskål, 1775. *Descr. Anim. Avium,* **19** : 91.

Matuta victor de Haan, 1850. *Fauna Japonica,* : 127; Suvatti, 1950. *Fauna of Thailand :* 148.

Matuta lunaris Rathbun, 1903. *Proc. U. S. Nat. Mus.,* **26** : 30; Stebbing, 1905. *South African Crustacea,* (4) : 54; Chopra, 1933. *Rec. Indian Mus.,* **35**(1) : 31; Chhapgar, 1957, *Jour. Bombay Nat. Hist. Soc.,* **54** : 405, pl. 2, figs. a-c; Sankarankutty, 1962. *Jour. Biol. Ass. India,* **4**(1) : 153, fig. 2; Ummerkutty & Deb, 1972. *Rec. Zool. Surv. India,* **66** (1-4) : 192.

Material & Measurements : 1 ♂ cb. 27.05 mm, cl, 26 mm. 5 ♀ cb. 32-36 mm, cl. 32-36 mm.

Habitat : It lives in the intertidal zone of sandy or muddy bottom at a depth of 10-20 metres. It is fairly abundant in coastal waters.

Distribution : South Africa, Red Sea, Both Coasts of India, Australia, China and Japan.

Remarks : It is commonly found along this coast. It is consumed by local people in Bombay (Chhapgar, 1957) and in Philippines (Motoh, 1980).

9. *Matuta planipes* Fabricius, 1798

Matuta planipes Fabricius, 1798, *Suppl. Ent. Syst. :* 369; Balss, 1922. *Archiv f. Naturgesch* 88A(3) : 125; Sakai, 1976. *Crabs of Japan and the Adjacent Seas,* **3**(1) : 141, pl. 44, fig. 2; Chhapgar, 1957, *Jour. Bombay Nat. Hist. Soc.,* **54** : 406, pl. 2; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 64, fig. 18; Deb, 1995. : *Wetl. Eco. Ser. 1, Zool. Surv. India :* 348.

Matuta lunaris Herbst, 1799, *Krabben :* **43** pl. 48, fig. 6; Alcock, 1896. *Jour. Asiat. Soc. Bengal,* **64**(2) No. 2 : 161.

Matuta flagra Shen, 1936. *China Contr. Inst. Zool. Nat Acad. Peiping,* **3**(3) : 64.

Material & Measurements : 2 ♀ cb. 22-35.05 mm., cl. 20-33.07 mm.

Habitat : It lives in the intertidal zone to infratidal area to a depth of 10-15 metres on sandy bottom.

Distribution : Pakistan, Both Coasts of India, Andamans, Burma, Thailand, Java, North-West Australia, China and Japan.

10. *Arcania erinaceus* (Fabricius, 1798)

Leucosia erinaceus Fabricius, 1798, *Suppl. Ent. Syst.* : 352.

Arcania erinaceus Sakai, 1976. *Crabs of Japan and the Adjacent Seas :* 93, text fig. 49; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 72, fig. 20 A-D.

Material & Measurements : 1 ♀ cb. 16 mm, cl. 17 mm.

Habitat : It is found from 85 metres depth (Sakai, 1976) on sandy mud bottom.

Distribution : Pakistan, East Coast of India, Sri Lanka, Singapore and Japan.

11. *Arcania septemspinosa* (Fabricius, 1787)

Leucosia septemspinosus Fabricius, 1787. *Mantissa Insect.,* **1** : 325.

Iphis septemspinosa Leach, 1817. *Zool. Miscell.,* **3** : 25; Miers, 1880. *Ann. Mag. Nat. Hist.,* **5** : 317.

Arcania septemspinosa Miers, 1886, *Rep. Sc. Res. Challenger Zool., :* 300; Chopra, 1933. *Rec. Indian Mus.,* **35**(1) : 43 Fig. 5; Chhapgar, 1957. *Jour. Bombay Nat. Hist. Soc.,* **54**(2) : 408, pl. 3a-c; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 72, fig. 21A-H.

Material & Measurements : 2 ♂ cb. 14.04-19.04 mm, cl. 14-20 mm. 2 ♀ cb. 15.02-18 mm, cl. 17-19.04 mm.

Habitat : It is found from 25-50 metres depth of sandy or muddy bottom. It is also littoral reported by Stephensen (1945).

Distribution : Persian Gulf, Red Sea, Karachi, Both coasts of India, Andamans and Malay Archipelago.

Remarks : It is commonly found along this coast. It is also a warm water species reported by Barnard (1950).

12. *Arcania undecimspinosa* de Haan, 1841

Arcania undecimspinosa de Haan, 1841. *Fauna Japonica :* 135, pl. 33, fig. 8; Alcock, 1896. *Jour. Asiat. Soc. Bengal,* **64**(11) No. 2 : 266; Sakai, 1935. *Crabs of Japan :* 58, pl. 10, fig. 1; Sankarankutty, 1962. *Jour. Mar. Biol. Ass. India,* **4**(1) : 155; Campbell, 1971. *Mem. Queensland Mus.,* **16**(1) : 41; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 76, fig. 22.

Arcania granulosa Miers, 1877. *Trans. Linn. Soc. London, Zool. Soc.,* **2**(1) : 240, pl. 38, fig. 29; Haswell, 1879. *Proc. Linn. Soc. New South Wales,* **4** : 58.

Material & Measurements : 1 ♀ cb. 26.05 mm, cl. 29.03 mm.

Habitat : It occurs on sandy or muddy bottom from 7-219 metres depth. (Tirmizi & Kazmi, 1988).

Distribution : Natal, Seychelles, Karachi, Maldives, East Coast of India, Andamans, Queensland, Australia, China and Japan.

13. *Leucosia biannulata* Tyndale-Biscoe & George, 1962

Leucosia longifrons var. *neocaledonica* Alcock, 1896. *Jour. Asiat. Soc. Bengal,* **65**(2) No. 2 : 218; Tirmizi., 1980. *Proc. 1st Pakistan Congr. Zool.,* : 106.

Leucosia longifrons Chhapgar, 1969. *Jour. Bombay Nat. Hist. Soc.,* **65**(3) : 610, pl. 1b.

Leucosia biannulata Tyndale-Biscoe & George, 1962. *Jour. Roy. Soc. West Australia,* **45**(3).: 92, figs. 4 13a, 13b, fig. 9; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 94, fig. 27A-F.

Material & Measurements : 1 ♂ cb. 19 mm, cl. 23.05 mm.

Habitat : It is found on sandy bottom at a depth of 30-100 metres.

Distribution : Karachi, Both Coasts of India.

Remarks : It is rarely found along this coast.

14. *Philyra globosa* (Fabricius, 1798)

Cancer globosus Fabricius, 1798. *Suppl. Ent. Syst.,* : 441.

Philyra porcellana Bell, 1855. *Trans. Linn. Soc. London. Zool.* **21**(1) : 300.

Philyra globosa Henderson, 1893. *Trans. Linn. Soc. London. Zool.* **5** 401; Alcock, 1896. *Jour. Asiat. Soc. Bengal,* **65**(2) No. 2 : 243; Chopra, 1933. *Rec. Indian Mus.,* **35**(1) : 27; Chhapgar, 1957. *Jour. Bombay Nat. Hist. Soc.,* **54** : 507, pl. 2, fig. k-m; Kensley, 1981. *Smith. Contr. Zool. No.* 338 : 39.

Material & Measurements : 1 ♂ cb. 18 mm, cl. 18.05 mm.

Habitat : It occurs from the depth of 20-150 metres on sandy or rocky bottoms.

Distribution : Natal, Persian Gulf, Karachi, Both Coasts of India, Mergui Archipelago.

15. *Phylyra globulosa* H. Milne Edwards, 1837

Cancer anatum Herbst, 1782. *Krabben* : 90, pl. 2, fig. 19.

Leucosia globulosa Fabricius, 1798. *Suppl. Ent. Syst.,* : 349.

Philyra globulosa H. Milne-Edwards, 1837. *Hist. Nat. crust.,* **1** : 132 ; ALcock, 1896. *Jour. Asiat. Soc. Bengal,* **65**(2) No. 2 : 245 ; Chopra, 1933. *Rec. Indian Mus.,* **35**(1) : 38 ; Pillai, 1951, *Bull. Cen. Res. Inst. Travancore,* **2**(1) : 13; Tirmizi & Kazmi. 1988, *Marine Fauna of Pakistan,* **4** : 98, fig. 28 A-E.

Material & Measurements : 1 ♂ cb. 26.00 mm, cl. 25.09 mm.

Habitat : It is generally found on the sandy and muddy bottoms, from 20-100 metres depth.

Distribution : South Africa, Persian Gulf, Pakistan, India and Gulf of Thailand.

16. *Philyra scabriuscula* (Fabricius, 1798)

Leucosia scabriuscula Fabricius, 1798. *Suppl. Ent. Syst.* : 349.

Philyra scabriuscula de Man, 1888. *Archiv f. Nat. Bd.*, **53** : 201 ; Alcock, 1896. *Jour. Asiat. Soc. Bengal*, **65**(2) No. 2 : 239 ; Chopra & Das, 1937. *Rec. Indian Mus.*, **39**(4) 388; Tyndale-Biscoe & George, 1962. *Jour. Roy. Soc. West Australia*, **45**(3) : 74, figs. 4, 6; Ummerkutty & Deb, 1972, *Rec. Zool. Surv. India*, **66**(1-4) : 192; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan*, **4** ; 106, fig. 31, A-I.

Material & Measurements : 2 ♂ cb. 9.08-9.09 mm, cl. 10-10.01 mm.

Habitat : It inhabits in the intertidal zone on sandy bottom.

Distribution : Persian Gulf, Red Sea, Zanzibar, Karachi, Both Coasts of India, Malayasia, Indonesia and Australia.

17. *Macropodia falcifera* (Stimpson, 1857)

Stenorhynchus falcifer Stimpson, 1857. *Proc. Acad. Nat. Sc. Philadelphia*, **3** : 219, pl. 1, fig. 1; Dofleins, 1904. *Valdivia*, : 70, fig. 6.

Stenorhynchus falcifera Stebbing, 1910. *Annls. S. African Museum :* 284; Balss, 1913. *Denksch med-naturw. Ges. Jena.*, : 109.

Macropodia falcifera Stimpson, 1907. Smith. Misc. Colls., **49** : 32; Barnard, 1950. *Ann. S. African Mus.*, **38** : 16, fig. 2b-f; Tirmizi & Kazmi, 1983. *Bull. Inst. Ocean. & Fish.*, **9** : 368.

Material & Measurements : 1 ♂ cb. 16.04 mm cl. with rostrum 19.04 mm. 1 ♀ cb. 15.05 mm cl. with rostrum 19.04 mm.

Habitat : It is found on sandy bottoms. Its bathymetric range is 6-90 m (Kensley, 1981) or from 17 to 53 fathoms (Barnard, 1950).

Distribution : South Africa, Pakistan and East Coast of India.

Remarks : This may be the first record of this species from the east coast of India.

18. *Doclea gracilipes* Stimpson, 1857

Doclea gracilipes Stimpson, 1857. *Proc. Acad. Nat. Sci. Philadelphia*, **3** : 216; Alcock, 1895. *Jour. Asiat. Soc. Bengal*, **64**(2) No. 2 : 229; Chopra, 1935. *Rec. Ind. Mus.*, **37**(4) : 470; Chhapgar, 1957. *Jour. Bombay Nat. Hist. Soc.*, **54** : 412, pl. 3, figs. o, p; Ummerkutty & Deb, 1972. *Rec. Zool. Surv. India*, **66**(1-4) : 192.

Material & Measurements : 2 ♂ cb. 34.09-38.07 mm, cl. 44.05-46.07 mm. 1 ♀ cb. 40 mm, cl. 40.05 mm.

Habitat : It is found from 30-50 metres depth on sandy, muddy or rocky bottoms.

Distribution : Both Coasts of India, Andamans, Sri Lanka, Hong Kong and Mergui.

Remarks : It is commonly found along this coast.

19. *Doclea ovis* (Herbst, 1788)

Cancer ovis Herbst, 1788. *Krabben,* **1** : 210.

Doclea ovis H. Milne-Edwards, 1834. Hist. Nat. Crust., **1** : 294; Sethuramalingam & Khan, 1991. *Brachyuran Crabs of Parangipettai Coast* : 25, pl. 17, fig. d.

Material & Measurements : 1 ♂ cb. 41.05 mm, cl. 45.07 mm. 1 ♀ cb. 45 mm cl. 50.0 mm.

Habitat : It occurs on sandy or muddy bottom at a depth of 30-100 metres.

Distribution : East Coast of India, Hong Kong and Japan.

20. *Parthenope longimana* (Linnaeus, 1764)

Cancer longimanus Linnaeus, 1764. *Mus. Lud. Ulr.* : 441; Herbst, 1790. *Krabben :* 252, pl. 19, figs. 105, 106.

Lambrus longimanus H. Milne-Edwards, 1834. *Hist. Nat. Crust.,* **1** : 354, pl. 26, fig. 1; Alcock, 1895. *Jour. Asiat. Soc.. Bengal,* **64**(2) No. 2 : 260; Pillai, 1951. *Bull. Cen. Res. Inst. Travancore,* **2**(1), Ser. C : 8.

Parthenope (Parthenope) longimanus Serène, 1968. *Singapore Nat. Acad, Sci. Spec. Publ.,* **1** : 59; Sakai, 1976. *Crabs of Japan and the Adjacenet Seas,* **1** : 266, fig. 144.

Parthenope longimana Griffin, 1972. *Steenstrupia-Zoological Museum, University of Copenhagen,* **2**(5) : 73.

Material & Measurements : 3 ♀ cb. 23.01-29.02 mm, cl. 22.0-27.0 mm.

Habitat : It is found on sandy mud or coarse gravel substratums at a depth of 60 to 70 metres.

Distribution : Persian Gulf, Mauritius, Pakistan, Both Coasts of India, Andamans, Sri Lanka, Gulf of Thailand, Singapore, Java, Sumatra, Australia, Philippines and Japan.

21. *Parthenope pransor* (Herbst, 1796)

Lambrus pransor Herbst, 1796. *Krabben :* 170, tab. 41, fig. 3.

Lambrus (Platylambrus) prensor Alcock, 1895. *Jour. Asiat. Soc. Bengal,* **64**(2) No. 2 : 262; Chopra, 1935. *Rec. Ind. Mus.,* **37**(4) : 473; Chhapgar., 1957. *Jour. Bombay Nat. Hist. Soc.,* **54** : 415, pl. 4 g.

Parthenope pransor Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 204, fig. 63-64.

Material & Measurements : 1 ♀ cb. 27.0 mm, cl. 24.06 mm.

Habitat : It lives in shallow waters on muddy or sandy substratums at a depth of 15-45 metres.

Distribution : Karachi, Both Coasts of India, Andamans, Sri Lanka and Singapore.

22. *Cryptopodia angulata* H. Milne Edwards & Lucas, 1841

Cryptopodia angulata H. Milne Edwards & Lucas, 1841. *Arch. Mus. Hist. Nat. Paris,* **2** : 481; Alcock, 1895. *Jour. Asiat. Soc. Bengal,* **64**(2) No. 2 : 282; Chopra, 1935. *Rec. Indian Mus.,* **37**(4) : 473; Chhapgar, 1957, *Jour. Bombay Nat. Hist. Soc.,* **54** : 415, pl. 4, fig. J-L; Tirmizi & Kazmi, 1988. *Marine Fauna of Pakistan,* **4** : 211, fig. 65.

Material & Measurements : 1 ♀ cb. 52.07 mm, cl. 29.09 mm.

Habitat : It inhabits on muddy or sandy bottoms at a depth of 34-50 metres.

Distribution : Karachi, Both Coasts of India and Sri Lanka.

Remarks : It is less commonly found along this coast.

SUMMARY

The present qualitative analysis based on collected specimens of representative samples of crabs at hand revealed a wealth of varieties of non-brachyrynchan crabs found along the Gopalpur Coast, Orissa. A total of 22 species belonging to 14 genera, 8 subfamilies, 6 families under infraorder Brachyura of order Decapoda have been recorded from a detailed study of the Nonbrachyryncan crabs. Most of the families are represented by two to three species while families which have good representation are Calappidae (4 species) and Leucosiidae (7 species). The study also helped in bringing out systematic notes along with habitat and a brief geographical distribution for each species. Of the 22 species, 8 species are found in the intertidal to shallow waters and 14 species are found in the shallow to greater depths. It is also observed that most of the these species are of wide distribution in the Indo-Pacific region. Among the collected species, *Dromia dehaani, Calappa lophos, Matuta lunaris,* and *Doclea gracilipes* are common and *Dromidia unidentata, Calappa pustulosa* and *Leucosia biannulata* are rare along this Coast.

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ON THREE NEW SPECIES OF SPIDERS OF THE GENUS *HIPPASA* SIMON (ARANEAE : LYCOSIDAE) FROM JABALPUR, MADHYA PRADESH, INDIA.

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INTRODUCTION

The genus *Hippasa* was established by Simon in 1885, with type species *Hippasa agelenoides* (Simon). Since the establishment of this genus, Tikader (1980) reillustrated and redescribed twelve species in *'Fauna of India, Spider* volume.

While Studying the spider collection collected by the second author from different localities of Jabalpur, we came across three new spices of *Hippasa* which are described here.

The type specimens will be deposited in due course in the National Collection of Zoological Survey of India, Calcutta.

1. ***Hippasa hansae*** sp. nov.

General : Cephalothorax and legs brown, abdomen brown with blackish patches. Total 8.00 mm. Carapce 3.20 mm. long, 2.20 mm. wide; abdomen 5.00 mm. long, 1.90 mm. wide.

Cephalothorax : Longer than wide, convex, clothed with pubescence, cephalic region abruptly tapering and narrowing. Anterior row of eyes very slightly procurved and wider than the second row. Bases of posterior eyes provided with conspicuous black patches. Space enclosed between posterior eyes much wider behind than in front. Centre of thoracic region provided with a conspicuous fovea; the brown bands radiate from the fovea to the lateral sides as in fig.1. Sternum heart-shaped, pointed behind, pale, clothed with hairs, and provided with a median longitudinal dark band. Labium as long as wide, with the basal excavation prominent. Maxillae pale, with broad distal ends. Chelicerae strong, provided with distinct scopulae. Legs long and slender, clothed with hairs and spines.

Abdomen : Longer than wide, elliptical, clothed with pubescence and anterior dorsal middle half provided with a pale lens-shaped marking, rest of abdomen provided with blackish and brownish pacthes as in fig. 1. Ventral side lighter in colour than dorsal. Epigyne as in fig. 2. Spermathecae as in fig 3.

Type-specimen : *Holotype* : Female in spiirit, other details as above.

Type-locality : Madan Mahal Fort, Jabalpur, M.P. India. Coll. Pawan Gajbe, 13.10.1997.

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* Government Autonomus Science College, Jabalpur.

This species resembles with *Hippasa partita* Cambridge but can be distinguished from it as follows : (i) Ventral side without any patches but in *H. partita* ventral side provided with three longitudinal dark bands extending from the epigastric fold to the base of spinnerets. (ii) Epigyne and spermathecae also structurally different.

2. ***Hippasa fabreae*** sp. nov.

General : Cephalothorax, legs and abdomen brown. Total length 17.50 mm. Carapace 7.50 mm. long, 5.80 mm wide; abdomen 10.20 mm. long, 6.20 mm. wide.

Cephalothorax : Longer than wide, narrowing anteriorly, clothed with pubescence, Lateral sides lighter than mid dorsal region. Centre provided with a conspicuous fovea and with thin conspicuous brown bands extending from it to the lateral sides. Anterior row of eyes slightly procurved and anterior medians larger than anterior laterals. Eyes of the second row larger than others; bases of posterior eyes provided with conspicuous black patches; space enclosed between the posterior eyes wider behind than in front. Sternum heart-shaped, pointed behind, clothed with hairs, and provided with a mid-longtudinal black band. Labium as long as wide with the basal excavation prominent. Maxillae broader at the distal end, and distal end provided with sonspicuous scopulae. chelicerea strong and retromargin of fang groove provided with three teeth. Legs long and strong, clothed with hairs and spines.

Abdomen : Longer than wide, elliptical, clothed with pubescence and hairs; anterior dorsal midddle half provided with a lens-shaped brown marking as in fig. 4. Ventral side same in colour as dorsal. Epigyne as in fig. 5. Spermathecae as in fig. 6.

Type-specimen : *Holotype* : Female in spirit, other details as above.

Type-locality : Khandari, Jabalpur, M. P. , India. Coll. *Pawan Gajbe,* 9.10.1997.

This species resembles *Hippasa olivacea* Thorell but can be distinguished from it as follows : (i) Abdomen provided with a lens-shaped marking but in *H. Olivacesa,* abdomen provided with dark greenish and pale patches. (ii) Epigyne and speramathecae also structurally different.

3. ***Hippasa wigglesworthi*** sp. nov.

General : Cephalothorax and legs brown, abdomen black, Total length 15.00 mm. Carapace 6.40 mm. long, 4.60 mm. wide; abdomen 8.80 mm. long, 4.60 mm. wide.

Cephalothorax : Longer than wide, convex, clothed with pubescence, cephalic region abruptly tapering and narrowing. Mid-dorsally chephalic and thoracic region darker than lateral areas; lateral margins provided with small black spots as in fig. 7. Anterior row of eyes very slightly procurved and wider than second row. Bases of posterior eyes provided with conspicuous black patches. Space enclosed between posterior eyes much wider in front. Centre of thoracic region provided with conspicuous fovea; thin brown bands radiate from fovea to the lateral sides. Sternum heart-shaped, pointed behind, clothed with hairs, pale and provided with a median longitudinal dark band. Labium as long as wide with the basal excavation prominent. Maxillae pale with blunt proximal ends and broad distal ends. Chelicerae strong, reddish brown, and

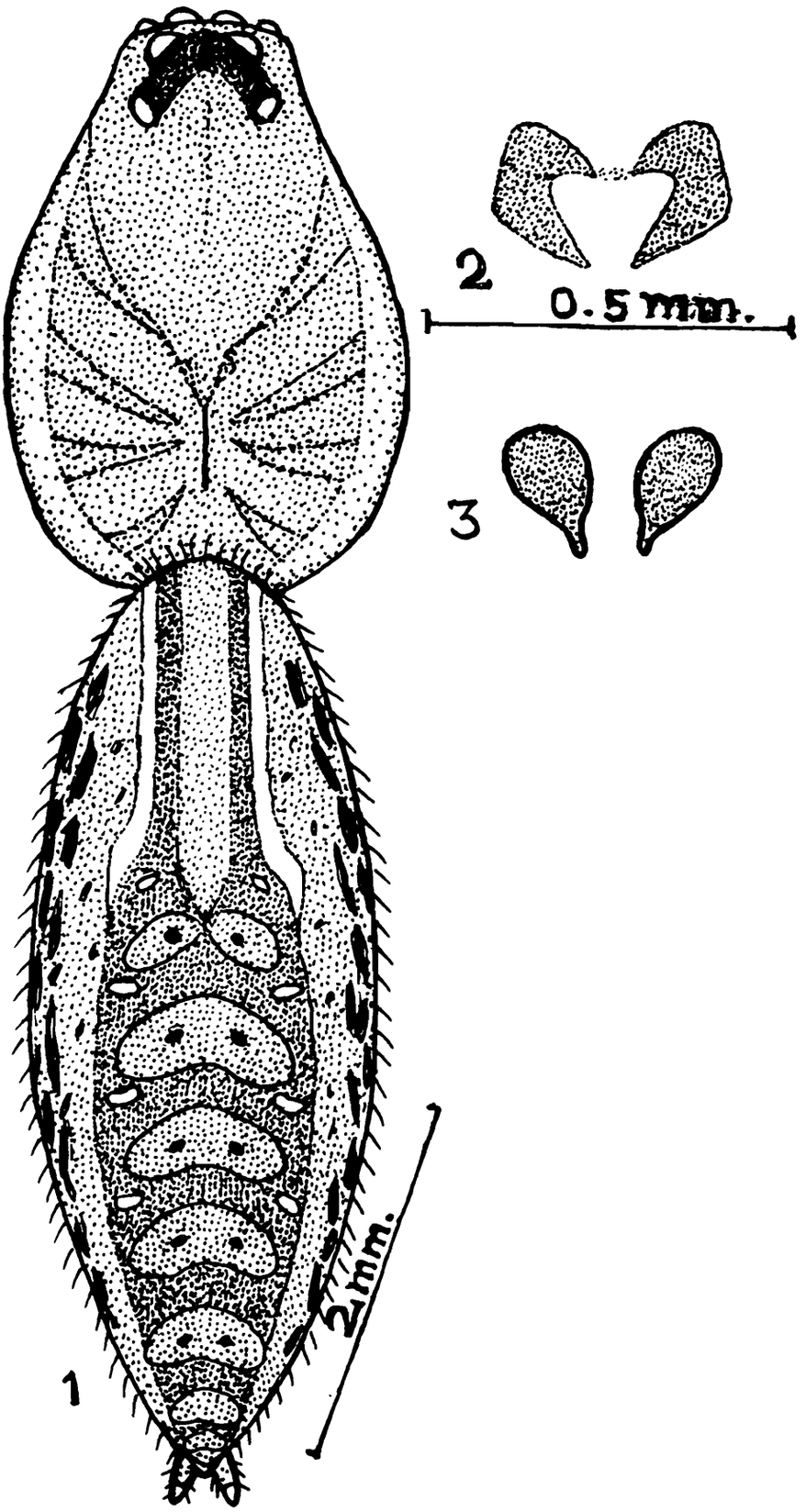

Fig. 1-3. *Hippasa hansae* sp. nov.
1. Dorsal view of female, legs omitted ; 2. Epigyne ; 3. Spermathecae.

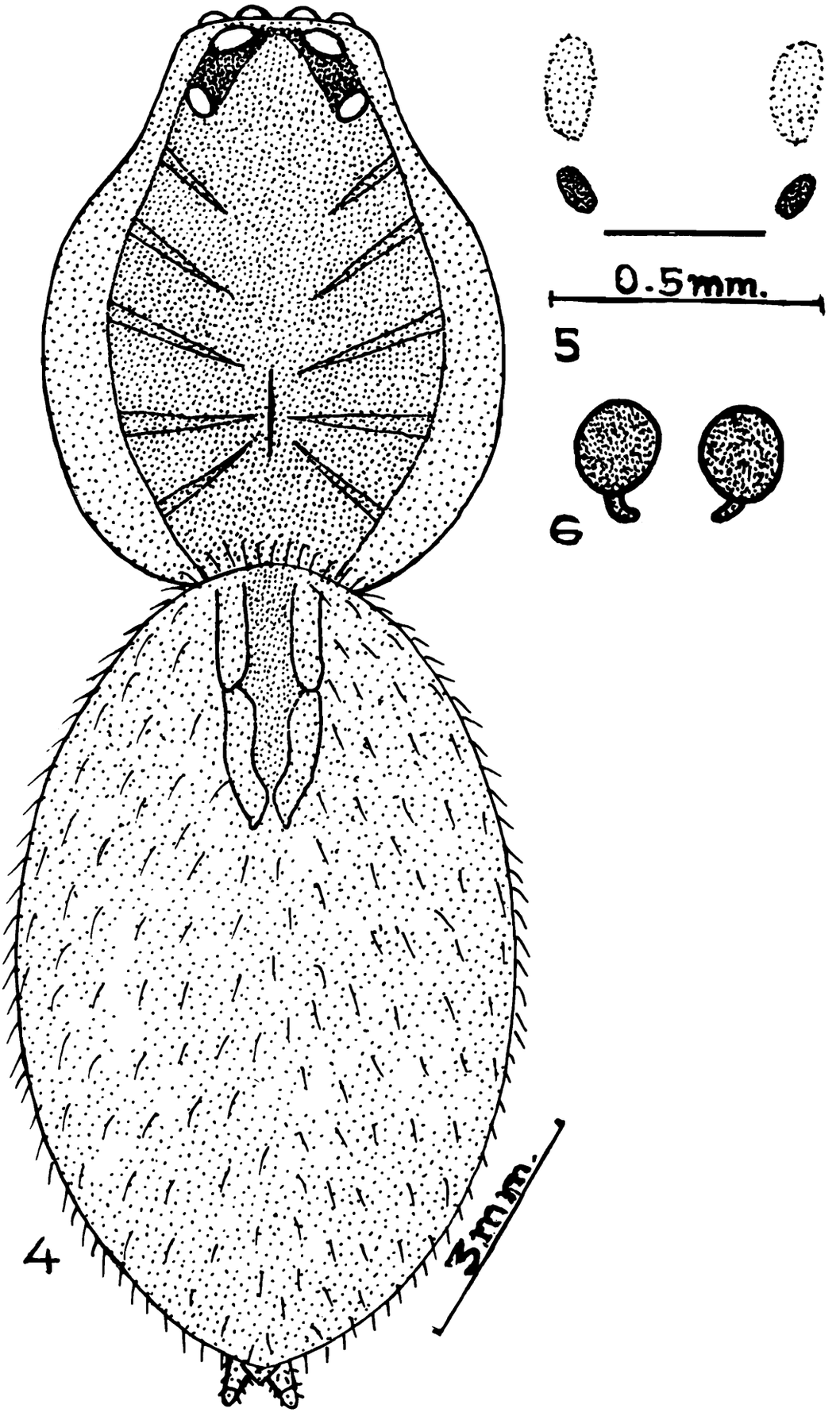

Fig. 4-6. *Hippasa fabreae* sp. nov.

4. Dorsal view of femal, legs omitted ; 5. Epigyne ; 6. Spermathecae.

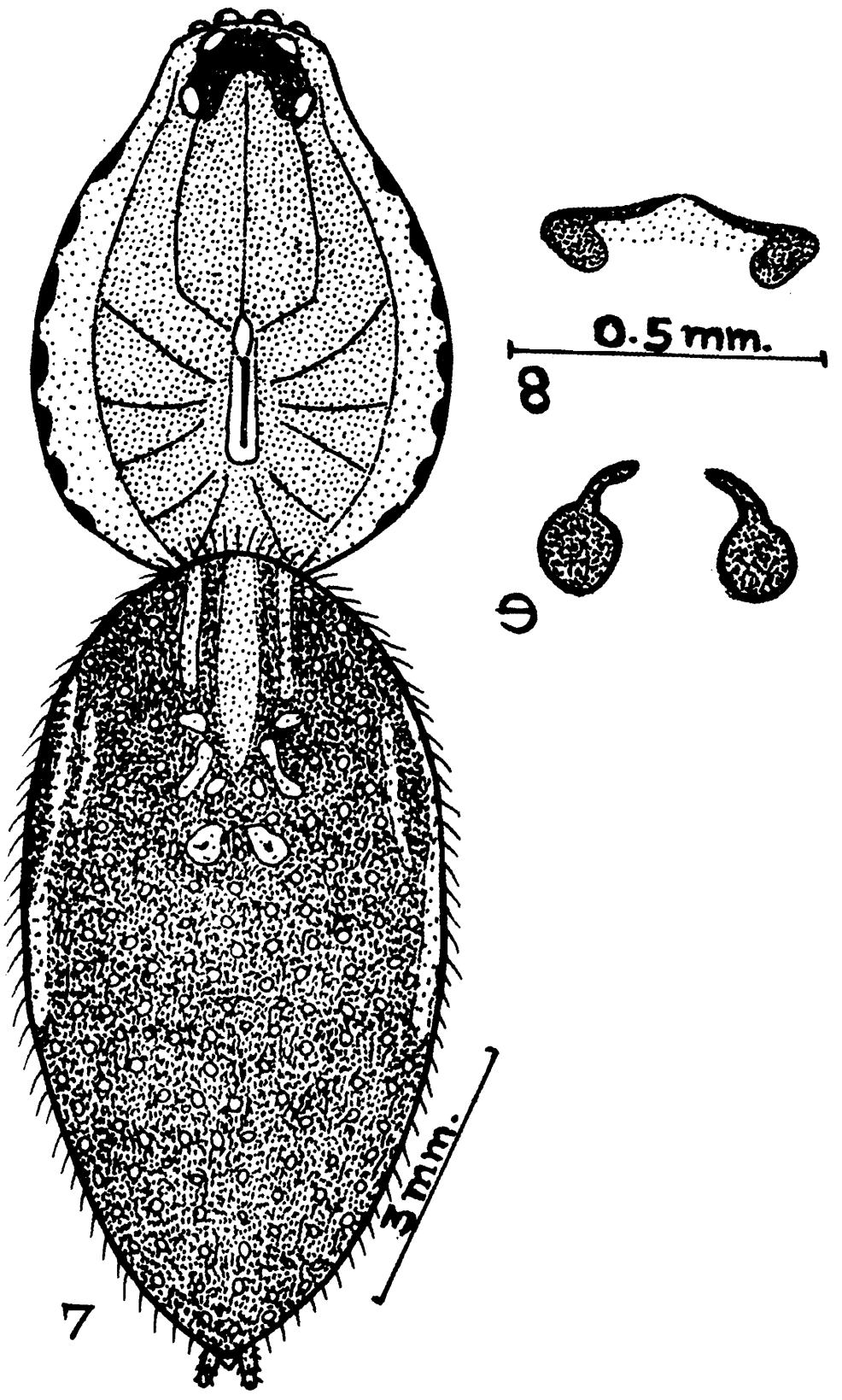

Fig. 7-9. *Hippassa wigglesworthi* sp. nov.
7. Dorsal view of female, legs omitted ; 8. Epigyne ; 9. Spermathicacae.

retromargin of fang groove porvided with four teeth. Legs long and slender, clothed with hairs and spines.

Abdomen : Longer than wide, oval, pointed behind, clothed with pubescence and anterior dorsal middle half provided with a reddish brown, lens shaped marking and few whitish patches, rest of abdomen provided with small brown dots as in fig. 7. Ventral side light brown with three black bands running from epigstric furrow to spinnerets. Epigyne as in fig. 8. Spermathecae as in fig. 9.

Type-specimen : *Holotype* : Female in spirit, other details as above.

Type-locality : Bheraghat, Jabalpur, M.P., India. Coll. *Pawan Gajbe,* 27.10. 1997.

This species esembles *Hippasa mahabaleshwarensis* Tikader but can be distnguished from it as follows : (i) Abdomen black and provided with brown dots but in *H. mahabaleshwarensis,* abdomen reddish brown with black spots, (ii) Epigyne and spermatheae also structutally different.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. J.R. B. Alfred, Director, Zoological Survey of India, Calcutta, for the facilities. The authors are also thankful to Shri K. Vinod, Stenographer, of this office for typing the manuscript.

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Rec. zool. Surv. India : **97** (Part-4) : 29-31, 1999

A NEW *CYRTOPHORA* SPIDER (ARANEAE : ARANEIDAE) FROM JABALPUR. MADHYA PRADESH, INDIA.

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INTRODUCTION

The spiders of the genus *Cyrotophora* are very little known from India. The genus was established by Simon (1864) with the type species *Cyrtophora citricola* (Forskal). Tikader (1982) redescribed and reillustrated five species from India in *Fauna of India, Spiders* volume.

While studying the spiders of the family Araneidae collected by the second author from different localities of Jabalpur, We came across a new species of *Cyrtophora* simon which is described here.

The type specimen will be deposited in due course in the National Collection, Zoological Survey of India, Calcutta.

Cyrtophora jabalpurensis sp. nov.

General : Cephalothorax and legs blackish with brownish patches, abdomen whitish brown. Total length 10.60 mm. Carapace 4.00 mm. long, 3.40 mm. wide; abdomen 7.00 mm. long, 4.30 mm. wide.

Cephalothorax : Slightly longer than wide, narrowing anteriorly, densely clothed with grey pubescence, thoracic region provided with a fovea trifid posteriorly; light brown patches present on mid-dorasal and lateral sides as in fig. 1. ocular quad forming a trapezium situated on an elevation, longer than wide, slightly wider in front than behind; ante-rior median eyes larger than posterior medians; lateral eyes larger than posterior medians; lateral eyes subequal in size, a little away from each other and situated on prominent tubercles; both rows of eyes strongly recurved. Sternum heart-shaped, pointed behind, brown and clothed with hairs. Labium wider than long, dark brown with pale distal margin. Maxillae dark brown with broad distal end. Chelicerae strong, provided with prominent boss. Legs relatively long, strong and stout, densely clothed with pubescence, hairs and spines, and provided with transverse brown patches.

Abdomen : High anteriorly and strongly overlapping the cephalothorax, thickly clothed with pubescence and hairs. Dorsum of abdomen provided with one pair of shoulder humps, one pair of lateral humps and one pair of bifid caudal humps as in fig. 1. Anteriorly provided with one pair of blackish patches; arrangement of paired sigilla and lines as in fig. 1. Ventral side brown with

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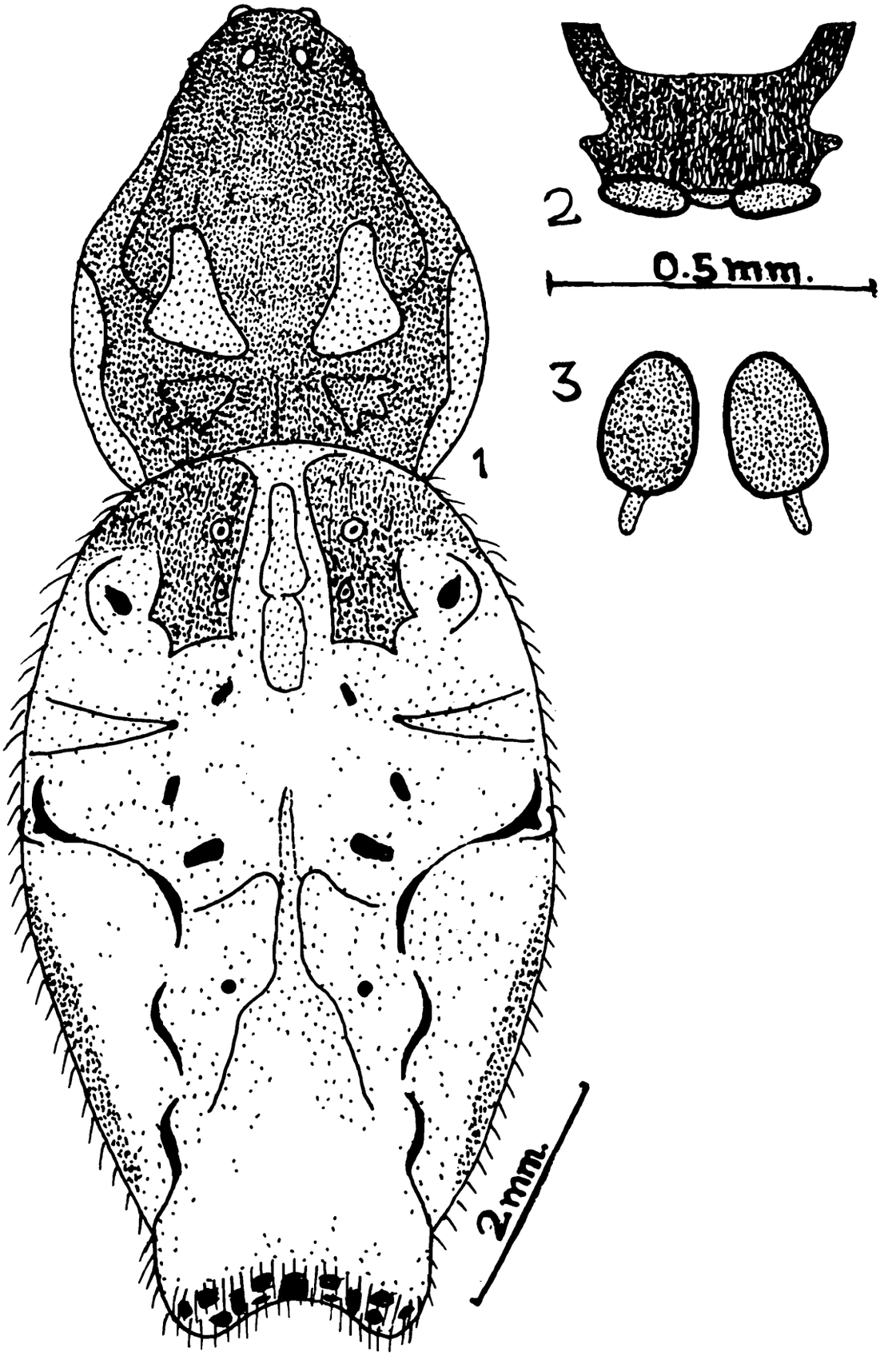

Fig. 1-3. *Cyrtophora jabalpurensis* sp. nov.

1. Dorsal view of female, legs omitted ; 2. Epigyne ; 3. Sperma-thecae (Internal genitalia.)

a chalk white patch between epigastric furrow and spinnerets. Epigye provided with a very broad and small scape; conspicuous black patch present above the epigyne as in fig. 2. Spermathecae as in fig. 3.

Type-specimen : *Holotype* : Female in spirit, other details as above.

Type-locality : Lamhetaghat, Jabalpur, M.P. , India, Coll. *Pawan gajbe,* 21. VIII. 1997.

This species resembles *Cyrtophora citricola* Forskal but differrs from it as follows : (i) Abdomen anteriorly provided with one pair of blackish patches but in *C. citricola,* abdomen provided with one pair of much larger greyish brown patches. (ii) Epigyne and spermathecae also structurally different.

ACKNOWLEDGEMENT

The authors are thankful to Dr. J.R.B. Alfred, Director, Zoological Survey of India, Calcutta, for facilities and to Shri K. Vioned, stenographer, of this station for typimg the manuscript.

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Tikader, B.K. 1982., *Funa of Ijdia, spiders,* 2(1) : 1-289.

Rec. zool. Surv. India : **97** (Part-4) : 33-43, 1999

ORTHOPTERA FAUNA OF PATALKOT CHHINDWARA, MADHYA PRADESH, INDIA

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INTRODUCTION

Patalkot is situated about 75 kms. away from Chhindwara city of Madhya Pradesh, towards north-west. It is a long, wide and deep place, surrounded by very high hills. The average depth of Patalkot is about 360 m., and to reach at the bottom of this place, one has to walk down on 850 stairs by the help of branches of Mahua and Palas trees. There are about 12 villages in Patalkot area, and one cave known as Raghu Raja Cave. Waterfall is situated nearby the cave, and its water fall from a height of about 20-30m. Nearly two-third of the total land of Patalkot is covered with forests of Bamboo, Mahua, Mango, Kusum, Tendu, Amla, Dhokara, Sarai, Jamun, Sal, Semar, Umar, many medicinal plants, and other thorny plants. A good type of white marble stone is found there.

The collection of Orthoptera is brought by the Survey parties of Zoological Survey of India, Jabalpur. This collection was done mostly by R. K. Singh, otherwise stated. There are 22 species under 20 genera and 8 families. All the species are new records for Patalkot, as well as to the District Chhindwara. However, 6 species marked with an asterisk (*) are new records to Madhya Pradesh.

A list of all the localities which come under Patalkot are listed below with their code numbers; P1, Patalkot, 14.ix.1991 ; P2, Around Amamai, 12.x.1992 ; P3, Near origin place of Gayeni river, 13.x.1992 ; P4, Near cave of Raghu Raja, 14.x.1992 ; P5, Around Chitawalmata, 15.x.1992 ; P6, Near Dauri Patha village, 16.x.1992 ; P7, Around Lohasur, 17.x.1992 ; P8, Around Jeetham, Rater village, 18.x.1992 ; P9, Around Mahuakhera, Rater village, 19.x.1992 ; P10, Around Semar Jheel, Rater village, 20.x.1992.

SYSTEMATIC ACCOUNT

Order Orthoptera

Superfamily GRYLLOIDEA

Family GRYLLIDAE

Subfamily GRYLLINAE

Genus ***Gryllodes*** Saussure, 1874

1. ***Gryllodes sigillatus*** (Walker)

1869. *Gryllus sigillatus* Walker, *Cat. Derm. Salt. Brit. Mus.*, **1** : 45.

1969. *Gryllodes sigillatus* : Chopard, *Fauna of India*, **2** Grylloidea : 85.

Material examined : 1M, P2 ; 1F, P4.

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

Remarks : This species is very common in houses or bunglows, and produce sound of high velocity during night or when it is dark. Frontal rostrum of head very narrow, and with a wide yellow transverse band above and a narrow curved one between the ocelli ; tegmina in male reaching upto the middle of abdomen, truncated at apex, female tegmina short and widely separated at apex ; wings absent.

Genus ***Plebeiogryllus*** Chopard, 1964

2. ***Plebeiogryllus guttiventris*** (Walker)

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

1964. *Plebeiogryllus guttiventris* : Randell, *Can. Ent.*, **96**(12) : 1593.

Material examined : 1M, P8.

Distribution : India : Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Orissa, Pondicherry, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal ; Myanmar and Sri Lanka.

Remarks : A common species found in India. Head with light lines on he occiput ; posterior femora short and thick, feebly striated with brown ; lateral field of tegmina with close veins.

Subfamily NEMOBIINAE

Genus ***Pteronemobius*** Jacobson & Bianchi, 1905

3. ***Pteronemobius fascipes*** (Walker)

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

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

Material examined : 1F, P4 ; 1M, P8.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal ; China ; Malaysia ; Myanmar ; Philippines and Taiwan.

Remarks : Size small ; maxillary palpi blackish at base, 4th and 5th joints white ; anterior and middle femora whitish in their basal half, brownish in the apical half ; posterior femora testaceous, adorned with three blackish bands.

Family OECANTHIDAE

Genus ***Oecanthus*** Serville, 1831

4. ***Oecanthus indicus*** Saussure

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

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

Material examined : 1F, P5 ; 1M, 1F, P9.

Distribution : India : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Tamil Nadu, Tripura and West Bengal ; Amboina ; China ; Japan ; Malaysia ; Philippines and Sumba.

Remarks : Body slender and glabrous ; anterior tibiae strongly dilated in basal half, with very large, oval tympana.

Family TRIGONIDIIDAE

Genus ***Trigonidium*** Rambur, 1839

5. ***Trigonidium humbertianum*** (Saussure)

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

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

Material examined : 1F, P4.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Gujarat, Kerala, Madhya Pradesh, Manipur, Meghalaya, Orissa, Tamil Nadu, Tripura and West Bengal ; Malaya and Sri Lanka.

Remarks : Body size small ; anterior tibiae perforated ; tegmina caudate and wings also long.

5. ****Trigonidium cicindeloides*** Rambur

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

1969. *Trigonidium cicindeloides* : Chopard, *Fauna of India,* **2** Crylloidea : 304.

Material examined : 1F, P9.

Distribution : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Goa, Himachal Pradesh, Karnataka, Maharashtra, Manipur, Meghalaya, Mizoram, Orissa, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal ; Africa ; Asia ; Madagascar ; Mauritius Island ; Mediterranian region.

Remarks : Small in size ; anterior tibiae unperforated ; tegmina strongly convex and short ; wings also short.

Superfamily TETTIGONIOIDEA

Family CONOCEPHALIDAE

Genus ***Conocephalus*** Thunberg, 1815

7. ***Conocephalus maculatus*** (Le Guillou)

1841. *Xiphidion maculatum* Le Guillou, *Revue suisse Zool.*, **4** : 294.

1980. *Conocephalus maculatus* : Pitkin, *Bull. Br. Mus. nat. Hist.* (Ent.), **41**(5) : 344.

Material examined : 1M, P2 ; 1M, P9.

Distribution : India : Himachal Pradesh, Madhya Pradesh (Bastar) ; Africa ; Australia ; Hong Kong ; Indonesia ; Jawa ; West Malagasien Region ; Philippines ; Sulawesi and Nepal.

Family PHANEROPTERIDAE

Genus ***Letana*** Walker, 1869

8. ****Letana infurcata*** Ingrisch, 1990

1990. *Letana infurcata* Ingrisch, *Ent. Scand.*, **21**(3) : 249.

Material examined : 1M, P8.

Distribution : India : Tamil Nadu.

Remarks : This species is characterised by the tegmina which is surpassing hind knees, and radial sector unforked.

9. ****Letana pyrifera*** Bey-Bienko

1956. *Letana pyrifera* Bey-Bienko, *Entomol. Obozr.*, **35** : 650.

1990. *Letana pyrifera :* Ingrisch, *Ent. Scand.*, **21**(3) : 263.

Material examined : 1M, P9.

Distribution : India : North-West to South-West India.

Remarks : Tegmina surpassing hind knees ; radial sector forked ; cerci with base-internal elevation protruding, expansion on internal margin distinctly longer than half the length of cercus.

Genus ***Phaneroptera*** Serville, 1831

10. ****Phaneroptera gracilis*** *Burmeister*

1838. *Phaneroptera gracilis* Burmeister, *Handb. Ent.*, : 690.

1955. *Phaneroptera gracilis :* Ragge, *Proc. zool. Soc. Lond.*, **127** : 250.

Material examined : 3M, 1F, P5 ; 1M, P8 ; 1F, P10.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Maldive Island, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal ; Africa ; Annam ; Australia ; China ; Duke of York ; Indo-china ; Kali Island ; Malaya ; Myanmar ; Solomon ; Sumatera and Sumba.

Remarks : Lateral pronotal lobes longer than deep ; hind femora very slender ; cerci very long;. supra-anal plate slightly convex posteriorly ; subgenital plate elongate and bifurcate at apex.

Genus ***Elimaea*** Stål, 1874

11. ****Elimaea (Orthelimaea) securigera*** Brunner

1878. *Elimaea securigera* Brunner, *Monogr. Phaneropt.*, : 93.

1990. *Elimaea (Orthelimaea) securigera :* Ingrisch, *Spixiana,* **13**(2) : 157.

Material examined : 1M, P6.

Distribution : India : Andaman & Nicobar Islands, Assam, Himachal Pradesh, Meghalaya and West Bengal ; Indonesia ; Nepal and Sri Lanka.

Remarks : Tegmina slender ; stridulatory file with a break shortly before posterior end ; cerci securiform ; lobes of subgenital plate widely separated in the middle.

Superfamily ACRIDOIDEA

Family PYRGOMORPHIDAE

Genus ***Atractomorpha*** Saussure, 1861

12. ***Atractomorpha crenulata*** (Fabricius)

1793. *T(ruxalis) crenulatus* Fabricius, *Ent. Syst.*, **2** : 28.

1969. *Atractomorpha crenulata* : Kevan & Chen, *Zool. J. Linn. Soc.*, **48** : 187.

Material examined : 1M, P5.

Distribution : India : Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Goa, Jammu & Kashmir, Karnataka, Kerala, Lakshadweep and Maldive Island, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal ; Bangladesh ; Kambodia ; Laos ; Malaya ; Myanmar ; Nepal ; Pakistan ; Sri Lanka ; N. W. Sumatera ; Thailand and Veitnam.

Remarks : Body slender ; eyes oval ; lateral lobes of pronotum with a distinct membraneous area ; hind femora not strongly keeled on outer face. Both adults and hoppers are serious pest of young plants.

Family ACRIDIDAE

Subfamily GOMPHOCERINAE

Genus ***Dnopherula*** Karsch, 1896

Subgenus ***Aulacobothrus*** Bolivar, 1902

13. ***Dnopherula (Aulacobothrus) luteipes luteipes*** (Walker)

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

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

Material examined : 1M, P4.

Distribution : India : Assam, Bihar, Himachal Pradesh, Jammu & kashmir, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Sikkim, Tamil Nadu and West Bengal ; Bangladesh ; China ; Japan ; Myanmar ; Nepal ; Pakistan ; Sri Lanka ; Taiwan and Thailand.

Remarks : Antennae longer or distinctly longer than head and pronotum together ; lateral carinae of pronotum faintly diverging anteriorly before second or third sulcus, and also diverging posteriorly behind 3rd sulcus.

Genus ***Leva*** Bolivar, 1909

14. ****Leva indica*** (Bolivar)

1907. *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 : 3M, 1F, P4.

Distribution : India : Bihar, Delhi, Orissa, Tamil Nadu, Tripura and West Bengal ; Sri Lanka.

Remarks : The specimens of the species are small in size, and generally occur in association with *Leva cruciata.* Lateral carinae of pronotum on prozona nearly parallel, divergent in metazona.

Subfamily Oedipodinae

Genus ***Gastrimargus*** Saussure, 1884

15. ***Gastrimargus africanus africanus*** (Saussure)

1888. *Oedaleus (Gastrimargus) marmoratus* var. *africana* Saussure *Mem. Soc. Phys. Hist. nat. Geneve,* **30**(1) : 39.

1992. *Gastrimargus africanus africanus* : Ritchie, *Bull. Br. Mus. nat. Hist.* (Ent.), **44** (4) : 248.

Material examined : 1F, P6.

Distribution : India : Andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Madhya Pradesh, Orissa, Sikkim, Uttar Pradesh and West Bengal ; Africa ; Myanmar ; Nepal ; Pakistan ; Saudia Arabia ; Sri Lanka : Thailand ; Tibet and Yemen A.R.

Remarks : Body large ; pronotum tectiform with high, sharp median carinae ; wings with dark brown or black fasciae, basal area bright yellow, apex influmate.

Genus ***Oedaleus*** Fieber, 1853

16. ***Oedaleus abruptus*** (Thunberg)

1815. *Gryllus abruptus* Thunberg, *Mem. Acad. Sci. St.-Petersb.*, **5** : 233.

1981. *Oedaleus abruptus* : Ritchie, *Bull. Br. Mus. nat. Hist.* (Ent.), **42**(3) : 104.

Material examined : 1F, P2 ; 1F, P4 ; 1F, P9.

Distribution : India : Andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal ; Bangladesh ; China ; Indo-china ; Hawaiian Islands ; Myanmar ; Nepal ; Pakistan; Sri Lanka and Thailand.

Remarks : This species is commonly found in short grasslands and is of minor importance of non-graminaceous crops. Pronotum short, with incomplete white cruciform marks.

Genus ***Trilophidia*** Stål, 1873

17. ***Trilophidia annulata*** (Thunberg)

1815. *Gryllus annulatus* Thunberg, *Mem. Acad. Sci. St.-Petersb.*, **5** : 234.

1965. *Trilophidia annulata* : Hollis, *Trans. R. ent. Soc. Lond.*, **117**(8) : 251.

Material examined : 1M, 1F, P1 ; 1F, P6.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Goa, Karnataka, Kerala, Himachal Pradesh, Madhya Pradesh, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal ; Afghanistan ; Bangladesh ; Borneo ; Hong Kong ; Japan ; Jawa ; Korea; Malaya ; Mongolia ; Myanmar ; Nepal ; Pakistan ; Thailand and Veitnam.

Remarks : Major pest of pastures throughout the year in India. Pronotum rugose, with a high median carina forming two teeth infront, and with lateral carinae.

Subfamily HEMIACRIDINAE

Genus ***Parahieroglyphus*** Carl, 1916

18. ***Parahieroglyphus bilineatus*** (Bolivar)

1912. *Hieroceryx bilineatus* Bolivar, *Trab. Mus. nac. Cienc. nat. Madr.*, (Ser. zool.) No. **6** : 60.

1916. *Parahieroglyphus bilineatus* : Carl, *Revue suisse Zool.*, **24** : 483.

Material examined : 1M, P9.

Distribution : India : Himachal Pradesh, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal ; Bangladesh.

Remarks : This species is reported to occur upto 2000m in N. India, and is plentiful in bamboo areas. Both hoppers and adults feed entirely on green foliage, preferring maize, rice and various

grasses. Frontal ridge of head parallel-sided or may diverge just below median ocellus ; cercus very large, divided into 3 lobes.

Genus ***Spathosternum*** Karsch, 1877

19. ***Spathosternum prasiniferum prasiniferum*** (Walker)

1871. *Heteracris* (?) *prasinifera* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** Suppl. : 65.

1936. *Spathosternum prasiniferum prasiniferum* : Tinkham, *Lingnan.. Sci. J.*, **15** : 51:

Material examined : 3M, 1F, P1.

Distribution : India : Andaman & Nicobar Islands, Arunachal Pradesh, Andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Tripura and West Bengal ; Bangladesh ; S.E. China; Hainan ; W. Malaysia ; Myanmar ; Nepal ; Pakistan ; Sri Lanka ; Thailand and Veitnam.

Remarks : Widely distributed species throughout in India. Generally, found in and around short grasses of plains, in pastures and cultivated fields. It is a major pest of crops in Punjab and Uttar Pradesh.

Subfamily CATANTOPINAE

Genus ***Catantops*** Schaum, 1853

20. ***Catantops pinguis innotabilis*** (Walker)

1870. *Acridium innotabile* Walker, *Cat. Derm. Salt. Brit. Mus.*, **4** : 529.

1956. *Catantops pinguis inntoabilis* : Dirsh, *Publcoes cult Co. Diam. Angola*, **28** : 105.

Material examined : 2M, P4 ; 1M, P5 ; 3F, P9.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Lakshadweep, Madhya Pradesh, Maldive Island, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh and West Bengal ; Afghanistan ; Bangladesh ; China ; Hong Kong ; Indo-china ; Japan ; kambodia ; Korea ; Malaya ; Myanmar ; Nepal ; New Guinea ; Pakistan ; Philippines ; Sri Lanka ; Sumatera ; Thailand; Tibet and Yunnan.

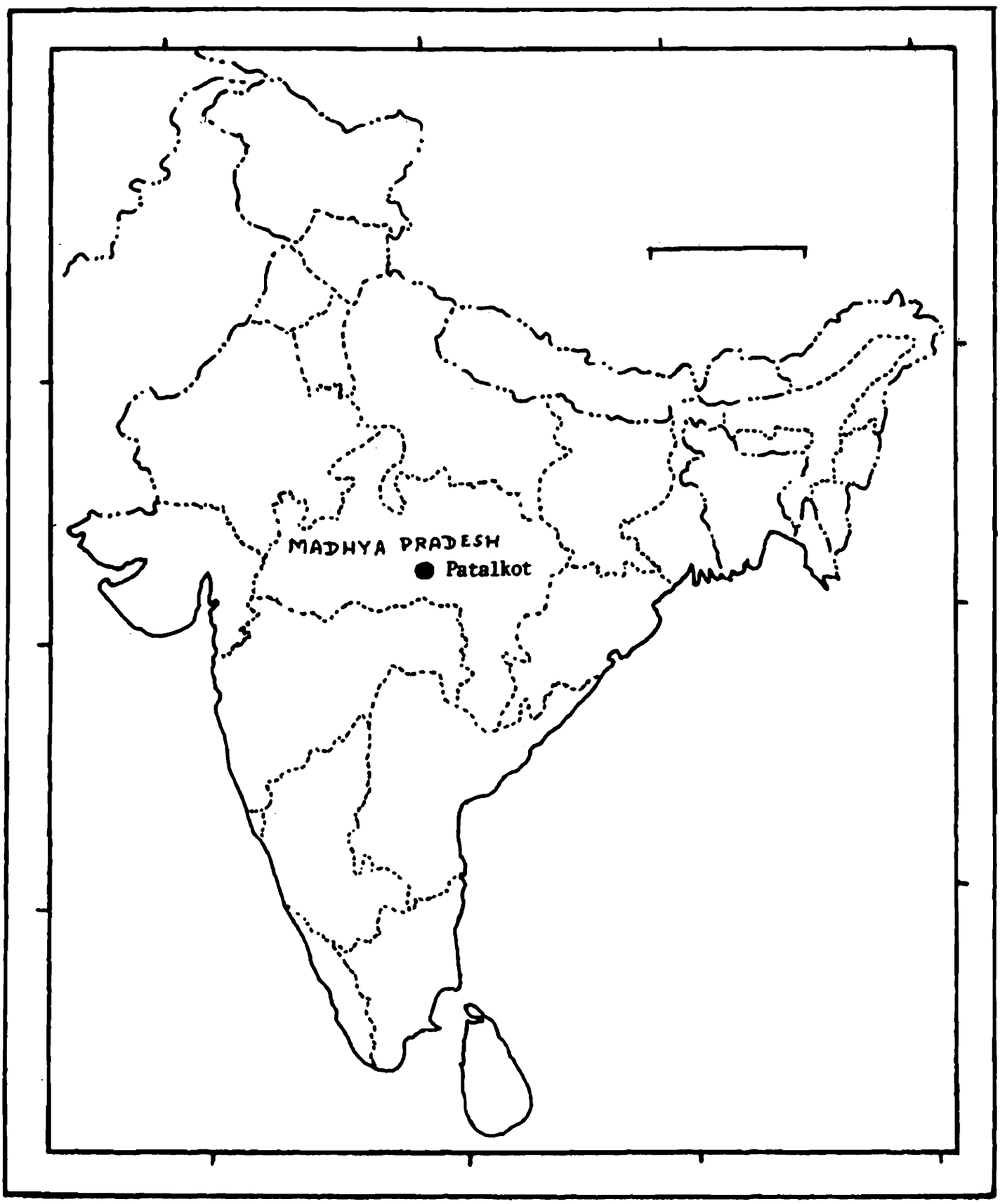
Remarks : Pronotum flat or subcylindrical ; prosternal tubercle cylindrical and rounded at apex; lateral lobe of pronotum without coloured pattern ; external disc of hind femur without black median spot below the upper carinula. This species is very minor crop pest.

Subfamily EYPREPOCNEMIDINAE

Genus ***Eyprepocnemis*** Fieber, 1853

21. ***Eyprepocnemis rosea*** Uvarov

1942. *Eyprepocnemis rosea* Uvarov, *Ann. Mag. nat. Hist.*, (11) **9** : 597.



Map of India showing Patalkot

Material examined : 1M, P9.

Distribution : India ; Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Meghalaya and Uttar Pradesh ; Bangladesh ; Myanmar ; Pakistan and Thailand.

Remarks : It is, generally, found in forest at high altitudes. Tegmina reach upto the apex of abdomen ; wings rose colour at base.

Family TETRIGIDAE

Genus ***Ergatettix*** kirby, 1914

22. ***Ergatettix dorsifera*** (Walker)

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

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

Material examined : 2F, P1 ; 1M, P4.

Distribution : India : Arunachal Pradesh, Assam, Bihar, Delhi, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal ; Bangladesh ; Central Asia ; Greater Sunda Island and S. China ; Myanmar ; Sri Lanka ; Sumatera and Taiwan.

Remarks : Median carina of pronotum indistinctly undulate, lateral carinae without dilated lobes on the hind process of pronotum ; hind femora with less protuberant tubercles on external surface.

SUMMARY

Twenty-two species are studied herewith, of which 6 are new records for Madhya Pradesh. *Eyprepocnemis rosea,* generally, found on high altitude is recorded here. *Parahieroglyphus bilineatus* though has been recorded earlier from Madhya Pradesh, but its record from Patalkot is interesting.

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Rec. zool. Surv. India : **97** (Part-4) : 45-48, 1999

MANTODEA OF PATALKOT CHHINDWARA DISTT., MADHYA PRADESH, INDIA

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INTRODUCTION

Patalkot is situated about 75 kms away from Chhindwara city of Madhya Pradesh, towards north-west. It is a long, wide and deep place, surrounded by very high hills. The average depth of Patalkot is about 360m. There are about 12 villages in Patalkot area. Nearly two-third of the total land is covered with forests. A good type of white marble stone is found there.

Madhya Pradesh, specially Patalkot is rich for mantid fauna. The collection from Patalkot is a post-monsoon, between middle of October. This period is good for mantid collection. Oothecae are laid at the end of monsoon, usually in September and continues usually upto January next year. The presence of diversity in Mantodea fauna in Madhya Pradesh, specially Patalkot is due to ecological conditions.

The collection of Mantodea is brought by the Survey party of Zoological Survey of India, Jabalpur, led by Dr. R. K. Singh. This study deals with 7 species, distributed under 5 genera. Five species are new records to Madhya Pradesh, and are marked by an asterisk (*)

SYSTEMATIC ACCOUNT

Order Mantodea

Family HYMENOPODIDAE

Subfamily ACROMANTINAE

Genus ***Ephestiasula*** Giglio-Tos, 1915

1. ****Ephestiasula amoena*** (Bolivar)

1897. *Pachymantis amoena* Bolivar, *Annls Soc. ent. Fr.*, **66** : 314.

1995. *Ephestiasula amoena :* Mukherjee et al., *Oriental Ins.*, **29** : 216.

Material examined : 1M (nymph), near cave of Raghu Raja, Patalkot, 14. x.1992 (Reg. No. I 15177A).

Distribution : India : Kerala, Tamil Nadu and West Bengal.

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Remarks : Vertex with small tubercle in the middle, lateral lobe cone shaped ; tip of prozona with two parallel black lines, with a blackish patch at mid-posterior end of pronotum ; fore femora with a blackish patch.

Family MANTIDAE

Subfamily LITURGUSTINAE

Genus ***Humbertiella*** Saussure, 1869

2. ****Humbertiella affinis*** Giglio-Tos

1917. *Humbertiella affinis* Giglio-Tos, *Bull. Soc. Entomol. Ital.*, **48** : 63.

1995. *Humbertiella affinis :* Mukherjee et al., *Oriental Ins.*, **29** : 240.

Material examined : 1F, near cave of Raghu Raja, Patalkot, 14. x. 1992 (Reg. No. I 15177A); 1M, Semar Jheel Rater Village, 20. x. 1992 (Reg. No. I 14806).

Distribution : India : Karnataka, Orissa ; and Sri Lanka.

Remarks : Frontal sclerite with narrow blackish stripe, superior bridge more arched in the middle ; large internal spines of fore femora black at apices ; fore wing with a less blackish, oblique band ; costal area more reticular than in *ceylonica* ; second anal vein 3-branched.

3. ***Humbertiella*** sp.

Material examined : 1F (nymph), Amamai village, Patalkot, 12.x.1992 (Reg. No. I 15155).

Remarks : Vertex straight ; eyes rounded ; pronotum flat, tuberculated, lateral margin smooth; fore femur with 4 discoidal and 4 external spines.

Subfamily MANTINAE

Genus ***Deiphobe*** Stål, 1877

4. ****Deiphobe brevipennis*** Sjöstedt

1930. *Deiphobe brevipennis* Sjöstedt, *Ark. Zool.*, **21**A (32) : 31, 32.

1995. *Deiphobe brevipennis* : Mukherjee et al., *Oriental Ins.*, **29** : 278.

Material examined : 2M, Around Jeetham, Rater village, 18.x.1992 (Reg. No. I 15225).

Distribution : Metazona of pronotum distinctly longer than fore tibiae with 8 external and 13 internal spines ; fore femora with 14 internal spines ; fore wing of male reaching upto abdomen; hind wing hyaline at base, with a large brown spot anteriorly, posterior area brownish-black.

Genus ***Mantis*** Linnaeus, 1758

5. ***Mantis religiosa*** Linnaeus

1758. *Gryllus (Mantis) religiosa* Linnaeus, *Syst. Nat.*, **10** : 426.

1995. *Mantis religiosa* Mukherjee et al., *Oriental Ins.*, **29** : 302.

Material examined : 1M, near cave of Raghu Raja, Patalkot, 14.x.1992 (Reg. No. I 15177A); 1M, Around Lohasur, Patalkot, 17.x.1992 (Reg. No. 15207).

Distribution : India : Karnataka, Madhya Pradesh, Manipur, Uttar Pradesh, West Bengal ; Asia ; Europe ; Africa and Australia.

Remarks : Superior margin of frontal sclerite angular ; metazona carinate ; prosternum with two rounded tubercles near base ; fore coxae with a basal spot internally ; fore femora without spot; anterior border of hind wing blackish opaque near apex.

6. **Mantis inornata* Werner

1930. *Mantis inornata* Werner, *Proc. zool. Soc. Lond.*, : 689.

Material examined : 1M, Around Jeetham, Rater village, 18.x.1992 (Reg. No. I 15225).

Distribution : India : Uttar Pradesh.

Remarks : Fore coxae without spot internally ; fore femora without any spot ; larger internal spines entirely black ; anterior half of costal area of fore wing reddish brown.

Family EMPUSIDAE

Subfamily EMPUSINAE

Genus *Empusa* Illiger, 1798

7. **Empusa fasciata* Brulli

1832. *Empusa fasciata* Brulli, *Exp. Morie,* **31** (Sec. 2) : 83.

1995. *Empusa fasciata* : Mukherjee et al., *Oriental Ins.*, **29** : 329.

Material examined : 1M, Around Jeetham, Rater village, 18.x.1992 (Reg. No. I 15203) ; 1M, Near Dauripatha village, Patalkot, 16.x.1992 (Reg. No. 15225) ; 1M, Around Semar Jheel, Rater village, 20.x.1992 (Reg. No. I 15248).

Distribution : India : Bihar; Balacan ; Philippines.

Remarks : Pronotum slender, border almost smooth ; fore coxae with a spiniform projection at distal end ; fore femora without lobe and superior edge almost straight ; middle and hind femora without dorsal lobes ; middle and hind coxae with rounded lobes.

ACKNOWLEDGEMENTS

We are grateful to the Director, Zoological Survey of India, Calcutta, for laboratory facilities. We are also thankful to the Officer-in-charge, Central Regional Station, Jabalpur, who has handed over the material to us for study and return.

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Rec. zool. Surv. India : **97** (Part-4) : 49-52, 1999

TWO NEW SPECIES OF *ANAGYRUS* HOWARD (ENCYRTIDAE : TETRACNEMINAE) FROM INDIA

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ABSTRACT : Two new species. viz., *Anagyrus agarwali* and *A. ishaqi* are described in detail with illustrations. Types are deposited in Zoological Museum, Aligarh Muslim University, Aligarh, India.

KEY WORDS : *Anagyrus,* Encyrtidae, Pseudococcid, Tetracnemini and Tetracneminae.

Members of the subfamily Tetracneminae constitute an economically important group of microhymenopterous parasitoids of coccoids. They belong to the tribe Tetracnemini and have tenth tergum with paratergites and fused condition of third valvulae with second valvifers.

Anagyrus agarwali* sp. nov.
(Figs. A & B)

Female : Body yellowish brown except head dark brown, wider than long in facial view, eyes black, frontovertex wider than eye width, ocelli brown, arranged in equilateral triangle. Antennae (fig. A) inserted near oral margin, a ring at apical part and base of scape, apical half of pedicel and second funicle segment pale yellow; club and rest of the funicle segment except first brown; latter, basal half of pedicel and major part of scape blackish-brown; scape about twice and a half times as long as wide; pedicel slightly more than twice as long as wide, slightly shorter than first funicle segment; funicle segments 1-6 longer than wide; first two funicle segments are subequal in length; club 3-segmented, slightly longer than thrice as long as wide, as long as preceding two funicle segments together.

Thorax with axillae meeting medially. Fore wings hyaline, slightly shorter than thrice as long as wide; costal cell long and narrow; marginal vein (fig. B) short, shorter than stigmal vein, latter shorter than postmarginal and marginal vien together. Legs yellowish brown; mid tibial spur slightly shorter than basitarsus.

Abdomen longer than throax, paratergites present; ovipostitor exserted, arising from base of the abdomen.

Body length : 1.6 mm (Including ovipositor)

Holotype ♀, India : Aligarh,ex pseudococcid on wild plant, 09 VI. 1996 (Anis Fatima)

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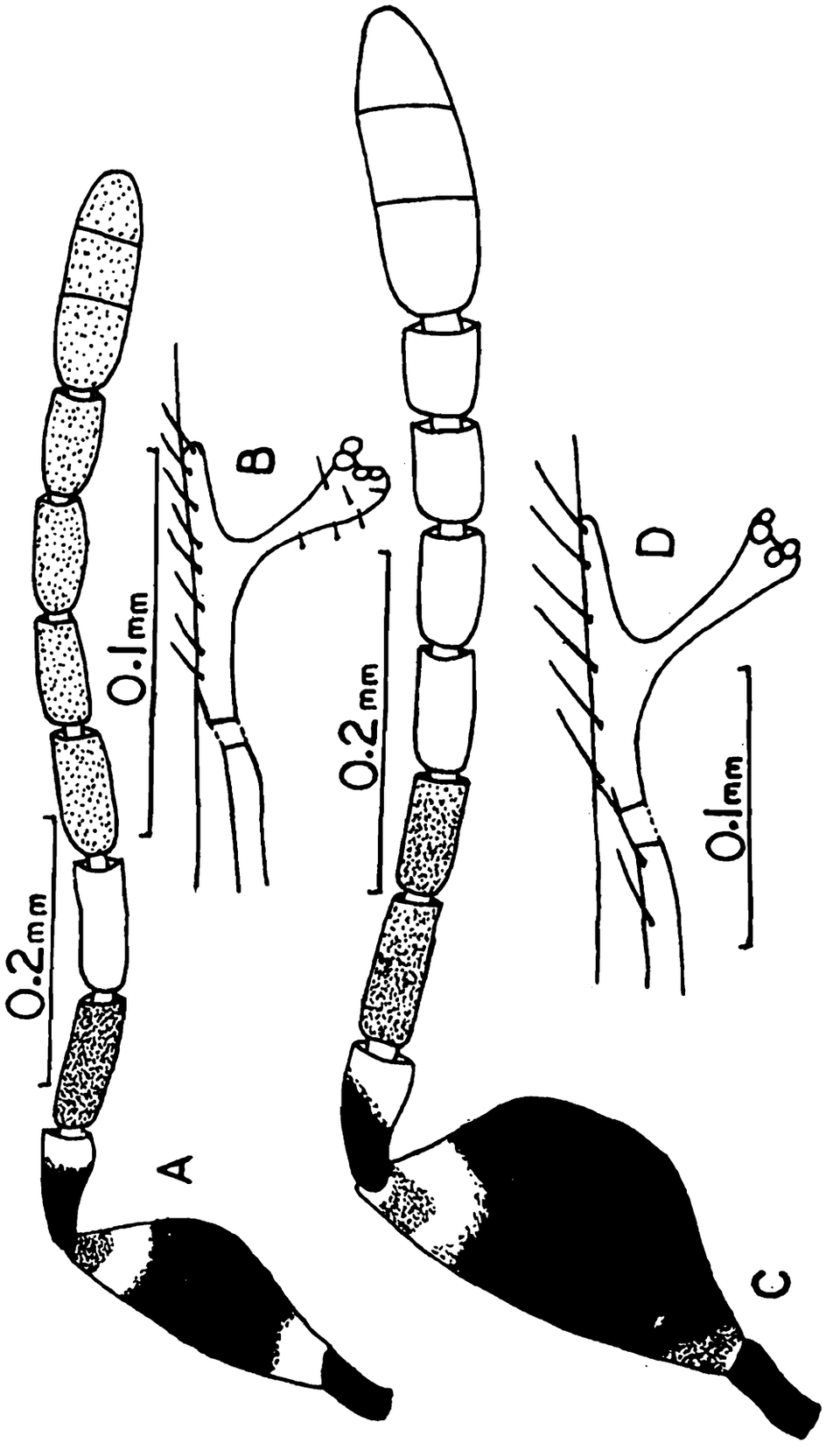
* Named after late Prof. M. M. Agarwal, Department of Zoology, A.M.U. Aligarh.



Figs. A & B *Anagyrus agarwali* sp. n. ♀
A. Antenna ; B. Part of fore wing venation.

Figs. C & D. *Anagyrus ishaqi* sp. n. ♀
C. Antenna ; D. Part of fore wing venation

Comments : The new species *A. agarwali* is closely related to *A. indicus* Shafee, *et al.* in having scape two and a half times as long as wide; club as long as preceding two funicle segments taken together; marginal vein four times as long as wide.

Anagyrus ishaqi sp. nov.
(Figs. C & D)

Female : Body brown. Head hypognathus, wider than long in facial view; eyes dark with transparent setae; frontovertex narrow than eye width; malar space shorter than eye width; ocelli brown arranged in acute angle triangle, lateral ocellus separated from inner margin of eye by its own diameter. Antennae (fig. C) inserted near oral margin, major part of scape, basal half of pedicel and basal two-funicle segments blackish brown to dark brown, rest of the antenna pale yellow; scape much flattened, twice as long as wide; pedicel more than twice as long as wide, as long as first funicle segment, latter segment longest, thrice as long as wide, second and third sub-equal in length, sixth segment shortest; club 3-segmented, thrice as long as wide, as long as preceding three funicle segments together.

Thorax slightly longer than abdomen. Fore wings hyaline, twice and a half times as long as wide; costal cell long; marginal vein (fig. D) longer than post marginal and shorter than stigmal vein, latter shorter than post-marginal and marginal veins together; marginal fringe short, spaced by their one-third of length. Legs yellowish brown.

Abdomen with paratergites; ovipositor slightly exserted, arising from base of the abdomen.

Body length : 1.13 mm (Inculding ovipositor).

Holotype ♀ India : Aligarh ex. pseudococcid on wild plant 31.X.1996 (Musharraf Ali Khan).

Paratype 1 ♀ (same data as above)

Allotype 1 ♂ (same data as above).

Comments : The new sp. *Anagyrus ishaqi* runs well in the key given by Agarwal (1965 : 43) and Shafee *et al.* (1975 : 09) and is closely related to *A. flavidus* Agarwal, it can be separated in having first funicle segment thrice as long as wide, club thrice as long as wide, as long as preceding three funicle segments together; postmarginal vein slightly shorter than marginal vein, shorter than stigmal vein.

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Rec. zool. Surv. India : **97** (Part-4) : 53-59, 1999

SOME OBSERVATIONS ON *GARRA HUGHI* SILAS FROM ANAMALAI HILLS, WESTERN GHATS, TAMIL NADU, INDIA

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A study of the specimens of *G. hughi* collected from Anamalai Hills, and the paratypes of the species, revealed the presence of scales on the dorsum and ventral surface and a high variability in scalation in this species. Since the absence of scales is taken as a key character in the identification of this species, the validity of this character in distinguishing the species of *Garra* is discussed and a revised key to identification of Peninsular species is provided.

Key Words : ***G. hughi,*** squamation, biometry

INTRODUCTION

During the faunistic surveys of Anamalai Hills by SRS/ZSI, from 1996-98 an interesting collection of *Garra* (Plate 1 figs 1,3 & 4) was made. The specimens showed close affinities to *Garra hughi* Silas, (except for the presence of scales on the dorsum and belly) but, did not key to *Garra hughi* on the basis of taxonomic literature available so far (Menon, 1964; Jayaram 1981; Talwar & Jhingran 1991; Rema Devi 1992). Hence the types were examined before establishing the correct identity of this *Garra* from the Anamalai Hills.

A study of two paratypes of *G. hughi* Silas revealed the presence of scales on the dorsum and belly (Plate 1 figs. 2,5,6 & Pl. 2. fig.1), contrary to the established diagnostic feature of this species, since Silas (1952) had figured a paratype with complete absence of scales on the back and belly. To find out whether other differences exist in the specimens from Anamalais, some important biometric characters were recorded and compared with the original description (Silas, (opcit) and those of the paratypes and are presented in Table 1. The data is based on 20 specimens of length range 37.0 to 88.0 mm SL, Reg. No. F. 5330, ZSI/SRS; Paratypes 2 exs., 42.5 & 56.0 mm SL Reg. No. F. 747/2/ZSI Calcutta; and Silas's description, based on 52 specimens 15.02 to 77.0 mm SL. The table shows overlapping of several characters, but for a slight difference in body depth. Since Silas's samples included very small specimens, differences in the mean values and in the range of some characters like diameter of eye (Pl. 1, fig. 2) snout length, width of body, and height of caudal peduncle, were observed. Except for the presence of pre-dorsal and pre-ventral scales in all the specimens examined, no striking differences were observed in the specimens from Anamalais. Another prominent character in *G. hughi* (Silas 1954, p.3) is the presence of minute striations at the edge of the rostral fold which character is also seen in the Anamalai specimens (Plate–2, fig. 3). Silas (opcit) remarks that the scales on the upper half of the

body especialy towards the dorsum have very dark bases and light margins. In the specimens from Anamalai also scales on the dorsum with dark bases are seen as two alternating or oblique rows of spots (Plate 1. Figs. 3 & 4).

Since absence of scales is considered a diagnostic character in the identification of *Garra hughi*, and since the paratypes of *G. hughi* showed the presence of pre-dorsal scales, the variation in squamation in the different *Garra* species were compared (Table 2 ; Menon 1964). A revised key to the identification of the peninsular forms based on these observations is provided.

DISCUSSION

Scales in *Garra* are absent in some species, especially the African and Himalayan forms, in certain areas of the body like the dorsum, chest and belly and post pelvic regions. The scales are more commonly absent on the chest and belly; in a few species on the back, and in a lesser number of species in the post-pelvic region also. The absence/presence of scales in the 37 species described by Menon 1964 and the four species discovered subsequently, viz. *G. menoni* (Rema Devi & Indra, 1984), *G. manipurensis* (Waikhom & Sarojnalini, 1988), *G. kalakadensis* (Rema Devi, 1992) and *G. surendranathanii* (Shaji et. al. 1996), is given in Table 2. It is seen that the scales are completely absent on the back, chest, belly and post pelvic regions only in 2 species viz. in *G.ignesti* (Africa) & to a certain extent in *G. rupecula* (Manipur & Assam).

The only peninsular species reported to be sharing this character is *G.hughi*. From the present study it is seen that this is a highly variable character in this species as observed in the specimens collected from Anamalais, the same hill ranges from where *G. hughi* was discovered by Silas in 1954, and in the two paratypes examined. In 15 other species scales are reportedly absent in one or more areas mentioned earlier, and 23 species have been described as being fully scaled. Of the 17 species known from India, 8 species are found in the Peninsula and in these species it is a highly variable feature especially in the four species in which scales are lacking on the dorsal/ ventral surfaces of the body. Scales are absent on chest and belly in *G. menoni*, on the chest and to a certain extent on the belly in *G. surendranathanii* and *G.kalakadensis*, and in *G.hughi* though reported to be absent on the dorsum, chest, belly and post pelvic, are found to be present, sometimes being sub-cutaneous. In all the 4 species mentioned above, it is consistently absent on the chest alone, other regions exhibiting presence or absence. Even Silas 1954, remarked on the variable nature of this character in his paper as follows, "The scales *totally absent* on the ventral surface as far back as and between the base of the pelvic fins. In a few specimens the scaleless area extends still further backwards to the origin of the anal fin. But generally in this post—pelvic area a few ill-defined scales almost completely embedded in the skin can be made out on carefull examination. On the dorsum, the scales are generally absent in a broad streak from the occiput to origin of the dorsal fin. In a few examples the scaleless area is seen to extend along the entire dorsal surface as a broad streak from the occiput to the base of the caudal fin. This condition has been figured from one of the paratypes *vide* (Plate, 1, fig 4). In such specimens careful examination has shown the presence of two or three scattered scales almost completely embedded in the integument in the post-dorsal region. In a few small examples rudimentary scales are also noticeable in part of the pre-dorsal area, generally more towards the base of the dorsal fin."

Though the absence of scales, in combination with certain other characters, was used in the diagnosis of *G. hughi* by Silas, subsequent workers used the absence of scales as a key character in distinguishing *G.hughi*. The two paratypes 42.5 & 56.0 mm SL of *G. hughi* revealed the presence of 9 pre-dorsal and 6 pre-anal scales, paradoxically the figured scaleless specimen of Silas is also 56 mm SL. In all the 20 specimens from Anamalai Hills, about 12-14 pre-dorsal and 0 to 5 pre ventral scales were observed.

Key to the peninsular species of **Garra**

1. a. One pair of barbels; proboscis trilobed.....*G. bicornuta* Rao

   b. Two pairs of barbels; proboscis may or may not be present.....2

2. a. Proboscis present.....*G. gotyla stenorhyrchus* Jerdon

   b. Proboscis absent 3

3. a. Body with lateral blotches ..... *G. suerndranathanii* Shaji, Arun & Easa

   b. Body without blotches 4

4. a. Depth of body about 5 or more than 5 times in SL 5

   b. Depth of body less than 5 times in SL 7

5. a. Snout with tubercles, about 2 times in head length; PD 8 to 10; rostral fold not demarcated from upper lip .....*G. mcClellandi* (Jerdon)

   b. Snout without tubercles, more than twice in HL, PD more than 10, rostral fold demarcated from upper lip 6

6. a. Lateral line scales 32-36; eye comparatively bigger, about 5.5 times in HL; HL less than 4 times in SL; PD scales 11-13... .....*G. menoni* Rema Devi, & Indra

   b. Lateral line scales 36–38; eye small about 6.5 times in HL; HL 4 times in SL; PD scales 0-14 ..... *G. hughi* Silas

7. a. Distance from vent to anal fin base less than 4 times in that between anterior origion of pelvic and anal fin; mental disc small, width about twice in head width ..... *G. mullya* Sykes

   b. Distance from vent to anal fin base more than 4 times in that between anterior origin of pelvic and anal fin; mental disc large, width less than twice head width. ....*G. kalakadensis* Rema Devi

ACKNOWLEDGEMENTS

We wish to thank the Director ZSI, Dr. J. R. B Alfred and the Joint Director & Officer-in-charge, Dr. P. T. Cherian, for providing necessary facilities, and especially to the latter for improving on the paper. We also wish to thank Dr. A. G. K. Menon, for critically going through the manuscript. Our special thanks are due to Dr. M. S. Ravichandran for collecting the specimens.

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Table 1. Comparison of morphometric characters of *Garra hughi* Silas 1954 with the specimens from Anamalai Hills and those of paratypes of *G. hughi*.

		Anamalai specimens N = 20		*Garra hughi* Silas 1954		*G. hughi* Silas paratypes N = 2	
Sl. No.	Characters	Range	Mean	Range	Mean	Range	Mean
1.	TL/HL	4.51-5.52	5.03	4.222-5.588	4.914	4.91-5.15	5.04
2.	TL/Depth of body	6.07-7.42	6.88	5.900-8.000	6.862	7.64-8.00	7.82
3.	TL/width of body	6.97-8.09	7.35	6.545-9.500	8.194	6.50-6.60	6.65
4.	TL/Caudal fin length	4.10-6.37	4.75	4.181-5.750	4.789	4.40-5.67	5.03
5.	SL/HL	3.65-4.38	3.97	3.444-4.307	3.870	3.79-4.24	4.01
6.	SL/Depth of body	4.93-5.82	5.45	4.600-6.454	5.428	6.29-6.44	6.36
7.	SL/Width of body	5.52-6.46	5.81	5.272-7.500	6.473	5.20-5.40	5.30
8.	SL/Predorsal dist.	1.77-2.11	1.97	1.875-2.111	2.000	1.98-2.09	2.04
9.	SL/Postdorsal dist.	1.70-2.11	1.98	1.838-2.090	1.960	1.89-1.98	1.93
10.	SL/Prepelvic dist.	1.75-2.07	1.94	1.812-2.058	1.946	1.96-2.01	1.98
11.	SL/Postpelvic dist.	1.93-2.32	2.06	1.944-2.400	2.052	1.99-2.04	2.01
12.	SL/Caudal fin length	2.39-4.69	3.61	3.181-4.750	3.789	3.40-4.66	4.03
13.	HL/Width of head	1.25-1.54	1.33	1.166-1.800	1.370	1.28-1.32	1.30
14.	HL/Depth of head	1.66-1.94	1.77	1.272-2.000	1.750	1.89-1.90	1.89
15.	HL/Snout	1.84-2.10	1.93	1.833-4.500	2.346	1.94-2.20	2.07
16.	HL/ED	5.05-7.73	6.59	3.250-7.500	5.358	5.60-6.29	5.94
17.	Snout length/ED	2.50-4.00	3.34	0.800-4.000	2.492	2.55-3.24	2.88
18.	I.O.W./ED	2.05-3.38	2.89	1.166-3.250	2.339	2.35-2.67	2.51
19.	HL/Height of Dorsal	1.38-1.74	1.57	1.250-1.714	1.471	1.40-1.47	1.43
20.	HL/Length of pectoral	1.07-1.29	1.20	1.000-1.666	1.150	1.05-1.10	1.07
21.	HL/Length of pelvic	1.18-1.54	1.40	1.269-1.666	1.431	1.29-1.33	1.31
22.	HL/Length of anal	1.70-2.08	1.87	1.500-1.875	1.710	1.69-1.81	1.75
23.	Length of CP/ Height of CP	1.17-1.60	1.36	1.500-2.00	1.729	1.53-1.55	1.54
24.	Post dorsal dist./ Predorsal dist.	0.95-1.07	1.01	0.950-1.148	1.020	1.00-1.10	1.05
25.	Depth of body/ Height of dorsal	1.00-1.33	1.15	0.875-1.200	1.055	0.87-0.95	0.91
26.	Width of mental disc/ Length of mental disc	1.15-1.42	1.31	1.142-1.625	1.407	1.48-1.60	1.54

Table 2. Squamation in *Garra* species
(Based on data in Menon, 1954)

Sl. No.	Species	Back	Chest	Belly	Post pelvic scales	Pre dorsal scales	L.I.	Distribution
1.	*Garra variabilis* (Heckel)	+	+	+	+	12-14	34-38	Asia : Syria, Iraq
2.	*G. rossica* (Nikolsky)	–	–	–	+	–	34-38	Asia : Baluchistan Afghanistan & E. Persia.
3.	*G. tibanica* Trewavas	+	+ N.O.	+ N.O.	+	10-14	31-36	Asia: S.W. Arabia, Africa
4.	*G. quadrimaculata* (Ruppell)	+	+ N.O.	+ N.O.	+	13-14	34-36	Africa
5.	*G. ignestii* (Gianferrari)	–	–	–	–	–	36	Africa
6.	*G. ornata* (Nichols & Griscom)	+	–	±	+	0/9-10	36-37	Africa
7.	*G. trewavasi* Monod	+	–	±	+	0/5	36	Africa
8.	*G. makiensis* (Boulenger)	+	+	+	+	13	38-42	Africa
9.	*G. dembeensis* (Ruppell)	±	–	±	+	0/4-10	38-42	Africa
10.	*G. ethelwynnae* Menon	–	–	–	+	–	32-34	Africa
11.	*G. rufa rufa* (Heckel)	+	+ N.O.	+ N.O.	+	11-13	34-38	Asia : Syria & Palestine
12.	*G. rufa obtusa* (Heckel)	+	–	+	+	9-12	32-36	Asia : Persia, Iraq, Armenia
13.	*G. barreimiae* Fowler & Steinitz	+	–	+	+	12	33-34	Asia : Arabia, Oman
14.	*G. lamta* Hamilton	+	+R	+	+	8-10	31-34	Asia : N. E. India, Nepal, Sikkim
15.	*G. mullya* (Sykes)	+	+R	+	+	9-11	32-34	Asia : India (except N.E.)
16.	*G. ceylonensis ceylonensis* Bleeker	+	+R	+	+	9-11	32-34	Asia : ceylon.
17.	*G. c. phillipsi* Deraniyagala	+	+R	+	+	9-11	32-34	Asia : Ceylon
18.	*G. annandalei* Hora	+	+R	+	+	9-10	33-34	Asia : N. E. India, Nepal
19.	*G. lissorhynchus* (McClelland)	+	–	–	+	11-14	32-35	Asia : N. E. India.
20.	*G. rupecula* (McClelland)	–	–	–	–	–	32-34	Asia : India : Manipur & Assam.
21.	*G. taeniata* Smith	+	+	+	+	9-10	32-33	Asia : Siam; Malaya.

Sl. No.	Species	Back	Chest	Belly	Post pelvic scales	Pre dorsal scales	L.I.	Distribution
22.	*G. borneensis* (Vaill)	+	+	+	+	9-10	28-31	Asia : Borneo
23.	G. Yunnanensis (Regan)	+	+	+	+	16	40	Asia : China·
24.	*G. gracilis* (Pellegrin & Chevey)	+	+	+	+	9-11	36-38	Asia : Indo-China.
25.	*G. naganensis* Hora	+	+R	+	+	12-14	38-40	Asia : India : Naga Hills, Assam.
26.	*G. kempi* Hora	+	–	+R	+	12-14	38-40	Asia : India : Assam.
27.	*G. mcClellandi* (Jerdon)	+	+	+	+	8-10	35-38	Asia : P. India : W. Ghats.
28.	*G. hughi* Silas	±	–	±	±	0-14	36-38	Asia : P. India : W. Ghats.
29.	*G. imberbis* Vinciguerra	+	+	+	+	16	44-45	Asia : Burma, Indo-China
30.	*G. imberba* Garmann	–	+	+	+	–	48-52	Asia : China, Indo-China.
31.	*G. gotyla gotyla* (Gray)	+	+	+	+	9-10	32-35	Asia : N. E. India, Pakistan, Burma
32.	*G. g. stenorhynchus* (Jerdon)	+	+	+	+	8-10	32-35	Asia : P. India : W. Ghats.
33.	*G. rhynchota* Koller	+	+	+	+	9-10	33-34	Asia : China.
34.	*G. nasuta* (McClelland)	+	+	+	+	9-10	33-34	Asia : India : Assam; Burma ; S. Indo-China.
35.	*G. notata* (Blyth)	+	–	–	+	14-16	34	Asia : Burma.
36.	*G. gravelyi* Annandale	+	+	+	+	8-9	32-34	Asia : Burma.
37.	*G. bicornuta* Rao	+	+	+	+	8-9	31-32	Asia : P. India : W. Ghats, Thunga System.
38.	*G. menoni* Rema Devi & Indra	+	–	–	+	11-13	32-36	Asia : P. India : W. Ghats.
39.	*G. manipurensis* Vishwanath & Sarojnalini	+	–	+	+	10-11	34	Asia : N. E. India, Manipur.
40.	*G. kalakadensis* Rema Devi	+	+R	±	+	9-11	31-33	Asia : P. India : W. Ghats.
41.	*G. surendranathanii* Shaji, Arun & Easa	+	–	±	+	11-12	35-36	Asia : P. India : W. Ghats.

Explanation of abbreviations/signs

+ Present ; ± Partially present/absent ; – Totally absent ; R. Reduced ; N.O. Not overlapping.

PLATE-1

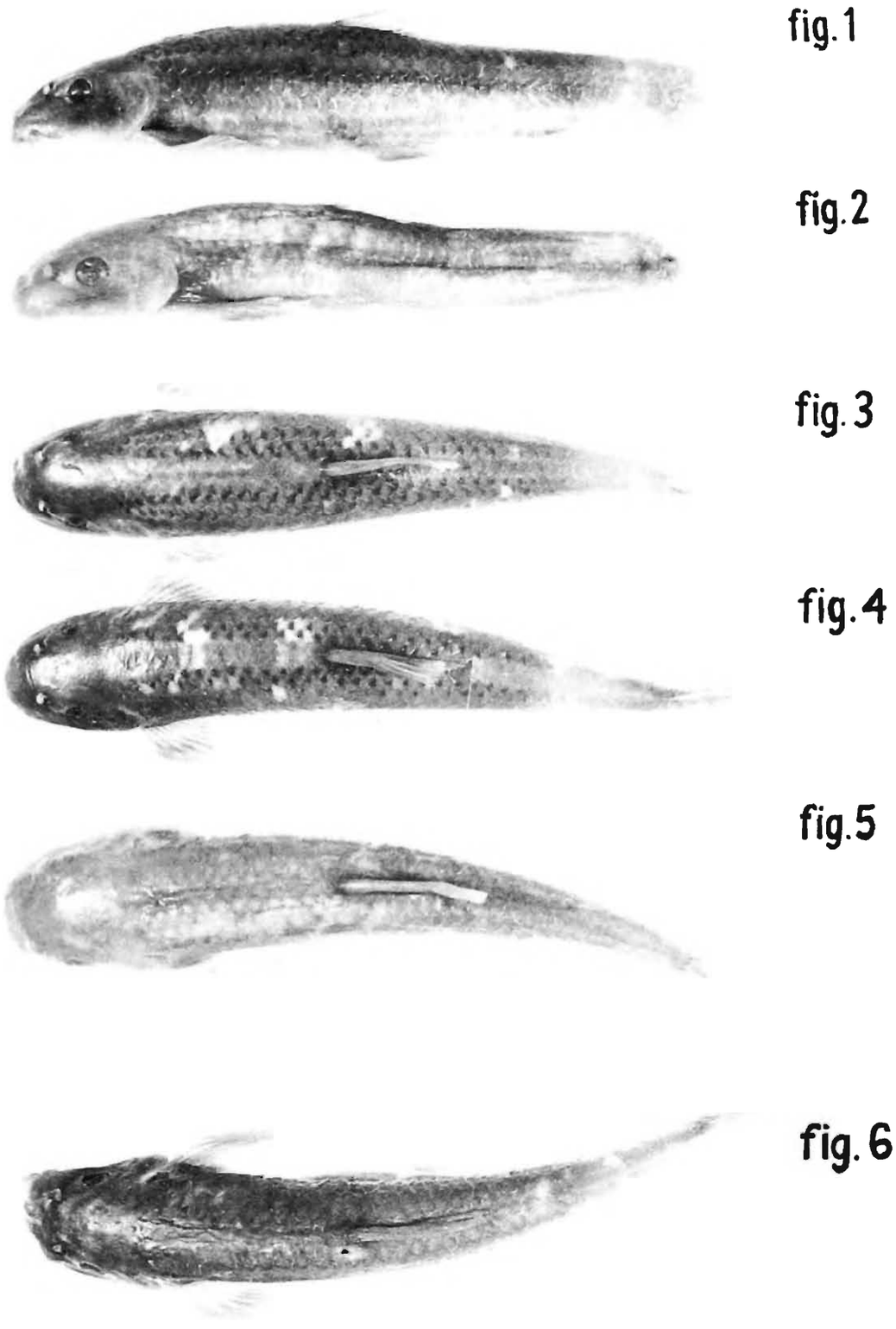

Fig. 1. Lateral view of *G. hughi,* 70.0 mmSL, from Anamalai Hills. (Eyes are proportionately smaller in in larger specimens)

Fig. 2. Lateral view of paratype of *G. hughi,* 42.5 mmSL (Eyes are larger in smaller specimens).

Fig. 3. Dorsal view of *G. hughi,* 70.0 mmSL from Anamalai Hills.

Fig. 4. Dorsal view of *G. hughi,* 80.0 mmSL from Anamalai Hills.

Fig. 5. Dorsal view of *G. hughi,* paratype, 42.5 mmSL

Fig. 6. Dorsal view of *G. hughi,* paratype, 56.0 mmSL.

PLATE-2

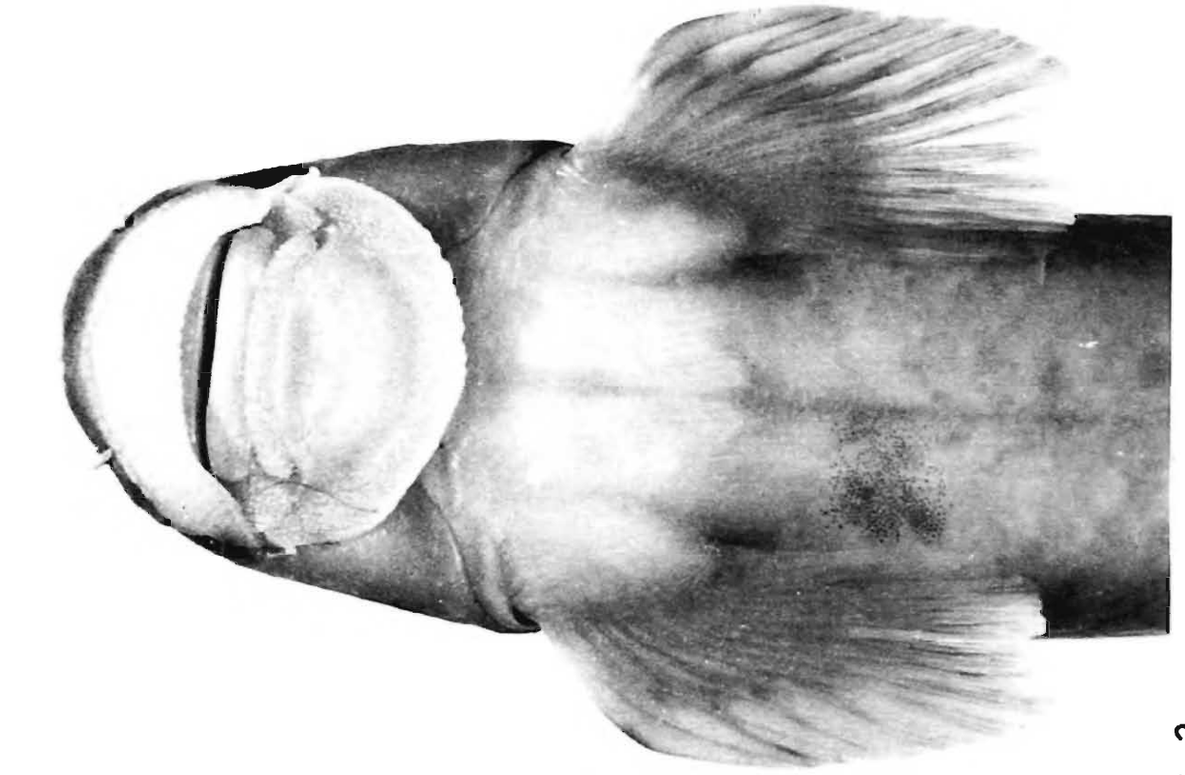

fig.3

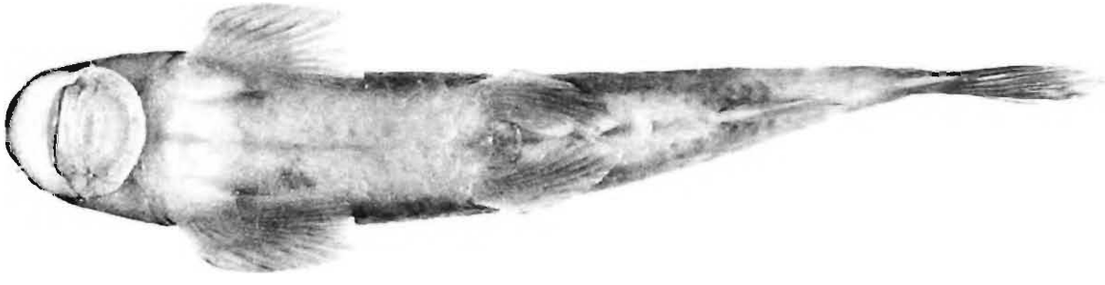

fig.2

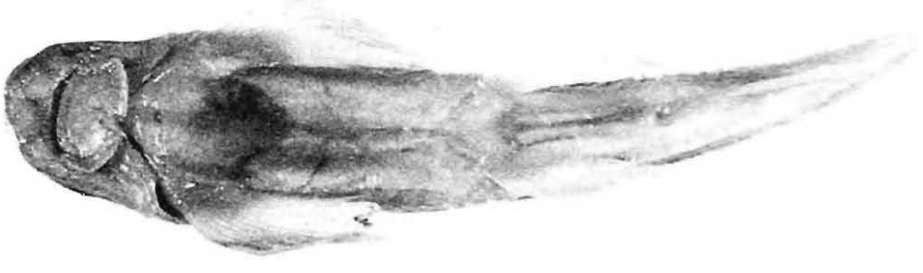

fig.1

Some observations on *Garra hughi* Silas from Anamalai Hills, Western Ghats, Tamil Nadu, India.

Fig. 1. Ventral view of paratype of *G. hughi,* 42.5 mmSL.

Fig. 2. Ventral view of *G. hughi*, 80.0 mmSL, from Anamalai Hills.

Fig. 3. Ventral view of *G. hughi,* 80.0 mmSL, showing striations at the edge of rostral fold.

Rec. zool. Surv. India : **97** (Part-4) : 61-63, 1999

PUNTIUS CHALAKKUDIENSIS, A NEW COLOURFUL SPECIES OF *PUNTIUS* (FAMILY : CYPRINIDAE) FISH FROM KERALA, SOUTH INDIA

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INTRODUCTION

From the upper reaches of the Chalakkudi river in Trichur District, Kerala State of South India two specimens of a colourful *Puntius* fish were collected in the year 1972 by the junior author, Dr M. P. Thobias. Resembling the popular aquarium fish *Puntius denisonii* Day at first glance, a closer examination revealed that they were quite distinct from *P. denisonii ;* they are here described as a new species. The Chalakkudi river, about 145 km. in length, originates from the high, evergreen, tropical mountains of the Anamalai and Nelliampathi ranges of the Western Ghats, flows westwards and finally drains into the Arabian Sea (see Map).

Puntius chalakkudiensis, sp. nov.

Holotype.- F. 3749, Southern Regional Station, Zoological Survey of India, Madras, 125.0 mm SL, Chalakkudi river, Western Ghats, Trichur, Kerala, India, 1972.

Paratype.- 1, F. 3750, 116.0 mm SL, same data as holotype.

Diagnosis.- *P. chalakkudiensis* is distinguishable from all other *Puntius* species by its inferior mouth (terminal or subterminal in all other species) and from *P. denisonii* by the distinctive black blotch on its dorsal fin.

Description.- Proportional measurements in SL: Head 4.51 (4.41-4.61), body depth 3.45, predorsal 2.16 (2.05-2.28), postdorsal 1.87 (1.84-1.90), preventral 1.95 (1.92-1.99), preanal 1.35 (1.34-1.36), distance from pectoral to pelvic origin 3.42 (3.40-3.44), from pelvic to anal 3.88 (3.82- 3.94) and length of body cavity (distance between pectoral base and anus) 1.98 (1.93-2.04).

Proportional measurements in HL: width of head 1.81 (1.73-1.89), its depth 1.38 (1.34-1.42), snout length 2.48 (2.44-2.53), eye 4.17 (3.92-4.43), interorbital width 2.76 (2.64-2.89).

One pair of maxillary barbels, 1.15 (1.13-1.17) in eye diameter, reaching to middle of eye when stretched. Mouth small, semicircular, inferior, width of mouth 2.36 (2.33-2.39) in width of head. Height of caudal peduncle 1.78 (1.77-1.80) in its length.

Fins.- Dorsal fin II, 8; ventral 1,7 ; anal fin II, 5; pectoral 1,15; caudal 19. The free margin of the dorsal fin is concave and commences slightly in front of the ventral; it is situated nearer snout than caudal base; predorsal distance 1.15 (1.08-1.23) in postdorsal distance; length of dorsal fin 1.09 (1.06-1.13), pectoral fin 1.25 (1.21-1.30), ventral 1.26 (1.25-1.27), anal 1.40 (1.35-1.45), caudal fin 0.80 (0.79-0.82) in head length.

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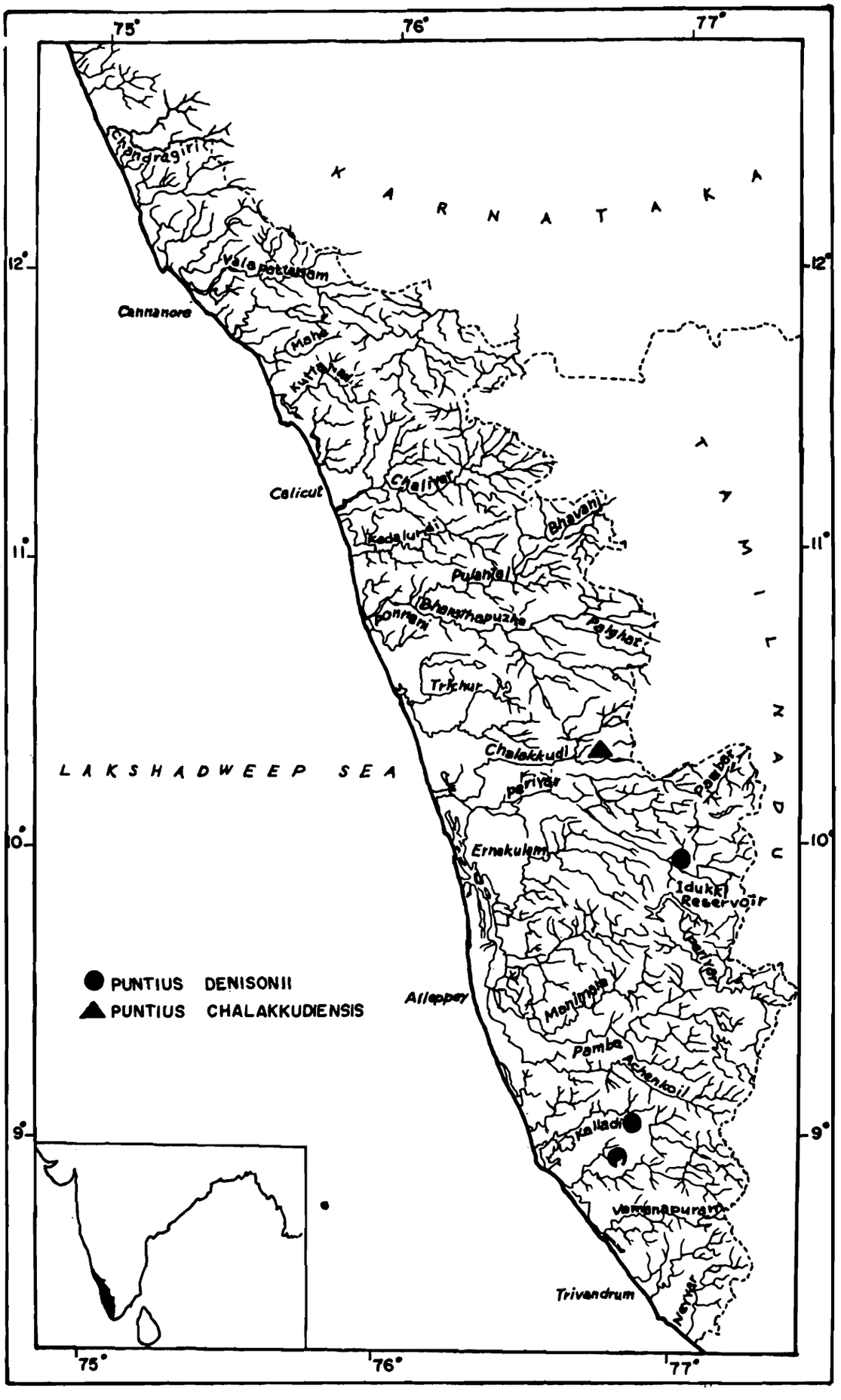
* St. Thomas College, Trichur.



Map of Kerala showing collection spot

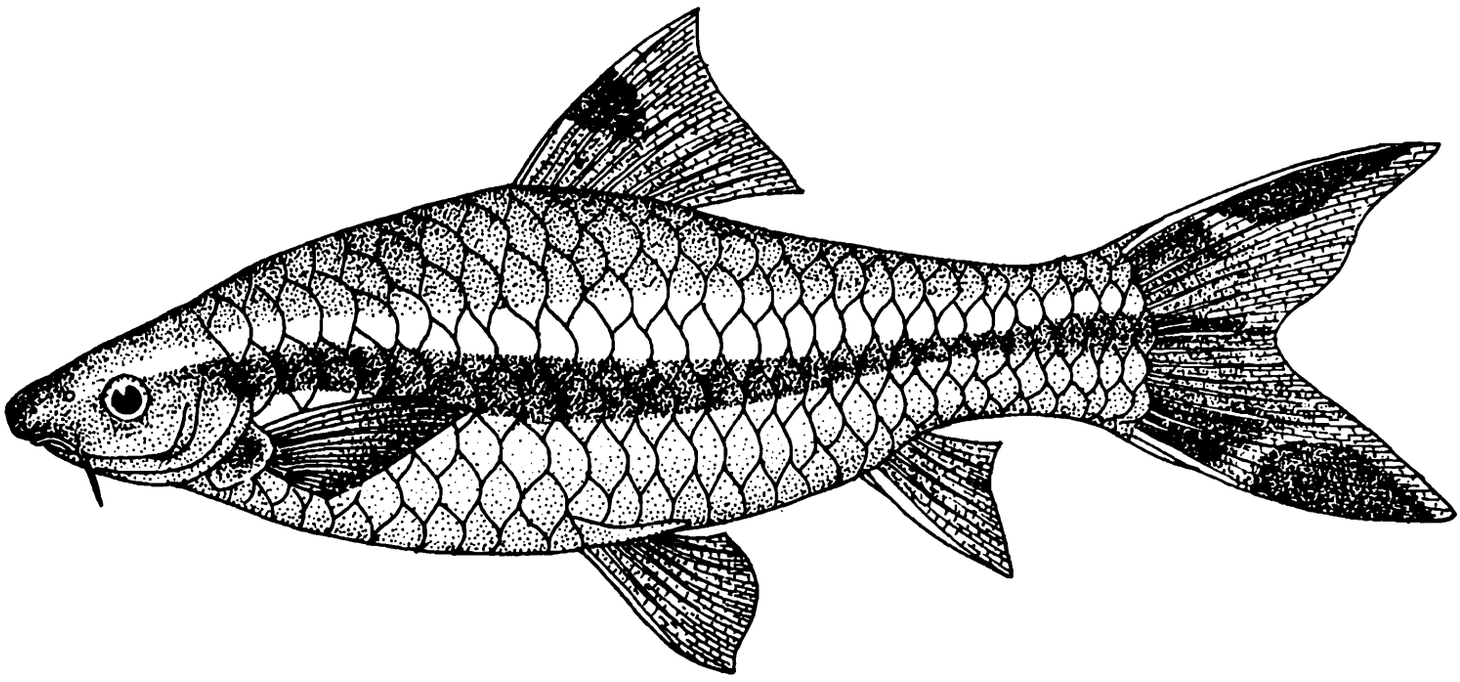


Fig. 1. Lateral view of *P. chalakkudiensis* sp. nov. (125.0 mm SL)

Scales.-Lateral line scales 28; $5/2^{1}/_{2}$ - 3 scales in a transverse series from base of first dorsal fin spine to base of first anal fin spine; 9 scales before the origin of dorsal fin.

Gill rakers. - 10 gill rakers on the first gill arch.

Colouration. - Body silvery with a black band from the snout to the base of the caudal fin; a pale scarlet stripe above this; caudal fin with an oblique dark band crossing the posterior third of each lobe; dorsal with a dark mark in the middle of the outer surface extending upto the second branched rays.

Comparison. - As mentioned earlier, this fish bears resemblance to *P. denisonii.* Howerver, it can be easily distinguished by the inferior position of its mouth, the longer snout and the distinctive black blotch on the dorsal fin.

Distribution. - Chalakkudy River, Western Ghats, Kerala, South India.

Etymology. - Named after the river where it is found.

ACKNOWLEDGEMENT

The authors are grateful to Dr J. R. B. Alfred, Director, Zoological Survey of India and Dr P. T. Cherian, officer incharge, Southern Regional Sttation, Zoological Survey of India, Chennai, for providing necessary facilities.

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TWO NEW SPECIES OF GENUS *SIOBLA* CAMERON (HYMENOPTERA : TENTHREDINIDAE) FROM INDIA AND A REVISED KEY TO THE INDIAN SPECIES

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INTRODUCTION

Genus *Siobla* was erected by Cameron (1877) taking *S.mooreana* as its type species. Later, in 1934 Malaise added another species i.e. *S. turneri* to this genus. However, while reviewing this genus from South East Asia in 1945, he, in addition to lowering species status of *S. punctata* Cameron 1899 to sub species level i. e. *S. mooreana punctata* Cameron 1899, raised another sub species *S. mooreana melaena* from Myanmar. Five new species were added to this genus by Saini *et al.*, 1985, thus raising the total to seven. In the present text, two new species are described and *S. mooreana punctata* malaise has been raised to species level after taking some morphological and external genitalia differences into consideration. The types of new species are presently with the authors, but will be submitted to IARI, PUSA, National Collections, New Delhi.

Remarks :

Genus *Siobla* Cameron is having a typical wing venation of Subfamily Tenthredinine, but cross vein of anal or lanceolate cell is long and strongly oblique. The genus is represented by following sum of characters ; supra antennal pit wide and deep, inner margins of eyes strongly converging downwards ; clypeus flat with truncate anterior margin ; antennae stout, some what compressed ; border of meso-sternum with blunt carina ; mesosternum without thorns ; hind legs large and knees surpassing apex of abdomen ; subapical tooth of claw much longer than apical one.

Abbreviations :

AST = Anterior subbasal tooth, CL = Clypeus, GP = Gonostipes, H = Harpe, IATS = Inner apical tibial spur, ICD = Intercenchri distance, IDMO = Interocular distance at the level of median ocellus, ITD = Intertegular distance, LB = Labrum, LID = Lower interocular distance, MB = Metabasitarsus, OATS = outer apical tibial spur, OCL = Ocello –occipital line, PNS = Parapenis, POL = Postocellar line, PST = Posterior subbasal tooth, VC = Valviceps, VV = Valvura.

Key to the Indian species of Siobla

1. Body wihout metallic lustre 2

— Body metallc blue except four apical antennal segments which are black ; brownish black are : labrum palpi, tarsi of four front legs ..... *S. infuscata* Saini *et al.*

2. Antenna bicoloured or entirely black ; atleast frontal area including ocelli and entire mesopleura black 3

— Antenna reddish yellow ; extremely narrow dark brown stripe encircles each ocellus, only dorsal border of mesopleuron brownish black ..... *S. kalatopi* Saini *et al.*

3. Fore wing distinctly infuscated towards apex 4

Fore wing hyaline or uniformly infumated 5

4. Labrum ; clypeus ; base of mandibles ; apical four antennal segments ; pronotal upper and lower angles ; scutellum ; appendage ; post-scutellum ; middle of broad hind margin of propodeum entire ; 2nd tergite ; lateral spots on 3rd tergite ; four front legs except basal $^{3}/_{4}$ th of their coxae and broad outer stripes on femora ; metaleg except basal $^{3}/_{4}$ th of metacoxa, apical $^{3}/_{4}$ of femora and apical 1/3rd of metatibia, pale ..... *S. mooreana* Cameron (Fig. 1,5,9)

– General body colour black except labrum ; four apical antennal segments ; anterior aspects of four front legs ; basal half of metatibia and all meta tarsal segments fulvous ; posterior angles of pronotum, pale ..... *S. punctata* Cameron

5. Antenna black ; clypeus truncate ; lower interocular distance equal to eye length ..... *S. malaisei* Saini *et al.*

– At least apex of antenna fulvous ; clypeus truncate to narrowly rounded or with irregular anterior margin ; lower interocular distance more than eye length 6

6. Only extreme apex of antenna paler ; hind trochanters black ..... *S. turneri* Malaise.

– At least 4 apical joints of antenna and hind trochanters pale to fulvous 7

7. Head distinctly punctured ; pro and mesonotum punctured like head ; few large and shallow punctures on apex of scutellum and along its antero-lateral tangent lines 8

– Head covered with minute, dense but shallow punctures ; pro-and mesonotum covered with scattered punctures ; few large and isolated punctures on posterior slope of scutellum 9

8. Legs pale yellow except most of all coxae ; posterior aspects of four front femora ; extreme tips of four front tibiae ; metafemora except basal 1/3rd and apical 1/3rd of metatibia fulvous to black. Entire abdomen black ..... *S. bengalensis* Saini *et al*

– Legs except coxae entirely fulvous ; 1st and 2nd abdominal tergites entirely and large spots on lateral sides of 3rd, fulvous ..... *S. darjeelingia* Saini, *et al.*

9. Antenna longer than head and thorax combined, 1st and 2nd antennal segment each longer than broad ; head entirely black ; pro-, meso-and metalegs with distal tip of coxae entirely fulvous ; in male only the basal half of metatibia and all metatarsal joints yellowish to fulvous ..... *S. harpeata,* sp. nov.

– Antenna as long as head and thorax combined, 1st antennal segment as long as broad, 2nd segment longer than broad ; fulvous frontal spot covering narrow inner orbits ; hind orbits ; temples and postocellar area ; four front legs except coxae, metaleg except coxa and femora fulvous ; in male head entirely black ..... *S. scapeata,* sp. nov.

Siobla punctata Cameron, 1899
(Fig. 13,2,6,10)

Siobla mooreana punctata Malaise, 1945 : *Opus. Ent. Suppl* : 122.

Female : Average length : 11 mm. General colour of body black ; posterolateral aspects of pronotum sordid whitish. Fulvous are : four apical antennal segments more or less, labrum, 9th abdominal tergite, anterior aspects of four front legs except base of coxae, femora and metatarsi Wings hyaline except infuscated apical margin upto proximal end of stigma. Stigma and venation dark brown to black.

Clypeus roundly truncate (Fig. 13) ; labrum convex with deflexed rounded anterior margin ; malar space 1.1 x diameter of an ocellus ; inner margins of eyes emarginate and slightly converging downwards ; LID : IDMO : EL = 1.5 : 3.0 : 2.3 ; OOL : POL : OCL = 1.0 : 0.75 : 1.0. Antenna longer than head and thorax combined ; 1st and 2nd antennal segments each longer than broad ; 3rd and 4th as 4 : 3 ; 4 to 9 slightly decreasing in length ; frontal area raised almost to level of eyes ; supraantennal tubercles moderately raised and confluent with frontal ridges ; median fovea broad and shallow with uneven bottom ; circum, inter and postocellar furrows sharp, lateral ones sunken, almost reaching hypothetical hind margin of head ; postocellar area as long as broad. Head carinated and converging behind eyes. Scutellum roundly raised with blunt apex. IATS : MB : OATS = 2.0 : 3.8 : 1.7.

Head on and around frontal area with dense minute but distinct punctures, surface between punctures less than the diameter of each puncture. Hind orbits covered with very fine and scattered punctures, area subshining. Mesonotum with minute, shallow and scattered punctures. Anterior slope of scutellum almost impunctate, smooth and shining, posterior slope with dense and deep punctures. Appendage impunctate. Mesepisternum densely rugosely punctured. Mesosternum covered with very fine, minute and shallow punctures. Metepisternum finely punctured along dorsolateral aspect. Abdomen impunctate shining. Body covered with silvery pubescence.

Female lancet with 11 serrulae, as in figure.-2

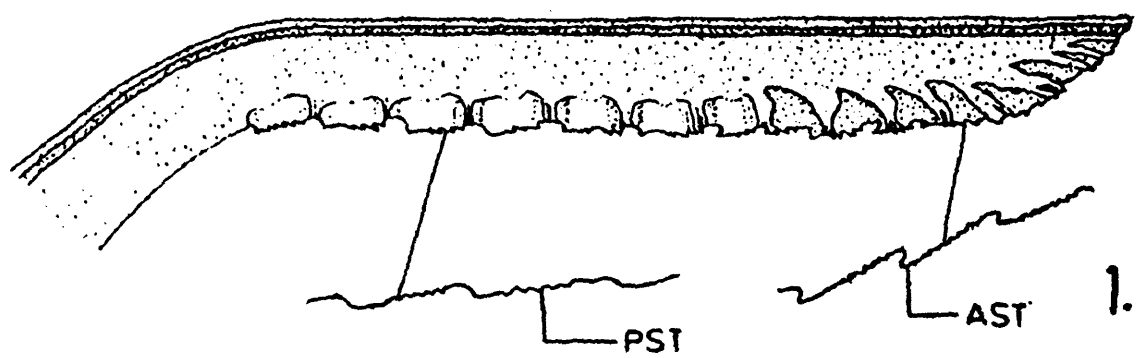
Male : Average length : 9.5 mm. Similar to female except following differences ; antenna may be entirely black, colour of both clypeus and labrum may be fulvous, scutellum may be partially to completely fulvous.

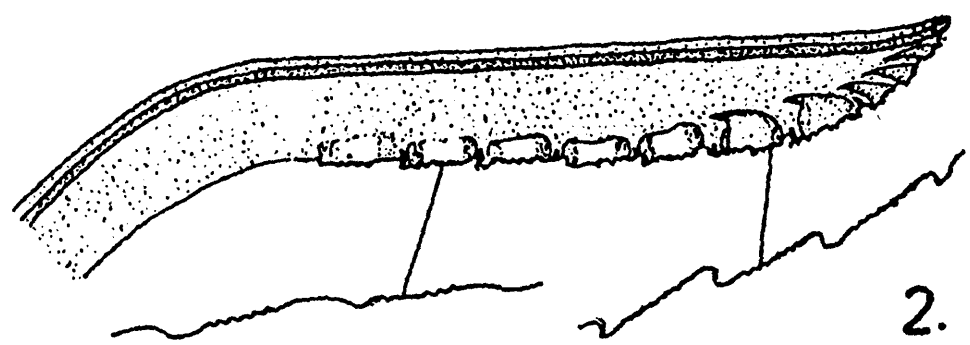
Penis valve Fig.—6

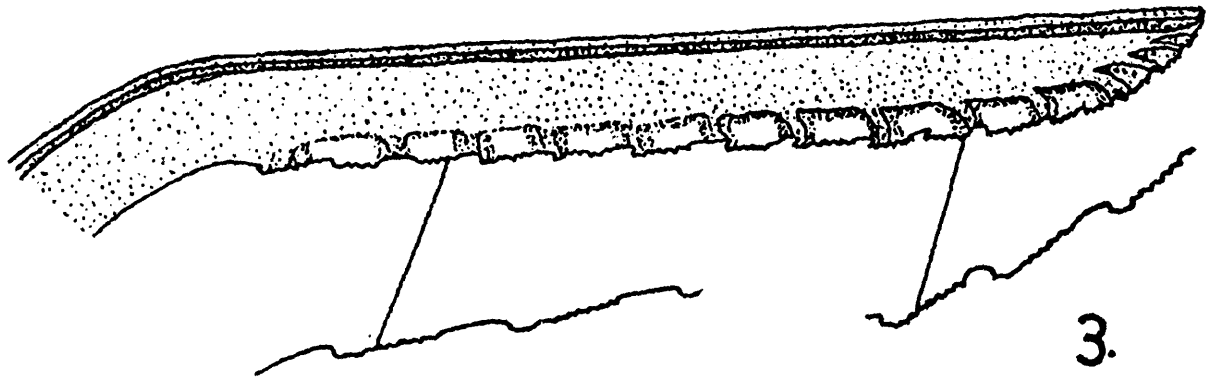
Gonoforceps Fig.—10

Specimens Examined : 1♀, 16♂♂ Nagaland, Pfutsero, 2400 M, 18. V. 93, 2 ♀♀ Manipur, Ukhrul, 1700 M, 15.VI.94. 12 ♀♀ Meghalaya, Cheerapunji, 1470 M, 20.IV.94, 10♀♀ Uttar Pradesh, Mandal, 2500 M, 19. VI. 87, 24♂♂ Himachal Pradesh, Kalatop, 2400 M 22. VII. 82,20♂♂ Himachal Pradesh, Kalatop, 2400 M 16.VI.84.

Population Variation : Males of this species exhibit considerable amount of variations as colour of four front legs except bases of coxae and a broad stripe on posterior aspect of femora, basal 3/5th of all tibiae and tarsii varies from fulvous to black and wings may be entirely infumated.







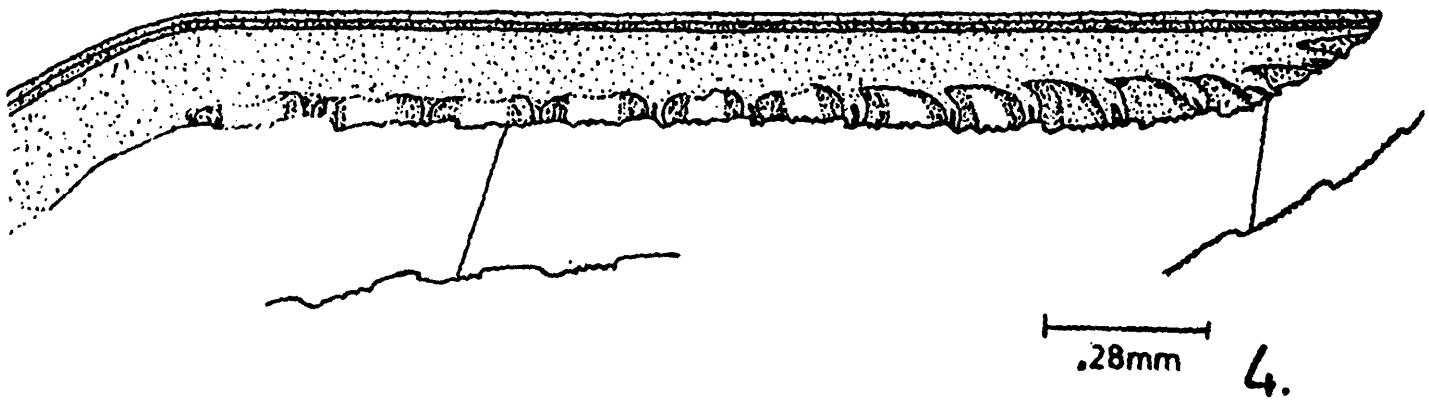


Fig. 1. Lancet of *S. mooreana* ; **Fig. 2.** Lancet of *S. punctata* ; **Fig. 3.** Lancet of *S. harpeata* sp. nov. ; **Fig. 4.** Lancet of *S. scapeata* sp. nov.

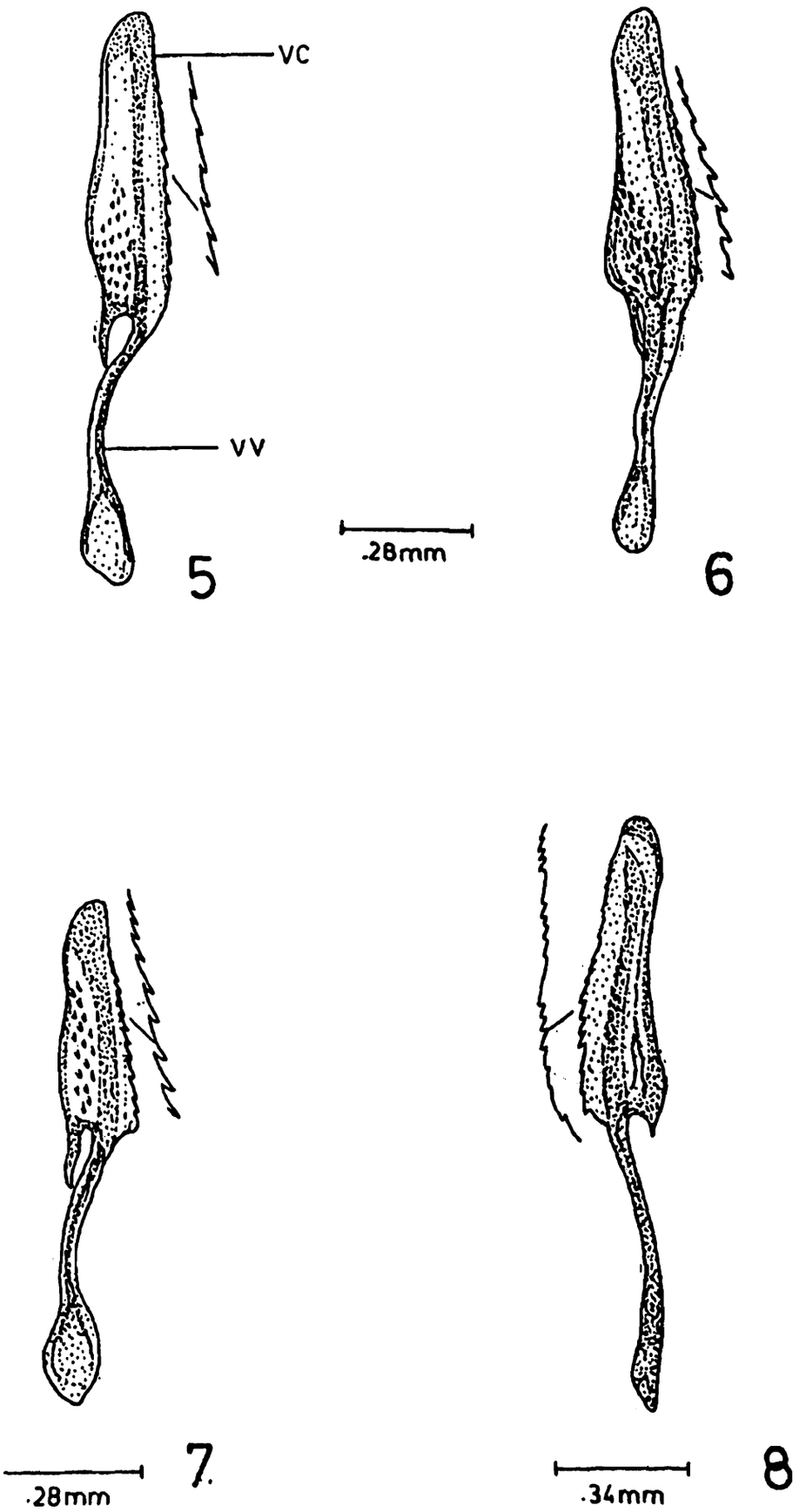


Fig. 5. Penis valve of *S. mooreana* ; **Fig. 6.** Penis valve of *S. punctata* ; **Fig. 7.** Penis valve of *S. harpeata* sp. nov. ; **Fig. 8.** Penis valve of *S. scapeata* sp. nov.

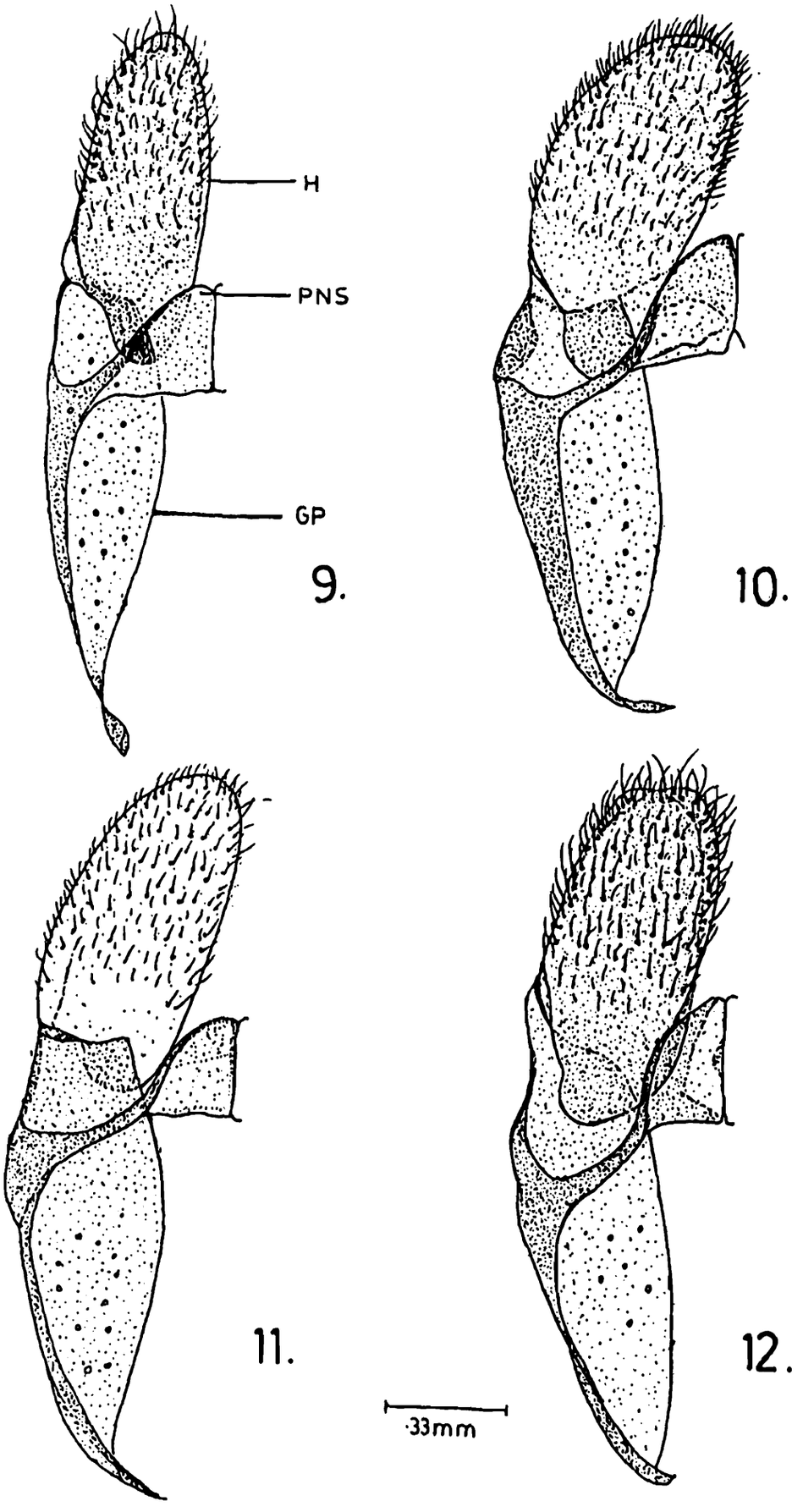


Fig. 9. Gonoforceps of *S. mooreana* ; **Fig. 10.** Gonoforceps of *S. punctata* ; **Fig. 11.** Gonoforceps of *S. harpeata* sp. nov. ; **Fig. 12.** Gonoforceps of *S. scapeata* sp. nov.

Discussion : *S. punctata* Cameron 1899 was given the status of subspecies by Malaise, 1945 as *S. mooreana punctata* on basis of some male specimens only. Its female has been recorded for the first time and studies of its female and male external genitalia revel considerable differences from the same *of S. mooreana* Cameron (1877). So its species status has again been restored.

Siobla harpeata sp. nov.
(Fig. 13,3,7,10)

Female : Average length = 12 mm. General body colour black, reddish to fulvous are : inner aspect of scapus, 3 apical antennal segments more or less, mandible bases, clypeus, labrum, spot on hind orbits, posterolateral aspects of pronotum, basal half of tegula, meso and metascutellii, propodeum, 2nd and 3rd tergites with their deflexed sides, tip of 9th tergite entirely, 2-4 sternites, all legs except extreme distal margin of all coxae, trochanters, femur, tibia and tarsii. Wings yellowish hyaline, infumated upto proximal end of stigma. Stigma and rest of venation dark to black.

Clypeus roundly truncate (Fig. 13) ; labrum subconvex with a roundly pointed anterior margin ; malar space 1.2 x diameter of an ocellus ; inner margins of eyes emarginate and distinctly converging below ; LID : IDMO : EL = 3.0 : 3.9 : 2.2, OOL : POL : OCL = 1.1. 0.75 : 1.0. Antenna slightly longer than head and thorax combined ; 1st and 2nd antennal segments each longer than broad ; length of 3rd and 4th as 2 : 1.1, 4 to 9 gradually decreasing in length. frontal area slightly above level of eyes ; supra antennal tubercles moderately elevated and confluent with low frontal ridges ; median fovea broad, distinct with uneven bottom and divided into two parts by weak horizontal ridge ; circum, inter and postocellar furrows sharp ; lateral furrows distinct and outwardly curved, not reaching hypothetical hind margin of head ; postocellar area convex, broader than long as 2:1.2. Head carinated and converging behind eyes. Scutellum convex. Appendage weakly carinated. IATS: MB : OATS = 2.0 : 3.6 : 1.7.

Head densely and minutely punctured. Mesonotum minutely, shallowly and sparsely punctured. Few large punctures on anterior slope of scutellum, its posterior slope and appendage impunctate. Mesepimeron and mesepisternum covered with large, shallow and almost confluent punctures. Propodeum and 1st two tergites punctured on lateral aspects, rest of the abdomen impunctate. Body covered with silvery pubescence.

Female lancet with 15 serrulae, as in figure–3.

Male : Average length–9.5 mm. Similar to female except following differences : meso and metascutellar appendages, 2nd and 3rd tergites except a median dirty patch, crescent shaped extreme anterior margin of 4th tergite, all legs except for coxae, metafemur and apical 1/3rd of metatibia, whitish. Head and thorax covered with comparatively minute and dense punctures.

Penis valve — Fig. 7

Gonoforceps — Fig. 10

Holotype : Female, Sikkim, Gangtok, 1700M, 14.V.93

Paratypes : 1♀ with same locality as of holotype, 1♀ Manipur, Ukhrul, 1700 M, 22.V.93,

3 ♂♂ Nagaland, Pfutsero, 2100 M, 20.V.93, 3♂♂ Arunachal Pradesh, Lazu (Khonsa) 2299 M, 6.V.94.

Population Variation : In some specimens black colour on abdomen covering more or less basal tergites.

Discussion : *S. harpeata* sp. nov. runs in Malaise's key of S.E. Asia (1945) upto couplet 13, but does not tally with *S. turneri* Malaise (1932), keyed out there. This species goes close to *S. bengalensis* Saini *et al.*, 1985, *S. darjeelingia* Saini *et al.*, 1985, but can be easily distinguished from them on the basis of puncturation of head and thorax.

Etymology : The species name *S. harpeata* is based on harpe (Gonoforceps), which has a strikingly different, light yellowish colour as compared to other known species of *Siobla*, which have dark brown colour.

Siobla scapeata sp. nov.
(Fig. 14,4,8,12)

Female : Average length-11.5 mm. Body black, reddish to dark brown are : scapus, 4 apical antennal segments, mandibles barring apex, labrum, clypeus, spot covering supraclypeal area, lower inner orbits, hind orbits extending upto temples and covering post-ocellar area, pronotum, lateral sides of mesonotal middle lobe meeting at apex, postero-lateral depressed sides of mosonotum, rectangular spot before scutellum, appendage, metanotum, nebulous spot on convexity of mesepisternum, propodeum except small spots on its deflexed sides, 2nd and 3rd tergites except their narrow posterior margin triangularly widened in middle ; 9th abdominal tergite, 2nd sternite more or less, extreme apices of all coxae & rest of legs entirely except metafemur. Wings yellowish hyaline, apical 1/3rd subinfuscated without any sharp limit. Stigma and venation dark brown to black.

Clypeus truncate with irregular anterior margin and a shallow median notch (Fig. 14) ; labrum subconvex with semicircular rounded anterior margin ; supra clypeal area triangularly raised

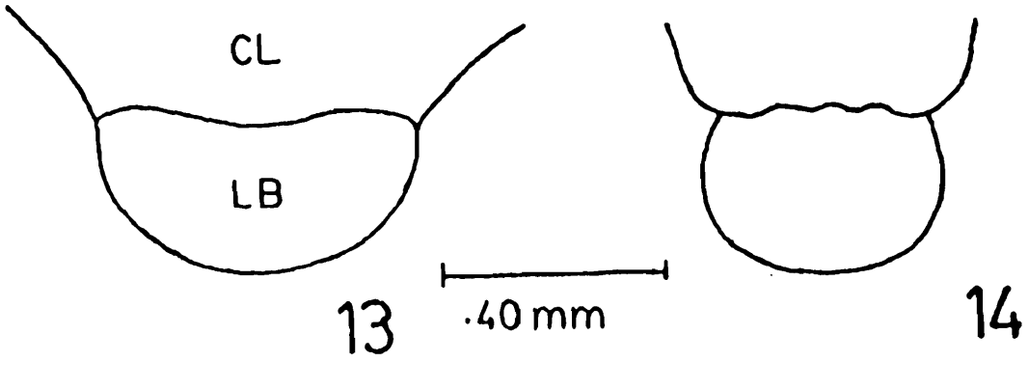


Fig. 13. Typical Clypeus of *Genus Siobla* ; **Fig. 14.** Clypeus of *S. scapeata* sp. nov.

without any carina ; malar space equal to diameter of an ocellus ; inner margins of eyes emarginate and distinctly converging below ; LID : IDMO : EL = 3.0 : 4.0 : 2.4 ; OOL : POL : OCL

= 2.0 : 1.0 : 1.1. Antenna as long as head and thorax combined, 1st segment as long as broad ; 2nd longer than broad ; length of 3rd amd 4th as 2.0 : 1.1 ; 4 to 6 gradually decreasing in length ; 7 to 9 almost equal in length ; frontal area almost at level of eyes ; supraantennal tubercles elevated and confluent with slightly low frontal ridges ; median fovea deep in its anterior half and shallowly extending up to median ocellus in its posterior half ; circum, inter-and postocelar furrows sharp; lateral furrows distinct almost reaching hypothetical hind margin of head ; postocellar area sub convex, broader than long as 6 : 5. Head carinated and converging behind eyes. Scutellum subconvex roundly raised. Appendage distinctly carinated in its anterior half. IATS : MB : OATS = 2.0 : 4.0 : 1.6.

Head covered with dense, minute, distinct, but shallow punctures. Mesonotum uniformly punctured. Scutellum with scattered and distinct punctures on its anterior slope, whereas its posterior slope with minute and dense punctures. Appendage almost impunctate. Mesepisternum and mesosternum with minute and shallow punctures. Propodeum with few punctures on its lateral aspects, remaining tergites almost impunctate shining. Body covered with silvery to golden pubescence.

Female lancet with 17 serrulae as in figure-4

Male : Average length –9.5 mm. Similar to female except following differences : antenna except 5 apical segments, clypeus, head, thorax and all abdominal tergites excepting 2nd, entirely black. Wings uniformly infumated.

Penis valve — Fig. 8

Gonoforceps — Fig. 12

Holotype : Female, Uttar Pradesh, Mukteshwar, 2288 M, 20.VI.91.

Paratypes : 24♂♂, Uttar Pradesh, Mandal, 2500 M, 19.VI. 87, 10♂♂, Himachal Pradesh, Kalatop, 2400 M, 28.VI.86, 1 ♀ Uttar Pradesh, Mukteshwar, 2288 M, 20.VI.91. 4♂♂ Uttar Pradesh, Binayak, 2225 M, 22.VI.91. 2♀♀ Uttar Pradesh, Chopta, 3000 M, 25. VI. 92.

Population Variation : In some specimens thorax and all abdominal tergites may be black.

DISCUSSION

S. scapeata sp. nov. shows remarkable differences from other known species of this genus, as its scapus is as long as broad (While in others known species it is longer than broad) and clypeus truncate with irregular anterior margin, Fig. –14 (in others it is truncate with rounded anterior margin, Fig. –13). Comparatively, it is close to *S. harpeata* sp. nov., but can be differentiated from it on the basis of following combination of characters : In *S. scapeata* sp. nov. pedicellus fulvous (black in *S. harpeata* sp. nov.), in *S. scapeata* sp. nov. broad frontal spot covering inner & hind orbits, temples & postocellar area (head entirely black in *S. harpeata* sp. nov.) ; in *S. scapeata* sp. nov. antenna as long as head and thorax combined (in *S. harpeata* sp. nov. antenna longer than head and thorax combined).

ETYMOLOGY

Species name *S. scapeata* sp. nov. pertains to its unique scapus, which is as long as broad.

SUMMARY

The genus *Siobla* Cameron is represented by eight species from India. In addition *S. harpeata*, sp. nov. and *S. scapeata* sp. nov. are described now from India. *S. mooreana punctata* Malaise (1945) now has been raised to species level, on the basis of more distinct morphological differences. A revised key for Indian species of this genus is provided.

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Rec. zool. Surv. India : **97** (Part-4) : 75-82, 1999

ON A COLLECTION OF CHALCIDOIDEA (HYMENOPTERA) FROM KASARAGOD DISTRICT (KERALA STATE)

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INTRODUCTION

Of the parasitic hymenoptera, the Superfamily Chalcidoidea forms one of the most important groups of natural enemies of injurious insect pests, especially those belonging to Lepidoptera, Coleoptera, Homoptera and Diptera. These minute wasps play an important role in biological and integrated control of serious pests. In many cases, Chalcids supress populations of potential pest species in the field, regulating their numbers and preventing them from reaching a level of economic importance.

The Chalcidoidea are cosmopoliton and according to the recent classification the superfamily is divided into 21 families (Boucek, 1988). The number of valid genera is most recently estimated to be about 2000 (Noyes, 1990) with approximately 70,000 world species. Their great diversity of form and colour, and their biological intricacy and specialisation combine to make them one of the most marvellously rewarding groups of the insects to study.

The Chalcidoid fauna of India is poorly known. Saunders and Westwood described several fig inhabiting chalcids from Ceylon and India during the last centuary. Ramakrishna Ayyar made extensive collections of Indian Chalcids, which were later described by Gahan, Rohwer, Weld, Ferriere and others. In recent years intensive studies on Indian fauna were made by Boucek, Subba Rao, Narendran, Hayat, Farooqi, Joseph, Alam Agarwal, Shafee etc.

The material on which the present paper is based is collected from the Kasaragod district by the author and others in the recent past. Information available in literature dealing with the Chalcidoid fauna of Kasaragod district (Mukerjee (1981), Mani (1989), Narendran (1989, 1994) are also included.

Order HYMENOPTERA

Superfamily CHALCIDOIDEA

Family EURYTOMIDAE

1. ***Prodecatoma cheriani*** Narendran, 1994

This is an uncommon species originally described from Kerala.

Material examined : 2 Females, Manjeswaram (Kasaragod), 27.ii.1988, T.C. Narendran & party.

Distribution : India (Kerala), Thaiwan.

2. ***Philolema maleena*** Narendran, 1994

This species is originally described from Kerala, which parasitises eggs of grasshopper on paddy.

Material examined : 26 females, Kasaragod, 27.ii.1988, 56 females, Manjeswaram (Kasaragod), 27.ii.1988, T.C. Narendran & party.

Distribution : India (Kerala, T.Nadu, Karnataka).

3. ***Plutarchia malabarica*** Narendran & Padmasenan, 1990.

The species is described from holotype collected from Neeleswaram (Kasaragod).

Material examined : 1 Female, Neeleswaram, 26.ii.1988, T. C. Narendran & party.

Distribution : India (Kerala)

4. ***Eurytoma kasaragodensis*** Mukerjee, 1981

Material examined : 1 female (Holotype), 1 female (paratype), Kasaragod, 16,iii.1975, M. S. Mani & party.

Distribution : India (Kerala)

5. ***Eurytoma amaranthusa*** Narendran, 1994

The species is originally described from Kerala, parasitising an indetermined larva boring into *Amaranthus* sp.

Material examined : 1 female (Holotype), Manjeswaram, 27.ii.1988, T. C. Narendran, & party.

Distribution : India (Kerala)

6. ***Eurytoma rajeevi*** Narendran, 1994

It is an hyperparasite on Lepidoptera through *Apanteles, Microgaster,* and *S. nicevillei.*

Material examined : 2 females, Manjeswaram, 27.ii.1988, 4 females, Kasaragod, 27.ii.1988, T.C. Narendran & party.

Distribution : India (Kerala), U.P. (Aligarh), A.P. (Tenali) and Thailand.

7. ***Eurytoma poroensis*** Mukerjee, 1981

The species is described from Poro North (North Bengal). Narendran (1994) reported its host as stem gall on rice.

Material examined : 1 female, Uppala (Kasaragod), 15.x.1993, K.C. Gopi & party.

Distribution : India (Kerala), Karnataka, T. Nadu & A. P.

Family : CHALCIDIDAE

8. ***Antrocephalus nasuta*** (Holmgren, 1869)

This is a commonly occuring species.

Material examined : 2 females, Central plantation crops research Inst. campus (Kasaragod), 14.x.1993, K.C. Gopi & party.

Distribution : All over Oriental Region, West Iran, and Papua New Guinea.

9. ***Antrocephalus phaeospilus*** Waterston, 1922

It is an uncommon species. Narendran (1989) reported few specimens of it from the different parts of Kerala. From the Kasaragod district it is reported here for the first time.

Material examined : 1 Female, Uppala (Kasaragod), 15.x.1993 K.C. Gopi & party.

Distribution : India (Kerala), Thaiwan.

10. ***Brachymeria euploeae*** (Westwood, 1837)

This is a common species, parasitising various lepidoptera. This is the first report of it from Kasaragod district.

Material examined : 1 female, Maruthome (Kasaragod), 26.x.1993, K.C. Gopi & party.

Distribution : India, North Borneo, Sumatra, Java and Philippines.

11. ***Brachymeria excarinata*** Gahan, 1925

This is a common species attacking several lepidoptera and coleoptera and often parasitic on Braconidae (*Apanteles* sp. including *plutellae*)

Material examined : 1 female, CPCRI campus (Kasaragod), 14.x.1993, K.C.Gopi & party.

Distribution : Oriental Region, Egypt, Japan and China.

12. ***Kriechbaumerella titusi*** Narendran, 1989

It is an uncommon species described from Kerala. This forms the first report of it from the Kasaragod district.

Material examined : 1 female, Uppala, 15.x.1993, K.C. Gopi & party.

Distribution : India (Kerala), Pondicherry (Karaikkal) and Java.

13. ***Hockeria atra*** Masi, 1929

It is an uncommon species. Husain & Agarwal (1982) reported its host as *Spilosoma* sp. (Arctiidae).

Material examined : 1 female, uppala, 15.x.1993, K.C. Gopi & party.

Distribution : India, Philippines, Java.

14. ***Hockeria tristis*** (Strand), 1911

This is a common species parasitising *Pyrausta machaeralis* (Walker) (Pyralidae)

Material examined : 1 female, CPCRI campus (Kasaragod), 14.x.1993, K.C. Gopi & party.

Distribution : All over Indian sub-continent.

Family : TORYMIDAE

15. ***Chrysochalcissa indica*** Narendran, 1994 (Fig. 4 & 5)

Narendran (1994) reported the genus for the first time from the Indian sub-continent by describing the species *indica* from Coimbatore (T. Nadu). This is the first report of it from Kerala...

Material examined : 1 female, Maruthome (Kasaragod), 26.x.1993, K. C. Gopi & party.

Distribution : Africa and Indo-Australian region.

Family : PTEROMALIDAE

16. ***Propicroscytus mirificus*** (Girault), 1915b

This is a very common species, parasitising gall midges in rice and stems of some other grasses.

Material examined : 2 females, Kasaragod, 27.ii.1988, P.M. Sureshan.

Distribution : India, Sri Lanka, Australia, S. China and E. Malaysia.

17. ***Netomocera nigra*** Sureshan & Narendran, 1990 (Fig. 1-3)

This species is described from Kerala and this forms the first record of it from Kasaragod district and the subsequent record after the description.

Material examined : 1 male, Muliyar R.F. (Kasaragod), 14.x.1993, K.C.Gopi & party.

Distribution : India (Kerala)

18. ***Metastenus concinnus*** Walker, 1834

This species is mainly known from Europe as a parasite of coccidophagous coccinellids. Boucek *et al.* (1979) reported it from Kerala, Kottayam.

Material examined : 1 female, Uppala, 15.x.1993, K.C.Gopi & party.

Distribution : India (Kerala), Europe.

19. ***Chlorocytus xanthopus*** (Cameron), 1906

This is an uncommon species. Boucek et al (1979) recognised this species from its single extant type specimen in British Museum as a member of *Chlorocytus* Graham

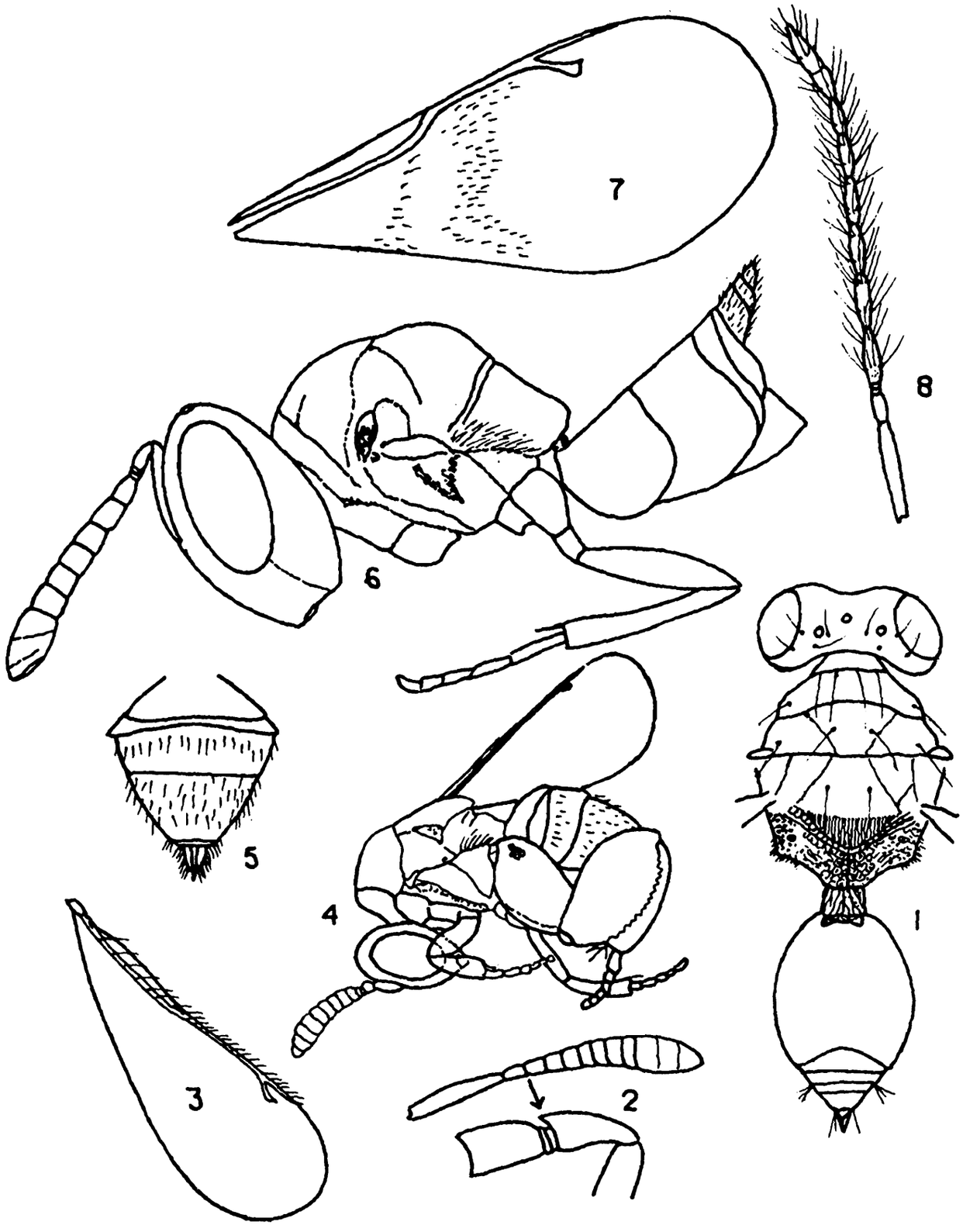

Fig. 1-3 : *Netomocera nigra* Sureshan & Narendran : female. 1, body in dorsal view, 2, antenna, 3, forewing.

Fig. 4-5 : *Chrysochalcissa indica* Narendran : female : 4, body in profile, 5, gaster in dorsal view.

Fig. 6-8 : *Psilocera vinayaki* Sureshan & Narendran : female 6, body in profile, 7, forewing, 8, male antenna.

Material examined : 1 female, Neeleswaram (Kasaragod), 26.ii.1988, 1 male, Periya (Kasaragod), 24.ii.1988, P.M. Sureshan.

Distribution : India (Kerala, Delhi), Pakistan.

20. ***Dinarmus acutus*** (Thomson), 1878

This is a European species which was recorded carlier from India under its Synonym *Bruchobius mayri* (masi) by Mani (1939). It is a parasite of Bruchids.

Material examined : 2 females, 1 male. Periya (Kasaragod), 25.ii.1988. P.M. Sureshan.

Distribution : India (Kerala), Europe, N. America.

21. ***Dinarmus maculatus*** (Masi), 1924

This is an uncommon species.

Material examined : 1 female, 1 male, Neeleswaram, 26.ii.1988, P.M. Sureshan.

Distribution : India (Kerala, W. Bengal), Burma.

22. ***Notoglyptus scutellaris*** (Dodd & Girault) 1915 a

Farooqi and Subba Rao (1986) recorded the species as *N. virescens* Masi from India. This is an uncommon species. This is the first record of this species from Kerala.

Material examined : 4 females, Manjeswaram, 27.ii.1988., P.M.Sureshan.

Distribution : India (Delhi, Kerala, U.P.), Italy, Japan and South Africa.

23. ***Sphegigaster stepicola*** Boucek, 1965

Until the report of this species from Indian subregion by Boucek et al (1979) it was only known from the Mediterranean subregion.

Material examined : 3 females, Kasaragod, 1 female, Manjeswaram, 27.ii.1988, P.M.Sureshan.

Distribution : India, Australia, Czechoslovakia and Algeria

24. ***Psilocera vinayaki*** Sureshan & Narendran, 1994 (Fig. 6-8)

The original description of this species is based on the female collected from Kasaragod. It closely resembles the Pakistan species *P. ghanii* Subba Rao, but differs distinctly as mentioned in the description.

Material examined : 1 female, (Holotype), Kasaragod, 27.ii.1988, P. M. Sureshan.

Distribution : India (Kerala).

SUMMARY

This paper deals with 24 species under 17 genera and 4 families of Chalcidoidea (Hymenoptera) from the Kasaragod district of Kerala (India). Of these, 18 species are reported for the first time from the district. The species *Chrysochalcissa indica* Narendran (Torymidae) is reported for the

first time from Kerala after its original description from Coimbatore (T.Nadu). The genera *Chlorocytus, Dinarmus, Notoglyptus, Psilocera* and *Sphegigaster* (Pteromalidae) are reported for the first time from Kerala.

ACKNOWLEDGEMENTS

The Author is grateful to the Director, Zoological Survey of India, Calcutta and the Officer-in-charge, Zoological Survey of India, Western Ghats Field Research Station, Calicut for providing facilities and encouragement. He is also grateful to Dr. T.C. Narendran, Professor, University of Calicut, Kerala for the helps he has rendered to confirm the identity of certain species.

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Rec. zool. Surv. India : **97** (Part-4) : 83-89, 1999

ON THE INDIAN SPECIES OF *SYNTOMOPUS* WALKER (HYMENOPTERA : CHALCIDOIDEA : PTEROMALIDAE)

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INTRODUCTION

The genus *Syntomopus* Walker contains 13 species from the world (Heydon, 1993). In Oriental Region the genus is known by one species viz. *S. fuscipes* Huang from China. In the Indian subcontinent the genus has been reported by an indetermined species (Boucek *et al*, 1979). Mani (1989) also reported this genus from India without naming any species. In continuation of our studies on Indian Pteromalidae three new species of *Syntomopus* are described from India.

The type specimens are presently kept in the collections of ZSI, WGFRS, Calicut for future deposition in the National Zoological collection, ZSI, Calcutta.

Genus ***Syntomopus*** Walker

Syntomopus Walker, 1833. 371, 372.

Type Species : *Syntomopus thoracicus* Walker, designated by Westwood, 1839 : 69.

Merismorella Girault, 1926. 1.

Type species : *Merismorella shakespearei* Girault ; by monotypy, Boucek, 1988 : 466. Synonymy.

The genus *Syntomopus* Walker is characterised by a transverse-quadrangular pronotum, depressed and flat thorax and clypeus with three broad and symmetrically arranged clypeal denticles. Heydon (1993) provided a detailed diagnosis of the genus and its affinities with other related genera.

Key to the Indian species of ***Syntomopus***

1. Propodeum with median carina effaced in the middle, indicated on anterior and posterior ends, width 1.5x maximum length ; Tl of gaster deeply incised in the middle (Fig. 17); POL 1.4 x OOL ; temple length 0.3 x eye length ; body dark green with golden yellow reflection on head and dorsal part of thorax. Length 3 mm. ..... *rajamalaiensis*, sp. nov.

— Propodeum with median carina either complete or indicated only anteriorly (slightly), width 1. 7-2 x maximum length ; Tl of gaster not as above (Figs. 5 & 9) ; POL greater than 1.4 x OOL (1.6-1.9x) ; temple length greater than 0.3x eye length ; body bright green or bluish black without golden reflection. Length 1.5-2.2mm 2

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2. Propodeum with median carina indicated only anteriorly ; POL 1.9x OOL ; scape length 0.8x eye length ; mesoscutum width 1.8x length ; forewing with mv 1.7x stv ; pmv 1.3x stv ; body bluish black ; antenna with scape and pedicel bluish black with metallic reflection, remainder dark brown ; legs except coxae not testaceous. Length 1.5-1.7 mm ..... *nigrus*, sp. nov.

— Propodeum with median carina complete ; POL 1.6x OOL ; scape length 0.6x eye length ; mesoscutum width 2.2x length ; forewing with mv 2.9x stv ; pmv 2x stv; body bright metallic green; antenna with scape and pedicel testaceous, remainder pale brown; legs except coxae testaceous. Length 1.7-2.2 mm ..... *carinatus*, sp. nov.

1. ***Syntomopus carinatus,*** sp. nov.
(Figs. 1-6)

Holotype Female : Length 2.1 mm. Head and thorax mainly and gastral petiole and coxae metallic green ; gaster brown with greenish tinge dorsally ; antenna brown with scape and pedicel testaceous ; eyes cupreous; legs except coxae testaceous with tips of tarsi brown ; tegulae brown; wings hyaline; veins light brown.

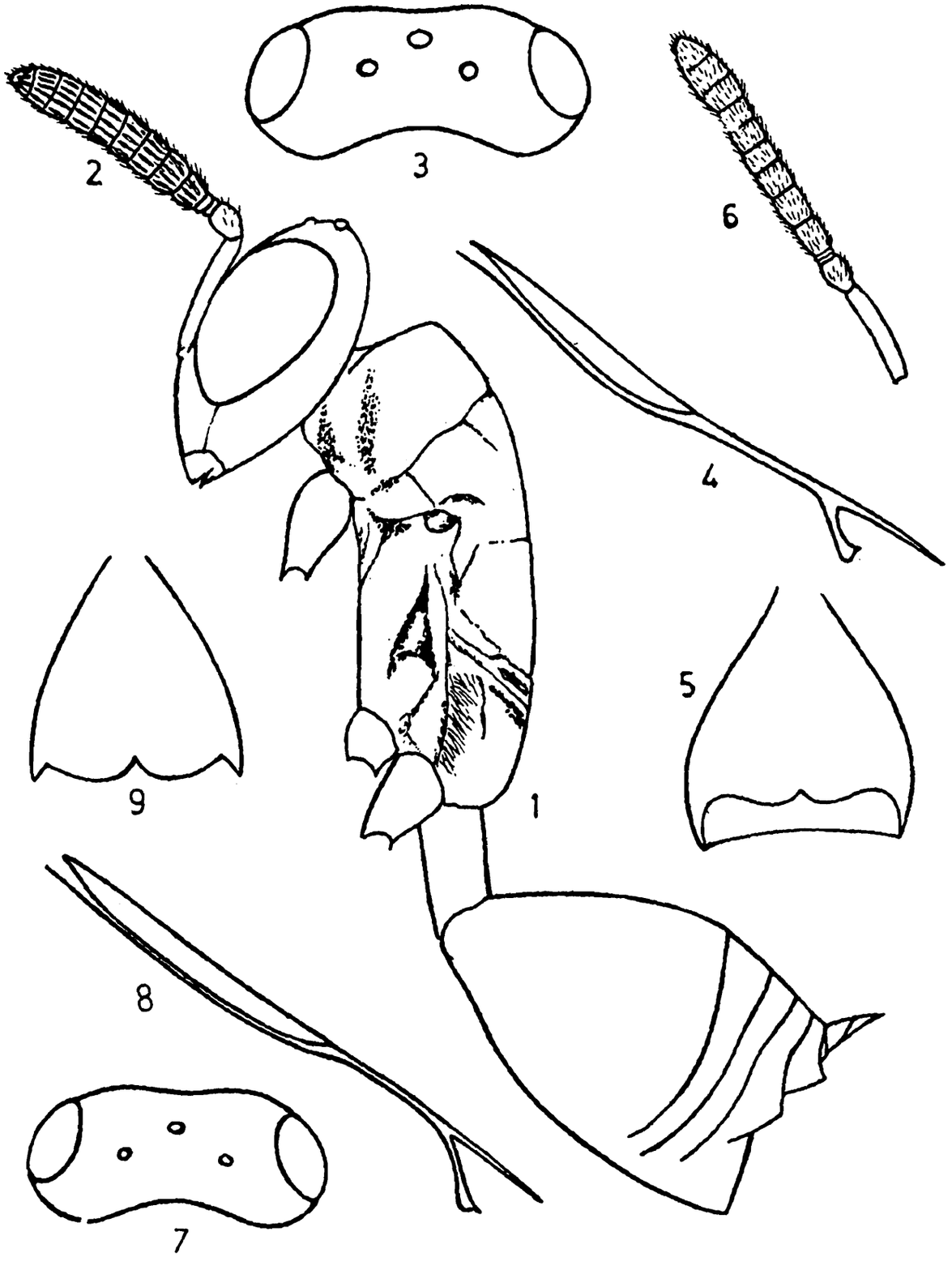
Head : (Figs. 1 & 3) Uniformly and finely reticulate, in dorsal view width 2.14x length and in front view width 1.2x height; temple 0.6x eye length; POL 1.6 x OOL; eyes seperated by 1.3x their length; malar space length 0.4x eye length. Antenna (Fig. 2) inserted well above lower margin of eyes ; scape not reaching median ocellus, length 0.6x eye length; pedicel plus flagellum length 0.7x width of head; funicle segments mostly transverse; club as long as 2.5 preceeding segments combined.

Thorax : (Fig. 1) Length 1.7x width; Pronotum with collar almost rectangular, anterior margin straight, while posterior margin emarginate, moderately reticulate except on a narrow shiny strip posteriorly. Mesoscutum uniformly sculptured as on pronotum, width 2.2x length; notaular grooves complete. Scutellum flat, level with mesoscutum, uniformly and finely reticulate. Propodeum width 2x maximum length, median area finely reticulate, lateral parts and nucha almost shiny; median carina complete; spiracles small and oval; post-spiracular groove deep. Prepectus broad, triangular, finely reticulate. Forewing (Fig. 4) with basal vein bare, pubescence less distinct. Relative lengths of smv, mv, pmv and stv as 56,33,23 and 11.5.

Gaster : (Figs. 1 & 5) length 1.8x width in dorsal view ; petiole length almost 2x width, finely reticulate ; hind margin of T1 incised medially; ovipositor sheaths exserted out; hypopygium reaching tip of gaster.

Allotype Male : Length 1.8mm. Resembles female in almost all characters, except in the nature of antenna (Fig. 6), shape of gaster and scutellum which is more elongate.

Holotype : Female : INDIA : Kerala, Kasaragod, 27.ii.88, Coll. P.M. Sureshan; *Allotype* : Male : Kerala, Agali (Palghat), 12.xii.87, Coll. P. M. Sureshan : *Paratypes* : 1 Female, 8 Males, data same as that of allotype ; 1 Female, 1 Male, Kerala, Mananthavady (Wynad), 22.ii.1988 ; 1 Female, Kerala, Thariyod (Wynad), 22.ii.88 ; 1 Male, Kerala, Peechi, 5.ii.89 ; 1 Female, Kerala, Shertallai, 27.ii.89 ; 1 Female, Kerala, Mukali (Palghat), 10.xii.1987 ; 1 Female, Kerala, Puzhamudi (Wynad), 23.ii.88 ; 1 Female, Kerala, Thirunelli. R. F. (Wynad), 1.ii.94 (Coll. P. M. Sureshan).



Figs. 1- 6. *Syntomopus carinatus* sp. nov. (Female) :
1. body in profile ; 2. antenna ; 3. head in dorsal view ; 4. forewing venation ; 5.Tl & T2 of gaster in dorsal view ; 6. male antenna.

Figs. 7- 9. *Syntomopus nigrus* sp. nov. (female) :
7. head in dorsal view ; 8. forewing venation ; 9. Tl of gaster in dorsal view.

Remarks : This species resembles *S. thoracicus* Walker in the shape of antenna, pronotum, scutellum and in having propodeum with a complete median carina, but differs in having mv 2.5 x stv (in *thoracicus* mv 1.9-2.2 x stv), tibiae and femora testaceous (in *thoracicus* tibiae highly darkened in the middle, often black and femora black).

2. ***Syntomopus nigrus,*** sp. nov.
(Figs. 7-12)

Holotype : Female : Length 1.7mm. Body bluish black with bluish reflection on propodeum and gaster (mainly) ; antenna with scape and pedicel bluish black with metallic reflection, remainder dark brown ; eyes cupreous ; coxae concolorous with thorax ; femora brownish black except on tips testaceous ; tibiae brown, paler at base ; tarsi testaceous with tips brown ; tegulae brown ; wings hyaline ; veins pale brown.

Head : (Figs. 7 & 10) Uniformly and finely reticulate, in dorsal view width 2.3 x length and in front view width 1.13 x height ; temples round, converging, length half of eye length ; POL 1.9 x OOL ; malar space length almost half of eye length ; eyes seperated by 1.3 x their length. Antenna (Fig. 11) inserted above lower margin of eyes ; scape not reaching median ocellus, slightly curved, length 0.8 x eye length ; funicle segments mostly transverse ; pedicel plus flagellum length 0.8 x head width.

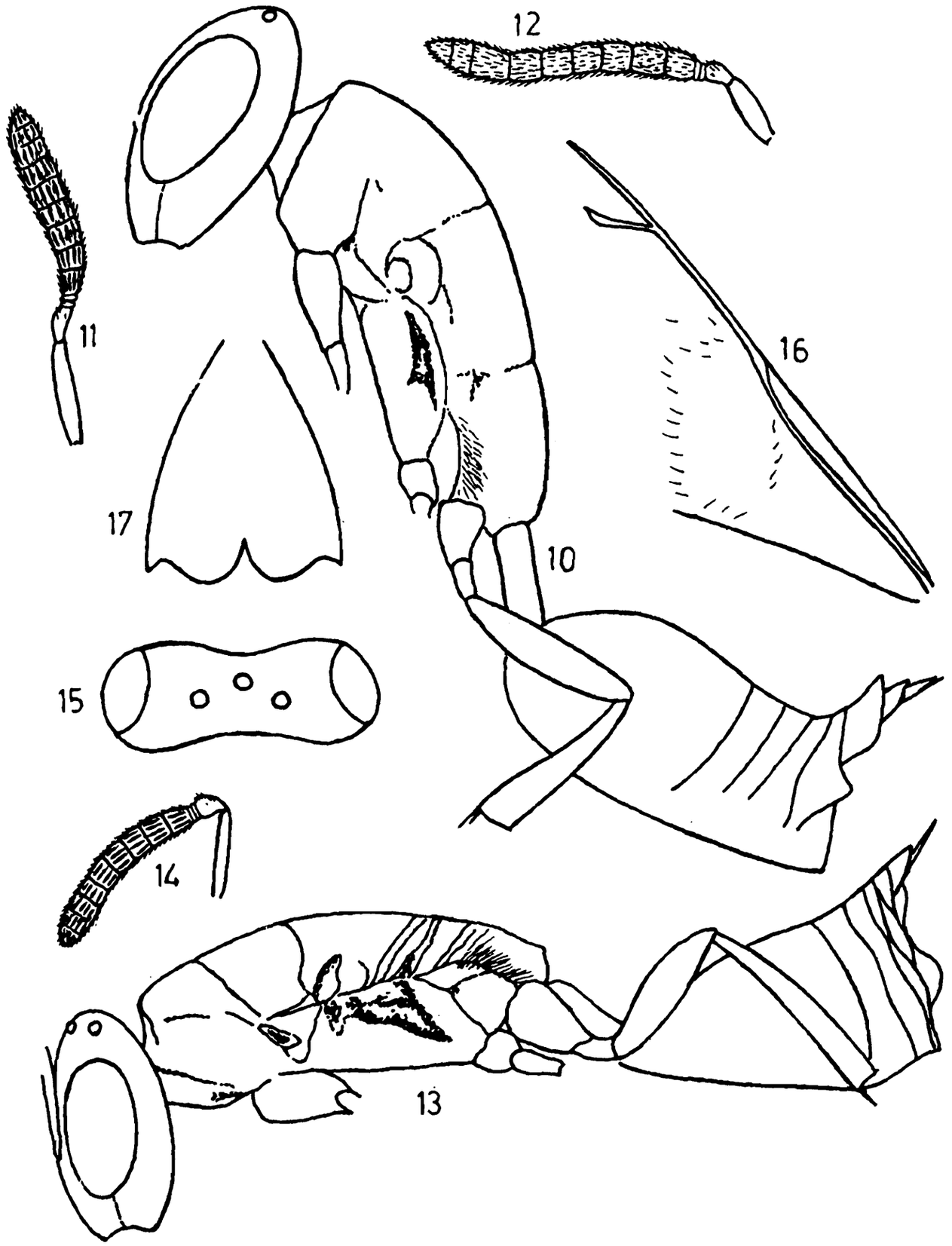
Thorax : (Fig. 10) Length 1.8 x width ; pronotal collar with anterior margin straight, posterior margin slightly emarginate, distinctly reticulate, except for a narrow shiny strip behind. Mesoscutum width 1.8 x length, similarly sculptured as on pronotum. Scutellum flat, finely reticulate, almost as wide as long. Propodeum uniformly and finely reticulate ; median carina absent ; spiracles very small ; post-spiracular sulcus distinct. Propodeum width 1.7x maximum length. Forewing (Fig. 8) with pubescence less distinct, basal part almost bare ; basal vein bare. Relative lengths of smv, mv, pmv and stv as 23, 12.5, 10 and 7.5.

Gaster : (Figs. 9 & 10) Length 1.9 x width ; ovate ; petiole length 1.9 x width, uniformly and finely reticulate ; hind margin of Tl incised in the middle ; ovipositor sheaths exserted out ; hypopygium reaching tip of gaster.

Allotype Male : Length 1.6mm. Resembles closely the female but differs in the nature of antenna (Fig. 12), shape of gaster, scutellum more elongate and in having brighter colour.

Holotype : Female : INDIA : Kerala, Anakatty (Palghat), 12.xii.87, Coll. P.M. Sureshan ; *Allotype :* Male : same data as that of holotype : *Paratypes* : 1 Female, Kerala, Kalkandi (Palghat), 13.xii.87, Coll. P.M. Sureshan ; 1 Female 3 Males, data same as that of holotype.

Remarks : This species resembles. *S. incisus* Thomson in having similar propodeum, body colour and first funicular segment quadrate, but differs in having smaller body (size 1.5-1.7mm) (in *incisus* body size varies between 3-5mm), Tl deeply incised in the middle and antenna with funicle segments strongly transverse except first and second (in *incisus* posterior margin of Tl often truncated, antenna with F2 only slightly transverse).



Figs. 10-12. *Syntomopus nigrus* sp. nov. (female) : 10. body in profile ; 11. antenna ; 12. male antenna.

Figs. 13-17. *Syntomopus rajamalaiensis* sp. nov. (female) : 13. body in profile ; 14. antenna ; 15. head in dorsal view ; 16. forewing venation ; 17. Tl of gaster in dorsal view.

3. ***Syntomopus rajamalaiensis,*** sp. nov.

(Figs. 13-17)

Holotye : *Female* : Length 3mm. Head and thorax dark green with golden yellow reflection on head and dorsal part of thorax ; lateral parts of thorax blackish ; gaster including petiole dark bluish green with metallic blue reflection mainly on Tl dorsally, almost black on lateral and ventral side ; eyes blackish brown ; ocelli dark brown ; antenna with scape dark blue, remainder dark brown ; legs with coxae concolorous with thorax ; trochanters dark brown; femora bluish black with metallic reflection ; tibiae and fore tarsi yellowish brown ; middle and hind tarsi yellow with tips brown ; tegulae dark brown ; wings hyaline ; veins pale brown.

Head : (Figs. 13 & 15) Uniformly and finely reticulate with meshes very small ; reticulation coarse on frons with meshes broad ; front of head flat. In dorsal view head width 2.5x length and in front view width 1.2x height; temple narrow, length 0.3x eye length; POL 1.4x OOL ; clypeus radiately striated; malar space length 0.5 x eye length ; eye length 1.7 x width in profile ; malar grooves less distinct. Antenna (Fig. 14) inserted little above lower margin of eyes; scrobe moderately deep and broad ; area just below toruli slightly projecting; scape not reaching front ocellus, length 0.7 x eye length ; pedicel plus flagellum length 0.8 x head width.

Thorax : (Fig. 13) Pronotal collar width 2.5 x length, moderately raised reticulate. Mesoscutum flattened dorsally, width 2.3 x length, mid lobe similarly sculptured as on pronotum, reticulation on side lobes narrow meshed ; notaular grooves complete. Scutellum flat, moderately raised reticulate, slightly wider than long (14 : 12). Dorsellum level with scutellum, nearly smooth. Propodeum width 1.5 x maximum length, median area moderately reticulate, lateral parts nearly smooth ; median carina effaced in the middle ; plicae sharp, but fading out just at anterior margin of propodeum ; spiracles elongatedly ovate ; post-spiracular sulcus distinct and microreticulate within ; callus with few scattered hairs. Prepectus broad, moderately reticulate with anterior part depressed, forming a deep concavity. Mesopleuron moderately reticulate, except on a triangular shiny area beneath wings. Metapleuron reticulate punctate. Forewing (Fig. 16) length 2.2 x width ; costal cell with a single complete row of setae ; basal part of forewing almost bare except few setae on basal vein ; pubescence otherwise moderately dense ; marginal fringe very small, almost absent. Relative lengths of smv, mv, pmv and stv as 26.5, 17, 12.5 and 6.5. Fore and mid coxae very finely reticulate, hind coxae finely reticulate. Relative lengths of hind coxa, femur, tibia and tarsus as 9,17,20 and 17.

Gaster : (Figs. 13 & 17) Length 1.7 x width in dorsal view ; petiole length 2 x width, moderately raised reticulate with 3 pairs of lateral setae directed anteriolaterally ; hind margin of Tl deeply incised medially ; ovipositor sheaths and ovipositor strongly protruded out ; hypopygium extending to hind margin of T5.

Allotype Male : Not known.

Holotype : Female : INDIA : Kerala, Rajamalai (Eravikulam National Park), 5.iv.94, Coll. K. C. Gopi & party.

Remarks : This species resembles *S. incurvus* Walker in having funicle segments of antenna transverse except first quadrate, pronotum width 2.5 x length ; mv of forewing 2.6 x stv ; scutellum nearly as wide as long and nearly flat and thorax flat having greenish tinge, but differs in having pronotum with lateral angles not prominent (lateral angles of pronotum more or less prominent in *incurvus*), propodeum with median carina not complete, effaced in the middle (in *incurvus* propodeum with median carina complete). It also resembles *S. fuscipes* Haung in the shape of antenna and gaster but differs in having T1-T4 incised in the middle posteriorly, very deeply in T1 and forewing with speculum open below (in *fuscipes* T1 only incised posteriorly, not very deeply and forewing with speculum closed below).

SUMMARY

Three new species of *Syntomopus* Walker viz., *S. carinatus, S. nigrus* and *S. rajamalaiensis* are described from India.

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Rec. zool. Surv. India : **97** (Part-4) : 91-93, 1999

A NEW SPECIES OF SPIDER OF THE GENUS *PHILODROMUS* WALCKENAER (ARANEAE : PHILODROMIDAE) FROM MADHYA PRADESH.

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The spiders of the family Philodromidae are little known in Indian Fauna. The genus was established by Walckenaer in 1825 with the Type-species *Philodromus aureolus* (Clerck). Tikader (1980) redescribed and reillustrated fifteen species of the genus *Philodromus* from different parts of India.

While studying the spiders of the family *Philodromidae* the authors came across a new species of the genus *Philodromus* which is described here.

The type specimen will in due course be deposited in the National Collection of Zoological Survey of India. Calcutta.

Philodromus jabalpurensis sp. nov.

General : Cephalothorax and legs light yellowish green, abdomen dirty chalk white. Total length 5.00 mm. Carapace 2.00 mm. long, 2.20 mm wide ; abdomen 3.20 mm. long, 2.60 mm. wide.

Cephalothorax : Wider than long, uniform in colour, posterior region slightly overlapped by the abdomen. Clypeus narrow, margin provided with small hairs directed forward. Sternum oval, clothed with fine hairs. Eyes round & black, ringed with white tubercles ; anterior row slightly recurved, almost equal in size and equidistant, posterior row of eyes. recurved, medians smaller than the laterals. Ocular quad longer than wide and wider behind than in front. Legs relatively long, I and II longer than III and IV, clothed with hairs and spines, dorsal side of I femur with one pair of spines directed outward ; tibiae of I and II with three pairs of ventral spines. Metatarsi provided with two pairs of ventral spines, tarsal scopulae well developed and claw tufts prominent.

Abdomen : Longer than wide, depressed, clothed with pubescence, mid-dorsally provided with light brown patch, posteriorly with light brown reticulations and dots as in fig. 1. Ventral side same in colour as dorsal side. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

Type-specimen : *Holotype* female in spirit, other details as above.

Type-locality : Sanjivani Nagar, Jabalpur, Madhya Pradesh, Coll. *Pawan Gajbe*, 6.x.1997.

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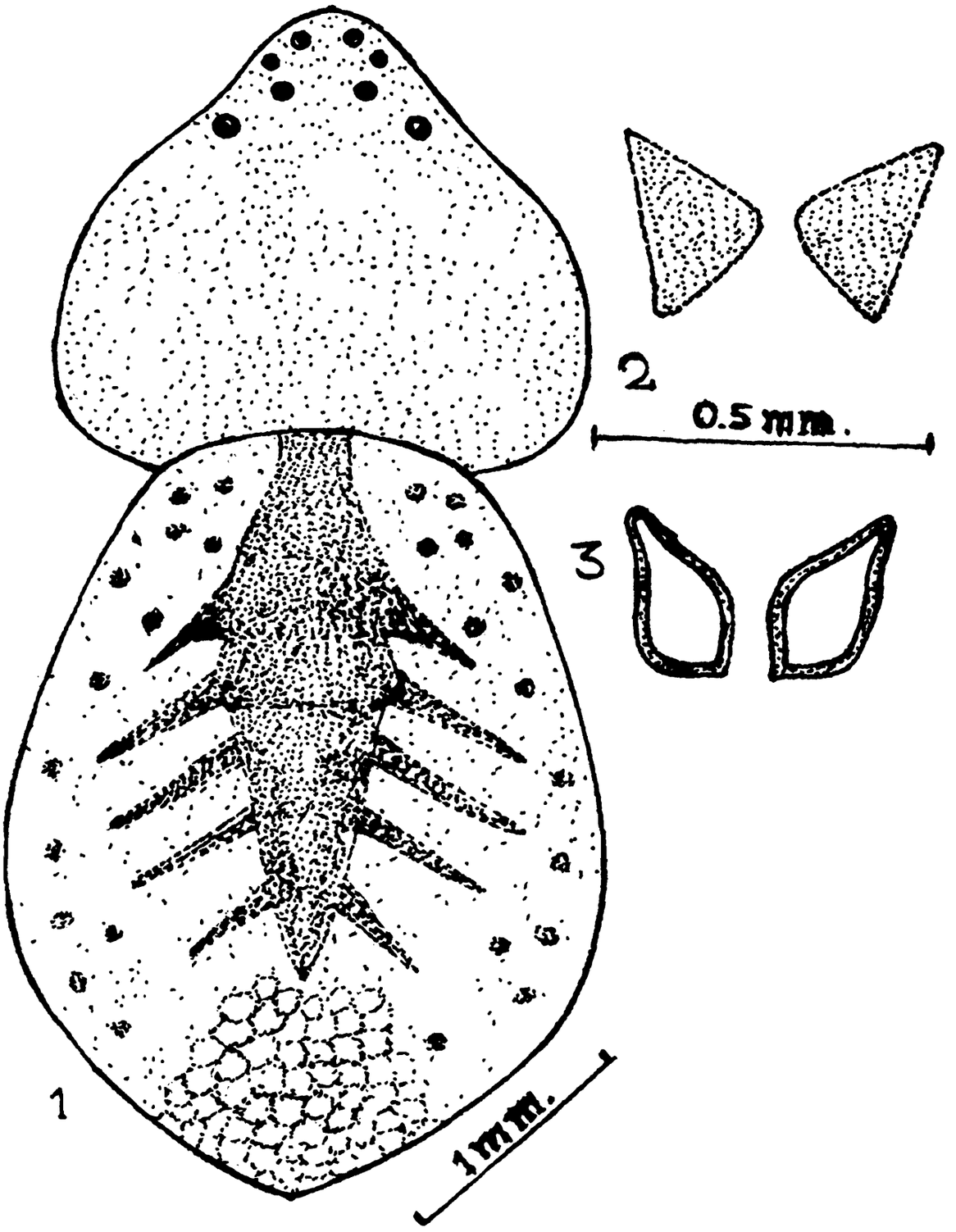

Fig. 1-3. *Philodromus jabalpurensis* sp. nov.
1. Dorsal view of female, legs omitted ; 2. Epigyne ; 3. Internal genitalia.

This species resembles *Philodromus shillongensis* Tikader but differs from it as follows : (i) Cephalothorax uniform in colour but in *P. shillongensis* cephalothorax laterally provided with pigmented patches. (ii) Abdomen mid-dorsally provided with light brown patch, light brown reticulation but in *P. shillongenis* abdomen dorsally provided with irregular brown dots. (iii) Epigyne and internal genitalia also structurally different.

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The authors are thankful to Dr. J.R.B. Alfred, Director, Zoological Survey of India, Calcutta, for facilities and to Shri K. Vinod, Stenographer, of this station for typing the manuscript.

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Rec. zool. Surv. India : **97** (Part-4) : 95-97, 1999

A NEW SPECIES OF SPIDER OF THE GENUS *PARDOSA* KOCH (ARANEAE : LYCOSIDAE) FROM MADHYA PRADESH.

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The genus *Pardosa* was established by Koch in the year 1848, with the type-species *Pardosa striatipes* Koch. Since the establishment of the genus only 25 species are known from India. Tikader.& Malhotra (1980) reillustrated and redescribed all the species in *Fauna of India* volume, with some new species.

While studying the spiders of the family Lycosidae the authors came across a new species of *Pardosa* which is described here.

The type specimen will in due course be deposited in the National Collection of Zoological Survey of India. Calcutta.

Pardosa jabalpurensis sp. nov.

General : Cephalothorax and legs light reddish brown, abdomen dark brown. Total length 11.00 mm. Carapace 4.50 mm long, 4.0 mm wide ; abdomen 6.10 mm. long, 4.0 mm wide.

Cephalothroax : Longer than wide, convex, cephalic region slightly higher and narrowing in front, clothed with pubescence and some hairs and spine like hairs on the clypeus. Centre of thoracic region with a fovea from which small deep brown patches radiate to the lateral side. Ocular area deep brown. Anterior row of eyes slightly recurved, less wider than the second row, medians slightly larger than the laterals and closer to laterals than to each other. Eyes of second row larger than the other. Ocular quad wider behind and narowing in front. Bases of posterior eyes provided with conspicuous black patches as in fig. 1. Space enclosed between posterior eyes wider posteriorly and narrowing anteriorly. Sternum heart-shaped, pointed posteriorly, light reddish yellow and clothed with pubescence and small spine like hairs. Labium nearly as long as wide and pale yellow in colour. Distal end of maxillae broader and provided with conspicuous scopulae. Chelicerae moderately strong, inner margin provided with three teeth and outer margin without teeth. Legs thin and long, clothed with spines and hairs and uniform in colour.

Abdomen : Longer than wide, widest at the middle, pointed behind, clothed with pubescence and some hairs. Abdomen middorsally provided with two white patches and round white spots throughout the abdomen. Ventral side lighter than the dorsal. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

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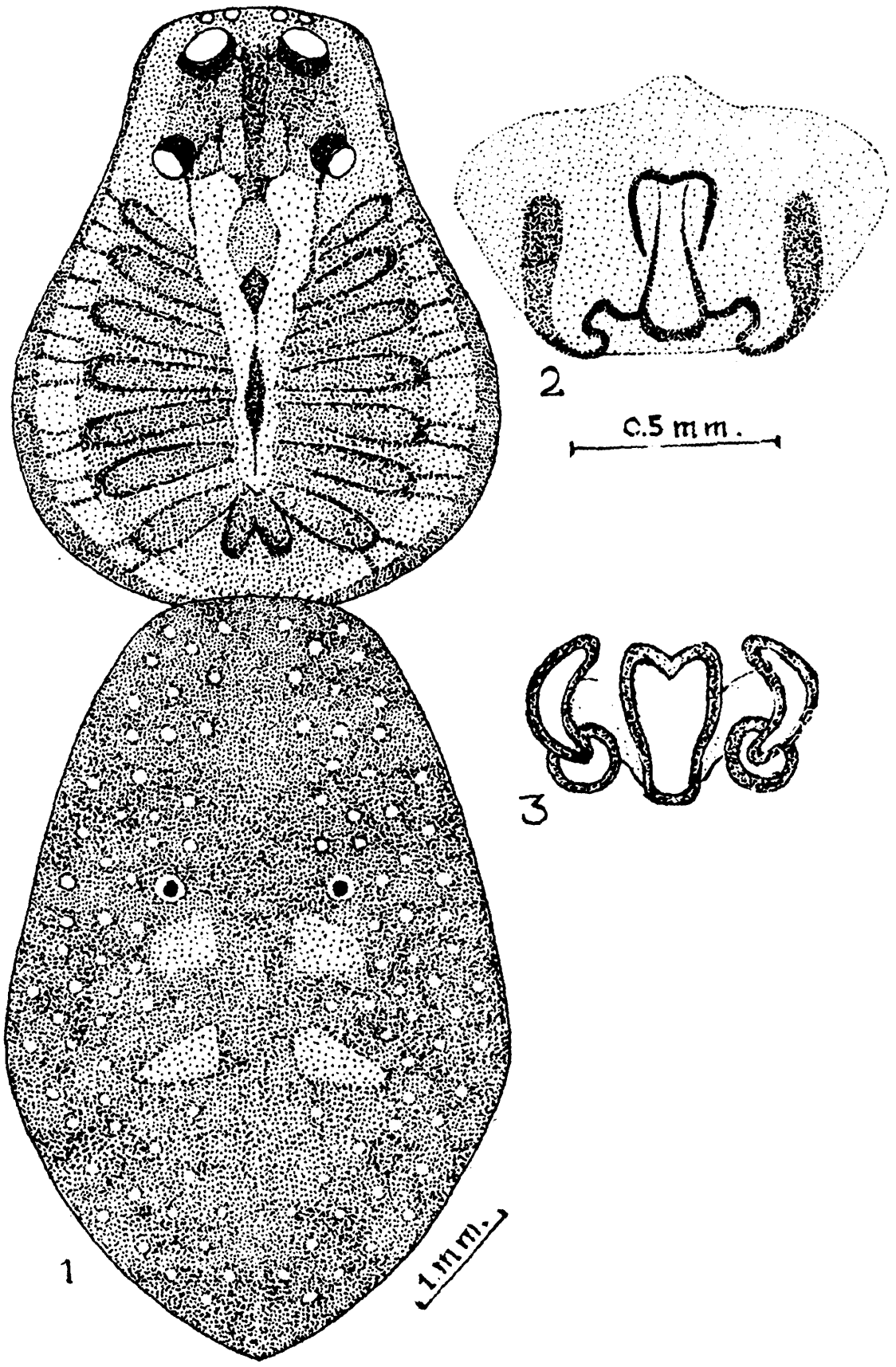

Fig. 1-3. *Pardosa jabalpurensis* sp. nov.

1. Dorsal view of female, legs omitted ; 2. Epigyne ; 3. Internal genitalia.

Type-specimen : *Holotype* female in spirit, other details as above.

Type-locality : Sanjivani Nagar, Jabalpur, Madhya Pradesh, Coll. *Pawan Gajbe*, 14. VIII.1997.

This species closely resembles *Pardosa sumatrana* (Thorell) but differs from it as follows : (i) Legs dorsally without irregular greenish brown patches but in *P. sumatrana* legs dorsally with irregular greenish brown patches. (ii) Abdomen mid-dorsally with two white patches but in *p. sumatrana* abdomen provided with dark brown and pale patches and black spots. (iii) Epigyne and internal genitalia also structurally different.

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The authors are thankful to Dr. J.R.B. Alfred, Director, Zoological Survey of India, Calcutta, for facilities and to Shri K. Vinod, Stenographer, of this station for typing the manuscript.

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Rec. zool. Surv. India : **97** (Part-4) : 99-101, 1999

NEW SPECIES OF SPIDER OF THE GENUS *SERGIOLUS* SIMON FROM MADHYA PRADESH (FAMILY : GNAPHOSIDAE)

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The genus *Sergiolus* was established by Simon in 1891 with type species as *S. variegatus* (Hentz). Since the establishment of the genus, Tikader & Gajbe (1976), described three species from different parts of India. Tikader in (1982) in his '*Fauna of India*' volume redescribed the same species.

While studying the spiders of the family Gnaphosidae the authors came across a new species of *Sergiolus* which is described here.

The specimen was collected from the large webs of *Stegodyphus sarasinorum* Karsch which was associated with the same species.

The type specimen will be in due course deposited in the National Collection of Zoological Survey of India, Calcutta.

Sergiolus lamhetaghatensis sp. nov.

General : Cephalothorax and legs brownish black, abdomen deep brown. Total length 7.50 mm. Carapace 3.10 mm. long, 2.20 mm. wide ; abdomen 4.50mm. long, 2.80mm. wide.

Cephalothorax : Longer than wide, narrow in front, convex, clothed with pubescence, posterior middle provided with an inconspicuous fovea. Eyes pearly white except anterior medians, posterior row of eyes slightly longer than the anterior row. Anterior row of eyes slightly recurved (as seen from in front), medians slightly larger than laterals and closer to adjacent laterals than to each other. Posterior row of eyes recurved, medians more or less round, smaller than the laterals and equally spaced. Ocular quad longer than wide and wider behind than in front. Sternum deep brown, oval, widest at the middle, pointed behind and clothed with hairs. Labium and maxillae longer than wide, deep brown,anterior end provided with conspicuous scopulae as in fig. 2. Chelicerae moderately strong, inner margin with one small tooth and outer margin with two large teeth. Legs relatively long and strong, clothed with hairs and spines. Tibia III with a median dorsal spine.

Abdomen : Longer than wide, nearly elliptical, thickly clothed with fine hairs and three pairs of sagillae on the dorsal side as in fig. 1. Ventral side lighter than the dorsal, yellowish green, clothed with hairs. Epigyne as in fig. 3. Internal genitalia as in fig. 4. Spinnerets prominent, anterior spinnerets longer than others as in fig. 5.

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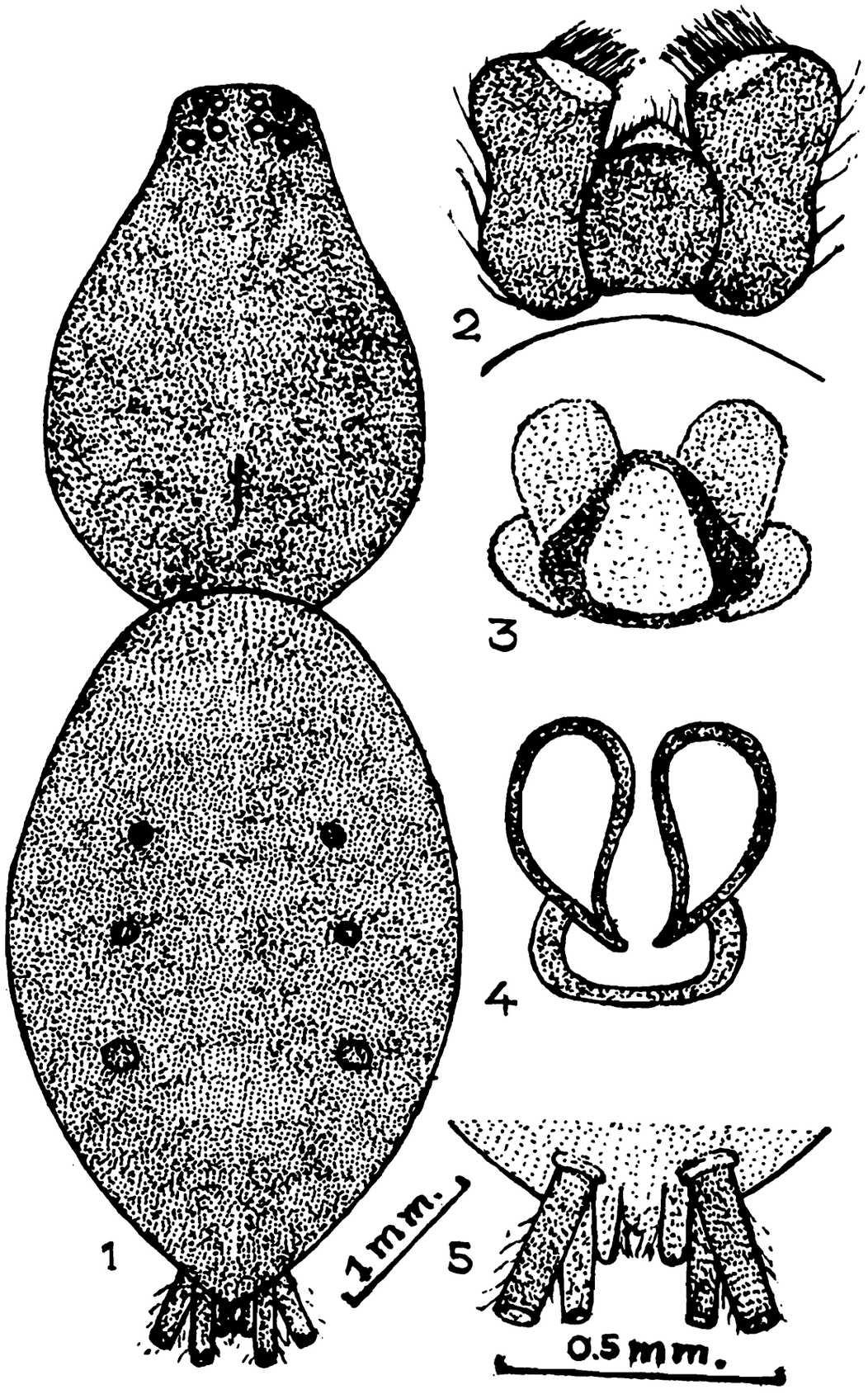

Fig. 1-3. *Sergiolus lamhetaghatensis* sp. nov.
1. Dorsal view of female, legs omitted ; 2. Labium and maxillae ; 3. Epigyne ; 4. Internal genitalia ; 5. Spinnerets.

Type-specimen : *Holotype* : Female in spirit, other details as above.

Type-locality : INDIA : Lamhetaghat, Jabalpur district Madhya Pradesh. Coll. *Pawan Gajbe,* 27.IX.1997.

This species closely resembes *Sergiolus poonaensis* Tikader & Gajbe, but differs from it as follows : (i) Outer margin of chelicera provided with two teeth but in *S. poonaensis* outer margin of chelicera provided with one tooth. (ii) Epigyne and internal genitalia also structurally different.

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FAUNAL RESOURCES OF WEST BENGAL—2
SOME SELECTED WETLANDS OF HAORA AND HUGLI DISTRICTS

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INTRODUCTION

The present paper deals with the wetland faunal resources of West Bengl based on some selected wetlands of Haora and Hugli districts. It includes a total of 32 freshwater wetlands comprising of 17 waterbodies from Haora and 15 from Hugli districts. The occurrence and diversity of species from these wetlands are dealt under 12 major faunal groups indicating the occurrence of each species recorded during 1991-92 and 1992-93.

The study of faunal diversity in wetlands/waterbodies of West Bengal was initiated by Annandale in the early part of twentieth century (*vide* Annandale and Dover, 1923). But after the Ramsar Convention in 1971, a fresh surge of interests was developed throughout the world including our country as well as in the State of West Bengal. Although the State covers an area of 88,752 sq. km. comprising of 18 districts, most of these studies in West Bengal were confined to Calcuta and its adjoining areas (Ghosh, 1987, 1990 ; Ghosh and Sen 1987, 1998 ; De *et al.*, 1989 ; Ghosh and Chattopadhyay, 1990, 1994). Of these, Ghosh and Chattopadhyay (1994) reported on the biological resources, particularly the aquatic flora (macrophytes) and avifauna of Santragachi jheel, Haora district, West Bengal. But, besides this report (Ghosh and Chattopadhyay, loc. cit.) no other studies were made so far from wetlands of these two districts.

Realising the importance of such studies from this part of the country, the present work on wetland faunal resources of West Bengal was initiated in late 1980s from different parts of the State. The first part of the work dealing with North and South 24-Parganas districts has been published (Nandi *et al.*, 1993) and the present one is the second in the series.

THE STUDY AREA

General

Both Haora and Hugli districts entirely fall under the physiographic subdivision known as 'mature delta' in the lower Ganga Plain. The vast plain of these two districts is endowed with fertile alluvial soils, 70 per cent of which is used for cultivation of paddy and kharif crops. These two districts, Haora and Hugli, have a total area of 1467 sq. km. and 3149 sq. km. with a population of 37.91 lakhs and 43.52 lakhs (as per 1991 census) i.e., having 2967 persons and 2311 persons per sq. km. respectively (Table 1). They are located between the latitudes 22°13' and 23°01' North and longitudes 87°30' and 88°30' East (Figs. 1 and 2). They are hemmed in between

Hooghly (Bhagirathi) river on the east and Rupnarayan river on the south-west and intersected by Damodar river. These rivers provide a network of waterways, notably the Damodar group with two branches *viz.*, the Kana Damodar or Kausiki and the old Damodar ; and the Bhagirathi group with its branch, the Saraswati. Numerous tributaries of the main rivers and creeks, called *khals*, which run dry or very shallow in summer months serve as the natural drainage system of the Damodar-Bhagirathi interriverine floodplain and Darakeswar-Damodar inter riverine floodplain areas of these two districts. The triangular portion west of the Darakeswar comprising of Goghat Police Station having an area of 378 sq. km. is the only upland region located in the Hugli district (Banerjee, 1972).

It may be mentioned that the very name of Haora district is derived from 'haor' (swampy area) which was earlier known to be present in countless number in this district. However, at present, this district is dominated by industrial establishments in the north-eastern sector.

Table 1. Physiographical features of Haora and Hugli districts

Parameters	Haora district	Hugli district
Area (in Sq. Km.)	1467	3149
Latitude	22°13'-22°47' N	22°39'-23°01'N
Longitude	87°51'-88°22' E	87°30'-88°30' E
Population (1991 census)	37.19 lakhs	43.52 lakhs
Population density (per sq. km.)	2967	2311
Climatic condition	Humid tropical	Humid tropical
Temperature (mean max.)		
Summer	35-40°C	34-40°C
Monsoon	28-32°C	27-32°C
Winter	11-18°C	11-17°C
Rainfall (Average)	167.6 cm	151.6 cm
Wet season (June to October)	120-150 cm	115-140 cm
Dry season (November to May)	15-45 cm	10-40 cm
Humidity	30-95%	30-95%
Soil type	Alluvial	Alluvial
Land scape type	'Mature delta' plain	'Mature delta' plain
Forest cover (sq. km.)	Nil	3 sq. km.
Protected area	Nil	Nil
Water resources (hectares)	12885	28267

Climate

The climatic conditions, though vary seasonally in these two districts, exhibit a regional uniformity consisting of two main seasons, *viz.*, the dry season from November to May and the wet season from June to October. The dry season during winter months (November to February) is characterised by cold weather with only a little cloud and rain, the fall varying from 0.32-2.5 cm. January is the coldest month with nearly uniform temperature of 13°C in the plains. Humidity gradually diminishes to about 60 per cent in February. Dew fall is highest in November and in the first half of December. Temperature rises gradually from March and is maximium in May which is marked as the hottest month with temperature reaching between 35°C and 40°C. Hailstorm sometimes diminishes the heat in March-April. Heat is also occasionally diminished by the "Nor' Westers" with sudden showers in summer (April-May). These districts receive an abundant rainfall (over 150 cm) through south-west monsoon which usually bursts in the second or third week of June. July is the wettest month with rainfall as high as 31 cm. Humidity becomes 90-95 per cent in monsoon months.

Soil

In general, soil of Haora and Hugli districts is alluvial type, poor in organic matter and nitrogen. The soil pH of the wetlands is near neutral varying between 6.5 and 7.5. Salinity in soil of some tidal flood areas of these two districts bordering Hugli and Rupnarayan rivers is negligible.

Vegetation

In ponds, *jheels* and marshy areas floating, fixed and amphibious macrophytes occur in abundance. This vegetation type includes emergent plants comprising mostly of the family Cyperaceae (*Mutha* grass) and Gramineae (fodder grass). The root and lower part of the stem of these hydrophytes are usually submerged under water while the leaves are exposed to the air. A number of species belonging to this vegetation type are commercially important such as *Shola* (*Aeschynomene indica*), *Madurkathi* and *Mutha* grass (*Cyperus* spp.), *Kalmi shak* (*Ipomoea aquatica*) and *Hogla* (*Typha elephantina*). Some rooted floating forms *viz.*, *Sushni shak* (*Marsilea quadrifoliata*) and *Paniphal* (*Trapa bispinosa*), naturally grown or cultivated in wetland areas are also known for their commercial value. Besides their commercial value, wetland plants are being increasingly recognized for their ecological values in recent years. They provide feeding, breeding, spawning and nesting sites for a large number of fishes, prawns, birds and other aquatic animals. While several plant species, namely, water hyacinth, wate lettuce and duckweeds, naturally grown in wetlands of Haora and Hugli districts, are being used in the pollution abatement of east Calcutta's sewage-fed wetlands. However, life form diversities of wetland plants occurring in these two districts can be conveniently categorised as follows (Table 2).

Table 2. Categorization of floral diversities with examples

Categories		Examples
A. Free floating forms :		
a) Floating hydrophytes	:	Kochuripana (*Eichhornia crassipes*), Tokapana (*Pistia*), Khudipana (*Lemna*). Guripana (*Wolffia*), Kutipana (*Azolla*), etc.
b) Suspended hydrophytes	:	Jhanji (*Ceratophyllum, Utricularia*).
B. Fixed anchored forms :		
a) Anchored submerged hydrophytes	:	Patashaola (*Vallisneria spiralis*), Panikola (*Ottelia*), Kureli/Jhanji (*Hydrilla*), Shaolaghas (*Najas*) etc.
b) Anchored floating hydrophytes	:	Padma (*Nelumbo nucifera*), Shapla (*Nymphaea* spp.), Panchuli (*Nymphoides* spp.), Paniphal (*Trapa* spp.), etc.
C. Amphibious forms :		
a) Emergent amphibious hydrophytes	:	Sushni shak (*Marsilea quadrifoliata*), Kalmi shak (*Ipomoea aquatica*), Halencha (*Enhydra fluctuans*), Senchi (*Alternanthera sessilis*), Shola (*Aeschynomene* spp.), Kochu (*Colocasia esculenta*), Ghechu (*Aponogeton* spp.), etc.
D. Facultative forms :		
a) Reeds	:	Nol/Khagra (*Phragmites karka*), Hogla (*Typha* spp.).
b) Sedge	:	Muthaghas (*Cyperus* spp.), etc.
c) Weeds	:	Thulkuri/Thankuni (*Centenella asiatica*).
E. Algal forms :		
a) Solitary unicellular algae	:	*Euglena, Microcystis*, Diatoms.
b) Colony forming algae	:	*Volvox*.
c) Filamentons algae	:	*Spirogyra, Oscillatoria*.
d) Branched coenocytic algae	:	*Chara, Nitella*.

Some algal forms *viz.*, *Spirogyra* and *Microcystis* occur abundantly in lentic freshwater systems. In summer months *Microcystis* often turns the water surface green in shallow water ponds. The colony forming algae, *Volvox*, particularly predominate in ponds during spring.

Wetland Profile

The wetlands of both Haora and Hugli districts are mainly small freshwater wetlands. Low salinity can only be encountered in wetlands adjacent to Hugli and Rupnarayan rivers for having tidal influence in some of them. The wetland units of these two districts vary in shape, size, origin and in vegetation type. There are both temporary and permanent wetlands as well as natural and man-made wetlands. The ponds, big or small, are locally known as *pukurs, dobas, dighies* and *jheels*. While *haors, beels, jolas* and *dahas* are natural wetlands. There is no lake or ox-bows as such in these districts. However, for convenience, these local wetland units are defined in addition to the common one (see 'Note' below) as follows (Table-3).

Table 3. Defining the local wetland units.

Local wetland units		Brief definition
A. Man-made wetlands		
i) *Pukur*	:	Small pond formed by hollowing out or impoundment.
ii) *Doba*	:	Very small pond formed usually and artificially to raise the homestead land.
iii) *Dighi*	:	Large, deep pond usually excavated by the Zamindars (feudal landlords) for religious and/or drinking purposes.
B. Natural or Man-made wetlands		
iv) *Jheel*	:	Shallow freshwater pond or marsh.
C. Natural wetlands		
v) *Beel*	:	Large, natural and shallow saucer-like depression often combining freshwater marsh, lake and/or floodplain.
vi) *Daha*	:	Natural pool of fresh standing water formed by sudden rushing outgress of river water due to spating of the river and break down of the embankment.
vii) *Haor*	:	A combination of floodplain and beel.
viii) *Jola*	:	A freshwater marsh.

Note : Mention may be made that *ponds* are small, man-made, fresh, standing waterbodies having less than 10 ha of open water. *Pools* are natural, standing freshwater bodies with less than 100 ha open water. *Lakes* are deeper waterbodies, natural or man-made. *Floodplains* are areas periodically innundated with flood water of a river. While *freshwater marshes* are more or less permanent waterbodies dominated by reeds.

Interriverine regions of these two districts often hold vast sheet of surface run-off or flood water during monsoon. These are locally called *jolas* (marshes). A number of large catchment basins, in fact, turn into marshes. Some of them are permanent, containing water even in the summer months. In Haora district these marshes are located (i) between Saraswati river and Kana Damodar (Rajapur *Jola*), (ii) between Damodar river and Kana Damodar (Amta *Jola*) and (iii) on the west of Haora town (Haora *Jola*). In the Hugli district they are found (i) between Bhagirathi and Saraswati river (Dunkuni *Jola*), (ii) around old silted up channels of Damodar at Pandua (Khanyan marsh), (iii) between the confluence of Chaubis Bigha *khal* and Kata *khal* at Baligori (Khanakul marsh), (iv) at the confluence of Amodar and Tarajuli (Sultanpur *beel*), (v) between Kalachhara and Jangipara Railway Station (Kumirmora *beel*) and (vi) the marshes between Damodar *khal* and Kana Damodar in Khanakul Police Station and between the Ghia and Kana Nadi (Banerjee, 1972).

The hydrological parameters observed in wetlands of these two districts are summarized in Table 4 as follows :

Table 4. Hydrology of the wetlands surveyed from Haora and Hugli districts.

Hydrological parameters	Range values of the parameters	
	Haora district	Hugli district
Water/wetland area (ha)*	0.1-87.0	0.1-70.0
Water depth (m.)**	1.2-10.0	1.5-7.0
Water temperature (°C)	10.0 34.0	14.0-34.5
pH	6.3-8.5	6.5-8.5
Electrical conductivity (µmhos/cm)	980-2900	1200-3300
Dissolved oxygen (mg/1)	5.2-10.7	5.0-9.0
Turbidity (cm)	14-75	7-55

Note : * Approximate area measurement of the wetlands is shown in Table 5.
** Maximum water depth for Haora district refers Siva *daha* and that of Hugli district refers to Dunkuni *jola*.

MATERIAL AND METHODS

A total of 32 freshwater wetlands, 17 from Haora and 15 from Hugli district (Table 5, Figs. 1-2) were surveyed during the year 1991-92 and 1992-93 respectively. The surveys were conducted thrice a year during Premonsoon (February-May), Monsoon (June-September) and Postmonsoon (October-January) periods. Both permanent and temporary wetlands including floodplains were taken into consideration. However, only 7 wetlands from Haora district and 4 wetlands from Hugli district were seasonally surveyed thrice a year with special reference to fringe

fauna. The geographical locations of these wetlands are shown in Figs. 1 and 2 and in Table-5 (asterisks indicate wetlands surveyed thrice a year). During the course of survey field observations on some environmental (Temperature, humidity, vegetation, soil type, etc.) and hydrological parameters (Temperature, pH, conductivity, turbidity, dissolved oxygen, etc.) were noted. Collections were made using nets (drag net, cast net and plankton net), seives as well as hand picking. Larger animals belonging to mammals, birds, reptiles and cultivable fishes were observed in the field. Major wetland faunal groups are represented in Tables 6-14 indicating the occurrence of the species in wetlands under Haora and Hugli districts in parantheses as numbered in Table 5 below.

Table 5 : List of wetlands surveyed fom Haora and Hugli districts, West Bengal.

Sl. No.	Name of the wetland	Name of the nearest town/ village	Approximate area (hectare)	Ecological category
	HAORA DISTRICT			
1.	Santragachi *jheel**	Haora	87.0	FW,P
2.	Paddapukur *jola*	Haora	(0.8) $^{+}$	FW,P
3.	Kulai *jheel*	Ranihati	0.36	FW,T
4.	Phuleswar *jheel**	Uluberia	0.9	FW,P
5.	Natibpur *jheel**$^{++}$	Uluberia	0.35	FW^{++},P
6.	Birshibpur *jheel**	Birshibpur	12.4	FW,P
7.	Malanchberia *jola*	Birshibpur	6.0	FW,T
8.	Kashipur *jola*	Kashipur	0.17	FW,T
9.	Bagnan *jheel*	Bagnan	0.6	FW,P
10.	Goalpota pond	Garchumuk	0.2	FW,P
11.	Sujan Saheber *dighi*	Bara Garchumuk	2.4	FW,P
12.	Gadiara pond*	Gadiara	0.1	FW,P
13.	Amta pond	Amta	0.3	FW,P
14.	Siva *daha**	Amta	4.2	FW,P
15.	Dadkhali *daha**	Amta	5.4	FW,P
16.	Jhikhira pond	Jhikhira	0.3	FW,P
17.	Udaynarayanpur pond	Udaynarayanpur	3.6	FW,P

Table 5. *Contd. :*

Sl. No.	Name of the wetland	Name of the nearest town/ village	Approximate area (hectare)	Ecological Category
HUGLI DISTRICT				
1.	Madrasipara *jheel*	Bandel	1.2	FW,P
2.	Locopara *jheel*	Bandel	6.0	FW,P
3.	Tribeni *jheel*	Tribeni	3.0	FW,T
4.	Hatgachha *dighi*	Kalitala	10.0	FW,P
5.	Khanyan *jola*	Khanyan	0.2	FW,T
6.	Jugihedo pond*	Pandua	1.2	FW,P
7.	Kalipur *jheel*	Arambagh	0.6	FW,T
8.	Muktarpur *jola*	Bali-Dewanganj	70.0	FW,T
9.	Kaknan *jheel*	Badar	1.8	FW,T
10.	Jagatpur *beel**++	Garerghat	60.0	FW++,T
11.	Krishinanagar pond	Khanakul	3.6	FW,P
12.	Radhanagar pond	Khanakul	0.1	FW,T
13.	Baligori *jheel**	Tarakeswar	20(2.85)+	FW,P
14.	Kamarkundu *jheel*	Kamarkundu	10.0	FW,P
15.	Dunkuni *jola**	Dunkuni	6900(9.2)+	FW,P

Abbreviations : FW = Freshwater ; P = Permanent Wetland, T= Temporary Wetland ; * = Wetlands surveyed seasonally (thrice a year) ; + = One of the wetland complex surveyed shown in paranthesis ; + + = Predominantly freshwater wetland with traces of salinity due to tidal influence.

FAUNAL RESOURCES

Haora and Hugli districts are not so rich in habitat and faunal diversity. Wetlands are inhabited by aquatic species as well as wetland dependent and wetland associated species. Some terrestrial and arboreal species are also found as 'occasional visitors' However, for the purpose of present report, species habitually found to live or spend a major part of their time as wetland components (Nandi *et al.*, 1993) are incorporated as follows :

Vertebrates

Mammals

In fact, aquatic mammals are absent from wetlands in these two districts. Besides Bandicoot Rat, *Bandicota indica* (Bechstein) belonging to the family Muridae, no other mammalian species

could be found to depend on wetlands or associated with wetlands. However, Jackal, Indian Fox, Small Indian Mongoose, Small Indian Civet, Indian Mole Rat, etc., are observed as 'occasional visitors' in and around wetlands. The Bandicoot Rat is well represented in the urban and suburban areas of these two districts. Some tribal people in groups were encountered to hunt these rats with sticks, bows and arrows around wetland marshes at Tribeni-Kalitala areas of Hugli district. Otters (*Lutra* species), an important wetland dependent species, though reported to occur earlier around Garchumuk and Amta areas of Haora district and around Garerghat, Pandua and Baligori (Tarakeswar) areas of Hugli district, could not be recorded. It may be mentioned that both Smooth Indian Otter, *Lutra perspicillata* and the Fishing Cat, *Felis viverrina* were enocountered in the remote wetlands of coastal plain of North and South 24-Parganas districts (Nandi *et al.*, 1993). The lack of suitable habitats coupled with industrial development, agriculture and human settlement have wiped out this important wetland species.

4.1.2. Birds :

A total of 54 species of birds, either as wetland dependants or as wetland associates, including both resident and migratory species, belonging to 14 families have been recorded in these two districts (Table 6). Of these, 27 species are resident and 17 species are migratory birds depending on wetlands, while 10 species, comprising 3 resident and 7 migratory, are referred herein as wetland associates. Only 5 species of resident birds, 3 species of the family Ardeidae, *viz.*, *Ardeola grayii* (Sykes), *Bubulcus ibis* (Linnaeus), *Egretta garzetta* (Linnaeus) and two species of the family Anatidae, *viz.*, *Dendrocygna javanica* (Horsfield) and *Nettapus coromandelianus* (Gmelin) have been found to occur in abundance. Of the 17 wetland dependent and 7 wetland associated migratory species, some birds even though they are occasionally abundant have been recorded here as common for not being available throughout the year/season.

The avian species, either resident or migratory, depending on wetlands are comprised of swimmers, divers, waders and some fish eating aerial predators like kites and kingfishers. These wetland dependent birds belong to 11 families *viz.*, Podicipedidae, Phalacrocoracidae, Ardeidae, Ciconiidae, Anatidae, Accipitridae, Rallidae, Jacanidae, Rostratulidae, Charadriidae and Alcedinidae. However, the resident birds show greater diversity of species (representing 27 species), while the migratory birds depending on wetlands, especially the anatids, occur in small or large flocks and represent sessonal numerical abundance of individual birds of a few species, namely, *Anas crecca* Linnaeus, *A. strepera* Linnaeus, *A. quequedula* and *A. clypeata* Linnaeus. The large flocks of migratory birds in Santragachi *jheel* of Haora district visiting between October to February over the years have helped to declare the area a sanctuary. A study of avian fauna made by the Zoological Survey of India in early 1980's indicates the occurrence of 68 species of birds including 27 migratory species has helped to designate the wetland as "S.E. Rly.Centenary Sanctuary for Birds" (Ghosh and Chattopadhyay, 1994).

Table 6. List of resident and migratory birds recorded in wetlands of Haora and Hugli districts, West Bengal.

Family and species (Common name)	Occurrence in wetlands of Haora district	Hugli district
A. RESIDENT BIRDS (Wetland dependent)		
Family : PODICIPEDIDAE		
1. *Podiceps ruficollis* (Pallas) (Little Grebe)	(1,2)	(14, 15)
Family : PHALACROCORACIDAE		
2. *Phalacrocorax niger* (Vieillot) (Little Cormorant)	(1, 2, 4, 9, 10, 14, 15)	(2, 4, 6, 8, 11, 13, 14, 15)
3. *Anhinga rufa* (Daudin) (Darter)	(1, 2)	(14, 15)
Family : ARDEIDAE		
4. *Ardea purpurea* Linnaeus (Purple Heron)	(2, 15)	(8, 10, 15)
5. *Ardeola grayii* (Sykes) (Pond Heron)	(1-17)	(1-15)
6. *Bubulcus ibis* (Linnaeus) (Cattle Egret)	(1, 2, 7, 8, 11, 14, 15)	(5, 8, 9, 10, 13, 14, 15)
7. *Egretta alba* (Large Egret)	(1, 2, 11, 15)	(8, 10, 15)
8. *Egretta garzetta* (Linnaeus) (Little Egret)	(1, 2, 6-11, 15, 17)	(1, 3-6, 8, 9, 13-15)
9. *Nycticorax nycticorax* (Linnaeus) (Night Heron)	(1, 11)	(4,13-15)
10. *Ixobrychus cinnamomeus* (Gmelin) (Chestnut Bittern)	(1, 9, 11, 15)	(1, 3, 4, 8-11, 13-15)
11. *Ixobrychus flavicollis* (Latham) (Black Bittern)	(1, 15)	(14, 15)
12. *Ixobrychus sinensis* (Gmelin) (Yellow Bittern)	(4, 7, 14)	(2, 8, 14, 15)
Family : CICONIIDAE		
13. *Anastomus oscitans* (Boddaert) (Openbill Stork)	(2, 10)	(10, 15)
Family : ANATIDAE		
14. *Dendrocygna javanica* (Horsfield) (Lesser Whistling Teal)	(1, 14, 15)	(13-15)
15. *Nettapus coromandelianus* (Gmelin) (Cotton Teal)	A (1, 14, 15)	(13-15)

Table 6. *Contd.*

Family and species (Common name)	Occurrence in wetlands of Haora district	Hugli district
Family : ACCIPITRIDAE		
16. *Haliastur indus* (Boddaert) (Brahminy Kite)	(11, 15)	(4)
17. *Haliaeatus leucoryphus* (Pallas) (Pallas's Fishing Eagle)	(11)	–
Family : RALLIDAE		
18. *Amaurornis phoenicurus* (Pennant) (Whitebreasted Waterhen)	(1, 2, 14, 15)	(13-15)
19. *Gallinula chloropus* (Linnaeus) (Indian Moorhen)	(2, 15)	(14, 15)
Family : JACANIDAE		
20. *Metopodius indicus* (Latham) (Bronzewinged Jacana)	(1, 14, 15)	(13-15)
Family : ROSTRATULIDAE		
21. *Rostratula bengalensis* (Linnaeus) (Painted Snipe)	(1, 14, 15)	(13-15)
Family : CHARADRIIDAE		
22. *Vanellus malabaricus* (Boddaert) (Yellow Wattled Lapwing)	(7, 15)	(15)
23. *Vanellus indicus* (Boddaert) (Red Wattled Lapwing)	(1)	(15)
Family : ALCEDINIDAE		
24. *Ceryle rudis* (Linnaeus) (Lesser Pied Kingfisher)	(1, 4, 9, 11, 14-16)	(1, 4, 11, 13-15)
25. *Alecdo atthis* (Linnaeus) (Common Kingfisher)	(1, 11, 14, 15)	(1, 4, 6, 13-15)
26. *Pelargopsis capensis* (Linnaeus) (Storkbilled Kingfisher)	(14, 15)	(13, 15)
27. *Halcyon smyrnensis* (Linnaeus) (Whitebreasted Kingfisher)	(1, 2, 8, 11, 12, 14, 15)	(4, 6, 11, 13-15)

Table 6. *Contd.*

Family and species (Common name)	Occurrence in wetlands of Haora district	Hugli district
B. MIGRATORY BIRDS (Wetland dependent)		
Family : ANATIDAE		
28. *Tadorna ferruginea* (Pallas) (Brahminy Duck)	(1)	(14, 15)
29. *Anas acuta* (Linnaeus) (Pintail)	(1)	(15)
30. *Anas crecca* Linnaeus (Common Teal)	(1)	(15)
31. *Anas strepera* Linnaeus (Gadwal)	(1)	(15)
32. *Anas quequedula* Linnaeus (Garganey)	(1)	(15)
33. *Anas clypeata* Linnaeus (Shoveller)	(1)	(15)
34. *Aythya fuligula* (Linnaeus) (Tufted Pochard)	(1)	(15)
35. *Aythya ferina* (Linnaeus) (Common Pochard)	(1)	(14,15)
36. *Aythya nyroca* (Gulderstadt) (White-eyed Pochard)	(1)	(15)
Family : CHARADRIIDAE		
37. *Tringa totanus* (Linnaeus) (Redshank)	(1,15)	(13,15)
38. *Tringa ochropus* Linnaeus (Green Sandpiper)	(15)	(13,15)
39. *Tringa glareola* Linnaeus (Wood Sandpiper)	(14,15)	(14,15)
40. *Tringa hypoleucos* Linnaeus (Common Sandpiper)	(10)	(8,13)
41. *Pluvialis dominica* (P.L.S. Muller) (Eastern Golden Plover)	(15)	(15)
42. *Gallinago stenura* (Bonaparte) (Pintail Snipe)	(15)	(15)
43. *Gallinago gallinago* (Linnaeus) (Fantail Snipe)	(15)	(15)
Family : RECURVIROSTRIDAE		
44. *Himantopus himantopus* (Linnaeus) (Black-winged Stilt)	(10)	(10)
C. REED INHABITING BIRDS (Wetland associates)		
Family : MUSCICAPIDAE (Resident & Migratory)		
A: *Resident species*		
45. *Orthotomus sutorius* (Penant) (Long-tailed Tailor bird)	(15)	(15)

Table 6. *Contd.*

Family and species (Common name)	Occurrence in wetlands of Haora district	Hugli district
B. *Migratory species*		
46. *Acrocephalus aedon* (Pallas) (Thickbilled Warbler)	(15)	(15)
47. *Acrocephalus stentoreus* (Hemprich and Ehrenberg) (Southern Great Reed Warbler)	(7,15)	(14,15)
48. *Acrocephalus dumetorum* Blyth (Blyth's Reed Warbler)	(7,15)	(14,15)
49. *Phylloscopus collybita* (Vieillot) (Chiffchaff or Brown Leaf Warbler)	(7)	(15)
50. *Phylloscopus fuscatus* (Blyth) (Dusky Leaf Warbler)	(7,15)	(14,15)
51. *Phylloscopus inornatus* (Blyth) (Yellowbrowed Leaf Warbler)	(7,15)	(14,15)
52. *Phylloscopus trochiloides* (Sundevall) (Dull Green Leaf Warbler)	(15)	(15)
Family : PYCNONOTIDAE (Resident)		
53. *Pycnonotus jocosus* (Linnaeus) (Redwhiskered Bulbul)	(7,15)	(14,15)
54. *Pycnonotus cafer* (Linnaeus) (Redvented Bulbul)	(15)	(15)

Mention may be made that there is no remarkable difference in the representation of waterfowls between the wetlands of coastal plains (North and South 24-Parganas districts ; Nandi *et al.*, 1993) and Gangetic plains particularly due to Santragachi jheel in Haora district which serves as the safe refuge for migratory birds. But, in the wetlands of North and South 24-Parganas districts, waders belonging to the families Ardeidae, Rallidae and Charadriidae were found to be represented by 31 species (Nandi *et al.*, 1993) compared to 20 species of Haora and Hugli districts.

Among the birds, 27 (50%) species are waterfowls, 11 (20%) waders, 10 (18.5%) reedland birds and the rest six species are kite, eagle and kingfishers. The waterfowls include 11 species of ducks and geese, 9 species of herons, egrets and bitterns and the rest 7 species are, 1 species each of a grebe, darter, cormorant, stork, rail, moorhen and jacana. Both waterfowls and waders are in great pressure of hunting in rural areas, particularly during winter months with the arrival

of migratory species. However, in some *jheels* at Kamarkundu, Baligori and Dunkuni of Hugli district and Amta, Santragachi of Haora district Lesser Whistling Teals and Cotton Teal are encountered throughout the year.

4.1.3. Reptiles

Six species belonging to four families comprising of turtle, monitor lizards and snakes were found to be associated with wetlands in both Haora and Hugli districts (Table 7). Of these, a trionychid pond turtle and two colubrid freshwater snakes are aquatic and exclusively wetland dependent. The rest three species belonging to the families Varanidae and Elapidae are terrestrial but often associated with wetlands for their food and/or shelter. The varanid monitor lizards are well adapted to swimming even in flowing flood water. In the floodplain areas they usually inhabit in burrows of high embankment with vegetative cover. However, flood plain areas of these two districts are also inhabited by a species of poisonous elapid snake, *Naja naja kaouthia,* locally known as 'Kaoute sap' There are several reports of death due to bite of this monocellate cobra species in and around paddy fields.

Table 7. List of wetland inhabiting/associated reptiles of Haora and Hugli districts.

Family and species	Haora district	Hugli district
Family : TRIONYCHIDAE		
1. *Lissemys punctata* (Bonaterre) (Indian Flap-shelled Turtle)	(10,11,14,15)	(4,6,13,15)
Family : VARANIDAE		
2. *Varanus bengalensis* (Daudin) (Large Bergal Monitor)	(8,11,15)	(1,15)
3. *Varanus flavescens* (Gray) (Yellow Monitor Lizard)	(15)	(15)
Family : COLUBRIDAE		
4. *Enhydris enhydris* (Schneider) (Smooth Water Snake)	(1-4,9-11,14-17)	(1-6,10,11, 13-15)
5. *Xenochrophis piscator* (Schneider) (Checkered Keelback)	(1,2,5,7,11, 14-17)	(1-4,6,8,10,11, 13-15)
Family : ELAPIDAE		
6. *Naja naja kaouthia* (Lacepede) (Indian Cobra)	(10,12)	(8,13,15)

4.1.4. Amphibians (Figs. 3-4) :

Five species of frogs and one species of toads belonging to three families *viz.*, Ranidae, Microhylidae and Bufonidae have been recorded (Table 8). All these species are wetland dependent for their larval development. The adult ones prefer cool shady bushes where they hide under stones, logs and among vegetation. The microhylid and the bufonid species are found active after showers. The Skipper Frog, *Rana cyanophlyctis* Schneider, is a truly wetland inhabiting species. They are invariably found floating on the water surface in ponds. pools and ditches as well as larger freshwater wetlands adjacent to the water edge. Sarkar (1984), while working on the amphibian fauna of Calcutta and its envirns covering both Haora and Hugli districts, recorded 13 species of amphibians belonging to four families from the area and mentioned that *R. cyanophlyctis* is one of the commonest frog of the area.

Table 8. List of amphibian fauna associated with wetlands of Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : RANIDAE		
1. *Rana cyanophlyctis* Schneider (Skipper Frog)	(1-17)	(1-15)
2. *Rana tigerina* Daudin (Indian Bull Frog)	(1,2,7,9,10, 11,14,15)	(4,6,8,9, 10,13-15)
3. *Rana limnocharis* Wiegmann (Paddy-field Frog)	(1,7,8,12-15)	(4-10, 13-15)
4. *Rana hexadactyla* Lesson (Green Frog)	(2,14)	(15)
Family : MICROHYLIDAE		
5. *Microhyla ornata* (Dumeril and Bibron) (Ornate Frog)	(6,14)	(10,13,15)
Family : BUFONIDAE		
6. *Bufo melanostictus* Schneider (Common Indian Toad)	(1,2,4,5,9, 13,14,16)	(1,2,4,13-15)

4.1.5. Fishes (Figs. 5-13) :

A total of 48 species of fishes belonging to 15 families have been recorded (Table 9). Of these, only two species of estuarine gobiid fishes *viz.*, *Apocryptes bato* and *Ophiocara porocephala* have been encountered in floodplain wetlands of Khanakul under Hugli district. While different varieties of gobiid fishes (Black, white and red varieties of *Gule* fish) and estuarine flat fishes (locally known as *Banspata*) are also reported to occur in the Garerght-Khanakul areas (Jagatpur *beel*). The tidal waters from Rupnarayan river nearby sometimes inundate this area and the irrigation waters of this region also bring estuarine element in the fish fauna of this floodplain wetland.

The cyprinid fishes as well as *Oreochromis, Anabas, Clarias* and *Heteropneustes* are extensively cultured in the freshwater wetlands of Haora and Hugli districts. The cyprinid fishes include major carps like *Catla catla* (Ham.), *Labeo rohita* (Ham.), *Labeo calbasu* (Ham.) and *Cirrhinus mrigala* (Ham.), minor carps like *Labeo bata* (Ham.) and exotic craps like *Cyprinus carpio* Linn, *Ctenopharyngodon idella* (Val.) and *Hypophthalamichthys molitrix* (Val.). Some weed fishes belonging to the genera *Puntius, Esomus, Rasbora* and *Lepidocephalus* under the family Cyprinidae abound in these wetlands. During March-April the local fisherwomen are found to catch *Lepidocephalus* species in plenty along with the freshwater gobiid fish (*Glossogobius giuris*) and shrimps in their scoop nets. The juveniles of the weed fish species occur in large numbers during rainy season which indicates that they are high fecund species and breeds naturally during summer months. However, a number of other weed fishes like *Chanda nama* (Ham.) and *C. ranga* (Ham.) (Family Chandidae), *Colisa fasciatus* (Schneider) (Family Belontidae) and *Badis badis* (Ham.) (Family Nandidae) also breed in summer and abound in monsoon months.

The channid, bagrid, silurid, clariid, anabantid and mastacembelid fishes (Table 9) are available in good numbers in these wetlands. These predatory species mostly abound in flood plain wetlands and are harvested from October to April prior to drying up of the temporary wetlands.

Table 9. List of fish fauna associated with wetlands of Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : NOTOPTERIDAE		
1. *Notopterus notopterus* (Pallas)	(1,4,5,9,11 14-16)	(2,4,6,11 13-15)
Family : CYPRINIDAE		
2. *Catla catla* (Hamilton)	(1,2,4-6, 9-17)	(1-4, 6, 11-15)
3. *Labeo rohita* (Hamilton)	(")	(")
4. *Labeo calbasu* (Hamilton)	(1,5,6,9,11, 14-17)	(2,4,6,11, 13,15)
5. *Labeo bata* (Hamilton)	(1,5,11,16)	(2,4,6,13,15)
6. *Cirrhinus mrigala* (Hamilton)	(1,2,4-6,9-17)	(1-6,11-15)
7. *Ctenopharyngodon idella* (Valenciennes)	(4,9,16)	(4,6,11,13)
8. *Cyprinus carpio* Linnaeus	(1,2,5,16,17)	(2,6)
9. *Hypophthalmichthys molitrix* (Valenciennes)	(1,2,5,11, 16,17)	(2,6,11,13)
10. *Puntius javanicus* (Blan.)	(16,17)	(2,4,6)

Table 9. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
11. *Puntius sarana* (Hamilton)	(3,9,11)	(2,4,6,13,15)
12. *Puntius sophore* (Hamilton)	(1,2,5,6,11, 14-17)	(1,2,4,6,11-15)
13. *Puntius ticto* (Hamilton)	(1-17)	(1-15)
14. *Puntius gelius* (Hamilton)	(1,3,7-9,12 14-16)	(5-10,13-15)
15. *Amblypharyngodon mola* (Hamilton)	(1-17)	(1-15)
16. *Esomus danricus* (Hamilton)	(1-17)	(1-15)
17. *Salmostoma bacaila* (Hamilton)	(1,9,14,15)	(2,6,8,13,15)
18. *Rasbora daniconius* (Hamilton)	(1,6,9,14,15)	(2,4,6,13-15)
19. *Lepidocephalus guntea* (Hamilton)	(1,6,9,11, 14-17)	(1,2,4,6,8,11, 13-15)
Family : BAGRIDAE		
20. *Mystus cavasius* (Hamilton)	(1,11,14,15)	(4,6,10,15)
21. *Mystus vittatus* (Bloch)	(9,11,14-17)	(4,6,8,12,13,15)
22. *Mystus tengra* (Hamilton)	(1,2,5,9,11, 14-17)	(1,2,4-6,8, 12-15)
Family : SILURIDAE		
23. *Ompak pabda* (Hamilton)	(14,15)	(10,15)
24. *Wallago attu* (Schneider)	(11,14,15)	(8,10,13,15)
Family : CLARIIDAE		
25. *Clarias batrachus* (Linnaeus)	(1-17)	(1-15)
Family : HETEROPNEUSTIDAE		
26. *Heteropneustes fossilis* (Bloch)	(1-17)	(1-15)
Family : BELONIDAE		
27. *Xenentodon cancila* (Hamilton)	(5,11)	(8,10)

Table 9. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : CYPRINODONTIDAE		
28. *Aplocheilus panchax* (Hamilton)	(1-17)	(1-15)
Family : CHANNIDAE		
29. *Channa orientalis* (Schneider)	(1-4, 6-17)	(1-15)
30. *Channa punctatus* (Bloch)	(1-17)	(1-15)
31. *Channa striatus* (Bloch)	(1-17)	(1-15)
32. *Channa marulius* Hamilton	(14-15)	(8-15)
Family : SYMBRANCHIDAE		
33. *Monopterus cuchia* (Hamilton)	(10-12)	(14, 15)
Family : CHANDIDAE		
34. *Chanda nama* (Hamilton)	(5,15)	(8,10)
35. *Chanda ranga* (Hamilton)	(1-17)	(1-15)
Family : GOBIIDAE		
36. *Glossogobius giuris* (Hamilton)	(1,2,4-6,9,11 14-17)	(1,2,4,6,8, 10-15)
37. *Oligolepis acutipinnis* (C.V.)	(5,11)	(10)
38. *Apocryptes bato* (Hamilton)	–	(10)
39. *Ophiocara porocephala* (Val.)	–	(10)
Family : ANABANTIDAE		
40. *Anabas testudineus* (Bloch)	(1-17)	(1-15)
Family : CICHLIDAE		
41. *Oreochromis mossambica Peters*	(1,2,6,9,11, 14,15)	(2,4,6,11, 14,15)
42. *Oreochromis nilotica* Valenciennes	(1,9)	(2,4,6,15)
Family : NANDIDAE		
43. *Nandus nandus* (Hamilton)	(6,11,14,15)	(14,15)
44. *Badis badis* (Hamilton)	(1-10, 14-17)	(4,6,8,10,13-15)

Table 9. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : BELONTIDAE		
45. *Colisa fasciatus* (Schneider)	(1-17)	(1-15)
Family : MASTACEMBELIDAE		
46. *Mastacembelus armatus* (Lacepede)	(11,15)	(8,15)
47. *Mastacembelus pancalus* (Hamilton)	(1-17)	(1-15)
48. *Macrognathus aculeatus* (Bloch)	C(1-17)	(1-15)

The higher representation of fishes (76 species) in the earlier study (Nandi *et al.*, 1993) is mainly attributed to brackishwater fishes available in 'bhasabadha' fisheries in North nd South 24-Pargnas districts.

4.2. Invertebrates

4.2.1. Decapod crustaceans (Figs. 14-18) :

Macrocrustaceans mainly belong to the order Decapoda and comprise of prawns and crabs. Four species of prawns and three species of crabs were identified from freshwater wetlands of these two districts (Table 10). Two species of *Macrobarachium viz., Macrobrachium lamarrei* (H.M. Edwards) and *M. dayanum* (H.M. Edwards) and a species of atyid shrimp abound in these wetlands. All the three species of crabs *viz.*, *Varuna litterata* (Fabricius), *Paratelphusa hydrodromus* Herbst and *Sartoriana spinigera* Wood Mason are common in occurrence. However, during summer months, the grapsid crab, *Varuna litterata,* locally known as *Chiti Kankra*, occurs in plenty (3-4 quintals) in Jagatpur *beel* of Hugli district, which is sold at Rs. 3/- per kilogram in the local market.

Table 10. List of decapod crustaceans recorded from wetlands in Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
DECAPODA : MACRURA		
Family : PALAEMONIDAE		
1. *Macrobrachium rosenbergii* (de Man)	(5,9,11)	(4,6,10)
2. *Macrobrachium lamarrei* (H.M. Edwards)	(1-17)	(1-15)
3. *Macrobrachium dayanum* (H.M. Edwards)	(1,2,4-6, 9-17)	(1,2,4,6,8, 10-15)

Table 10. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : ATYIDAE		
4. *Caridina* sp.	(1-17)	(1-15)
DECAPODA : BRACHYURA		
Family : GRAPSIDAE		
5. *Varuna litterata* (Fabricius)	(5,11,12)	(10,13)
Family : POTAMONIDAE		
6. *Paratelphusa hydrodromus* Herbst	(7,8,15)	(5-10)
7. *Sartoriana spinigera* Wood Mason	(1-4,6,9-17)	(1,2,4,6,11-15)

4.2.2. Insects :

Aquatic insects dominate the fringe fauna over all other major groups. There are altogether 13 insect orders inhabiting the fringe areas of the wetlands. They depend on wetlands for their adult and/or larval life. Majority of them serve as the food for fishes and water birds. Only dominant orders are dealt herein as follows :

4.2.2.1 Order Hemiptera (Figs. 19-24) :

Twenty seven taxa belonging to seven families have been identified from various freshwater wetlands of these two districts (Table 11). Of these, so far 15 species are determined at the species level, namely, *Diplonychus annulatus* (Fabr.), *Diplonychus molestum* (Dufour), *Lethocercus indicus* (Lep. & Serv.) (Family : Belostomidae) ; *Corixa pronotoria* Distant, *Micronecta scutellaris* (Stal) (Family Corixidae) ; *Limnogonus nitidus* (Mayr), *Naboandelus signatus* Distant, *Rhagadotarsus kreepalini* Breddin (Family Gerridae) ; *Hydrometra greeni* Kirkaldy (Family Hydrometridae) ; *Laccotrephes griseus* (Guerin), *Ranatra elongata* Fabr., *Ranatra filiformis* Fabr., *Ranatra sordidula* Dahrn (Family Nepidae) ; *Anisops batilliformis* Landblad and *Anisops sardea* Herrich-Shaffer (Family Notonectidae). Among these species, water bugs (*Diplonychus* spp.) are mostly available in abundance in all the wetlands. The males of these water bugs have been found to carry eggs on their back even in pre and postmonsoon periods. *Ranatra* species also occur in abundance. Of the three species recorded, *Ranatra filiformis* is the most frequently occurring species found in both culturable fish-ponds as well as uncultivated ponds amongst fringe vegetation. But *Ranatra elongata* occurs as bottom fauna of temporary wetlands usually without any hydrophytes. However, *Anisops* species usually predominate in piscicultural ponds. While the other common species belonging to *Lethocercus, Micronecta, Gerris, Limnogonus, Rhagadotarsus* and *Plea* are more or less common inoccurrence. The rest of the hemipteran species are scarcely recorded in these two districts.

Table 11. List of hemipteran fauna occurring in wetlands of Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : BELOSTOMIDAE		
1. *Diplonychus* spp. (3 species)	(1-17)	(1-15)
2. *Lethocercus* sp.	(1,12,13)	(9,12,15)
Family : CORIXIDAE		
3. *Corixa* spp. (2 species)	(3,15)	(5,6,10,13,17)
4. *Micronecta* spp. (2 species)	(1,7,9,14,15)	(1,6,10,13, 15,17)
Family : GERRIDAE		
5. *Gerris* spp. (2 species)	(1,4-6,9,11,14 15,17)	(2-4,6,11,13,15)
6. *Limnogonus* spp. (2 species)	(1,4,6,11,12,14,15)	(4,6,13,15)
7. *Naboandelus* sp.	—	(4)
8. *Rhagadotarsus* spp. (2 species)	(6,11,14,15)	(4,6,13)
Family : HYDROMETRIDAE		
9. *Hydrometra* spp. (2 species)	(6,14,15)	(6,13,14)
Family : NEPIDAE		
10. *Laccotrephes* spp. (2 species)	(1,2,9,12-15)	(2,6,13-15)
11. *Ranatra* spp. (3 species)	(1-17)	(1-15)
Family : NOTONECTIDAE		
12. *Anisops* spp. (3 species)	(1,4-6,9,11,12)	(4,6,10,13, 15,17)
Family : PLEIDAE		
13. *Plea* spp. (2 species)	(1,3,4,7,9,12,	(2,4,6,9,13,15)
(Total - 27 Species)	14,15)	

4.2.2.2. Order Coleoptera (Fig. 25) :

So far 35 species belonging 21 genera under 4 families *viz.*, Dytiscidae, Hydrophilidae, Chrysomelidae and Curculionidae have been identified from wetlands of these two districts. (Table 12). It includes 17 species of dytiscids comprising of 9 genera and 13 species of hydrophilid belonging to 8 genera as wetland dependent aquatic beetles. The rest 5 species belonging to Chrysomelidae (3 species) and Curculionidae (2 species) are aquatic weed associated species.

Table 12. List of Coleopteran species occurring in wetlands of Haora and Hugli districts.

Family and species (No. of species)	Occurrence in wetlands of	
	Haora district	Hugli district
Family : DYTISCIDAE		
1. *Canthydrus* spp. (3 species)	(1,3, 4, 6-17)	(1-15)
2. *Clypeodytes* spp. (2 species)	(6, 7, 13)	(6,14)
3. *Cybister* spp. (2 species)	(1, 12, 13)	(1, 6, 7, 12-15)
4. *Eretes* sp.	(12)	(12)
5. *Hydaticus* sp.	(7)	(9)
6. *Hydrocoptus* sp.	(6)	(13-15)
7. *Hydrovatus* spp. (3 species)	(1,9,12,14,15)	(2.11.13-15)
8. *Laccophilus* spp. (3 species)	(1,4,6,7,12,14,15)	(1-6,9,10,12-15)
9. *Uvarus* sp.	(7)	(9)
Family : HYDROPHILIDAE		
10. *Amphiops* spp. (2 species)	(4,6,9-12, 14,15)	(10,14)
11. *Berosus* sp.	(5-7,9)	(4,5,9,11)
12. *Enocrus* sp.	—	(14)
13. *Helochares* spp. (3 species)	(1,6,7,9-12,14,15)	(1,5,6,9,10,14,15)
14. *Hydrophilus* sp.	—	(10)
15. *Laccobius* sp.	(15)	—
16. *Regimbertia* spp. (3 species)	(6,12,15)	(1,5,6,9,13-15)
17. *Sternolophus* spp. (2 species)	(6,7,12,14,15)	(1,6,9,10,13)
Family : CHRYSOMELIDAE		
18. *Altica* sp.	(6)	—
19. *Cassida* sp.	(1)	—
20. *Lema* sp.	(5)	—
Family : CURCULIONIDAE		
21. Curculionids (2 species) (Total-35 species)	(1,6)	(6,7,10)

Of the above 35 species of Coleopterans 11 species could be identified as follows : Family : Dytiscidae-*Canthydrus morsbachi* (Wehneke), *Canthydrus ritsemai* (Regimbart), *Canthydrus laetibilis* (Walker), *Hydaticus fabricii* Mac Leay, *Eretes sticticus* (L.) and *Hydrocoptus subvittulus* Mots ; and Family : Hydrophilidae *Berosus indicus* Mots., *Helochares anchoralis* Sharp, *Helochares crenatus* Sharp, *Regimbartia attenuata* F. and *Sternolophus rufipes* (F.).

4.2.2.3. Miscellaneous insects :

The nymphs or naiads and/or larval forms of the orders Odonata and Diptera were often encourtered in wetlands of these two districts. Dragon fly nymphs belonging to the family Libellulidae were most frequently found on the bottom of shallow water around fringe vegetation. They are short and stout forms with narrower head and broader strongly spined abdomen devoid of caudal gills. Damsel fly nymphs belonging to the family Coenagrionidae have elongated cylindrical body, broader head, slender abdomen with caudal gills. These nymphs are quite common in these wetlands. The larvae and pupae of mosquitoes belonging to the family Culicidae and chironomid larvae are encountered in abundance especially in temporary wetlands used for jute retting in the Hugli district. No attempt of identifying these larval forms at the species level has been made.

However, adult odonate belonging to the genera *Crocothemis, Orthetrum, Lathrecista, Diplacodes, Neurothemis, Brachythemis, Ischnura, Ceriagrion, Pseudagrion* and *Agriocnemis* are common in occurrence in and around wetlands of these two districts (Dr. T. R. Mitra, Pers. comm.). An orthopteran insects, *Grylotalpa* sp. is also common in wet sandy soils at the water edge.

4.2.3. Arachnids :

The wetlands of Haora and Hugli districts are associated with six species of spiders belonging to three families *viz.*, Lycosidae, Tetragnathidae and Salticidae. They are usually observed amongst floating and emergent vegetation of these wetlands These spiders are belonged to the genera *Pardosa* (2 species), *Hippasa* (1 species) and *Lycosa* (1 species) (Family Lycosidae), and *Tetragnatha* (1 species) (Family Tetragnathidae), in addition to an undetermined species of jumping spider (Family Salticidae). Mention may be made that most of these spider specimens represent immature forms.

4.2.4. Annelids :

Three species of earth-worms *viz.*, *Metaphire posthuma* (Vaillant), *Lampito mauriti* Kinber and *Perionyx excavatus* (Perrier) in the wet soils and three species of leeches *viz.*, *Glossiphonia weberi* Blanchard, *Helobdella nociva* Harding and *Hemiclepsis marginata* Muller in waters have been recorded from some wetlands of these two districts.

4.2.5. Molluscs (Figs. 26-30)

Sixteen species of molluscs belonging to 8 families have been recorded from wetlands of Haora and Hugli districts. Of these 16 species, 7 out of 15 species of gastropods occur abundantly in these two districts. The viviparid species, *Bellamya bengalensis* (Lamarck) occur in large numbers in almost all the wetlands surveyed from both the districts. This species. *B. bengalensis*,

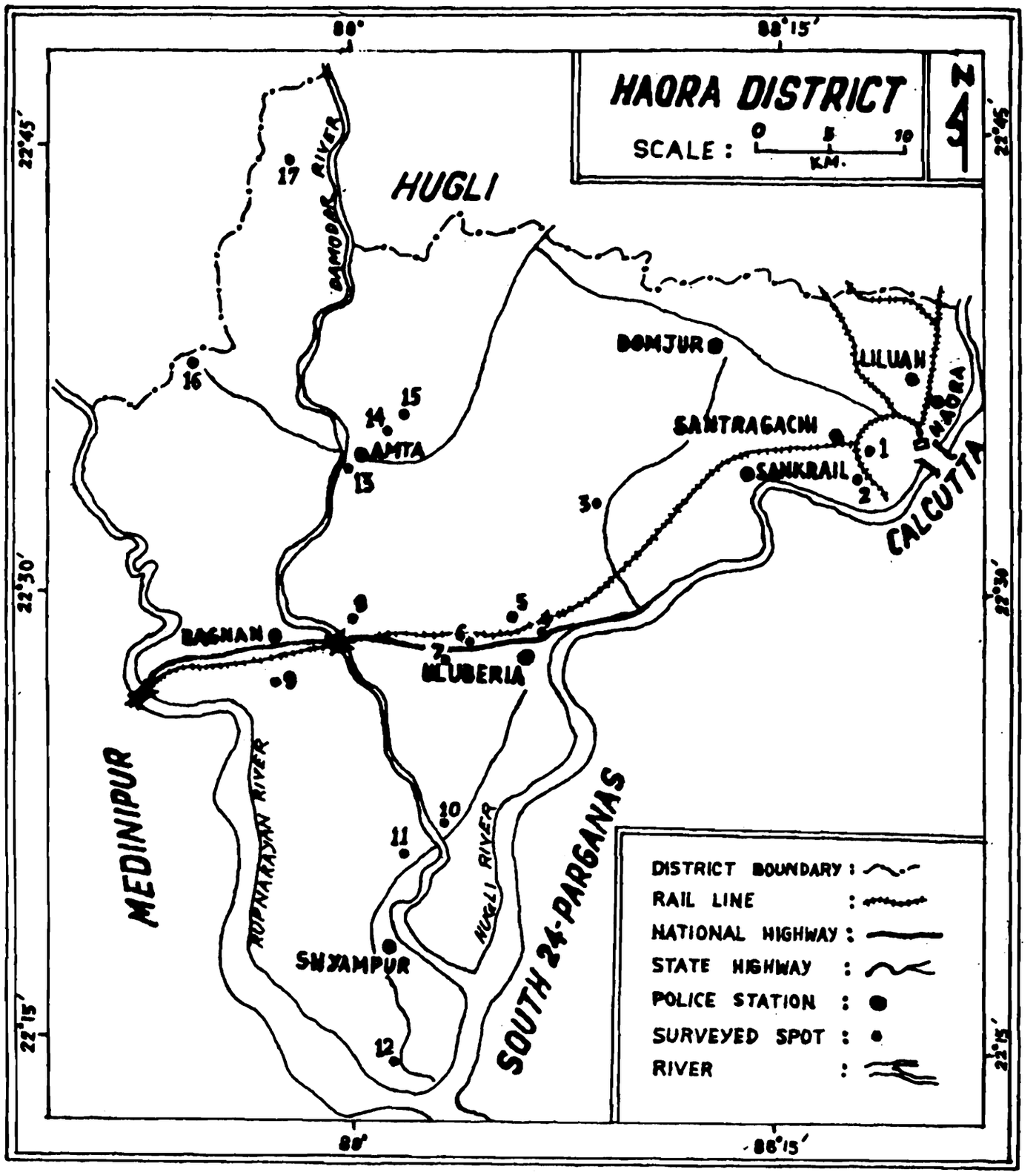
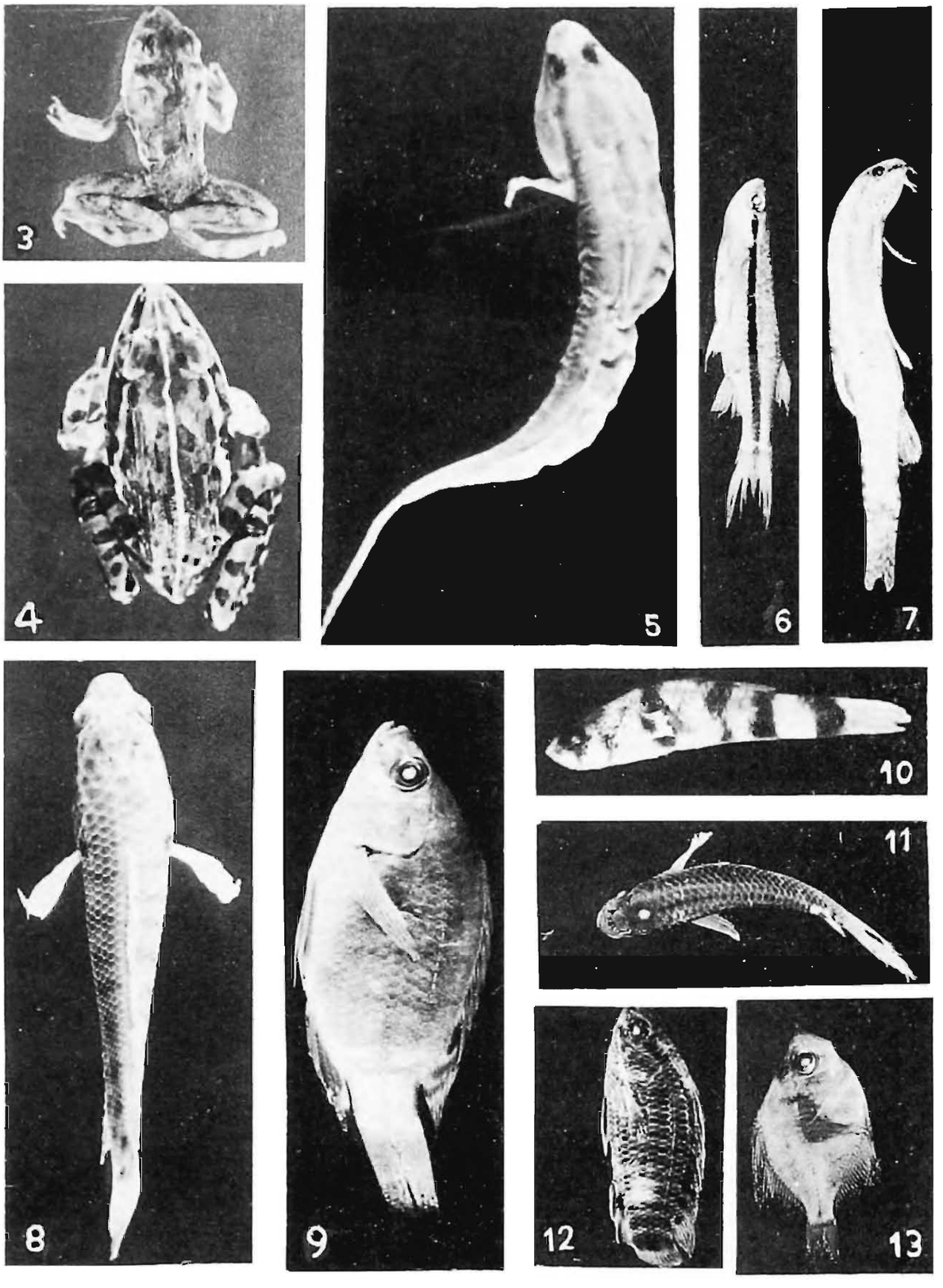


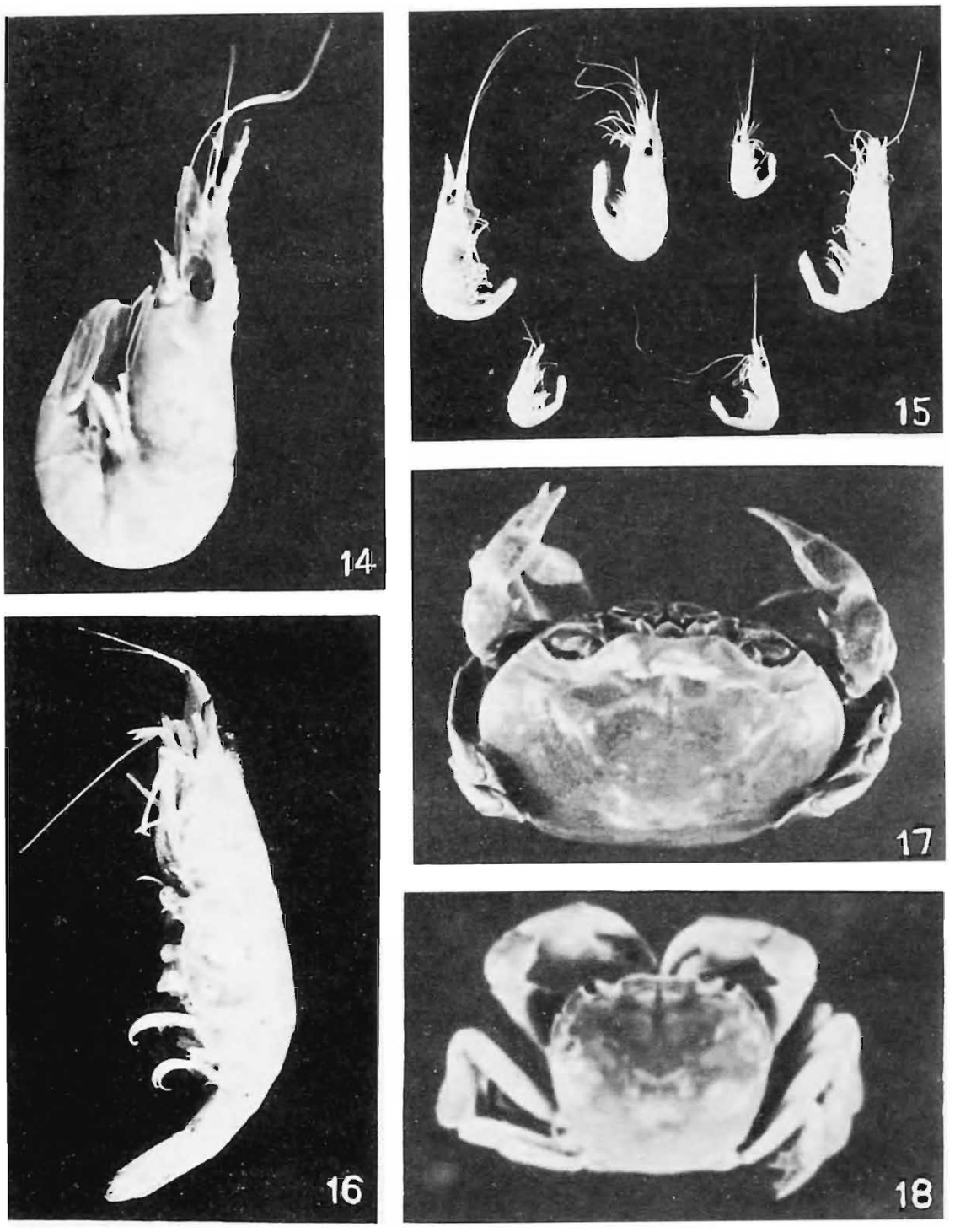
Fig. 1. Map of Haora districts showing the location of wetlands surveyed.
(Name of wetlands : 1. Santragachi *jheel*, 2. Paddapukur *jola*, 3. Kulai *jheel*, 4. Phuleswar *jheel*, 5. Natibpur *jheel*, 6. Birshibpur *jheel*, 7. Malanchberia *jola*, 8. Kashipur *jola*, 9. Bagnan *jheel*, 10. Goalapota pond, 11. Sujan Saheber *dighi*, 12. Gadiara pond, 13. Amta pond, 14. Siva *daha*, 15. Dadahali *daha*, 16. Jhikhira pond, 17. Udayanarayanpur pond).

PLATE 1



Figs. 3-13. Some common wetland fauna (frogs and fishes) of Haora and Hugli districts.
Fig. 3. *Rana cyanophlyctis* Fig. 4. *Rana tigerina* Fig. 5. *Ophiocara porocephala* Fig. 6. *Esomus danricus* Fig. 7. *Lepidocephalus guntea* Fig. 8. *Channa punctatus* Fig. 9. *Oreochromis mossambica* Fig. 10. *Oligolepis acutipennis* Fig. 11. *Aplocheilus punchax* Fig. 12. *Badis badis* Fig. 13. *Chanda ranga.*

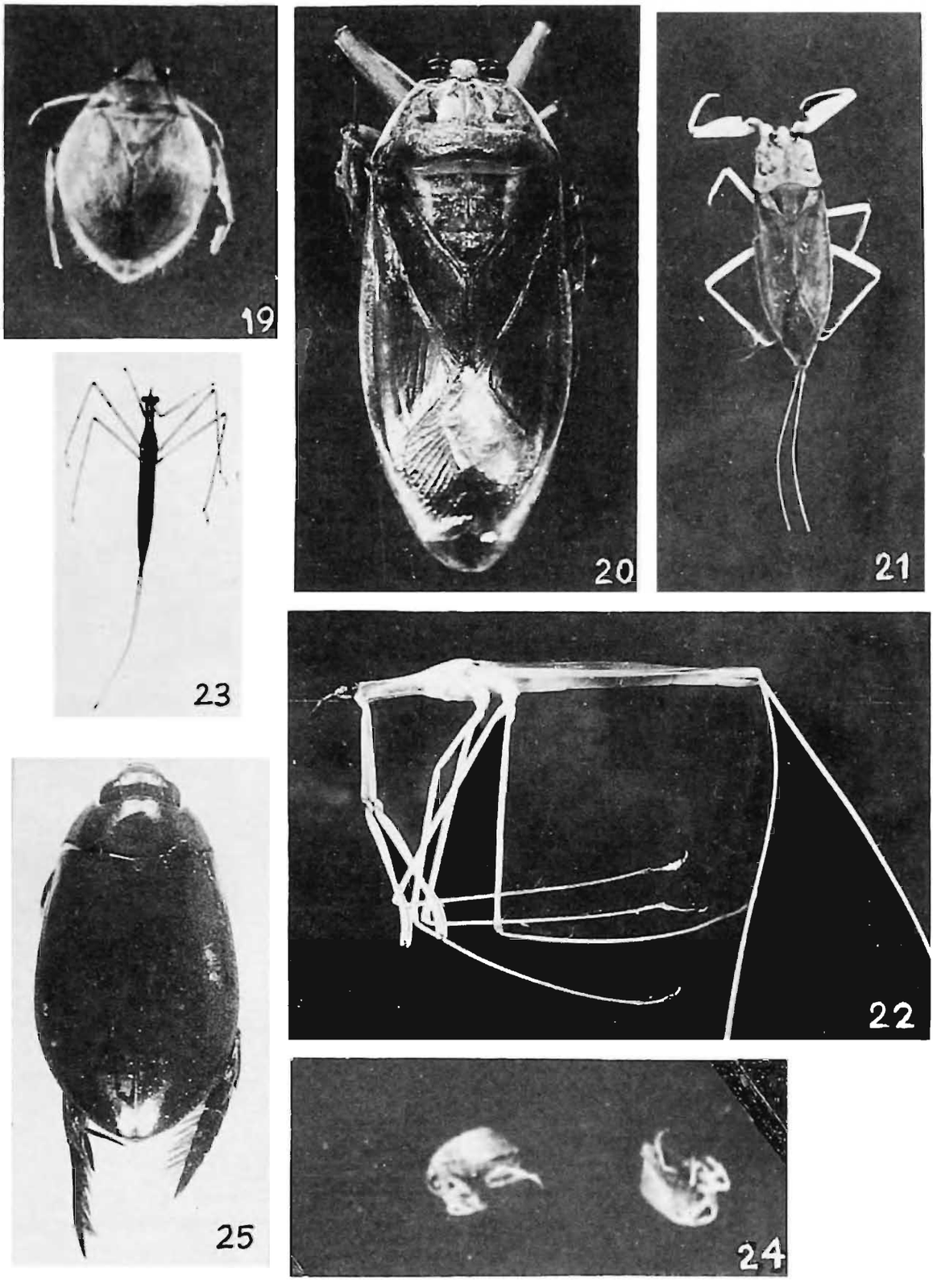
PLATE 2



Figs. 14-18. Some commercially important prawns and crabs of freshwater wetlands in Haora and Hugli districts.

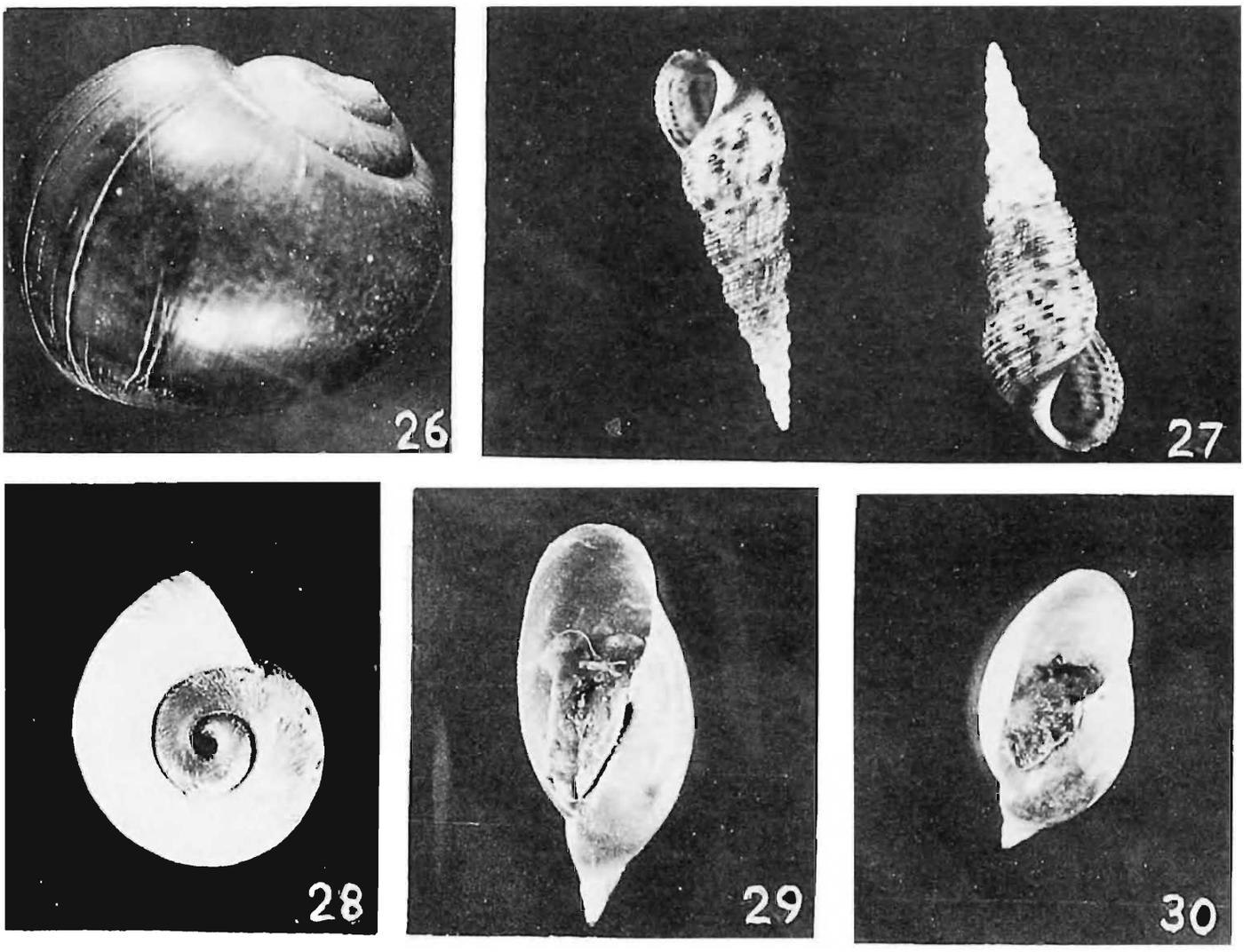
Fig. 14. *Mcrobrachium resenbergi* Fig. 15. *Macrobrachium lamarrei* Fig. 16. *Macrobrachium dayanum* Fig. 17. *Sartoriana spinigera* Fig. 18. *Varuna litterata.*

PLATE 3



Figs. 19-25. Some common insect fauna of freshwater wetlands in Haora and Hugli districts. Fig. 19. *Diplonychus annulatus* Fig. 20. *Lethocercus indicus* Fig. 21. *Laccotrephes griseus* Fig. 22. *Ranatra elongatum* Fig. 23. *Ranatra filiformis* Fig. 24. *Plea* sp. Fig. 25. *Cybister* sp.

PLATE 4



Figs. 26-30. Some common molluscs of freshwater wetlands in Haora and Hugli districts.
Fig. 26. *Pila globosa* Fig. 27. *Thiara tuberculata* Fig. 28. *Indoplanorbis exustus* Fig. 29. *Lymnaea acuminata* Fig. 30. *Lymnaea luteola.*

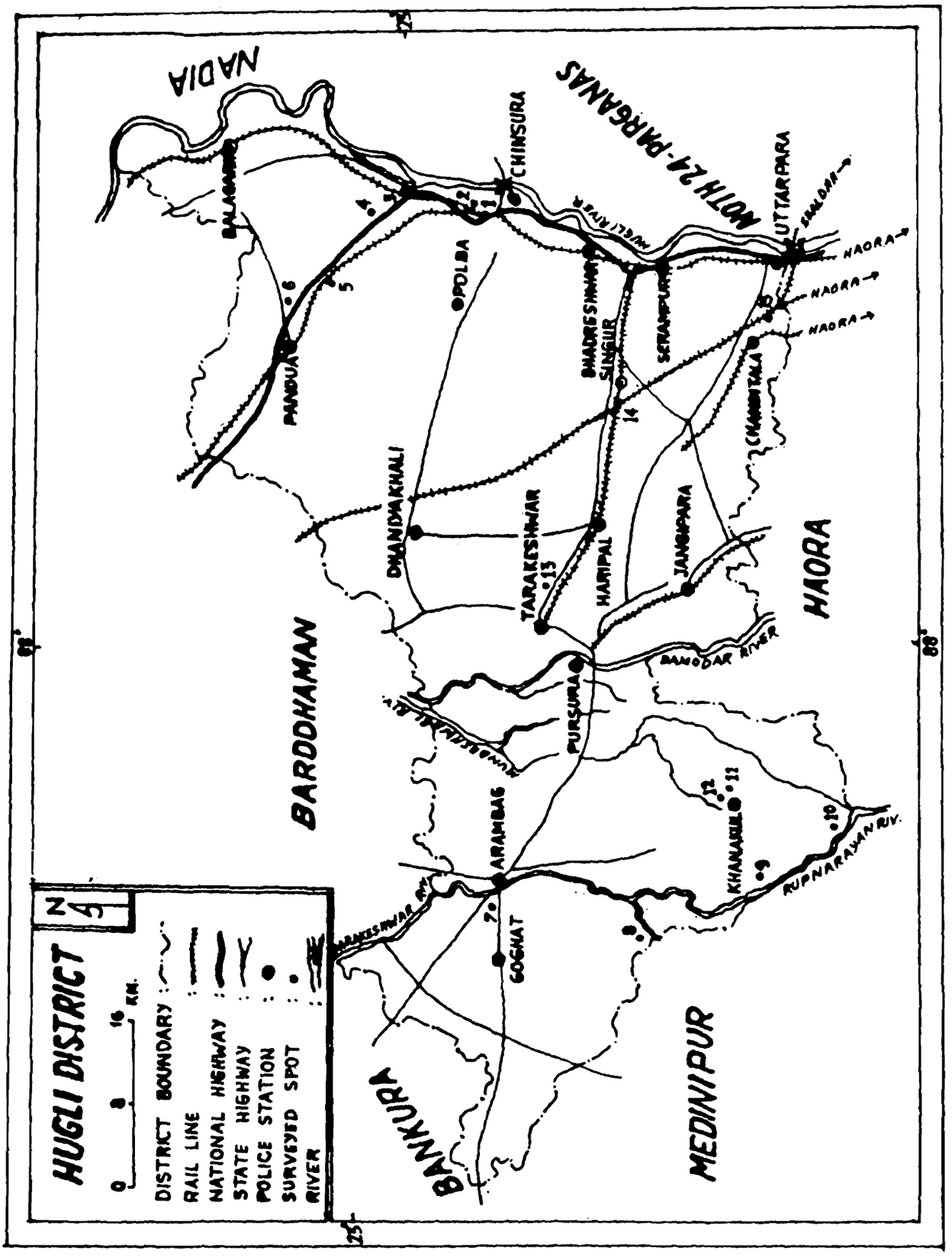


Fig. 2. Map of Hugli district showing the location of wetlands surveyed.
(Name of wetlands : 1. Madrasipara *jheel*, 2. Locopara *jheel*, 3. Tribeni *jheel*, 4. Hatgachha *dighi*, 5. Khanyan *jola*, 6. Jugihedo pond, 7. Kalipur *jheel*, 8. Muktarpur *jola*, 9. Kaknan *jheel*, 10. Jagatpur *beel*, 11. Krishnanagar pond, 12. Radhanagar pond, 13. Baligori *jheel*, 14. Kamarkundu *jheel*, 15. Dunkuni *jola*).

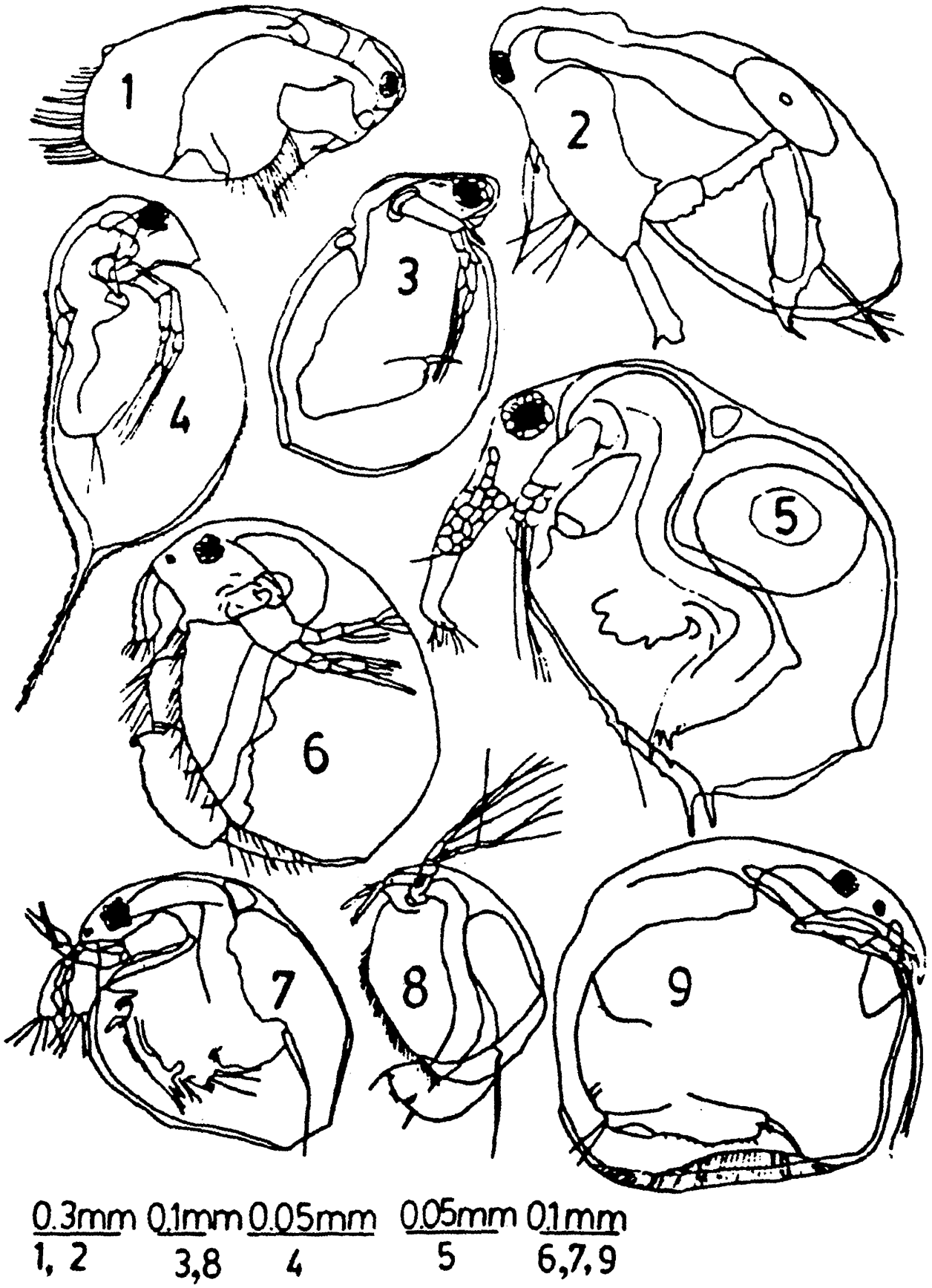


Fig. 31. Some interesting and uncommon species of Cladocera occurring in freshwater wetlands of Haora and Hugli districts.

(1. *Latonopsis australis*, 2. *Pseudosida bidentata*, 3. *Ceriodaphnia reticulata*, 4. *Daphnia similis*, 5. *Bosminopsis deitersi*, 6. *Macrothrix spinosa*, 7. *Guernella raphalis*, 8. *Grimaldina brazzai*, 9. *Chydorus ventricosus*).

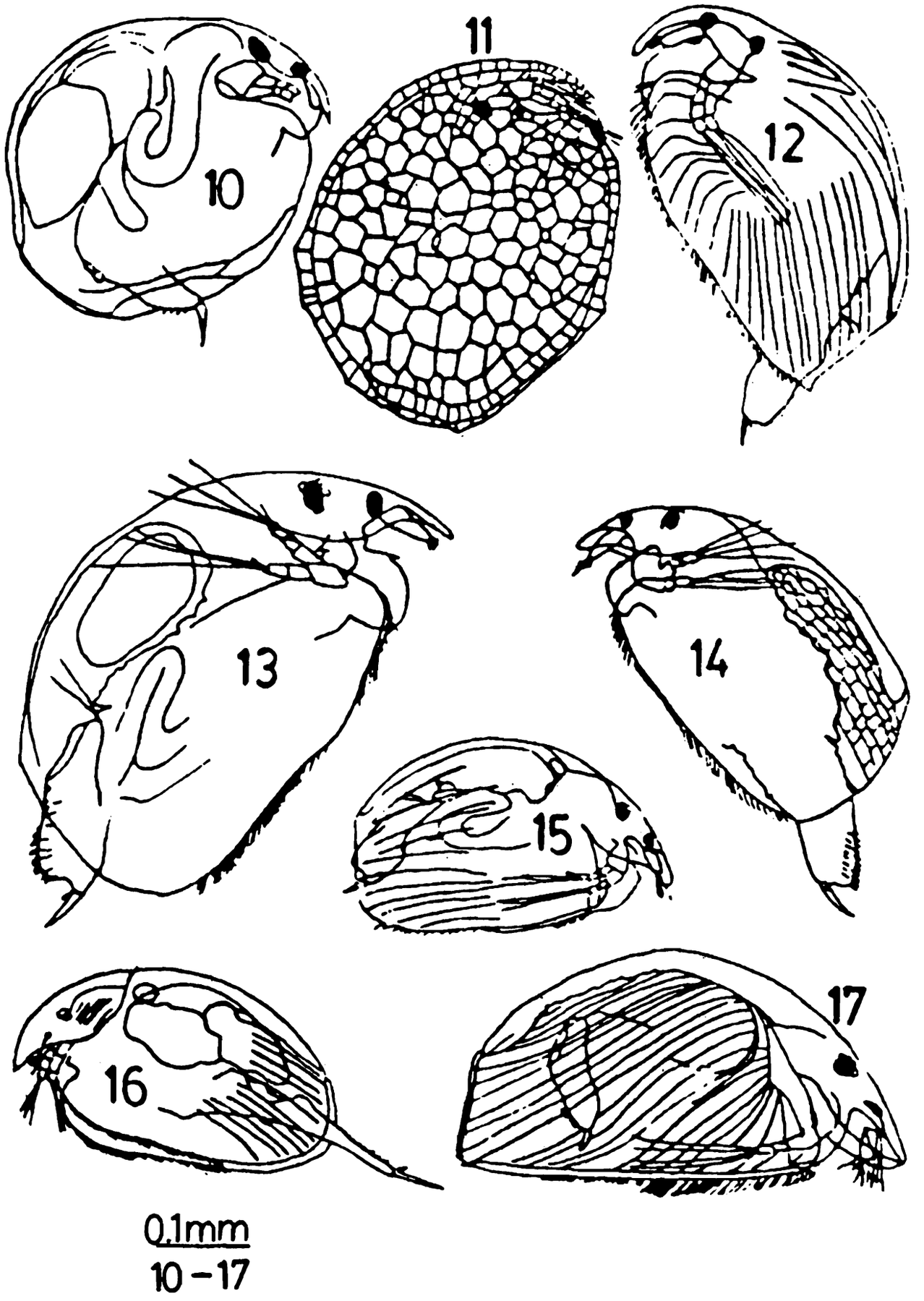


Fig. 31. Some interesting and uncommon species of Cladocera occurring in freshwater wetlands of Haora and Hugli districts.

(10. *Chydorus eurynotus*, 11. *Chydorus faviformis*, 12. *Alonella excisa*, 13. *Alona monacantha*, 14. *Alona costata*, 15. *Alona verrucosa*, 16. *Camptocercus australis*, 17. *Graptoleberis testudinaria*).

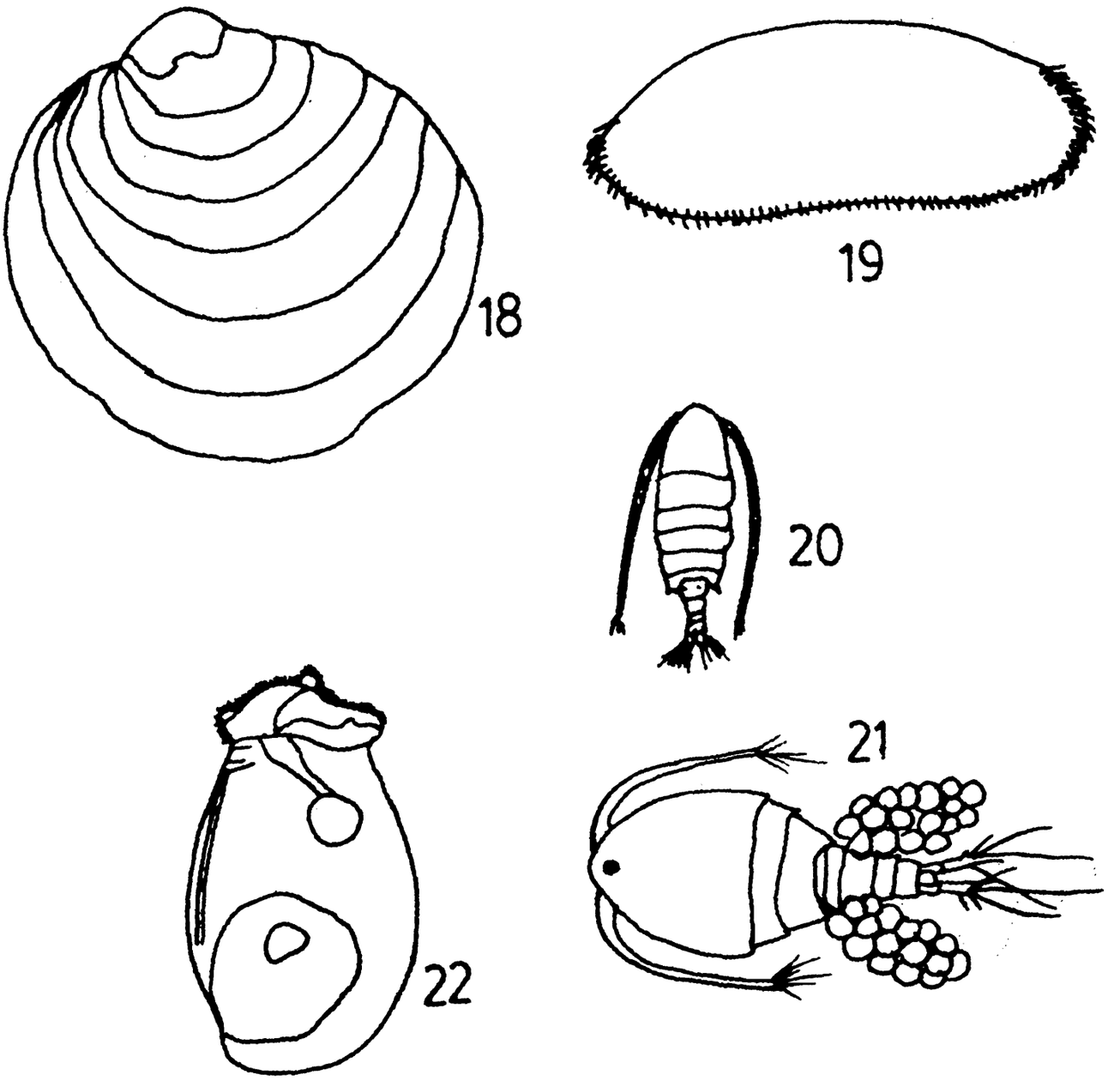


Fig. 31. Some representative species of other groups of zooplankton.

(18. *Cyclestheria hislopi* — Conchostraca
19. *Stenocypris* sp. — Ostracoda
20. *Diaptomus* sp. — Copepoda
21. *Mesocyclops hyalinus* — "
22. *Asplacha* sp. — Rotifera)

as well as a pilid gestropod, *Pila globosa* (Swainson) and a bivalve species, *Lamellidens marginalis* (Lamarck) are consumed by the poor people of these two districts. These molluscs and their flesh are found to be sold in *bhagas* (lots/groups) in the rural markets held twice a week. Raut and Biswas (1991) while studying the population density of *L. marginalis* in relation to soil from ten ponds of West bengal including a pond from Haora district observe that this species occurs in higher number in sandy clay substratum at a water depth of 57 to 73 cm. It is worthmentioning that 2.37% of this freshwater mussel (19 of 800 *L. marginalis*) are known to bear pearl from Hugli district (Raut and Biswas, 1989).

The occurrence of *Neritina violacea* (Gmelin), a brackishwater species (Subba Rao, 1989), at Gadiara of Howrah district indicates the influence of tidal flood water in this wetland.

4.2.6. Zooplankton (Figs. 31.1-31.22)

So far 74 species of zooplankton belonging to five different groups *viz.*, Copepoda, Ostracoda, Cladocera, Conchostraca and Rotifera have been recorded from fresh water wetlands of Haora and Hugli districts (Table 14). Of the 74 species of zooplankton, 52 species (70.2%) are represented by cladocerans, 8 species (10.8%) by copepods, 6 species (8.1%) by ostracods, 1 species (1.3%) by conchostracans and 7 species (9.4%) by rotifers. In all, 53 named species are recorded from Haora district and 39 species from Hugli district. While of the 52 named species of Cladocera recorded from these two districts 22 species are new records to West Bengal (Venkataraman and Das, 1993).

Table 13. List of molluscan species recorded from wetlands in Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
MOLLUSCA : GASTROPODA		
Family : NERITIDAE		
1. *Neritina violacea* (Gmelin)	(12)	—
Family : ASSIMINEIDAE		
2. *Assiminea francessiae* (Gray)	—	(10)
Family : THIARIDAE		
3. *Thiara granifera* (Lamarck)	(1,2,12)	(1, 4,)
4. *Thiara scabra* (Muller)	(12)	(15)
5. *Thiara tuberculata* (Gray)	(1,2,4-6,14,15)	(1,10,12,13,15)
Family : VIVIPARIDAE		
6. *Bellamya bengalensis* (Lamarck)	(1-17)	(1-15)
7. *Bellamya dissimilis* (Muller)	(2, 4)	(8, 10)

Table 13. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : PILIDAE		
8. *Pila globosa* (Swainson)	(1-17)	(1-15)
Family : BITHYNIIDAE		
9. *Gabbia orcula* Frauenfild	(1,2,6,14,15)	(4,10,15)
10. *Digoniostoma ceremeopoma* (Benson)	(6,7,12)	(10-13,15)
Family : PLANORBIDAE		
11. *Indoplanorbis exustus* (Deshayes)	(1-17)	(1-15)
12. *Gyraulus convexiusculus* (Hutton)	(1,4,6,7,9,11,14,15)	(3-15)
13. *Gyraulus labiatus* (Benson)	(6,7,12,14)	(13)
Family : LYMNAEIDAE		
14. *Lymnaea luteola* Lamarck	(1-5,7,9-12,14,15)	(1,2,5,6,8-11,13-15)
15. *Lymnaea acuminata* lamarck	(1,14,15)	(8,14,15)
MOLLUSCA : BIVALVIA		
Family : UNIONIDAE		
16. *Lamellidens marginalis* (Lamarck)	(1,2,6,9,11,14,15)	(1,2,6,11,15)

Of the five different groups of zooplankton, copepods are commonly found in limnetic as well as littoral regions of freshwater wetlands. Both conchostracans and cladocerans are found in greatest abundance near the fringe vegetation. The species of ostracods and rotifers were encountered in a wide variety of aquatic habitats. But, all these, organisms provide very good food for the fishes.

Among copepod, species of *Diaptomus* and *Mesocyclops* commonly occur in wide variety of wetlands, The ostracods species are scarcely recorded. The cladocerans exhibit greatest diversity in species as well as in abundance by a number of species *viz., Diaphanosoma excisum* Sars, *Scapholeberis kingi* Sars, *Moina micrura* Kurz, *Chydorus barroisi* (Richard), *Dunhevedia crassa* King and *Alona karua* (King). However, some temperate species of Cladocera *viz., Diaphanosoma brachyurum, Daphnia similis, Grimaldina brazzai, Chydorus pubescens, Chydorus faviformis, Leydigia acanthocercoides, Graptoleberis testudinaria, Alona intermedia, Alona costata, Alona rectangula* and *Camptocereus australis* are extremely rare representative of one or a few wetlands in West Bengal (Venkataraman and Das, 1993). These species were not recorded earlier from West bengal. They are introduced into West Bengal presumably by means of passive spread by

migratory birds (Proctor *et al.*, 1967). A palaearctic species of cladoceran *viz., Diaphanosoma brachyurum* (Lieven) has also been reported from floodplain wetlands in West Bengal (Venkataraman and Das, 1994). The conchostracans and rotifers are not so common in occurrence (Table 14).

Table 14. List of zooplankton species recorded from wetlands in Haora and Hugli districts.

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
CRUSTACEA : COPEPODA		
Family : DIAPTOMIDAE		
1. *Diaptomus* spp. (3 species)	(1,4,5,7,10, 12,13,15,17)	(3-7,13,15)
2. *Paradiaptomus* sp.	(5,7,9,12)	(5,15)
3. *Spicodiaptomus* sp.	(5,8,17)	(3,6)
Family : CYCLOPIDAE		
4. *Mesocyclops hyalinus* Rehberg	(1,4-10,12-14)	(1,3,4,6,10,13-15)
5. *Mesocyclops leucarti* (Claus)	(1,3,8,12,15,17)	(1,14)
6. *Thermocyclops* sp.	(1,7,12)	(13)
CRUSTACEA : OSTRACODA		
Family : CYPRIDAE		
7. *Cypris* spp. (3 species)	(3,6,7,15)	(13,15)
8. *Stenocypris* spp. (2 species)	(14,15)	(3,9,14,15)
Family : NOTODROMADIDAE		
9. *Centrocypris* sp.	—	(6,13,14,15)
CRUSTACEA : CLADOCERA		
Family : SIDIDAE		
10. *Diaphanosoma brachyurum* (Lieven)*	—	(10,11)
11. *Diaphanosoma excism* Sars	(1,4,5,6,9,10,12,17)	(4-8, 10,13)
12. *Diaphanosoma sarsi* Richard	(1,5,9)	—
13. *Latonopsis australis* (Sars)*	(1,8,14)	(13-15)
14. *Pseudosida bidentata* Herrick*	(7,8)	—

Table 14. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
Family : DAPHNIIDAE		
15. *Ceriodaphnia cornuta* Sars	(1,11)	(3,7,10,11,13,15)
16. *Ceriodaphnia reticulata* (Jurine)*	(1,14,15)	—
17. *Daphnia lumholtzi* Sars	(5,6,9,17)	(4,15)
18. *Daphnia similis* Claus*	(17)	—
19. *Scapholeberis kingi* Sars	(1,5,8,11,17)	(3,11,13,15)
20. *Simocephalus exspinosus* (Koch)	(1,13-15)	(3,4,15)
21. *Simocephalus latirostris* Stingelin*	(1,13,14)	(15)
22. *Simocephalus vetulus* (O.F. Muller)	(1,5,8,9,17)	(3,10,13)
Family : MOINIDAE		
23. *Moinodaphnia macleayi* (King)	(1)	—
24. *Moina micrura* Kurz	(5,8,14,17)	(1,4,6,10,13,15)
25. *Moina weismanni* Ishikawa*	—	(11)
26. *Bosminopsis deitersi* Richard*	(1,8,15)	—
Family : MACROTHRICIDAE		
27. *Bosmina longirostris* (O.F. Muller)	(15)	(6,13)
28. *Grimaldina brazzai* Richard**	(1,7)	—
29. *Guernella raphalis* Richard*	(1,7)	—
30. *Ilyocryptus spinifer* Herrick	(4,14)	(11)
31. *Macrothrix spinosa* King*	(1,4-6,8,14)	(3,6,8,10,12,13,15)
32. *Macrothrix triserialis* (Brady)	(1,3,6-8,12)	(10,12,15)
Family : CHYDORIDAE		
33. *Alona affinis* Leyding	(1,12)	(11,15)
34. *Alona costata* Sars	(1,6-8,14)	—
35. *Alona davidi* Richard	(1,8,9,14)	(15)
36. *Alona intermedia* Sars*	(1)	(13,15)

Table 14. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
37. *Alona karua* (King)	(1,3,6-8,9,14)	(4,8,13-15)
38. *Alona kwangsiensis* Chiang*	(1)	(11)
39. *Alona monacantha* (Stingelin)*	(7)	—
40. *Alona pulchella* Sars	(1,4,6,7,12,14)	—
41. *Alona quadrangularis* (O.F. Muller)	(6-8)	—
42. *Alona rectangula* Sars	—	(14)
43. *Alona verrucosa* Sars*	(1,6-8,14)	(15)
44. *Alonella excisa* (Fischer)*	(7,13,14)	(5,15)
45. *Camptocercus australis* Sars*	(3)	(13)
46. *Chydorus barroisi* (Richard)	(1,6,7,14)	(8,9,12,13,15)
47. *Chydorus eurynotus* Sars*	(1,6-8,14)	(8,10,13,15)
48. *Chydorus faviformis* Birge*	(8)	—
49. *Chydorus pubescens* Sars*	(7,8,10,11)	—
50. *Chydorus ventricosus* Daday*	(6-8, 14)	(11,13)
51. *Dunhevedia crassa* King	(1,6,7,9,14)	(13,15)
52. *Dunhevedia serrata* Daday*	(8)	(5)
53. *Euryalona orientalis* (Daday)	(1,3)	(9-11)
54. *Graptoleberis testudinaria* (Fischer)	(8)	—
55. *Indialona globulosa* (Daday)	(6-8,14)	(9-11)
56. *Kurzia latissima* (Kurz)	(1,3,7)	—
57. *Kurzia longirostris* (Daday)	(1,3,7,14)	(12)
58. *Leydigia acanthocercoides* (Fischer)	(4)	—
59. *Oxyurella singalensis* (Daday)	(1,8,14)	(13,15)
60. *Pleuroxus denticulatus* Birge	(1,7,14)	—
61. *Pleuroxus similis* Vavra	(1,4,8)	—

Table 14. *Contd.*

Family and species	Occurrence in wetlands of	
	Haora district	Hugli district
CRUSTACEA : CONCHOSTRACA		
Family : CYCLESTHERIDAE		
62. *Cyclestheria hislopi* Baird	(4)	(3,5,6,9,15)
ROTIFERA		
Family : ASPLANCHIDAE		
63. *Asplancha* sp.	(4,5,9,12)	(1,6,7,13,15)
Family : BRANCHIONIDAE		
64. *Branchionus calcyflorus* Pallas	(4,5)	(1)
65. *Branchionus falcatus* Zacharias	(9)	(1)
66. *Branchionus* sp.	(4,8,12)	(1,9)
67. *Keratella tropica* (Apstein)	(5)	(5)
68. *Keratella* sp.	(5)	(2,5,15)
Family : FILINIIDAE		
69. *Filinia* sp.	(12)	(1,9)
(Total :-74 species)		

Note : New records for West Bengal (*) and India (**).

PISCICULTURAL PRACTICES

Water resources of Hugli district are greater than Haora district (Table 15). This is also true for cultivable water resource which includes mostly ponds. Fish culture in ponds plays an important role in the inland fishery resources of these two districts. In Haora district, of the total 5,554.66 ha impounded water area, 76.34% are in cultivable condition, 7.48% and 16.17% are in semiderelict and derelict conditions respectively. While in the Hugli district, though it has nearly three times greater impounded water area (16,268.01 ha) than Haora district the cultivable water area is 56.70%, the semi-drelict and derelict areas are 27.94% and 15.35% respectively (Anonymous, 1986). It indicates that a greater proportion of inland impounded water resource is in semi-derelict condition in Hugli district. It can be made suitable for pisciculture with little improvement. In fact, now-a-days, a large number of rural ponds are being desilted/reexcavated through Government schemes/assistance in Hugli district. However, most of the large *beels* and *dighies* which once constituted a major source of internal fish supply, have progressively gone into dereliction requiring heavy capital investment for reclamation.

The culturable fishes in these two districts can be categorised as follows :

i) Major carps : *Catla catla, Labeo rohita, Cirrhinus mrigala, Labeo calbasu.*

ii) Minor carps : *Labeo bata, Puntius sarana*

iii) Siluroid species : *Clarias batrachus, Heteropneustes fossilis*

iv) Exotic species : *Cyprinus carpio, Ctenopharyngodon idella, Hypophthalamichthys molitrix, Puntius javanicus, Oreochromis mossambica, Oreochromis nilotica.*

Almost all the major carps and a number of exotic species are grown in ponds in various combinations. This process of composite fish farming usually yields relatively higher production even though very little attention is paid to supplementary feeding and management of most of these ponds. As the yield of water is much more than that of the same acreage of land, the enterprising youngsters and local bodies are taking much interest in piscicultural practices in these two districts. However, virtually, no attempt is made of mono and/or synergestic culture of giant freshwater prawn, *Macrobrachium rosenbergii,* a highly priced species, in freshwater wetlands. Similarly, attempts to culture freshwater pearl in mussel, *Lamellidens marginalis,* have not so far been made in the private sector though there is a report on the occurrence of pearl in freshwater mussel (2.37%) in Hugli district (Raut and Biswas, 1989). It is worthmentioning that the Fishery Department, Government of West Bengal is trying to develop standard methods for culturing freshwater pearl in West Bengal (Sengupta, 1992).

Table 15. Wetlands/water resources of Haora and Hugli districts.

Types of resources	Haora district (in ha)	Hugli district (in ha)
1. River	1,007.36	4,358.74
2. Canal/*Khal*	2,019.82	3,714.94
3. *Beel / Baor*	118.28	3,884.76
4. Tank*	8,170.70	19,763.50
5. Impounded water area	5,554.66	16,268.01
a) Culturable	4,240.45	9,224.22
b) Semi-derelict	415.70	4,545,76
c) Derelict	898.51	2,498.03

Source : Anonymous, 1986 ; Saha, 1970*

SOCIO-ECONOMIC ASPECTS

Both Haora and Hugli districts are dominated by small and medium sized wetlands. These wetlands, Besides day to day domestic use, support fisheries and offer a number of economic activities, namely, irrigation, jute-retting, brick-making, grazing as well as growing or cultivation of edible and economic species of aquatic plants. A few wetlands are also important in respect of waterfowl habitat. Each and every village and even its small units (*paras*) have a number of freshwater fish ponds. These fish ponds and floodplain wetlands are important source of sustenance for thousands of rural fisherfolks. They represent socially, economically and educationally backward communities of West Bengal. Majority of these active fisherfolks are women who earn their daily bread using a scoop-net (*Chhakni jal*) or hand net in these wetlands.

The entire Hugli district is a gift of waterways, notably the Damodar group, and the Bhagirathi group (Banerjee, 1972). This district is prone to frequent floods at Arambagh subdivision. In the

floodplain areas of Khanakul, Arambagh and Goghat Blocks, human settlements are seen on high and raised land which remains above water during the monsoon floods. During this period, each settlement (*para*) exposes itself as an isolated island amidst vast expanse of flood water.

However, both Hugli and Haora districts are important in respect to economic activities in and around the wetlands. In the Hugli district, a commercially important species of wetland plant locally known as *paniphal* (*Trapa bispinosa*) is widely grown these days in the hundred of railway *jheels* along Haora-Tarakeswar rail-link. Fruits of *Trapa bispinosa* and *Trapa maximowiczii* (*paniphal*) are eaten as food. It is sold at Rs. 4/- to Rs. 10/- per kg. in the Calcutta market. While in and around Kulgachi-Birshibpur, Haora district *Typha* (Hogla) species are widely grown in the derelict and semi-derelict wetlands. *Typha elephantina* is commercially exploited for making mats and screens. More than 300 bundles of *hogla* leaves are produced per hectare of wetlands and one bundle of dried leaves of this species costs Rs. 50-60/- in the local *hogla* shop. A large number of roadside shops are engaged in this trade.

Several wetland plants are used for a variety of purposes such as food, vegetables, fodder, medicine, mat-making, thatching, fuelwood, fertilizer and pollution abatement. The lotus plant (*Nelumbium* sp.) is cultivated at Kantapukur (near Kulgachia, Haora) and sold for ritualistic purposes. The seeds of *shapla* and *saluk* (*Nymphaea* sp.) are made into puffed grain by frying them like popcorn. The puffed seeds are eaten as such by the poor people or made into home-made confectionery. The stems and leaves of *shapla, saluk, susni sak* (*Marsilea quadrifolia*) ; *kalmi sak* (*Ipomoea aquatica*), *kachu sak* (*Colocasia esculenta*), etc., are used as vegetables. These vegetable plants are collected by the poor womenfolk for domestic consumption or for selling in the local market. These species are quite common in the derelict and semi-derelict wetlands of these two districts. The spongy petioles of *shapla, saluk* and *kachu* are made into delicious dishes even by the affluents as holiday-dish.

The grasses belonging to the family Cyperaceae and Graminae, etc. are often used as fodder for the cattle in addition to mat-making. Two species of Cyperaceae *viz.*, *Cyperus tegetum* (Madur-kathi) and *Juncellus inundatus* (Pati) grown in Balarampur (near Bishibpur) and Garhbhabanipur (near Amta) respectively are used for mat-making.

The plants, flowers and seeds of some Nymphaeaceae are used as tonic for fever, piles, skin disease and dysentry. The Brahmi sak (*Herpestes monicria*, Family Scrophulariaceae) and Kulekhara (*Hygrophila spinosa*, Family Acanthaecae) naturally grown along the water edge of these wetlands are well known for their medicinal value. Some plants like *Bera-kalmi* (*Ipomoea* sp.), also grown along the water margin, are sun-dried and used as fuel by the poors. *Dhanchi* plant *Coronitha* (= *Sesbania*) *cannabina* is cultivated in floodplain wetlands of Hugli district for fire wood and often for natural manuring by making compost fertilizer. Water hyacinth, *Azolla* and other free floating species are also used as compost fertilizer or utilized for the bio-gas plant. These free floating species especially water hyacinth act as water purifiers as they are known to treat sewage and polluted water. It is worth-mentioning that Calcutta's sewage has under gone natural purification in east Calcutta wetlands through this aquatic plant.

The temporary wetlands and roadside ditches are extensively used as paddy seed bed (*Bijtala*) for *boro* (winter rice) cultivation and mostly for jute retting in late monsoon months. During this time the water of these temporary wetlands turn black with a foul smell due to jute steeping and, with the progress of steeping process, these place prove to be notorius breeding grounds for mosquitoes.

The floodplain wetlands of Khanakul (Hugli district), virtually, left fallow during monsoon since no cultivation could be possible due to flood water run-off. While in dry winter season *robi* (dry season, October to March) crops (potato, gourd, mustard, cucumber, etc.) are extensively grown with the supply of water from Damodar Valley Corporation (DVC). The cultivation of *boro* paddy follows the *robi* crops in these floodplain wetlands.

DISCUSSION

The wetlands of Haora and Hugli districts are primarily freshwater wetlands. They are, in general, smaller in size and offer less ecological diversity in wetlands in comparison to those of North and South 24-Parganas districts having both fresh and brackishwater wetlands in addition to mangrove swamps. The faunal diversity in the selected freshwater wetlands of Haora and Hugli districts (combined) represents a total of 286 species of 12 major groups (Table 16), while both freshwater and brackishwater wetlands of North and South 24-Parganas (combined) and Sundarban mangrove ecosystem are represented by 295 and 945 species respectively (Nandi *et al.*, 1993; Mandal and Nandi, 1989). The freshwater wetlands of North and South 24-Parganas districts representing the coastal plains are inhabited by 235 species only compared to 286 species of Haora and Hugli districts representing the Gangetic plains (Table 16). The thereatened wetland fauna of these two districts representing 8 species are listed in Table 17.

Table 16. Comparative faunal diversity (major groups) of freshwater wetlands of North and South 24-Parganas districts (combined) and Haora and Hugli districts (combined)

Major groups	North and South 24-Parganas district (Combined)	Haora distict	Hugli district	Haora and Hugli district (Combined)
Mammals	3	1	1	1
Birds	67	54	53	54
Rreptiles	6	6	6	6
Amphibians	6	6	6	6
Fishes	56	46	48	48
Decapod crustaceans	7	7	7	7
Hemipterans	20	26	27	27
Coleopterans	24	33	31	35
Spiders	8	6	6	6
Annelids	9	6	6	6
Molluscs	12	15	15	16
Zooplankton	17	70	55	74
Total =	235	276	261	286

Table 17. List of threatened' animals occurring in the wetlands of Haora and Hugli districts.

Groups and species	Status of the species as indicated			Present
	IWA, 1972 (1986)	CITES, 1978	IUCN, 1990	Observation
Birds :				
1. *Haliaeetus leucoryphus* (Pallas's Fishing Eagle)	—	—	Rare	Rare
Reptiles :				
2. *Lissemys punctata* (Indian Flap-shelled Turtle)	Schedule I	Appendix I	—	Intermediate
3. *Varanus bengalensis* (Large Bengal Monitor Lizard)	"	"	—	Rare
4. *Varanus flavescens* (Yellow Monitor Lizard)	"	"	Intermediate	Rare
5. *Xenochrophis piscator* (Checkered Keelback)	Schedule II	—	—	Common
6. *Naja naja* (Indian Cobra)	"	—	—	Rare
Amphibians :				
7. *Rana hexadactyla* (Green Frog)	—	Appendix II	—	Rare
8. *Rana tigerina* (Indian Bull Frog)	—	Appendix II	—	Intermediate

Abbreviations : IWA = Indian Wildlife Act ; CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora ; IUCN = International Union for Conservation of Nature and Natural Resources.

Note : 1. The term "threatened" is used in the conservation context to donote species which are "Endangered", "Vulnerable" "Rare," etc., as defined in the IUCN Red List of Threatened Animals (1990).

2. Birds belonging to Alcedinidae, Anatidae, Ardeidae, Ciconiidae, Jacanidae, Phalacrocoracidae, Podicipedidae, Scolopacidae, etc., as well as colubird snakes and freshwater frogs (*Rana* sp.), though listed as 'Small Game' under Schedule IV of the Indian Wildlife (Protection) Act, 1972, are not referred here as threatened animals.

3. Even though the frogs *viz. Rana hexadactyla* and *R. tigerina* are not marine species of commercial importance, they may be considered currently "commercially threatened" as a sustainable commercial resource.

It is evident that Haora and Hugli districts possess relatively poor faunal diversity with respect to vertebrate fauna. But there is higher representation of invertebrate fauna in these two districts over North and South 24-Parganas districts (Table 16). The higher representation of vertebarate fauna (138 vs 115 species) in the freshwater wetland of coastal plains was mainly due to greater diversity of mammals (3 vs 1 species), birds (67 vs 54 species) and fishes (56 vs 48 species). The

additional mammalian species viz. *Felis viverrina* and *Lutra perspicillata* were encountered in the remote wetlands of North and South 24-Parganas for their suitable habitat in wilder environment. The same was true for higher representation of birds like gulls and terns as well as charadriid and muscicapid species. The occurrences of some species like *Notopterus chitala, Tetraodon cutcutia* and some mullets attributed to the higher representation of fishes.

On the other hand, the higher representation on invertebarate diversity (171 vs 97 species) in the wetlands of Gangetic plains of Haora and Hugli districts was found mainly due to greater diversity of hemipterans (27 vs 20 species), coleopterans (35 vs 24 species) and zooplankton (74 vs 17 species). The habitat diversity of wetlands viz. *beel, jheel, jola, daha,* etc., coupled with macrophyte diversity might have offered ample niches for macrophyte associated insect diversity in the wetlands of these two districts. The higher zooplankton diversity in these wetlands might be due to intensive collection from open water as well as weeds in addition to lower predating pressure and lesser diversity of fishes.

The biological resources of freshwater wetlands in other parts of the country also exhibit species richness. The species diversity of avifauna of Keoladeo Ghana National Park of Bharatpur in Rajastan, a man-made freshwater lake, is the richest in the country supporting 364 species of birdlife and is one of the best waterfowl habitat in the world (Ewans, 1989). Ichthyofauna of fresh water wetlands in India *viz.*, Bharatpur wetland in Rajasthan (40 species recorded out of 50 listed species ; Kumar and Vijayan, 1988 ; 46 species ; Kumar *et al.*, 1995) ; Kolleru Lake in Andhra Pradesh (63 species ; Anon, 1988) ; Kabar Lake in Bihar (48 species ; Ramakrishna, 1990) and even in the lakes of temperate region of the country (Lakes of Kashmir : 36 species ; Das, 1964) indicate the species richness of fishes. Both macro-invertebrate and zooplankton fauna of Haigam Lake, a shallow freshwater lake on the floodplain of Jhelum River in Jammu & Kashmir State is also very rich in molluscs, annelids, arthropods, protozoons and rotifers (Scott, 1989). Zooplankton community of Bharatpur wetland are constituted of rotifers (26%) and microcrustaceans *viz.*, cladocerans, ostracods and copepods (63%) in addition to others (Ali and Vijayan, 1983). Venkataramaman (1992) recorded 39 species of cladocerans from the above mentioned wetland. It appears that the cladoceran diversity is considerable in wetlands of Bharatpur as well as in West Bengal.

SUMMARY

1. A funal resource survey of 17 freshwater wetlands of Haora district and 15 from Hugli district reveals the presence of a total of 286 species of wetland fauna belonging to 12 major groups including zooplankton.

2. It includes, among vertebrates, one species of mammal, 54 species of birds, 6 species from both reptiles and amphibians and 48 species of fishes while invertebrate elements comprising of decapod crustaceans (7 species), hemipterans (27 species), coleopterans (35 species), spiders (6 species), annelids (6 species), molluscs (16 species) and zooplankton (74 species).

3. Of the 286 species of wetland fauna, 276 species have been recorded from Haora district and 261 species from Hugli district, differing in fishes, insects, molluscs and zooplankton (Table 16).

4. The present survey reveals 22 new records of Cladocera from West Bengal in additon to the records of the occurrences of 10 temperate species of cladocerans form these wetlands (Venkataraman and Das, 1993).

5. The diversity of fauna from these wetlands (Gangetic plain region) is discussed with special reference to those from freshwter wetlands of North and South 24-Parganas districts representing coastal plain region.

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TEMPORAL VARIATIONS IN ABIOTIC FACTORS OF A TROPICAL FLOODPLAIN LAKE, UPPER ASSAM (N. E. INDIA)

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INTRODUCTION

Floodplain lakes, locally called 'beels', comprise an integral component of the Brahmaputra and the Barrak river basins of Assam (N. E. India) and cover over 93% of total fish-prone lentic area of this state. Information about their abiotic parameters, a pre-requisite for scientific management, is till now confined to fewer published reports (Dey and Kar, 1987 ; Yadava *et al.* 1987 ; Kakati and Bhattacharya, 1989 ; Yadava and Dey, 1990 ; Dutta *et al.* 1995) from lower Assam.

The present study, first of its kind in floodplain lakes of Upper Assam, deals with temporal variations in abiotic factors of Samuajan beel and ecological correlations between these parameters. The results obtained are discussed in comparison with works in beels of Assam as well as those elsewhere in India.

MATERIAL AND METHODS

The observations were undertaken from March, 1994-February, 1995 in Samuajan beel (Longitude : 94° 56' E ; latitude : 26° 75' N) located in the Dhemaji district, Upper Assam region of the Brahmaputra basin. This ox-bow lake (area : 54 ha, depth : 0.7-2.4 m) was covered with luxuriant growth of *Eichhornia crassipes, Hydrilla, Potamogeton, Nymphaea* etc. Water samples were collected from this beel at regular monthly intervals. Air and water tempertures were noted with a thermal proble ; pH and specific conductivity were noted with pH and conductivity metres respectively ; disssolved oxygen was estimated by modified Winkler's method and other chemical parameters were analyzed following APHA (1985). Rainfall data was collected from local meterological laboratory. Ecological relationships were established by computing correlation coefficients (r) between various factors.

REMARKS AND DISCUSSION

Temporal variations in abiotic factors of Samuajan beel are indicated in Table : 1 ; their salient features and ecological correlations are discussed hereunder :

Rainfall : Total monthly rainfall (0-486 mm) is distinctly influenced by South-west monsoons. It registered a significant direct correlation with water temperature ($r = 0.815$) which apparently resulted due to concentration of precipitation during warmer months. Besides, the rainfall depicted

inverse correlations with important parameters namely specific conductivity (r = –0.509) alkalinity (r = –0.743), total hardness (r = –0.615), Calcium (r = –0.584) and Magnesium (r = –0.590) and, hence, it exercised significant dilution impact in the present study.

Table 1. Monthly variations in abiotic factors of Samuajan beel

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Rainfall (mm)	22.0	50.5	190.0	389.0	476.0	302.4	156.0	360.0	18.0	0	16.0	34.5
Air temperature (°C)	21.0	24.0	30.0	33.0	38.0	28.0	26.0	25.0	25.0	21.0	15.0	20.0
Water tmperature (°C)	22.5	23.0	28.0	28.0	31.0	30.0	30.0	27.0	23.0	18.0	17.0	22.0
Transparency (cm)	79.0.	81.0	84.0	60.0	15.0	16.0	12.0	23.0	47.0	83.0	45.0	55.0
Specific Conductivity (µS/cm)	186.0	174.0	123.0	85.0	112.0	80.0	70.0	142.0	148.0	160.0	120.0	108.0
pH	7.5	7.5	7.1	7.1	6.5	6.5	6.5	6.5	6.5	7.2	7.2	7.2
Dissolved oxygen (mg/l)	5.6	7.2	5.6	4.0	4.8	7.2	6.4	7.2	6.4	11.2	6.0	10.4
Free Carbon dioxide (mg/l)	4.0	6.0	8.0	6.0	8.0	4.0	4.0	4.0	6.0	6.0	6.0	6.0
Total Alkalinity (mg/l)	100.0	90.0	70.0	44.0	56.0	38.0	36.0	40.0	70.0	92.0	70.0	90.0
Total Hardness (mg/l)	110.0	120.0	80.0	60.0	66.0	50.0	48.0	90.0	102.0	95.0	90.0	80.0
Calcium (mg/l)	48.3	52.5	44.1	31.5	35.1	25.2	23.0	50.4	54.6	54.6	50.4	44.1
Magnesium (mg/l)	14.9	16.4	8.7	6.9	7.3	6.0	6.0	9.6	11.5	9.8	9.6	8.7
Sodium (mg/l)	38.0	20.0	22.0	22.0	12.0	16.0	15.0	20.0	28.0	34.0	35.0	40.0
Potassium (mg/l)	2.0	3.0	4.0	4.0	7.0	3.0	2.0	3.0	6.0	4.0	2.0	2.0
Chloride (mg/l)	9.4	9.4	10.9	12.5	14.0	15.6	14.0	15.6	15.6	7.8	7.8	12.5
Sulphate (mg/l)	10.0	12.2	5.2	4.2	33.1	29.4	29.4	11.6	7.5	13.6	12.7	9.6
Phosphate (mg/l)	0.01	0.05	0.05	0.06	0.29	0.28	0.27	0.04	0.04	0.03	0.04	0.05
Nitrate (mg/l)	1.40	1.40	1.30	1.70	1.80	1.80	1.60	1.56	1.20	1.30	1.36	1.66
Silicate (mg/l)	4.08	1.28	1.21	3.23	1.82	1.68	1.68	2.41	5.10	5.10	3.39	4.07

Temperature : Air temperature (15-33°C, 21.5±9.5°C) and water temperature (13-31°C, 24.4 ± 4.7°C) followed identical annual trends ; the former significantly influenced the latter (r = 0.861). The recorded tropical ranges corraborated with other Indian floodplain lakes (Dey, 1981 ; Dey and Kar, 1987 ; Vass, 1989 ; Yadava and Dey, 1990 ; Singh and Roy, 1990 ; Sinha *et al.* 1994 ; Sharma, communicated). Mean water temperature is noticed to be higher than mean air temperature and it is evidently attributed to heating caused due to shallow nature of the sampled beel and thick growth of aquatic macrophytes.

Transparency : Samuajan beel reflected low transparency (12-84 cm, 50.0 ± 28.2 cm) with broadly bimodal pattern ; annual range, however, remained lower than other beels of Assam (Lahon, 1983 ; Goswami, 1985 ; Dey and Kar, 1987 ; Yadava and Dey, 1990) but mean transparency coincided with the observations by Dey (1981). Further, relatively lower transparency (12-23 cm) noticed during rainy season (July-October) is corraborated by its general inverse relationship with rainfall (r = –0.521) and also with water temperature (r = –0.565). It, however,

registered positive correlations with pH (r = 0.841), alkalinity (r = 0.792), hardness (r = 0.668), Calcium (r = 0.561), Magnesium (r = 0.632) and Sodium (r = 0.566).

pH : It depicted slightly acidic to slightly alkaline nature (pH : 6.6-7.5, 6.8 ± 0.4) ; mean and annual values corresponded with the works of Dey and Kar (1987) and Yadava *et al.* (1987). Acidic nature (pH : 6.5) indicated presently from July-October (monsoons) can be assigned to influx of Carbonic acid with rainwater while the lake water is noticed to be nearly circumneutral during the remaining study period. This aspect is corraborated by inverse correlation between hydrogen-ion concerntration and rainfall (r = -0.557).

Specific conductivity : Samuajan beel is characterised by relatively low ionic concentration (Conductivity: 70-186 µS/cm, 125.6 ± 37.2 µS/cm) which, in turn, can be attributed to predominant effects of abundant rainfall, weathered and leached nature of surrounding rocks and soils and the lowered buffering capacity of demineralized waters (Steinitz-Kannan *et al.* 1983 ; Sharma, 1995). Impact of rainfall is further ascertained by inverse correlation (r = –0.508) between the two parameters. Mean conductivity value is notably lower than the floodplains from Kashmir (Khan, 1987), West Bengal (Vass, 1989) and Bihar (Singh and Roy, 1990) but agreed with the reports from Deepar beel (Dey, 1981) as well as Sone beel (Dey and Kar, 1987) of Assam State. Further, specific conductivity registered inverse correlation with water temperature (r = -0.579) and direct relationships with transparency (r = 0.644), pH (r = 0.598), alkalinity (r = 0.763), total hardness (r = 0.952), Calcium (r = 0.848) and Magnesium (r = 0.925) in the present study.

Dissolved oxygen : Its concentration ranged between 4.0-11.2 mg/l (6.8±3.3. mg/l) and dissolved oxygen depicted 64.0-118.2% saturation. The recorded annual range broadly coincided with the works of Lahon (1983), Yadava *et al.* (1987), Vass (1989), Yadava and Dey (1990), Singh and Roy (1990) and Sinha *et al.* (1994) while its mean value agreed with Yadava *et al.* (*loc cit.*). This dissolved gas did not depict any definite annual pattern but its higher concerntration and supersaturation level particularly during winter months are corraborated by its inverse correlation with water temperature (r = –0.653) which, in turn, is in confirmity with the results of Lahon (*loc cit.*), Goswami (1985), Dey and Kar (1987) and Singh and Roy (*loc cit.*).

Free Carbon dioxide : It occurred throughout the present study period in low concentrations (4.0-8.0, 5.6 ±1.4mg/l) but did not follow any definite pattern. The stated range, however, coincided with the works of Lahon (1983), Goswami (1985), Dey and Kar (1987) and Sharma (1995) but is lower than the results of Yousuf *et al.* (1986), Singh and Roy (1990) and Sinha *et al.* (1994).

Total Akalinity : It ranged between 36-100 mg/l (66.3±33.3 mg/l) and mean value reflected marginally 'hardwater' nature of Samuajan beel. Alkalinity is exclusively attributed to bicarbonate ions in this study and this feature is in general conformity with other floodplains of Assam. The observed range and mean value are, however, higher than the reports by Lahon (1983), Dey and Kar (1987), Yadava *et al.* (1987) and Yadava and Dey (1990). Further, alkalinity did not depict any definite pattern but remained low (36-56 mg/l) during the rainy season (June-October) than during rest of the study period (70-100mg/l). This feature is attributed to dilution impact of rainfall and is evident from their inverse correlation (r = –0.743). On the contrary, alkalinity

registered direct correlations with specific conductivity (r = 0.762), pH (r = 0.771), hardness (r = 0.779), Calcium (r = 0.684), Magnesium (r = 0.740) and Sodium (r = 0.749) ; these relationships agreed with Sharma (1995) while that with pH coincided with the works of Lahon (1983), Goswami (1985) and Dey and Kar (1987).

Total Hardness : The present observations (48 –120 mg/1, 82.5 ± 23.1mg/1) reaffirmed hardwater character of Samuajan beel ; the recorded values are, however, higher than the reports by Lahon (1983), Goswami (1985), Yadava and Dey (1990), Singh and Roy (1990) and Sinha *et al.* (1994). Further, total hardness depicted a bimodal annual pattern with low values (48-60 mg/1) during monsoons and high range (80-120 mg/1) in the remaining period. The former feature indicating dilution impact of rainfall is also supported by an inverse correlation (r = –0.615) between the two parameters.

Calcium (42.8±11.2mg/1) > Sodium (25.1±9.g mg/1) > Magnesium (9.6±3.2mg/1) > Potassium (3.0 ± 1.6 mg/1) contributed to hardness ; the stated order corresponded with the observations of Yadava *et al.* (1987) and Sinha *et al.* (1994). First three alkaline earth metals also depicted direct relationships (r = 0.689, r = 0.749, r = 0.710 respectively) with total hardness. Further, Calcium content is distinctly higher than other floodplain lakes of Assam (Lahon, 1983 ; Goswami, 1985 ; Dey and Kar, 1987 ; Yadava and Dey, 1990 ; Goswami, 1997) while Sodium concentration agreed with the report by Sinha *et al.* (loc cit.).

Chloride : Low concentration of this cation (7.8-15.8 mg/1, 12.0 ± 2.9 mg/1) in Samuajan beel corresponded with its range in natural freshwaters (Wetzel, 1983) and, hence, reflected absence of organic pollution. Further, Chloride depicted its general conservative nature while minor variations noticed in the present study are influenced by dilution caused by the rainfall (r =-0.757).

Sulphate : Its concentration (4.2-33.3 mg/1, 14.9±9.9mg/1) coincided with the range in natural freshwaters (Wetzel, 1983) ; mean value corresponded with Yousuf *et al.* (1986). Sulphate content registered a distinct increase (29.4-33.1 mg/1) during monsoon season (July-September) than during rest of the study period (4.2-13.6 mg/1) but did not exhibit significant direct correlation with rainfall thus indicating importance of its release from *in-vitro* decomposition of detritus. Further, it registered inverse correlations with water temperature (r = -0.506), specific conductivity (r = - 0.452), pH (r = -0.534), total alkalinity (r = -0.456) and hardness (r = -0.568) while direct relationships are noticed with phosphate (r = 0.935) and nitrate (r = 0.602).

Phosphate : It fluctuated between 0.01–0.29mg/1 (0.09±0.1mg/1) ; annual range is identical with the results of Yousuf *et al.* (1986), Yadava *et al.* (1987), Vass (1989) and Sinha *et al.* (1994) but is lower than the report by Singh and Roy (1990). Further, it registered unimodal pattern with higher content during monsoon period (0.27-0.29 mg/1), thereby, indicating its influx with rainwater as also supported by direct relationship with rainfall (r = 0.577). In addition, phosphate indicated inverse correlations with water temperature (r = -0.770), specific conductivity (r = -0.669), transparency (r = -0.617), alkalinity (r = -0.629), hardness (r = -0.760), Calcium (r = -0.513), Magnesium (r = -0.623) and Sodium (r = -0.726) while it showed positive relationships with nitrate (r = 0.698), sulphate (r = 0.935) and chloride (r = 0.521). In general, lower phosphate content in water column of Samuajan beel, during most part of the present study period, is attributed to its uptake by luxuriant growth of aquatic macrophytes.

Nitrate : It ranged between 1.2-1.8mg/l (1.5±0.2mg/l and did not depict any definite annual pattern ; annual range and mean value are slightly higher than the reports by Lahon (1983), Yousuf *et al.* (1986), Yadava *et al.* (1987), Vass (1989) and Sinha *et al.* (1990). This micronutrient depicted marginal increase during monsoon and positive correlation with rainfall (r = 0.743) as also noted by Goswami (1985) and Yadava (1987). On the other hand, it registered inverse relationships with water temperature (r = -0.655), specific conductivity (r = -0.667), transparency (r = -0.642), alkalinity (r = -0.569), hardness (r = -0.736), Calcium (r = -0.770), Magnesium (r = -0.519) and Sodium (r = -0.480).

Silicate : Its concentration (1.2-5.1 mg/l, 2.8±1.5 mg/l) is lower than the reports by Dey (1981), Yousuf *et al.* (1986), Yadava *et al.* (1987) and Singh and Roy (1990). Silicate content is relatively higher from November-February and again in March while during the rest of the study period it varied between 1.2-2.4 mg/l. It, however, registered inverse correlations with water temperature (r = -0.689), rainfall (r = -0.534) and phosphate (r = -0.541) while showed positive relationships with alkalinity (r = 0.482), Calcium (r = 0.513) and Sodium (r = 0.770).

SUMMARY

Samuajan beel indicated tropical water temperature (17.0-31.0°C), low transparency (50.0 ± 28.2 cm), slightly acidic to slightly alkaline pH (6.5 - 7.5), low specific conductivity (70-186 µS/cm) and hardwater (alkalinity : 66.3 ± 23.3 mg/l ; total hardness : 82.5 ± 23.1 mg/l, Ca > Na > Mg > K). Dissolved oxygen ranged between 4.0-11.2 mg/l (64.0-118.2% saturation) and very low free Carbon dioxide (4.0-8.0 mg/l) is recorded throughout the study period. This floodplain lake exhibited low Chloride (12.0 ± 2.9 mg/l), Sulphate (14.9 ± 9.9 mg/l), Phosphate (0.09 ± 0.1 mg/l) and Silicate (2.8±1.5mg/l) contents and its nitrate concentration ranged between (1.5±0.2 mg/l). Comments are made on monthly variations in abiotic factors and on ecological correlations between various parameters.

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ON A COLLECTION OF FISH FAUNA FROM CHENNAI, CHENGLEPUT AND THIRUVALLUR DISTRICTS OF TAMIL NADU

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ABSTRACT

The primary freshwater fishes of Chennai, Chengleput and Thiruvallur districts, collected through several surveys were found to belong to 51 species under 16 families and 7 orders. Earlier reports included 15 more species. Two species are new additions to the list of fishes known from Chennai. The distribution of fishes in the different water bodies surveyed is discussed.

INTRODUCTION

The present paper deals with the fish collections brought through 20 local surveys from 29 water bodies, mostly tanks and other lentic waters, the details of which are provided in Table 1. The collections constituted 1909 specimens and were found to belong to 51 species, the systematic list of which is provided. This includes the first reference, material collected and distribution. Under 'material collected' the number of specimens examined followed by their length range, register number and locality number as in Table 1 is provided. Systematic listing is after Menon (1998).

TABLE-1 : List of Collection Localities

Sl. No.	Date	Localities	Collector
1.	22.02.80	Vandalur	Koshy Mathew & Party
2.	27.09.92	Kattupakkam-T. N. Agricultural Farm	M. Mary Bai & Party
3.	21.10.92	Kalpakkam-Water Body In Bird Santuary	K. V. Lakshminarayana & Party
4.	22.01.93	Kalpakkam-Water Body In Bird Sanctuary	T. S. N. Murthy & Party
5.	20.07.95	Namili Village	M. S. Ravichandran & Party
6.	13.09.95	Chembarambakkam Lake	M. Mary Bai & Party
7.	13.09.95	Pond Near Vaingaivasal	M. Mary Bai & Party.
8.	16.11.95	Chembarambakkam Lake	M. Mary Bai & Party.
9.	16.11.95	Karasangal Anaicut	M. Mary Bai & Party.
10.	19.12.95	Pozhuvamkarnai	P.T. Cherian & Party
11.	19.12.95	Pulambakkam	P.T. Cherian & Party
12.	19.12.95	Saravambakkam	P.T. Cherian & Party

TABLE-1 : *Contd.*

Sl. No.	Date	Localities	Collector
13.	20.12.95	Vedanthangal	P.T. Cherian & Party
14.	28.11.96	Thamal	M.S. Ravichandran & Party
15.	30.12.96	Koovam Tank	M.B. Raghunathan & Party
16.	20.01.97	Alathur, 13 Km. East Of Mahabalipuram	M. Mary Bai & Party
17.	20.01.97	Payanur Near Kelambakkam	M. Mary Bai & Party
18.	20.01.97	Pond Near Mahabalipuram	M. Mary Bai & Party
19.	20.01.97	Pudupakkam Near Kelambakkam	M. Mary Bai & Party
20.	21.01.97	Double Tank Near Red Hills	M. Mary Bai & Party
21.	21.01.97	Tamaraikulam-Madavaram	M. Mary Bai & Party
22.	22.01.97	Appur Near Singaperumal Koil	M. Mary Bai & Party
23.	22.01.97	Vallakulam, Senneerkuppam	M. Mary Bai & Party
24.	30.01.97	Ratnamangalam, 3 Km. From Kolappakkam	M. Mary Bai & Party
25.	19.02.97	Palar River at Mamandur	M.B. Raghunathan & Party
26.	19.02.97	Uttaramerur	M.B. Raghunathan & Party
27.	07.10.98	Porur Tank	Geetha.
28.	16.07.98	Singaperumal Koil Paddy Field	M. B. Raghunathan & Party
29.	28.08.98	Singaperumal Koil Paddy Field	M. B. Raghunathan & Party

Order OSTEOGLOSSIFORMES

Family NOTOPTERIDAE

Genus ***Notopterus*** Pallas

1. ***Notopterus notopterus*** (Pallas)

1769. *Gymnotus notopterus* Pallas, *Spicilegia zoologica,* part 7 ; pl. 6, fig. 2.

(Type locality : Indian ocean).

Material examined : 2 exs., 75.0-85.0 mm SL, F. 5180, 21.

Distribution : India, Nepal, Pakistan, Bangladesh, Myanmar, Malaysia, Thailand and Indonesia.

Order CYPRINIFORMES

Family CYPRINIDAE

Sub Family CULTRINAE

Genus ***Chela*** Hamilton

2. ***Chela cachius*** Hamilton

1822. *Cyprinus (Chela) cachius* Hamilton, *Fish. Ganges,* pp. 258, 384.

(Type locality : River Ganges, about the commencement of the delta).

Material examined : 2 exs., 20.0 & 22.5, F. 5263, 26 ; 8 exs., 24.0-28.0, F. 5582, 28 ; 1 ex., 31.0, F. 5598, 29.

Distribution : India, Pakistan, Bangladesh, Myanmar.

3. ***Chela laubuca*** (Hamilton)

1822. *Cyprinus laubuca* Hamilton, *Fish. Ganges,* pp, 260, 384.

(Type locality : Ponds in northern parts of Bengal).

Material examined : 6 exs., 20.0-24.0, F. 5176, 17 ; 96 exs., 17.0-45.0, F. 5216, 22 ; 36 exs., 33.0-40.0, F. 5581, 28.

Distribution : India, Pakistan, Bangladesh, Nepal, Myanmar, Thailand, Malaysia and Indonesia.

Genus ***Salmostoma*** Swainson

4. ***Salmostoma clupeoides*** (Bloch)

1795. *Cyprinus clupeoides* Bloch, *Naturg. Ausland Fische,* 12, p. 49, pl. 408,

(Type locality : Tranquebar)

Material examined : 4 exs., 41.0-87.0 mm SL, F. 4747, 8 ; 3 exs., 50.0-63.0, F.5175,17.

Distribution : India : Peninsular India : Gujarat, Maharashtra, Mysore, Tamil Nadu and Madhya Pradesh.

Sub Family RASBORINAE

Genus ***Amblypharyngodon*** Bleeker

5. ***Amblypharyngodon microlepis*** (Bleeker)

1853. *Leuciscus microlepis* Bleeker, *Verh. Batav. Genootsch,* 25, p. 41.

(Type locality : R. Hooghly).

Material examined : 1 ex., 45.0, F. 4585, 13 ; 4 exs., 54.0-72.0, F. 4748, 8; 1ex., 59.0 F. 5083, 2; 42 exs., 15.0-17.0, F. 5209, 18; 5 exs., 27.0-29.0, F. 5212, 16; 7 exs., 18.0-40.0, F. 5219, 22; 5 exs., 31.0-46.0, F. 5578, 28.

Distribution : India : Bengal through Chota-Nagpur to Peninsular India, except the west face of the Western Ghats.

Genus ***Danio*** Hamilton

6. ***Danio rerio*** (Hamilton)

1822. *Cyprinus rerio* Hamilton, *Fish. Ganges,* pp. 323, 390.

(Type locality : R. Kosi)

Material examined : 2 exs., 34, F. 5085, 2.

Distribution : India, Pakistan, Nepal, Bangladesh & Myanmar.

Genus ***Esomus*** Swainson

7. ***Esomus danricus*** (Hamilton)

1822. *Cyprinus danrica* Hamilton, *Fish Ganges,* pp. 325, 390, pl. xvi, fig. 88.

(Type locality : Ponds and ditches of Bengal)

Material examined : 4 exs., 38.0-39.0, F. 4494, 5; 8 exs., 50.0-67.0, F. 4749, 8; 95 exs., 22.0-54.0, F.5177, 17 ; 19 exs., 22.0-48.0, F. 5191, 23 ; 21 exs., 24.0-32.0, F. 5201, 24 ; 14 exs., 24.0-34.0, F. 5205, 18 ; 17 exs., 30.0-37.0, F. 5215, 16 ; 40 exs., 16.0-21.0, F. 5218, 22.

Distribution : India : Earlier confined to North India but now it is reported from South ; Nepal, Bangladesh & Pakistan.

8. ***Esomus thermoicos*** (Valenciennes)

1842. *Nuria thermoicos* Cuvier and Valenciennes, *Hist. Nat. Poiss.,* xvi, p. 238

(Type locality : Ceylon)

Material examined : 8 exs., 41.0-53.0, F. 4510, 7 ; 8 exs., 36.0-53.0, F. 4579, 10 ; 14 exs., 31.0-46.0, F. 4582, 11 ; 10 exs., 30.0-57.0, 13 ; 1 ex., 38.0, F. 4592, 12 ; 6 exs., 23.0-67.0, F. 5089, 1; 14 exs., 19.0-48.0, 15; 7 exs., 25.0-37.0, F. 5255, 25; 3 exs., 30.5-37.0, F. 5264, 26 ; 96 exs., 35.0-48.0, F. 5579, 28 ; 22 exs., 23.0-48.0, F. 5593, 29.

Distribution : India : Peninsular India ; Sri Lanka.

Genus ***Rasbora*** Bleeker

9. ***Rasbora caverii*** (Jerdon)

1848. *Leuciscus caverii* Jerdon, *Madras J. Lit. & Sci.,* 15, p. 320

(Type locality : Cauvery river, Coorg State).

Material examined : 1 ex., 69.0, F. 4495, 5; 4 exs., 38.0-41.0, F. 4511, 7; 4 exs., 32.0-45.0, F. 4577, 10 ; 6 exs., 37.0-52.0, F. 4583, 11 ; 1 ex., 43.0, F. 4591, 12; 4 exs., 34.0-44.0, F. 5265, 26; 1 ex., 24.0, F. 5178, 17; 7 exs., 22.0-28.0, F. 5187, 21; 9 exs., 27.0-58.0, F.5190, 23; 16 exs., 25.0-38.0, F. 5580, 28; 11 exs., 25.0-37.0, F. 5594, 29.

Distribution : Peninsular India : Karnataka, Tamil Nadu (Cauvery drainage and Tambraparni); Sri Lanka.

10. ***Rasbora daniconius*** (Hamilton)

1822. *Cyprinus daniconius* Hamilton, *Fish Ganges*, p. 327, pl. 15, fig. 89.

(Type locality : Rivers of Southern Bengal).

Material examined : 3 exs., 34.0-50.0, F.4501, 6; 2 exs., 30.0 & 41.0, F. 4578, 10; 3 exs., 35.0-46.0, F.4584, 11; 1 ex., 49.0, F.5090, 1; 1ex., 26.0, 25; 23 exs., 25.0-40.0, F. 5213, 16.

Distribution : India, Sri Lanka, Pakistan, Nepal, Bangladesh, Myanmar and Thailand.

Genus ***Horadandia*** Deraniyagala

11. ***Horadandia atukorali*** Deraniyagala

1943. *Horadandia atukorali* Deraniyagala, *J. Royal Asiatic* Soc., xxxv, p. 158, fig. 1.
(Type locality : Attidiya, Colombo, Ceylon).

Material examined : 1 ex., 12.0. F. 3962. 3.

Distribution : India : Kerala, Tamil Nadu; and Sri Lanka.

Genus ***Barbodes*** Bleeker

12. ***Barbodes sarana subnasutus*** (Valenciennes)

1865. *Cyclochelichthys pinnauratus* Day, *Proc. Zool. Soc. London*, p. 300; *Fish Malabar*, p. 209, pl. 15. Fig. 2.

(Type locality : Wynaad).

Material examined : 1 ex., 135.0, F. 4743, 9 ; 4 exs., 50.0-125.0, F. 5166, 17.

Distribution : India : Peninsular India.

Genus ***Catla*** Valenciennes

13. ***Catla catla*** (Hamilton)

1822. *Cyprinus catla* Hamilton, *Fish. Ganges*, pp. 287, 387, pl. 13, fig. 81.

(Type locality : In the rivers and tanks of Bengal).

Material examined : 1 ex., 95.0. F. 5081, 2.

Distribution : Pakistan ; India : Northern India, introduced into the rivers of Peninsular India ; Bangladesh ; Nepal ; Myanmar and Sri Lanka.

Genus ***Labeo*** Cuvier

14. ***Labeo rohita*** (Hamilton)

1822. *Cyprinus rohita* Hamilton, *Fish. Ganges*, pp. 301, 388, pl. 36, fig. 85.

(Type locality : Freshwater rivers of the Gangetic provinces).

Material examined : 3 exs., 135.0-170.0, F. 4573, 10.

Distribution : India : Northern India, introduced into Peninsular India and Sri Lanka, Pakistan, Nepal, Bangladesh and Myanmar.

Genus ***Cirrhinus*** (Oken)

15. ***Cirrhinus mrigala*** (Hamilton)

1822. *Cyprinus mrigala* Hamilton, *Fish. Ganges*, pp. 279, 386, pl. 6, fig. 78.

(Type locality : Ponds and freshwater rivers of the Gangetic Provinces).

Material examined : 1 ex., 95.0, F. 5082, 2.

Distribution : Pakistan, India : Northern India, introduced into Peninsular India ; Nepal and Bangladesh.

Genus ***Puntius*** (Hamilton)

16. ***Puntius amphibius*** (Valenciennes)

1842. *Capoeta amphibia* Valenciennes, *Hist. Nat. Poiss.*, 16 : p. 282, pl. 478.

(Type locality : Bombay).

Material examined : 2 exs., 39.0-72.0, F. 5164, 17 ; 1 ex., 45.0, F. 5583, 28.

Distribution : Peninsular India and Sri Lanka.

17. ***Puntius chola*** (Hamilton)

1822. *Cprinus chola* Hamilton, *Fish Ganges*, p. 312, 389.

(Type locality : North-eastern parts of Bengal).

Material examined : 5 exs., 42.0-86.0. F. 4502, 8; 19 exs., 21.0-45.0, F. 5097, 15; 2 exs., 40.0 & 42.0, F. 5165, 17 ; 2 exs., 19.0 & 20.0, F. 5204, 18.

Distribution : India, Pakistan, Nepal, Bangladesh, Myanmar and Sri Lanka.

18. ***Puntius conchonius*** (Hamilton)

1822. *Cyprinus conchonius* Hamilton, *Fish Ganges*, pp. 317, 389.

(Type locality : North-east Bengal and rivers Kosi and Ami).

Material examined : 1 ex., 43.0, F. 5084, 2.

Distribution : India : Assam, West Bengl, Bihar, U.P, Orissa, Andhra Pradesh and Cauvery drainage in Tamil Nadu and Karnataka ; Pakistan and Bangladesh. Now introduced widely as aquarium fish.

19. *Puntius dorsalis* (Jerdon)

1849. *Systomus dorsalis* Jerdon, *Madras J. Lit. & Sci.*, pp. 314, 316.

(Type locality : Tanks and rivers in the neighbourhood of Madras).

Material examined : 1 ex., 95.0, F. 4503, 6; 1 ex., 50.0, F. 4751, 8; 3 exs. 17.0-21.0, F.5165,17.

Distribution : India : Peninsular India, Cauvery and most of the drainages in Tamil Nadu, Krishna, Godavary, Mahanadi, Narmada; and Sri Lanka.

20. *Puntius filamentosus* (Val.)

1844. *Leuciscus filamentosus* Valenciennes, *Hist Nat. Poiss.*, 17, p.96, pl. 492.

(Type locality : Alleppey, Kerala).

Material examined : 2 exs., 80.0 & 85, 27.

Distribution : Peninsular India : Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh ; & Sri Lanka.

21. *Puntius sharmai* Menon & Rema Devi

1992. *Puntius sharmai* Menon and Rema Devi, *J. Bombay nat. Hist. Soc.*, 89(3) : 353-354

(Type locality : Madras).

Material examined : 6 exs., 19.0-20.0, F.5161, 17 ; 10 exs., 22.0-23.0, F. 5585, 28 ; 9 exs., 35.0-40.0, F. 5595, 29.

Distribution : India, Tamil Nadu.

22. *Puntius sophore* (Hamilton)

1822. *Cyprinus sophore* Hamilton, *Fish Ganges*, pp. 310, 319, pl. 19, fig. 86.

(Type locality : Ponds of Bengal).

Material examined : 1 ex., 31.0, F. 4496, 5; 1 ex., 52.0, F. 4504, 6; 62 exs., 35.0-45.0, F. 4576, 10; 60 exs., 35.0-41.0, F. 4581, 11; 1 ex., 37.0, F. 4587, 13; 11 exs., 36.0-42.0, F. 4590, 12; 5 exs., 39.0-70.0, F. 4750, 8; 17 exs., 33.0-50.0, F. 5079, 14; 3 exs., 35.0-42.0, F. 5091, 1; 6 exs., 22.0-40.0, F. 5098, 15; 3 exs., 52.0-60.0, F. 5256, 25; 1ex. 31.0, F. 5162, 17; 2 exs., 27.0 and 28.0, F. 5186, 21; 2 exs., 35.0-40.0, F. 5192, 23; 4 exs., 28.0-30.0, F. 5199, 24; 2 exs. 30.0 & 31.0, F. 5214, 16; 2 exs., 44.0-45.0, F. 5584, 28; 7 exs., 22.0-60.0, F. 5596, 29.

Distribution : India, Pakistan, Bangladesh, Myanmar and Yunan.

23. *Puntius ticto* (Hamilton)

1822. *Cyprinus ticto* Hamilton, *Fish Ganges*, pp. 314, 389, pl. 8, fig. 87.

(Type locality : Southeastern parts of Bengal).

Material examined : 2 ex.,40.0 & 41.0, F. 4505, 6; 3 exs., 32.0-36.0, F.4752, 8; 43 exs., 24.0-25.0, F. 5168, 17; 3 exs., 19.0-21.0, F. 5184, 21; 14 exs., 16.0-28.0, F. 5195, 20; 20 exs., 29.0-36.0, F. 5586, 28; 5 exs., 42.0-48.0, F. 5597, 29.

Distribution : India : Except Kerala, Nepal; Pakistan and Bangladesh.

24. ***Puntius vittatus*** Day

1865. *Puntius vittatus* Day, *Proc. Zool. Soc. London*, p. 303.

(Type locality : Madras).

Material examined : 1 ex., 29.0, F.4497, 5; 1 ex., 33.0, F. 5163, 17; 3 exs., 22.0-23.0, F. 5185, 21; 2 exs., 20.0 & 24.0, F. 5193, 23; 9 exs., 9.0-18.0, F. 3965, 4.

Distribution : Peninsular India : Goa, Kutch, Karnataka, Kerala, Tamil Nadu; and Sri Lanka.

Family COBITIDAE

Subfamily COBITINAE

Genus ***Lepidocephalus*** Bleeker

25. ***Lepidocephalus thermalis*** (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. Nat. Poiss.*, 17, p.78.

(Type locality : Ceylon).

Material examined : 2 exs., 31.0, F.4498, 5; 3 exs., 31.0-35.0, F.4512, 7; 3 exs., 41.0-45.0, F.4580, 10; 1 ex., 30.0, 13; 4 exs., 20.0-23.0, F.5099, 15 ; 1 ex., 28.0, 25 ; 2 exs., 26.0 & 27.0, 26 ; 40 exs., 15.0-30.0, F.5173, 17; 7 exs., 18.0-30.0, F. 5200, 24 ; 10 exs., 20.0-30.0, F. 5210, 18; 7 exs., 27.0-32.0, F. 5211, 16 ; 2 exs., 34.0 & 35.0, F. 5587, 28.

Distribution : Peninsular India and Sri Lanka.

Order SILURIFORMES

Family BAGRIDAE

Genus ***Mystus*** Scopoli

26. ***Mystus bleekeri*** (Day)

1846. *Bagrus keletius keletius* (nec. Valenciennes), *Nat. Geneesh. Arch. Ned. Ind.*, 3(2), p.135

(Type locality : Bengal).

Material examined : 5 exs., 73.0-84.0, F.5257, 25; 2 exs., 38.0 & 64.0, F. 5170, 17.

Distribution : Throughout India, Pakistan, Nepal, Bangladesh and Myanmar.

27. ***Mystus cavasius*** (Hamilton)

1822. *Pimelodus cavasius* Hamilton, *Fish Ganges*, pp. 203, 379, p. 11, fig. 67.

(Type locality : Gangetic provinces).

Material examined : 1 ex., 73.0, F. 4746, 9.

Distribution : India, Nepal, Pakistan, Bangladesh, Burma, Malaysia, Thailand, Indonesia.

28. ***Mystus gulio*** (Hamilton)

1822. *Pimelodus gulio* Hamilton, *Fish Ganges*, pp. 201, 379, pl. 23 fig. 6.

(Type locality : Higher parts of the Gangetic estuaries where the water is not very salty).

Material examined : 1 ex., 100.0., F. 5171, 17.

Distribution : India, Pakistan, Nepal, Bangladesh, Burma, Sri Lanka, Malaysia, Thailand, Indonesia.

29. ***Mystus vittatus*** (Bloch)

1797. *Silurus vittatus* Bloch, *Ichthyol Hist. Nat.* 11, p. 40, pl. 371, fig. 2.

(Type locality : Tranquebar, S. India).

Material examined : 1 ex., 82.0, F. 4506, 6 ; 2 exs., 69.0-80.0, F.4753, 8;1 ex., 103.0, F. 5092, 1.

Distribution : India, Pakistan, Nepal, Bangladesh, Myanmar, Sri Lanka and Thailand.

Family SCHILBEIDAE

Genus ***Pseudeutropius*** Bleeker

30. ***Pseudeutropius atherinoides*** (Bloch)

1797. *Silurus atherinoides* Bloch, *Naturges, ausland, Fische*, 8. p.48, pl. 371, fig. 1

(Type locality : Tranquebar).

Material examined : 1 ex., 50.0, 27.

Distribution : Throughout India except Kerala; Pakistan, Bangladesh, Nepal and Myanmar.

Family HETEROPNEUSTIDAE

Genus ***Heteropneustes*** Muller

31. ***Heteropneustes fossilis*** Bloch

1794. *Silurus fossilis* Bloch, *Naturgesch. ausl. Fische*, 8 : 46, pl. 370, fig. 2.

(Type locality : Tranquebar).

Material examined : 1 ex., 111.0, F.5599, 29.

Distribution : India, Pakistan, Sri Lanka, Nepal, Bangladesh, Myanmar, Thailand and Laos.

Order CYPRINODONTIFORMES

Family ORYZIIDAE

Genus ***Oryzias*** Jordon & Snyder

32. ***Oryzias melastigma*** (McClelland)

1839. *Aplocheilus melastigma* McClelland, *Asiat. Res.*, 19, *Indian Cyprinidae*, pp. 301, 427, pl. 42, fig. 3.

(Type locality : Tanks at Calcutta).

Material examined : 2 exs., 16.0 & 20.0, F. 4508, 6; 1 ex., 25.0, F. 5095, 1; 32 exs., 16.0-22.0, F.5100, 15; 36 exs., 15.0-25.0, F. 5266, 26; 2 exs., 25.0, F. 5179, 17; 1 ex., 21.0, F.3960, 3; 2 exs., 22.0 & 23.0, F. 5588, 28; 1 ex., 18.0, F. 5601, 29.

Distribution : India : Peninsular India, Orissa, W. Bengal; Sri Lanka and Bangladesh.

Family APLOCHEILIDAE

Genus ***Aplocheilus*** McClelland

33. ***Aplocheilus blocki*** (Arnold)

1911. *Haplocheilus panchax* Var. *blockii* Arnold, *Wochenschr. Aquarien und Terrarienkunde*, 8 : 672

(Type locality : Ceylon).

Material examined : 1 ex., 19.0, F. 5100, 13; 3 exs., 22.0-26.0, F. 5206, 18; 5 exs., 11.0-20.0, F. 3961, 3; 14 exs., 10.0-29.0, F. 3964, 4.

Distribution : Peninsular India : West Coast, from Kutch Southwards along the coast to Kerala; Sri Lanka.

Family POECILIIDAE

Genus ***Gambusia*** Poey

34. ***Gambusia affinis*** (Baird & Girard)

1853. *Heterandria affinis* Baird and Girard, *Proc. Acad. nat. Sci. Philad.*, 6 : 390.

(Type locality : San Antanio river drainage, Texas).

Material examined : 4 exs., 8.0-19.0, F.5198, 20; 244 exs., 20.0-38.0, F. 5188, 21; 1 ex., 17.0, F. 5600, 29.

Distribution : India, Pakistan, Bangladesh, Sri Lanka and Myanmar. Introduced for larvicidal use.

Genus ***Poecilia*** Bloch and Schneider

35. ***Poecilia reticulata*** Peters

1859. *Poecilia reticulata* Peters, *K. Preussischen Akad. Wiss., Berlin.* 412

(Type locality : Venezuela).

Material examined : 44 exs., 11.0-28.0, F.4500, 5.

Distribution : The Netherlands, Antilles, the Venezuelan Islands, Trinidad and British Guiana, introduced in India.

Genus ***Xiphophorus*** Heckel

36. ***Xiphophorus helleri*** Heckel

Material examined : 3 exs., 35.0-44.0, F.5086, 2.

Distribution : Eastern Mexico, introduced into India.

37. ***Xiphophorus maculatus*** Gunther

Material examined : 3 exs., 24.0-27.0, F.5087, 2.

Distribution : Eastern Mexico, introduced into India.

Order PERCIFORMES

Suborder CHANNOIDEI

Family CHANNIDAE

Genus ***Channa*** Scopoli

38. ***Channa punctatus*** (Bloch)

1793. *Ophiocephalus punctatus* Bloch, *Naturges. ausland. Fische,* (2) : 139, pl. 358

(Type locality : Rivers and lakes of Coromandel Coast).

Material examined : 1 ex., 41.0, F. 4513, 7 ; 1 ex., 83.0, F. 4742, 9 ; 6 exs., 45.0-102.0, F.4588, 13; 2 exs., 75.0-114.0, F. 5080, 14; 1 ex., 21.0, F. 5217, 22; 4 exs., 63.0-83.0, F. 5591, 28.

Distribution : India, Afghanistan, Pakistan, Nepal, Sri Lanka, Bangladesh, Myanmar and Yunan.

39. ***Channa striatus*** (Bloch)

1793. *Ophiocephalus striatus* Bloch, *Naturges. ausland. Fische,* (2) : 141, pl. 359.

(Type locality : Malabar).

Material examined: 1 ex., 240.0, F. 4741, 9 ; 1 ex., 230.0, F. 4574, 10.

Distribution : India, Sri Lanka, Pakistan, Bangladesh, Nepal, Myanmar, Malay-Archipelago, Thailand upto Philippines.

Sub Order PERCOIDEI

Family CHANDIDAE

Genus ***Chanda*** Hamilton

40. ***Chanda nama*** Hamilton

1822. *Chanda nama* Hamilton, *Fish Ganges* : 109, 371, pl. 39, fig. 37.

(Type locality : Bengal).

Material examined: 1 ex., 22.0, F. 5196, 20 ; 5 exs., 18.0–40.0, F. 5189, 21.

Distribution : India, Pakistan, Bangladesh, Nepal and Myanmar.

41. ***Chanda ranga*** Hamilton

1822. *Chanda ranga* Hamilton, *Fish Ganges* : 113, 371, pl. 16, fig. 38.

(Type locality : Freshwaters of all parts of Gangetic provinces).

Material examined: 51 exs., 24.0-53.0, F. 5258, 25.

Distribution : India, Pakistan, Bangladesh, Myanmar, Malaysia and Thailand.

Sub Order GOBIOIDEI

Family GOBIIDAE

Genus ***Glossogobius*** Gill

42. ***Glossogobius giuris*** Hamilton

1822. *Gobius giuris* Hamilton, *Fish Ganges* : 51, pl. 33, fig. 15.

(Type locality : Gangetic Provinces).

Material examined: 3 exs., 31.0-50.0, F. 4514, 7 ; 3 exs. 60.0-85.0, F. 4745, 9; 1 ex., 60.0, F. 5169, 17; 1 ex., 70.0, F. 5202, 19 ; 2 exs., 32.0-33.0, F. 5260, 25.

Distribution : Indo-West Pacific, India, Pakistan, Bangladesh.

Genus ***Favonigobius*** Whitley

43. ***Favonigobius reichei*** (Bleeker)

1853. *Gobius reichei* Bleeker, *Natuurk. Tijdschr. Ned. Indie*, 5 : 509.

(Type locality : Padang, Indonesia).

Material examined: 1 ex., 58.0, F. 5090, 1.

Distribution : Indo-west Pacific.

Sub Order LABROIDEI

Family CICHLIDAE

Genus ***Etroplus*** Cuvier

44. ***Etroplus maculatus*** (Bloch)

1785. *Chaetodon maculatus* Bloch, *Syst. ichth.*, pl. 427, fig. 2.

(Type locality : India).

Material examined: 3 exs., 16.0-19.0, F. 3966, 4 ; 2 exs., 58.0, F. 4509, 6; 4 exs., 40.0-61.0, F. 4755, 8 ; 6 exs., 22.0-30.0, F. 5194, 20; 2 exs., 25.0-50.0, F. 5182, 21; 5 exs., 40.0-48.0, F. 5259, 25.

Distribution : Peninsular India and Sri Lanka.

Genus ***Oreochromis*** Gunther

45. ***Oreochromis mossambica*** (Peters)

1852. *Chromis (Tilapia) mossambicus* Peters, *Montab, Akad. Wiss., Berlin.* 681.

(Type locality : Mozambique).

Material examined: 2 exs., 73.0, F. 5088, 2 ; 14 exs., 10.0-23.0, F. 3959, 3; 25 exs., 10.0-30.0, F. 3963, 4 ; 1 ex., 28.0, F. 4499, 5; 2 exs., 67.0 & 80.0, F. 4756, 8; 1 ex., 130.0, F.4575, 10; 5 exs., 25.0-32.0, F. 5174, 17 ; 72 exs., 18.0-27.0, F. 5208, 18 ; 1 ex., 28.0, F. 5197, 20 ; 142 exs., 18.0-45.0, F. 5183, 21 ; 7 exs., 35.0-63.0, F. 5592, 28; 2 exs., 15.0-17.0, 29.

Distribution : East Africa. Introduced species.

Sub Order ANABANTOIDEI

Family ANABANTIDAE

Genus ***Anabas*** Cuvier

46. ***Anabas testudineus*** Bloch

1795. *Anthias testudineus* Bloch, *Naturges. ausland. Fische,* (6): 121, pl. 322

(Type locality : Japan, East Indies).

Material examined: 2 exs., 60.0 & 112.0, F. 4744, 9.

Distribution : India, Pakistan, Bangladesh, Sri Lanka, Nepal, Myanmar, Thailand, Cambodia, S. China, Indo-China, Malay and Malay Archipelago.

Family BELONTIIDAE

Sub Family TRICHOGASTERINAE

Genus ***Colisa*** Cuvier

47. ***Colisa fasciatus*** (Schneider)

1801. *Trichogaster fasciatus* Schneider, *Syst. Ichth.* 164, pl. 36.

(Type locality : Tranquebar).

Material examined : 2 exs., 30.0-38.0, F. 4507, 6; 5 exs., 26.0-30.0, F. 5172, 17 ; 70 exs., 26.0-36.0, F. 5181, 21 ; 1 ex., 39.0, F. 5261, 25 ; 6 exs., 28.0-30.0, F.5589, 28.

Distribution : India, Pakistan, Nepal, Bangladesh and Upper Myanmar.

Sub Family MACROPODINAE

Genus ***Pseudosphromenus*** Bleeker

48. ***Pseudosphromenus cupanus*** (Valenciennes)

1831. *Polyacanthus cupanus* Valenciennes, *Hist. nat. Poiss.*, 7 : 357.

(Type locality : Arian Coopam river at Pondicherry).

Material examined : 1 ex., 24.0, 10 ; 25 exs., 23.0-37.0, 13 ; 2 exs., 20.0-21.0, F. 5207, 18 ; 1 ex., 30.0, F.5262, 25 ; 13 exs., 27.0-34.0, F. 5590, 28.

Distribution : Peninsular India and Sri Lanka.

Order SYNBRANCHIFORMES

Suborder MASTACEMBELOIDEI

Family MASTACEMBELIDAE

Genus ***Mastacembelus*** Scopoli

49. ***Mastacembelus armatus*** (Lacépède)

1800. *Macrognathus armatus* Lacépède, *Hist. nat. Poiss.*, 2 : 286.

(Type locality : not known).

Material examined : 1 ex., 42.0, F. 5203, 18.

Distribution : India, Pakistan, Sri Lanka, Nepal, Myanmar, Thailand, Malaysia to South China.

Genus ***Macrognathus*** Lacépède

50. ***Macrognathus aral*** (Bloch & Schneider)

1801. *Rhynchobdella aral* Bloch and Schneider, *Syst. Ichth.*, 479, pl. 89.

(Type locality : Tranquebar, Tamil Nadu).

Material examined : 1 ex., 120.0, F. 5094, 1.

Distribution : India, Pakistan, Sri Lanka, Bangladesh, Nepal and Myanmar.

51. *Macrognathus pancalus* Hamilton

1822. *Macrognathus pancalus* Hamilton, *Fish Ganges*, 30, 364, pl. 22, fig. 7.

(Type locality : Tanks of Gangetic Provinces).

Material examined : 3 exs., 107.0-132.0, F. 4757, 8.

Distribution : India, Pakistan, and Bangladesh.

DISCUSSION

Though several faunal and hydrographical aspects of Chennai and its environs have been studied by many workers, only a few papers by Raj (1916), Venkateswarlu et. al (1975), Raghunathan (1978), Rema Devi (1994, 1996) and Mary Bai et al (1997) deal with the fish fauna of this area. From available literature it is observed that 170 species are known from Chengleput MGR districts. Of these 52 are primary freshwater species. The present paper deals with the distribution of 51 species from freshwater bodies of the three districts under report. Of the species listed here *Danio rerio* (Ham.), *Xiphophrus helleri* Heckel and *X. maculatus* Gunther collected from Kattupakkam Agricultural farm, are cultured for aquarium pruposes and do not occur in the wild. *Favonigobius reichei* (Blkr.), an estuarine species, was collected for the first time from the freshwaters of Vandalur. *Chela laubuca* (Ham.) and *Mystus bleekeri* (Day) are new reports from Chennai waters, subsequent to their reports from Bhavani headwaters by Rajan (1955) and Cauvery River by Jayaram (1982). The following 15 species viz. *Anguilla bengalensis* Gray & Hardwicke, *A. bicolor* Mc Cl., *Salmostoma bacalia* (Ham.), *Puntius arenatus* (Day), *Cirrhinus reba* (Ham.), *Labeo calbasu* (Ham.), *Mystus keletius* (Val.), *Proeutropiichthys taakree* (Sykes), *Wallago attu* (Bloch & Schn.), *Clarias batrachus* (Linne.), *Xenentodon cancila* (Ham.), *Nandus nandus* (Ham.) *Mugil cephalus* (Linnaeus), *Rhinomugil corsula* (Ham.) & *Channa orientalis* (Bloch) reported earlier are not represented in the present collections. Excluding the introduced aquarium species *Danio rerio* and the exotic species *Gambusia affinis, Poecilia reticulata, Xiphophorus helleri, X. maculatus* and *Oreochromis mossambica,* the primary freshwater fishes of Chennai and its environs, reported so far numbers 60.

Some interesting observations on distributin of fishes, collected during various surveys are as follows.

Maximum species composition comprising 19 species was observed in Payanur tank near Kelambakkam. Other speciose areas include Chembarambakkam tank, Porur tank, Palar river at Mamandur, Tamaraikulam at Madavaram and Pozhuvaṃkaranai, most of which are located in Chengleput district. Among the species collected, those which are most commonly encountered

(frequnecy of occurrence being 35-50%) in their order of predominance are ***Puntius sophore,*** *Oreochromis mossambica, Lepidocephalus thermalis, Esomus thermoicos* and ***Rasbora caverii.*** All other species fall within the range of 4-23% frequency of occurrence.

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Rec. zool. Surv. India : **97** (Part-4) : 167-170, 1999

DESCRIPTION OF A NEW SPECIES OF *HAPLEGINELLA* DUDA (DIPTERA : CHLOROPIDAE) FROM INDIA

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INTRODUCTION

The genus *Hapleginella* Duda is recorded for the first time from the Oriental Region and a new species, *H. orientalis* is described from India.

Hapleginella Duda is a relatively small genus hitherto reported only from the Holarctic Region. Though Andersson (1977) and Kanmiya (1983) placed the genus in the *Oscinella* genus group, Nartshuk (1987) considered it belonging to the tribe Botanobiini along with *Gaurax* Loew,. *Pseudogaurax* Malloch and other congeneric forms. One new species, *H. orientalis* from Meghalaya in north-eastern Himalaya is described here. This is also the first record of the genus from the Oriental Region.

The type specimens are deposited in the collections of the Southern Regional Station, Zoological Survey of India, Chennai.

Genus ***Hapleginella*** Duda

1933. *Hapleginella* Duda, *Palaeark. Fliegen,* **68** : 77. *Type species* : *Hapleginella laevifrons* (Loew) (= *Oscinis laevifrons* Loew). By original designation and monobasic.

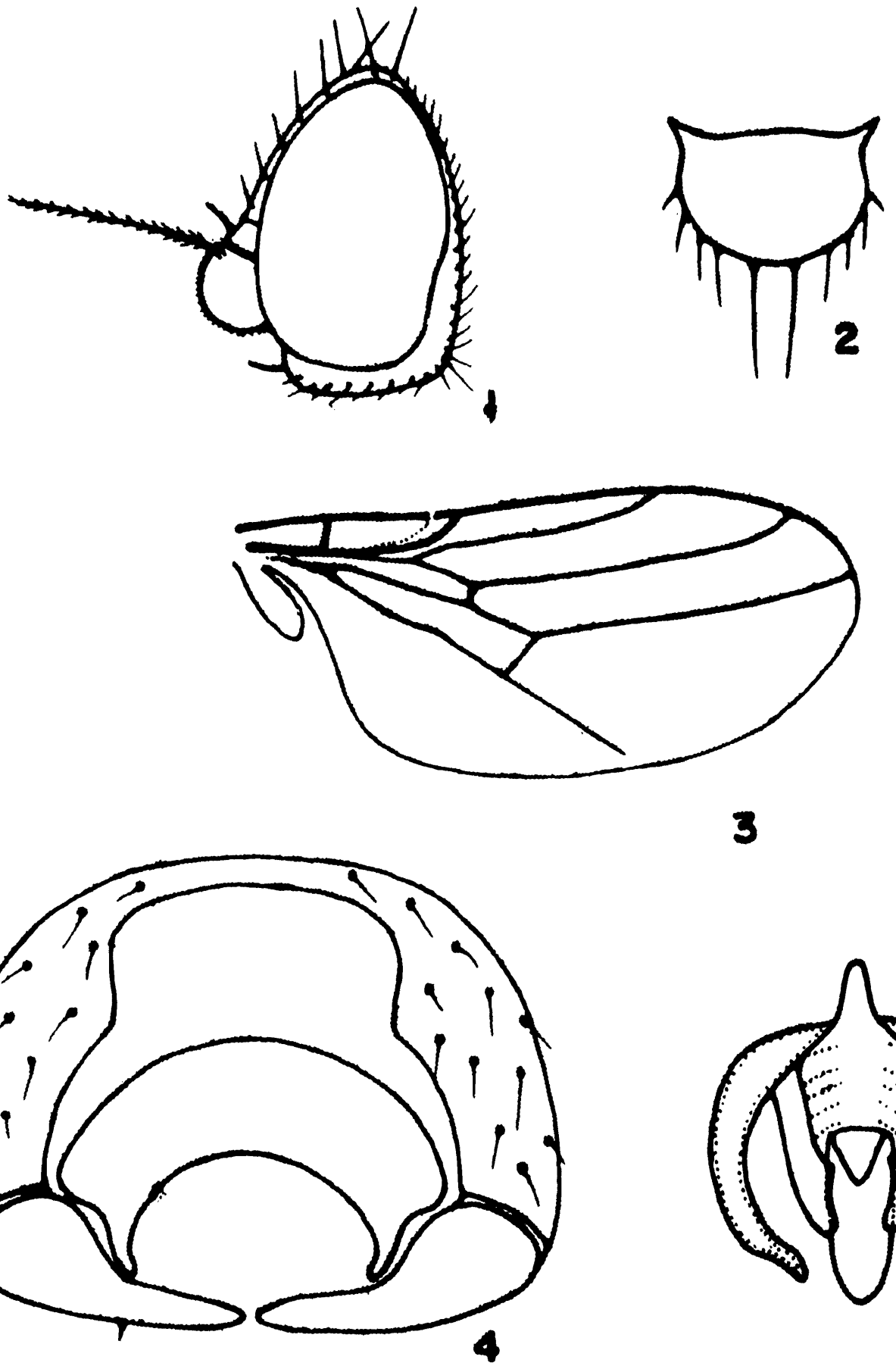
Head higher than long, mostly black; frons subshiny, with a few *fr* ; frontal triangle large, glabrous, reaching anterior margin of frons ; *if* in one row on the triangle ; face concave, facial carina low, rarely reaching lower facial margin ; antenna mostly yellow ; arista slender with short hairs ; eye large, suboval, with sparse, almost inconspicuous fine pubescence ; gena partly tomentose ; labella slightly elongated ; head bristles moderately long with 6-7 *orb* and rather reclinate *oc* ; scutum convex, shining with short dense hairs at times arising from punctae ; scutellum wider than long, tomentose with slightly convex disc ; pleura glabrous ; *anepst* bare ; thoracic bristles rather well developed with 1 *h*, 1+2 *npl*, 1+1 *pa*, 1 *dc*, 2-4 *ss* and not approximated *as* ; tibial and femoral organs present, the latter with two indistinct rows of warts ; m-m cross-vein oblique ; anal angle well developed ; haltere yellow ; male genitalia with bowl-shaped phallapodemic sclerite and short, stout phallus.

Distribution : Holarctic and Oriental Regions.

Hapleginella orientalis, sp. nov.

(Figs. 1-5)

Male and *Female* : *Head* (Fig. 1) higher than long, length, height and width in ratio 11 : 13 : 18. Frons sloping, slightly projecting above eye in front, subshiny, brownish black with straight



Figs. 1-5. *Hapleginella orientalis*, Sp. nov. 1, Head, lateral view ; 2, Scutellum ; 3, Wing ; 4, Epandrium ; 5, Hypandrium and Phallic complex.

anterior margin and a few *fr* ; frontal triangle large, glabrous, shiny, reaching anterior margin of frons and ending with obtuse apex. Face concave, brownish black ; facial carina low, linear, reaching lower facial margin. ant 2 short, yellowish brown ; ant 3 yellow with darkish tinge at apex above, width 1.33x the length; arista dorsal, slender, dark brown with distinct, concolourous pubescence. Eye large, with very fine scattered pubescence, long axis vertical. Gena brownish, width one fourth that of ant 3; vibrissal angle developed, a right angle; vibrissae distinct. Labella prolonged, very slender, brownish black; palpi short, yellow. Face and upper half of gena silvery grey tomentose. All head bristles and frontal hairs fairly stout, black; *ovt* and *pvt* subequal, the latter erect and cruciate; *ivt* shorter than *ovt* ; *orb* 6, reclinate, anterior ones progressively becoming shorter, longest half the *ovt* ; *oc* reclinate, convergent, equal to *orb* ; *if* in a row of 7-8 on the triangle on each side.

Thorax wholly black. Scutum as long as wide, shiny, with dense piliferous punctae bearing short black hairs. Scutellum (Fig. 2) wider than long, width and length in the ratio 7 : 6, nearly rounded in outline with slightly convex, dull, tomentose disk bearing punctate hairs. Pleura glabrous, shiny ; *anepst* without and *kepst* with a few hairs. All thoracic bristles fairly stout ; *h* 1, short ; *npl* 1+2, subequal, a little longer than *ovt* ; *pa* 1 and 1 *dc* equal to *npl* ; *pa* 2 slightly shorter than *pa* 1 ; *as* somewhat approximted at base, nearly as long as scutellum ; *ss* 1 two-fifths the *as*, *ss* 2 two-thirds the *ss* 1, *ss* 3 two-thirds the *ss* 2 and *ss* 4 half the *ss* 3. All scutellar bristles rather spine-like, borne on small warts.

Legs short, not thickened ; femora broadly brownish black in the middle, with yellow basal and distal ends ; coxae partly dark brown ; rest of the areas of all the legs yellow ; tibial organ present ; femoral organ with two rows of warts.

Wing (Fig. 3) hyaline with pale brown veins ; length to width 12 : 5 ; proportions of costal sectors 2 to 4 in ratio 16 : 9 : 6; r-m cross-vein beyond middle of discal cell, opposite 0.67 of its length ; m-m cross-vein strongly oblique ; terminal sectors of veins r 4+5 and m 1+2 nearly parallel, both a trifle bent towards costa at tip ; anal area developed. Knob of haltere pale yellow with a brown spot, stalk dark brown.

Abdomen oval, black but the two basal segments broadly in the middle yellow. Female cerci slender. Male genitalia (Figs. 4 & 5) : Very much similar to that of the type species *laevifrons* but surstyli are a little more pointed as also the cerci ; postgonites short, blunt at apex.

Length : Male, 1.7 mm, Wing 1.7 mm. Female, 1.9 mm., Wing 1.89 mm.

Holotype : Male : India : Meghalaya : Shillong, Elephant Falls, 1650 m, 28.vii.1979, Coll. P.T Cherian. Paratypes, 1 female, colection data same as of holotype ; 1 male, Meghalaya Shillong, 1650 m, 22.viii.1979, Coll. P.T. Cherian.

H. orientalis is closely related to *laevifrons* (Loew) but it is easily distinguished by the densely punctate thoracic hairs. Besides, in *orientalis* facial carina is complete and reaches lower facial margin and scutellar bristles are borne on small but distinct warts.

Remarks : Two of the specimens were collected from the leaves of a shrub overhanging a small waterfall and the other by sweeping bushes.

ACKNOWLEDGEMENTS

We are thankful to the Director, Zoological Survey of India, Calcutta for encouragement.

Abbreviations : *anepst*, anepisternum ; *as*, apical scutellar bristle ; *dc*, dorsocentral bristle ; *fr*, frontal hairs ; *h*, humeral bristle ; *if*, interfrontal bristle ; *ivt*, inner vertical bristle ; *kepst*, katepisternum ; *npl*, notopleural bristle ; *oc*, ocellar bristle ; *orb*, fronto-orbital bristle ; *ovt*, outer vertical bristle ; *pa*, postalar bristle ; *pvt*, postvertical bristle ; *ss*, subapical scutellar bristle.

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Rec. zool. Surv. India : **97** (Part-4) : 171-180, 1999

Short Communication

ON THE SCYPHOZOA OF DIGHA COAST

INTRODUCTION

Numerous attempts have been made for collecting specimen at Digha (West Bengal) over decades, but only now, with the establishment of Marine Aquarium & Research Centre, Zoological Survey of India, opportunities have arisen for undertaking long term studies on various biological aspects of a number of organisms readily available here. Apart from the scientific interest *per se*, some of these studies are of great importance for the economics of Fisheries industries. In all advanced countries, the biology of various non-fish organisms has been investigated for the excellent reason that some of these may be beneficial or injurious to fish and as such all data pertaining to the ecology and life cycle of these "Friend or Foe" species are relevant to the economics of fisheries.

In January 1995, one of the leading newspapers in Calcutta published a series of news items with great prominance and caused a furore. This was the "invasion" of large Jelly fish in an unprecedented degree such that the fisheries industry was completly halted.

A preliminary investigation was attempted by the authors with Prof. Amalesh Chaudhury of Calcutta University and they came to the conclusion that the 'Invasion' was nothing more than the normal swarming in shallow water which takes place every year, often twice a year, and this spells no danger to fish population. Investigetions sugested a correlation of swarming and breeding (Brahmachary, unpublished). Since January 1996, a collaborative project was intiated with Prof. Brahmachary and the Marine Aquarium & Research Centre and the major findings are now being described.

Schyphozoa at Digha

Two large Scyphozoan species *Acromitus rabanchatu* Annandale and *A. flagellatus* Haeckel are well known in Digha Coast (Bharati Goswami, 1992). From the observations already made it seems likely that two more species probably occur. So far only a single specimen each of the two likely new species/genus has been found.

Seasonal abundance :—

(a) *Adult Scyphozoa* :—In 1995 during January & February huge numbers of adult scyphozoa

Table-1. Adult Scyphozoa (144-264 cm in diamter) observed in 1996.

Month	Total No.	*A. flagellatus.*	*A. rabanchatu*	Violet Banded
Jan.	136	87	48	1
Feb.	218	162	56	0
Mar.	23	21	2	0
April	No Netting throughout the month			
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
Aug.	0	0	0	0
Sept.	25	0	25	0
Oct.	24	24	0	0
Nov.	0	0	0	0
Dec.	6	0	6	0
Total	432	294	137	1

Table-2. Juvenile Scyphozoa observed during 1996.

Month	Total No.	*A. rabanchatu*	*A. flagellatus.*	Yellowish	Whitish	Diameter (cm)
Jan.	0	0	0	0	0	0
Feb.	0	0	0	0	0	0
Mar.	0	0	0	0	0	0
April	No Netting throughout the month					
May	73	5	8	60	0	21-56
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug.	0	0	0	0	0	0
Sept.	325	135	110	0	80	13.8-26.4
Oct.	125	0	125	0	0	37-56
Nov.	0	0	0	0	0	0
Dec.	4	0	2	2	0	31-34
Total	527	140	245	62	80	

were noticed and they continued to come even in March though in declining numbers. From April to July none was noticed but in August a small number came again. None was noticed between September-November but they began to migrate in December.

Since January 3, 1996, regular observation on adult (diameter 144—264 cm) Scyphozoa, cast off on shore has been carried out within a certain zone near MARC. Most are cast out from fishing net and only a few by tidal action.

The data have been tabulated (Table 1) and Fig 1 (a & b) gives a quantitative picture of 1996.

b) *Medusa* : Only after the advent of bagda netting (1994), these small organisms could be regularly observed. Fig-2a & fig-5a shows the approximate abundance over months in 1995 and 1996.

c) *Juvenile Jelly fish* : In December 1995 a few Juvenile jelly fish were noticed. Between January to December 1996, the juveniles were observed only in May (diameter 21-56 cm), September (13.8-26.4 cm) and October (37-56 cm). Table 2 and fig 3 furnish data on the juvenile Scyphozoa.

Fish as Food for scyphozoa : 426 adult scyphozoa were examined for detecting fish or shrimps caught by them, if any. A total of 10 fish as found in only 5 of these 426 individuals. The largest, a ribbon fish, measured about 6 inches (18 cm) in length. None of these fish was significantly digested and it is possible that pressure exerted in crowded net might have forced the fish deep inside the gastrovascular cavity (coelenteron) of the scyphozoa.

Rearing medusae in Laboratory : In view of studying various aspects of the life history including growth rate, the longevity of medusae was determined in the laboratory and artificial feeding was attempted.

a) *Longevity* : Table 3 shows the longevity of medusae, ranging from 30 hours to more than 146 hours, under different conditions.

Table-3. Longevity of Schyphomedusae under laboratory condition

Description	Condition of aeration & Container	Longevity
Very small	no aeration, Small container	30 Hours
Very small	no aeration Larger tray	30 Hours
Small	Aeration Larger tray	50-52 Hours
Slightly larger	Aeration Larger tray	146 Hours

b) *Artificial feed* : Freshly collected sea water was put in small and large containers once or twice per day and in this manner a very small supply of plankton was ensured as food for medusae. Newly hatched brine shrimp (*Artemia*) and *Sepiella inermis* were put in the container and seen to be consumed by the medusae.

Pulsatile System of Medusae : Isolated tentacles with a portion of bell executed pulsatory movements. These were also maintained in pasteurized sea water in the refrigerator. After 23 hours they were brought back to normal temperature and observed to pulsate rhythmically as in normal intact condition. This system may further be studied in connection with the interesting problem of biological clocks.

Abundance of Fish vis a vis that of Scyphozoa : 'Sarini' netting within a certain area of the beach (from Hospital Ghat to New Digha Ghat) and the fish catches (Kg/month) were noted, Fig-4 shows that fish catch is independent of the presence or absence of adult Scyphozoa.

Discussion: Various species of jelly-fish are known to congregate in large numbers (Harson, 1991) and some of these assemblages are for breeding in relatively shallow water. Jelly fish are known to reproduce in two different modes*, one of which is direct development from planula to medusa to adult and relatively a small number of scyphozoan species follows this pathway (Foutin, 1889): Apparently the scyphozoan species of Digha belongs to the same category.

The present findings reveal that scyphozoans at Digha assemble twice a year in shallow water. The peak period occurs in January and February and a second minor peak takes place around September (August-October). Interestingly only during these periods medusae are available and this correlation (Fig 2 and Fig 5) suggests the possibility that, as in some other species in various parts of the world, the scyphozoa at Digha congregate for spawning and development follows from medusae.

Without running sea-water, some of he medusae could be reared for at least 30 hrs even in small containers and with aeration at least one larger specimen could be kept alive for 146 hrs. During captivity they also fed on hatchlings of brine shrimp and the cuttle fish *Sepiella inermis*. Thus it may be possible to rear medusae in the laboratory if running sea-water be available. As certain fragments of medusae continue to execute well defined biological rhythms in small vessels containing pasteurized sea-water, these may also serve as a system for studying such rhythms.

The interaction of fish and Scyphozans, if any, is of interest in connection with fisheries ; fishermen may well be scared at the sight of the huge congregation of scyphozoa but adult scyphozoa are not known to feed on fish even if their juveniles do so (Hardy, 1958; Nandi, 1984). The present data show hardly any record of predation of fish by adult scyphozoa at Digha.

---

* Cnidarian follow a complex life history, which be devided under two categories, sexual and asexual. In most scyphozoa, sexual union of the gamates give rise to planula larva which metamorphose to settled scyphistoma, which produce asexually immature medusae and ultimately turn into adult.

In some scyphozoa, planula directly metamorphose into medusa.

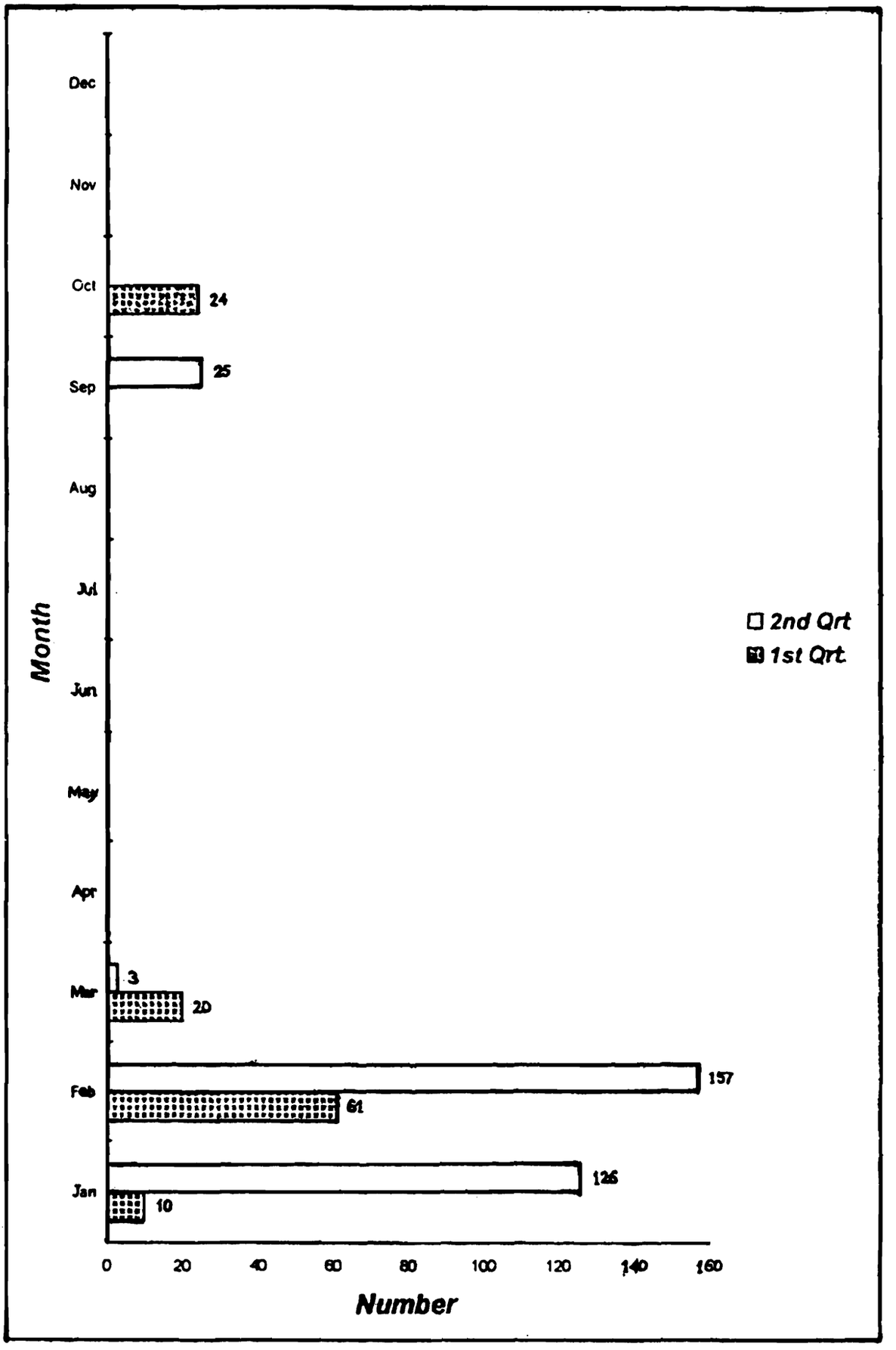

Fig : 1. Fortnightly abundance of adult Scyphozoa, 1996

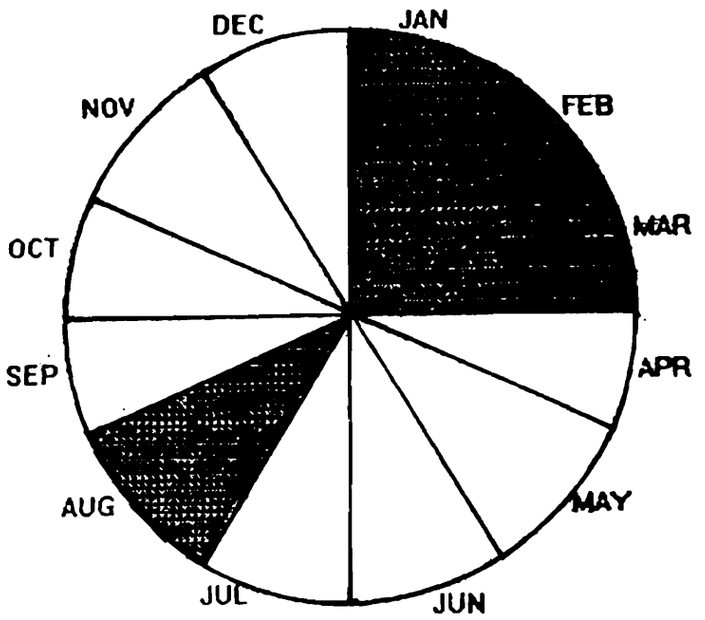

Fig. 2a

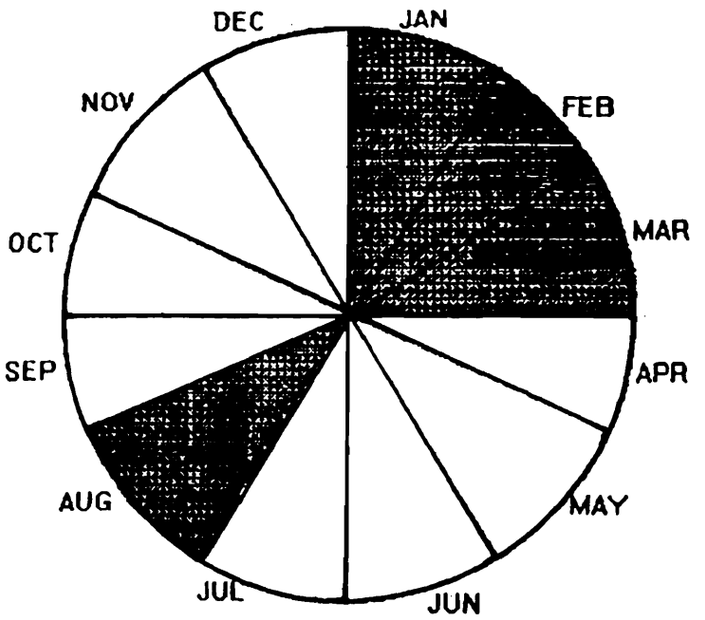

Fig. 2b

Fig : 2a. Availability of Medusa, 1995.

Fig : 2b. Availability of adult Scyphozoa, 1995.

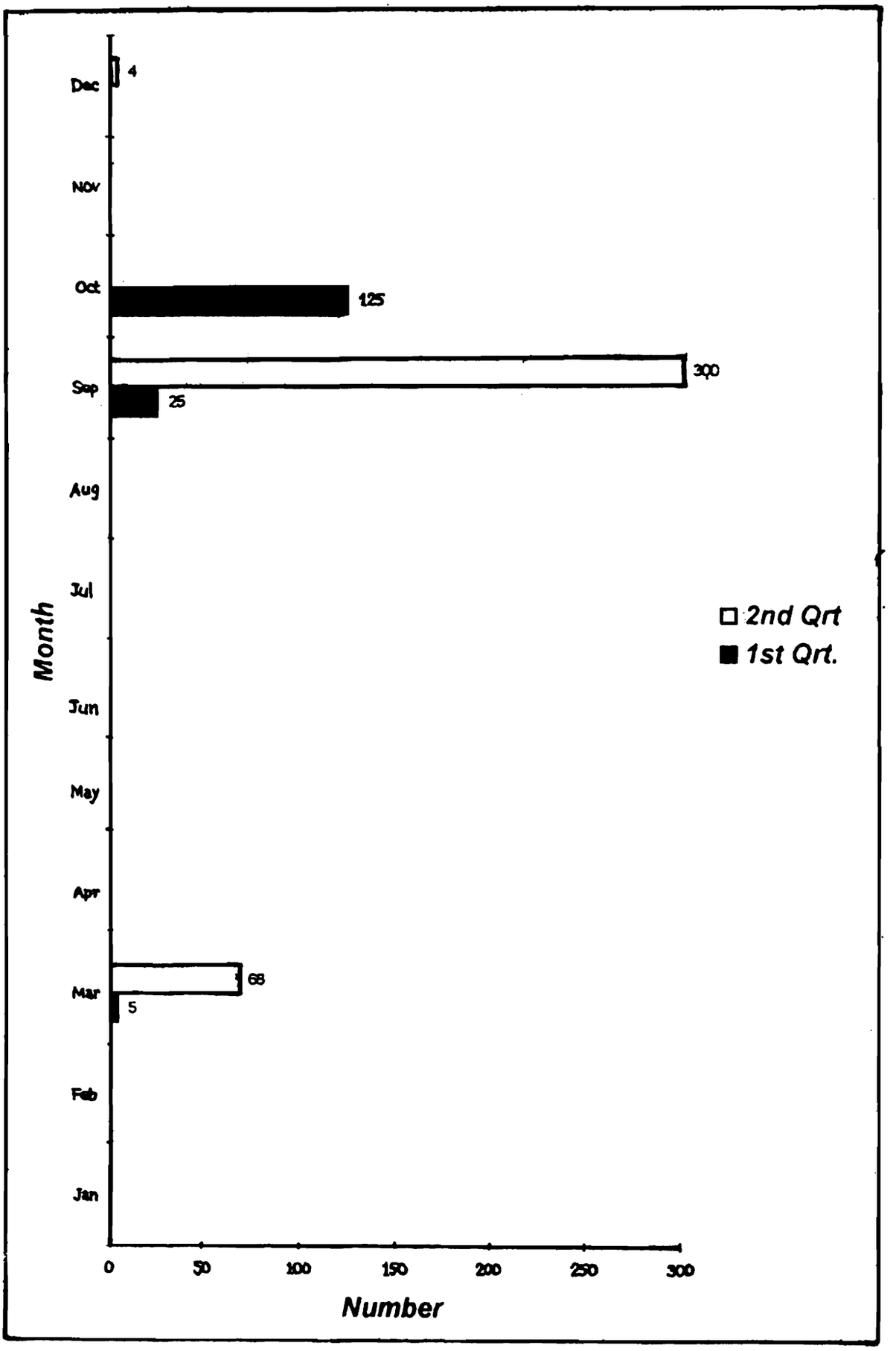

Fig : 3. Fortnightly abundance of juvenile Scyphozoa, 1996.

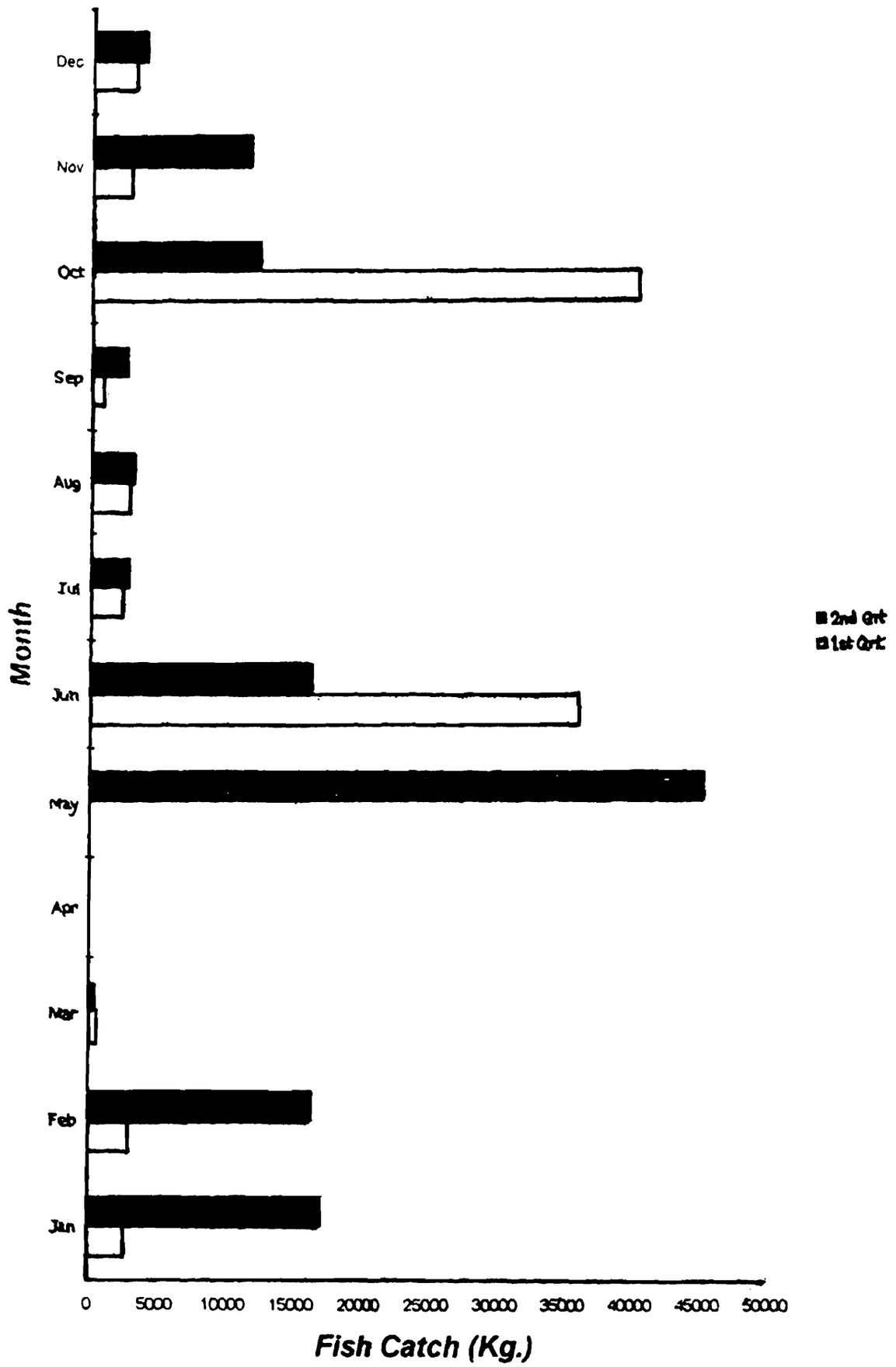

Fig : 4. Fortnightly landing pattern of commercial fishes by shore net, durng 1996.

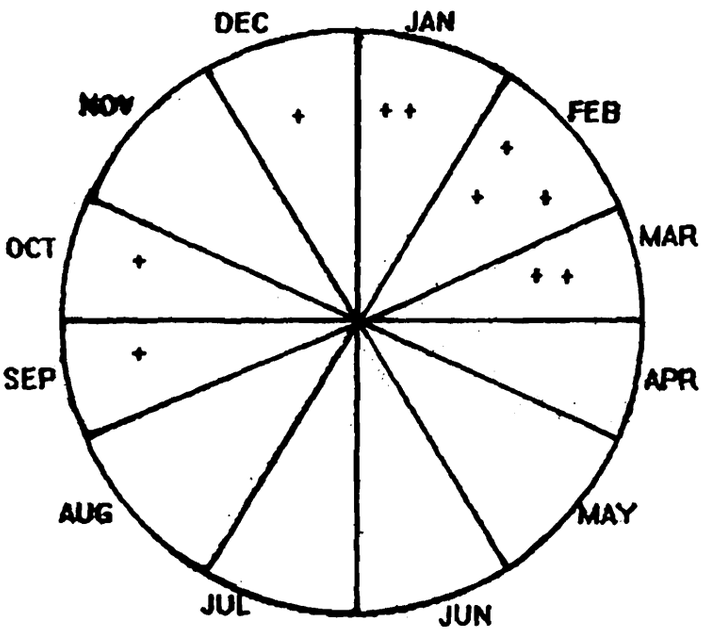

Fig. 5a

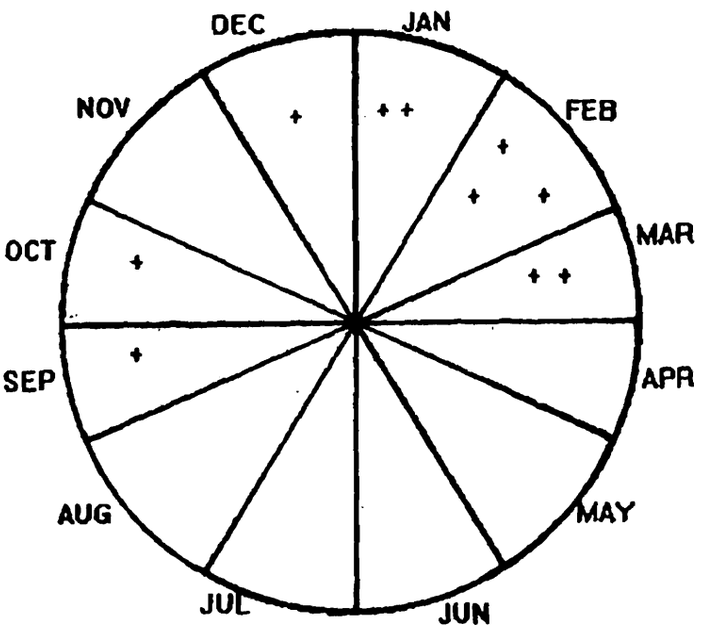

Fig. 5b

Fig : 5a. Availability of Medusa, 1996.
Fig : 5b. Availability of adult Scyphozoa, 1996.

Again, the data on fish catch by sarini nettings in the beach indicate that there is no correlation, positive or negative, between the invasion of Scyphozoans and fish yield. The socalled decline in fisheries business experienced by motorized vessels may be due to overfishing.

SUMMARY

It seems resonable to assume that adult Scyphozoa at Digha congregate in shallow water in order to breed as is known in a number of species. These Scyphozoa of Digha appear to reproduce by spawning & production of Medusae. A minority of Scyphozoan species is indeed known to do so. The same was also suggested by Nandi (1984) for Scyphozoa in the Sunderbans. The principal breeding phase seems to be in January-February with a second, minor peak in August-October. Adult Scyphozoa do not feed on fish. Fish catches indicate no correlation, positive or negative, between the presence of Scyphozoa and fish yield. The partial success achieved in rearing and feeding medusae in laboratory can be improved if the facility of running sea-water be available.

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Short Communication

STATUS OF HEAVY METALS IN COASTAL WATER OF DIGHA (WEST BENGAL)

INTRODUCTION

India has a vast coastline and utilisation of marine resources which has an important bearing in the national development. Apart from fishing prospects, other marine and aquatic forms of life may provide several useful substances. However, the increasing incidence of marine pollution by industrial, agricultural and domestic effluents, oil spillage etc. has resulted in a considerable environmental disbalance causing large scale damage to marine biota including the micro-organisms.

It is estimated that over 35×10^8 tons of sediments containing high values of metals in particulate matter is added annually into the Indian ocean. Observations on the dissolved metals showed that about 85% of it settle within the estuarine region and at the confluence, leaving only 15% to flow out into the Bay of Bengal. Unlike most of the organic pollutants, metals can not be degraded biologically and chemically in nature and many of the heavy metals are hazardous to marine organisms. The sources of heavy metal pollution to the marine system have been mainly the disposal of domestic sewage, agriculture and industrial waste as well as discharges of ship borne pollutants (deliberate and operational). The purpose of this study is to provide a status report for the occurrence of well known heavy metal pollutants eg. Copper (Cu), Cadmium (Cd), Manganese (Mn), Zinc (Zn), Lead (Pb) and Nickel (Ni) in Digha marine water samples in the Bay of Bengal.

Studies presented here were conducted for three consecutive years i.e. 1995, 1996 and 1997 at Digha coast which is situated close to the Gangetic mouth on East Coast of India at latitude 21° 36' N and longitude 87°30' E. Coastiline is straight and the beach is flat and compact. Marine water samples were collected fortnightly at 10-20 meters distance inside from the sea surface both at low and high tides in a stretch of 200-500 meters of either side of the beach near this research centre (Fig. 1).

MATERIALS AND METHODS

The marine water samples collected fortnightly were filtered to remove suspended impurities. The dilutions were made (when required) by the triply distilled water, to make it to the detectable range. The Hitachi made Zeeman Double Beam Absorption Spectrophotometer (Model no. Z-6100) and the Cathode lamp for each element (Separately) were utilised for routine analysis of such water samples. The instrument was calibrated for each metal to be detected with known standard reference solutions prepared from pure metals (Sigma/Aldrich grade). After calibration

and programming, samples were directly aspirated into the air acetylene flame and the concentration was recorded by Automatic Absorption Spectrophotometer. Before each determination, zero was set with double distilled water. Results on the instruments were displayed in µg/l from which the actual concentration of the heavy metal in the water sample could be computed. Metal content can also be obtained in ppm (mg/l). The other methods used here are those of APHA (1985), ADONI (1985), NEERI (1986) and further incorporated by Mitra *et al.* (1994) and Kataria (1995).

RESULTS & DISCUSSION

The concentration of the heavy metals detected in Digha marine water samples for the elements Cu, Cd, Mn, Zn, Pb, and Ni are depicted through figures 2 and 3 respectively. These values are expressed distinctly seasonwise i.e. premonsoon, monsoon, and postmonsoon expressing the block period of March to June, July to October and November to February respectively. From such observations, it has been found that the metal concentrations were higher during the monsoon period, which may be attributed to the influence of monsoon run off and simultaneously the lowering of pH and salinity was also noticed during this period.

The presence of heavy metals on the surface and deeper waters in the Bay of Bengal was evidenced as back as in 1980 by National Institute of Oceanography workers. The occurrence of heavy metals namely, Cu, Zn, Co and Ni in µg/l reported are 6.8-9.5, 15.3-20, 7-9 and 11.2-12.2 respectively. Also the maximum concentration of such heavy metals in zooplanktons occurring both in the Arabian sea and Bay of Bengal are reported to range (in ppm) between 232-228 for Cu, 22494-170 for Zn, 783-322 for Co and 178-81 for Ni in the dry weight samples. Unlike most of the organic pollutants, metals can not be degraded biologically and chemically in nature including the evidence that most of the heavy metals are quite hazardous to marine organisms. Elements like Tin (Sn), and Mercury (Hg) assume greater toxicity as they disrupt some enzyme related biological functions of the body, Mathur *et al.* (1986).

Though the heavy metal values obtained in our studies at this area are reasonably below the permissible limits, but the continuous influx and possible increasing trend of heavy metals concentration may adversely affect the growth of susceptible phyto and zooplanktons resulting into disrupting the entire food chain of a large number of marine organisms. Also the impact of such pollution load in combination with other physical and weather pattern factors may be much more than anticipated.

Monitoring of Digha coastal water in respect of heavy metal pollution threat assume more significance in view of ongoing industrial activities around this area which include the newly emerging Haldia Refinery/Industrial complex, Paradeep port trust, and the Vishakhapatnam port and the Industrial complex in the Bay of Bengal. Although, this area has been generally considered as of clean environment, but the same may not remain true for longer because of such ongoing activities. It is therefore necessary to remain vigilant and to maintain such profile in order to cope with any likely eventuality. Our studies on this line is an elementary attempt to establish a baseline for heavy metal impact on marine system

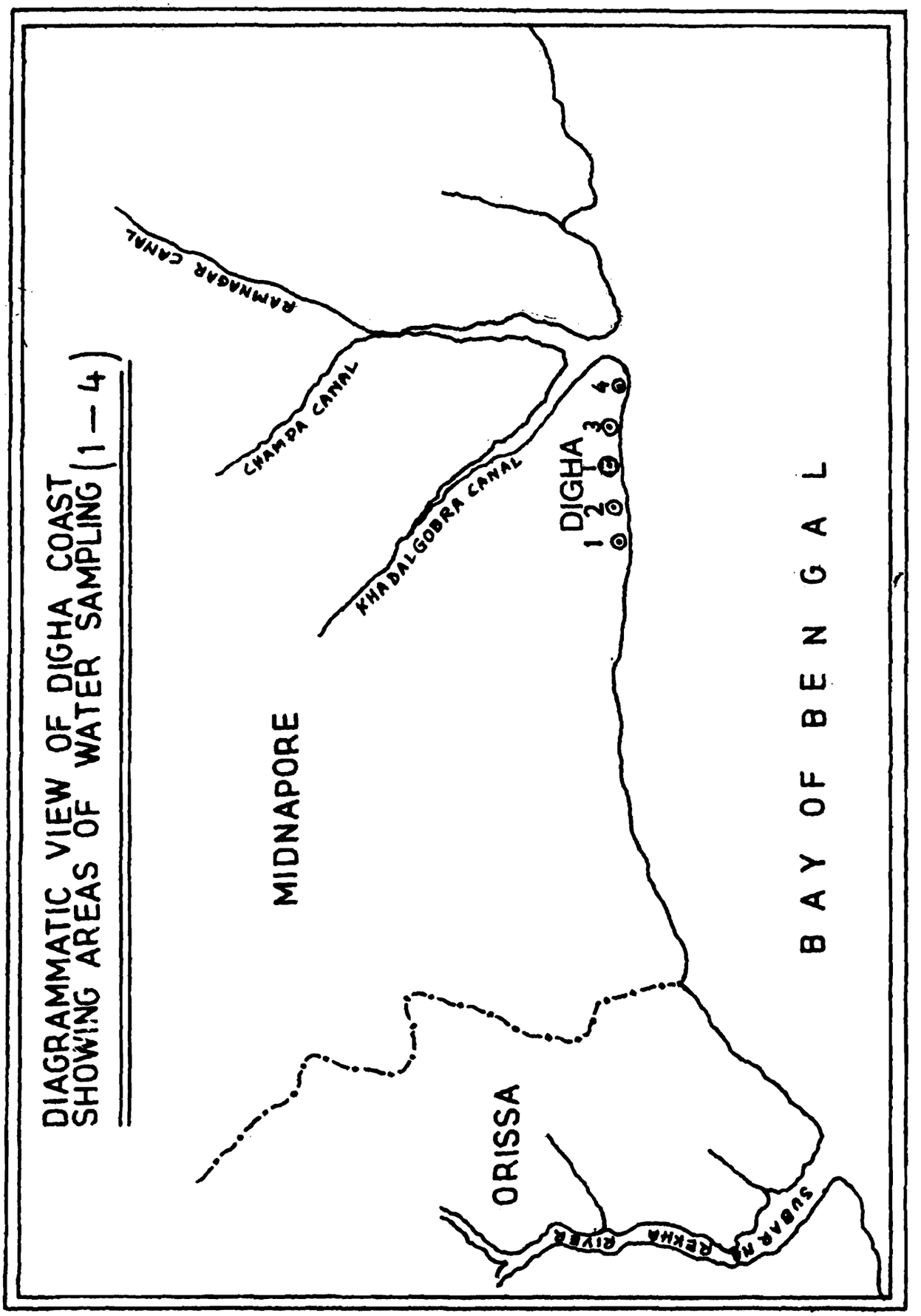
DIAGRAMMATIC VIEW OF DIGHA COAST
SHOWING AREAS OF WATER SAMPLING (1 — 4)
RAMNAGAR CANAL
CHAMPA CANAL
KHADALGOBRA CANAL
DIGHA
1 2 3 4
MIDNAPORE
BAY OF BENGAL
ORISSA
SUBAR N.
REKHA
RIVER

Fig : 1

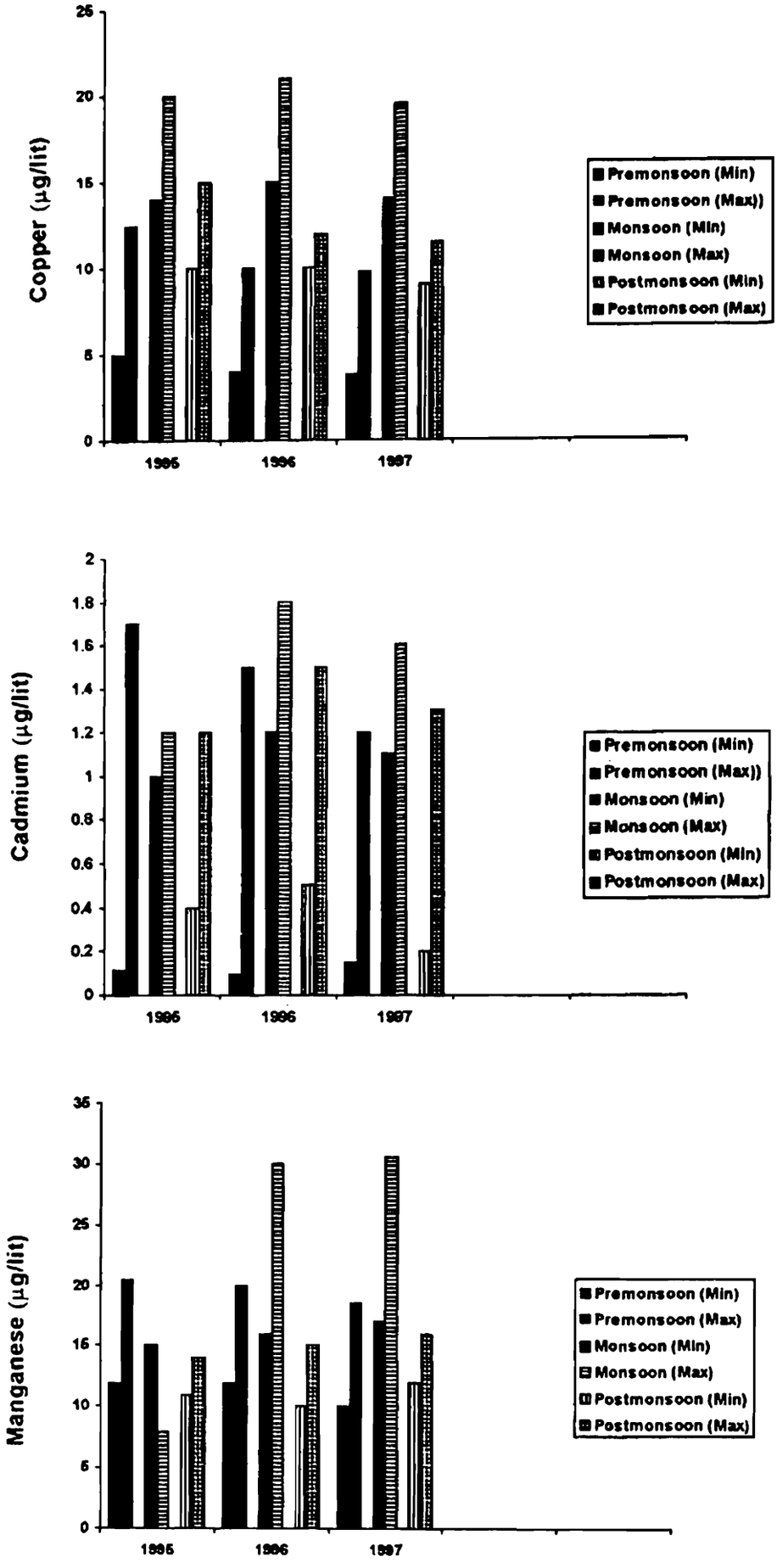
Copper (µg/lit)
25
20
15
10
5
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max))
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
Cadmium (µg/lit)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max))
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
Manganese (µg/lit)
35
30
25
20
15
10
5
0
1995
1996
1997
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)

Fig : 2

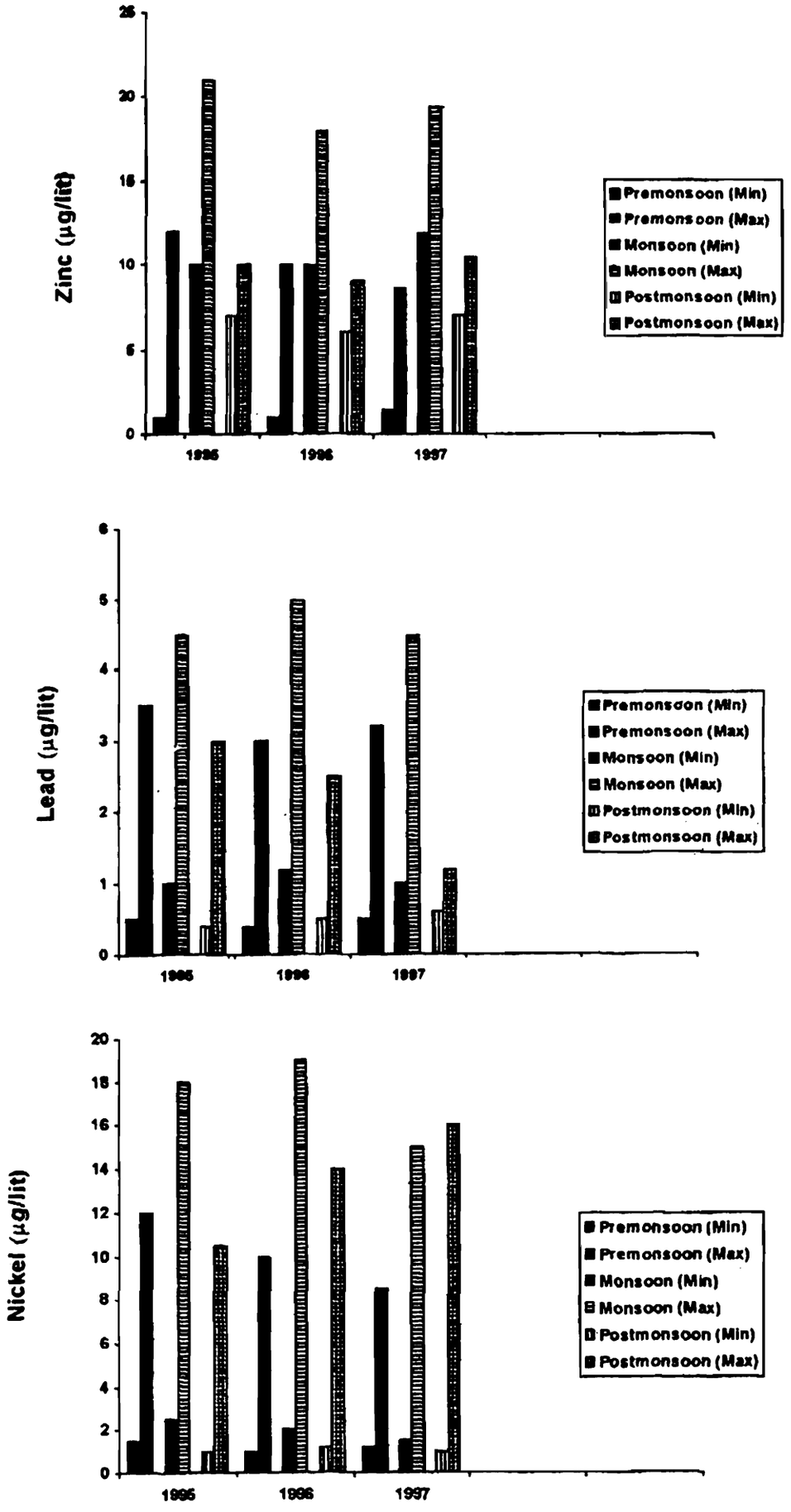
Zinc (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997
Lead (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997
Nickel (µg/lit)
Premonsoon (Min)
Premonsoon (Max)
Monsoon (Min)
Monsoon (Max)
Postmonsoon (Min)
Postmonsoon (Max)
1995
1996
1997

Fig : 3

SUMMARY

It is an established fact that most of the heavy metals are hazardous to marine organisms. Elements like tin and mercury assume greater toxicity as they disrupt some enzyme related biological functions of the body. Over 35×10^8 tons of sediments containing high values of metals in particulate matter, is added into the Indian Ocean annually. Observations on the dissolved metals showed that about 85% settle within the estuarine region and at the confluence, leaving only 15% to flow into the Bay of Bengal. The purpose of this paper is to provide a status report for the occurrence of well known heavy metal pollutants in and around Digha coastal water samples in the Bay of Bengal. The study depicts occurrence of heavy metals namely, copper, cadmium, manganese, zinc, lead nickel for the study period 1995 to 1997. Heavey metals reduce respiration, feeding, growth, development and sexual maturity and may also be responsible for morphological aberrations in almost all organisms. The synergistic effect of heavy metals with low pH, low dissolved oxygen, high temperature and alkalinity may cause episodal fish kills.

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Short Communication

NEW RECORD OF *HYDROBASILEUS CROCEUS* (BRAUER) AND *BRACHYDIPLAX CHALYBEA* BRAUER (INSECTA : ODONATA : LIBELLULIDAE) FROM THE STATE OF ORISSA, INDIA

In the days of March 24 and 28 of 1997, when we were passing through a watery land of Satapada (Puri), Orissa, we have collected two female specimens of the species *Hydrobasileus croceus* (Brauer) and *Brachydiplax chalybea* Brauer, which are not reported from Orissa before.

Fraser (1936) reported *H. croceus* only from western and southern India and later Lahiri (1987) and Srivastava and Sinha (1995) also confirmed its distribution in Assam and Meghalaya. *B. chalybea* was reported earlier only from Assam (Guahati) (Fraser, 1936) and Meghalaya (Srivastava and Sinha, 1995) within the Indian territory. Fraser and Dover (1922), Srivastava and Das (1987) and Prasad and Ghosh (1988) have not mentioned the presence of these two species in Orissa.

So it is the first record of *H. croceus* from the state, Orissa and second record from eastern India. At the same time the present collection of *B. chalybea* is a new record from Orissa.

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Short Communication

STUDIES ON SOME PHYSICOCHEMICAL PARAMETERS OF WATER QUALITY WITH NOTES ON OCCURRENCE OF COMMERCIALLY IMPORTANT MARINE FISHES AT DIGHA COAST IN WEST BENGAL

INTRODUCTION

The comprehensive marine water quality studies on the fast emerging tourist centre Digha, located at the juncture of coasts of West Bengal and Orissa in the Bay of Bengal, has been taken up to assess the viability/environmental feasibility for the vast marine resources as well as to study the sustainability and further scope in fish and shrimp culture along this coastal belt. Due to emerging need and pressing requirement of fish/shrimp as a rich natural food, attention of scientists, industrialists, government planners and the non government organisations, have been focussed on exploring more virgin coastal areas to produce more and more shrimps and edible fishes by the culture and captive methods. The coastal belt ranging from Rasulpur to Digha (via Junput, Sankarpur and Mohana) under Midnapore district of West Bengal has been found to attract them.

Under the present study, efforts have been made to incorporate and correlate the occurrence and abundance of thirty six available commercially important marine fish species in the study area for the period of premonsoon of 1993 upto postmonsoon of 1997 (March 1993 to February 1998). This is however, an ongoing monitoring/study work.

MATERIALS AND METHODS

Studies presented here were conducted during March 1993 to February 1998 at Digha which is situated close to the Gangetic mouth on the east coast of India at latitude 21°36' N and longitude 87°30'E. Coastline is straight and the beach is flat and compact. Marine water samples were collected in sterile glass bottles at 10-20 meters distance inside from the sea surface both at low and high tides in a stretch of 200 to 500 meters on either sides of beach near this research centre (Figure 1).

Generally temperature, pH, and dissolved oxygen were determined in the field itself. The regular analysis of these parameters was done once or twice a week throughout the study period. Surface water temperature, density, total dissolved soilds and total suspended solids were measured conventionally. pH and conductance were measured by Elico pH meter (Model No. LI-120) and Elico conductivity meter (Model No. C.M. 180) respectively. Chlorinity/salinity were measured by Argentometric titration. Modified Winkler's method was employed for the estimation of dissolved oxygen and the biochemical oxygen demand was measured by incubating the sample at 20 ±1°C in a BOD incubator (Model No. Cl-65, Remi cooling incubator) for five days.

Phosphate (PO_4-P), and nitrate (NO_3-N) were determined by following the Grashoft (1976) procedure. The remaining chemical parameters like total hardness, alkalinity, free carbondioxide, and sulphate were estimated by procedures defined in standard methods in APHA (1985), NEERI (1988), Martin (1970), Wilson (1975) and Aston (1978).

Since monsoon plays an important role in the biological and commercial activity of marine living resources, the three distinct seasons defined are premonsoon (March-June), monsoon (July-October), and the postmonsoon (November-February). Each season was further divided into early (I) and late (II) stages, each representing a block of two months duration.

Marine fish specimens collected from dragnet hauls from Paschim Gadadharpur, Udaypur, Ongaria Ghat, Jatranala Ghat, New Digha Beach, Hospital Ghat, about 6 Km, 5Km, 3Km, 2Km and 1Km respectively on the western side of Digha : Seahawk Ghat, about 1 Km on the east side of Digha.

Fishes were collected from fishing vessels from Digha Mohana, a more or less estuary zone about 4 Km on the east from Digha and from Sankarpur Harbour, a minor fishing harbour 5 Km away from Chauda Mile (near Ramnagar) in the Champa canal which falls into the sea across Digha Mohana.

RESULTS

During this period occurance and abundance pattern of 36 commercially important marine fishes of this area studied are given as in table no. 1.

The mean values of these parameters for every two months of interval for the three seasons (premonsoon, monsoon, postmonsoon) for the five year study period (March 1993-February 1998) are expressed here through figures 2-16, for each parameter separately. Free carbondioxide was reported in trace only, generally, every year during the early monsoon period (July & Aug.) therefore, this parameter could not be expressed through figure. The significance of mean values of different parameters was analysed using the one way analysis of variance technique, Snecedar and Cochran (1967) for each parameter separately.

DISCUSSION

From the results appeard so far, it appears that except temperature, chlorinity/salinity, conductance as well as total dissolved solids, all other parameters remain almost constant to the seasonal/digonal variations, which depict the general normalcy in the marine water quality parameters. The significance of chlorinity/salinity data variation with regard to monsoon season is such that the values increase moderately to sufficiently high from monsoon to postmonsoon and to premonsoon respectively.

Similar studies recently carried out at different riverine and marine systems in India by Mathur *et al.* (1986), Zingde *et al.* (1980), Malik *et al.* (1995), Srivastava *et al.* (1996) and Elango *et al.* (1992) assume significance of our present work as any catastrophic event to marine biological

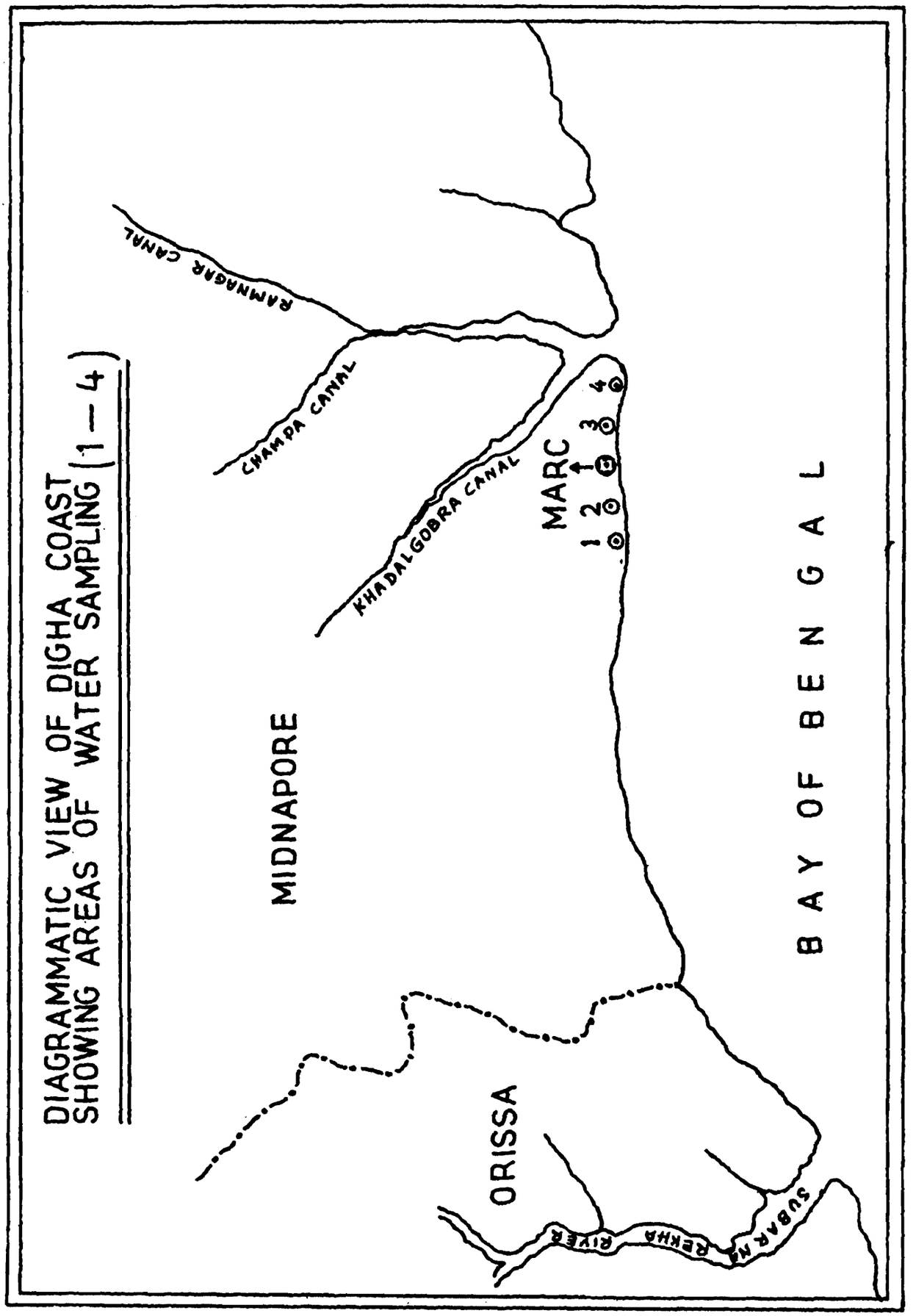


Fig 1 : Showing areas of water sampling points at Digha coast.

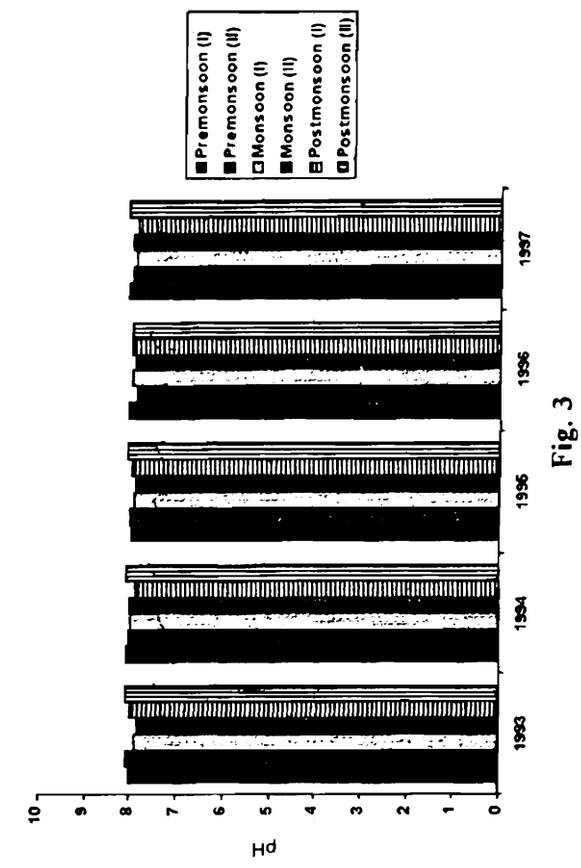
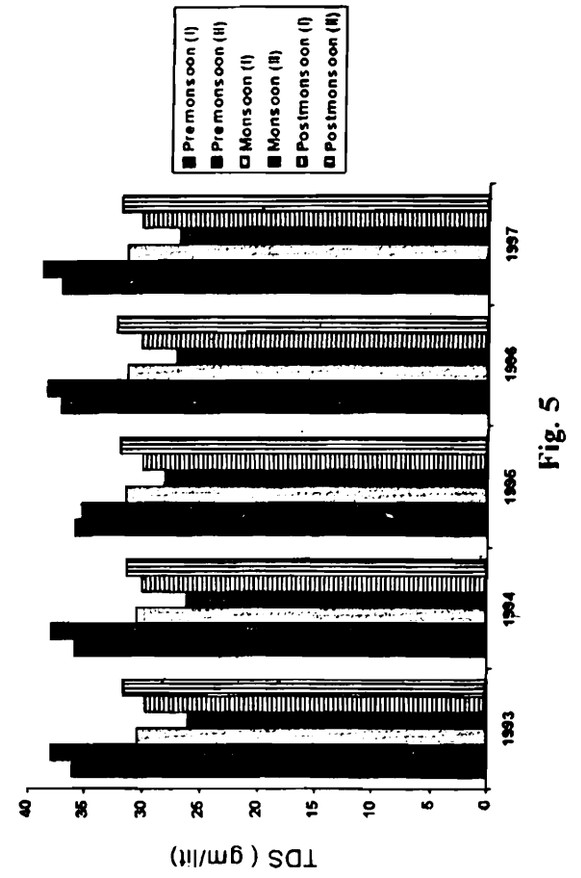


Fig. 3



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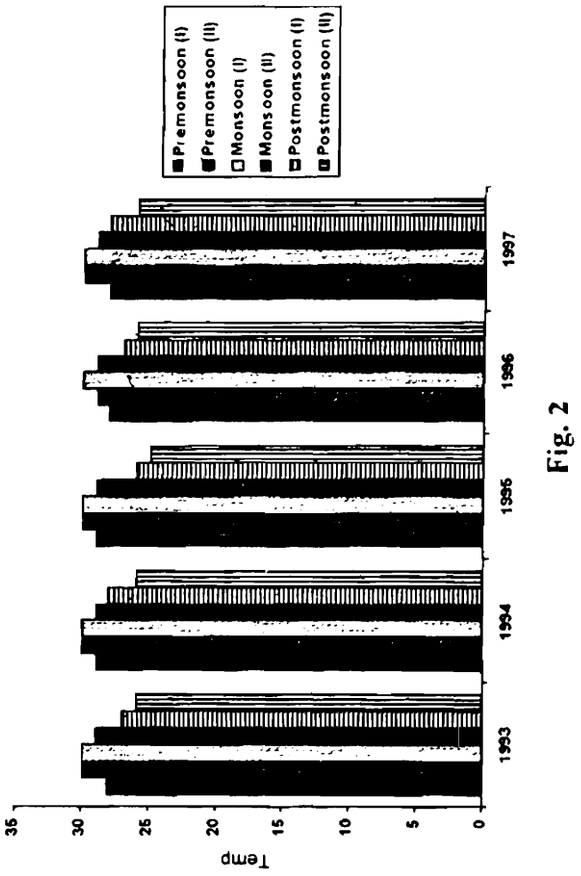


Fig. 2

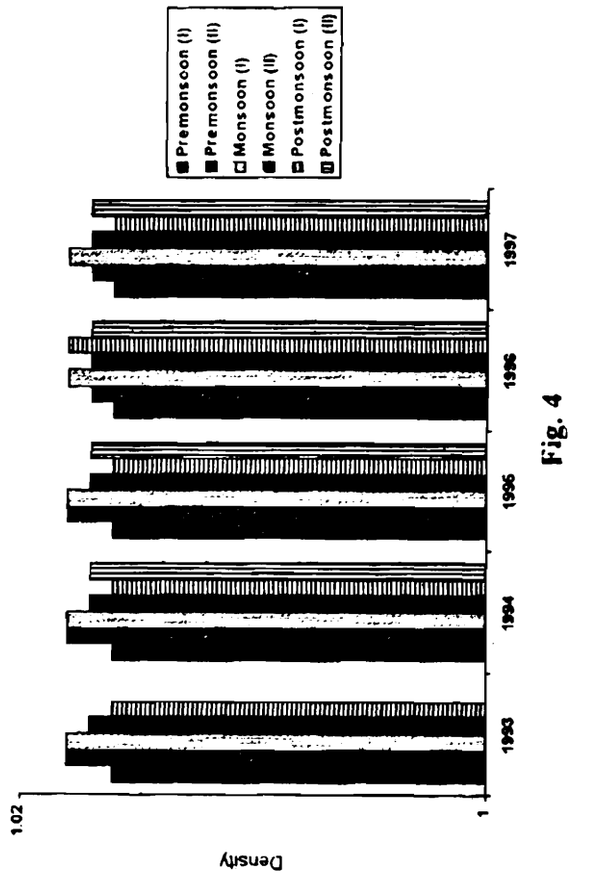
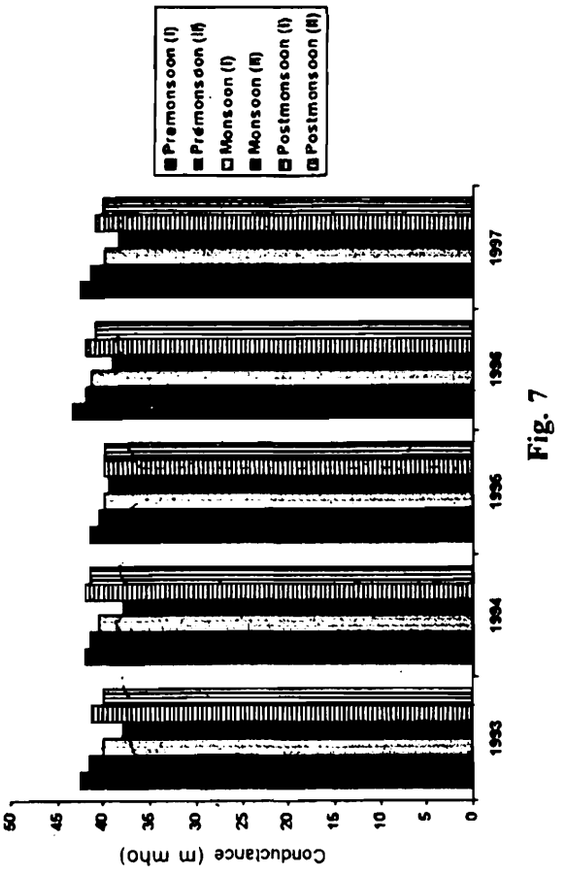


Fig. 4

Fig 2 : Temperature variation profile ; **Fig 3 :** Observed pH values of sea water samples throughout the year ; **Fig 4 :** Recorded sea water density ; **Fig 5 :** Measured total dissolved solids (gm/lit).



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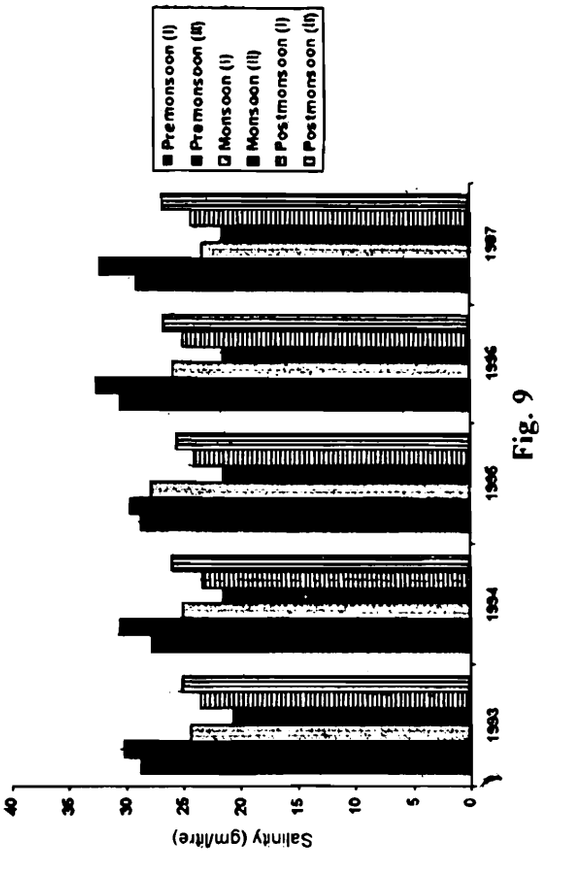

Fig. 9

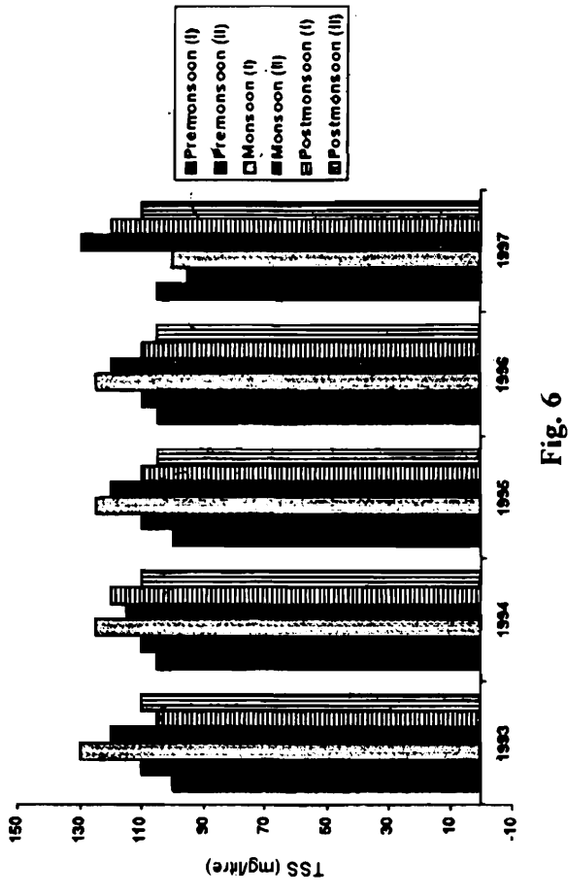

Fig. 6

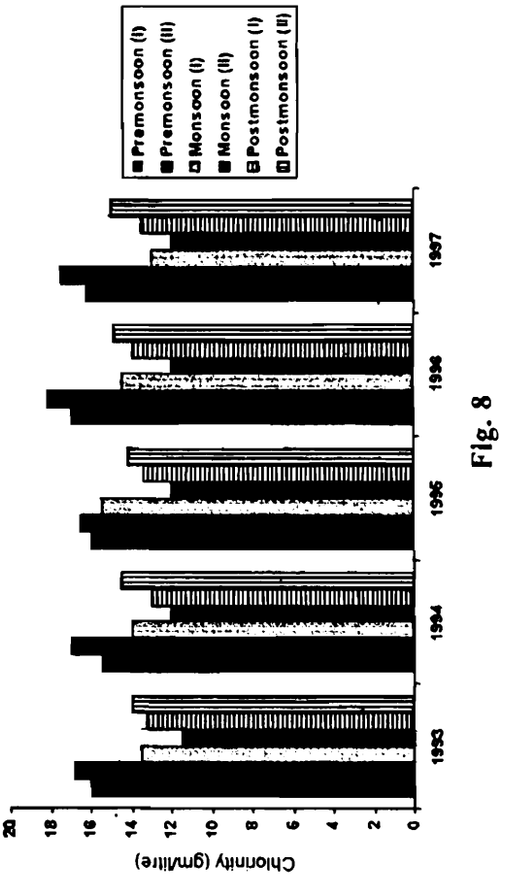

Fig. 8

Fig 6 : Measured total suspended solids (mg/lit) ; **Fig 7 :** Recorded conductance values for the sea water samples ; **Fig 8 :** Observed chlorinity variation for the sea water samples ; **Fig 9 :** Corresponding salinity values.

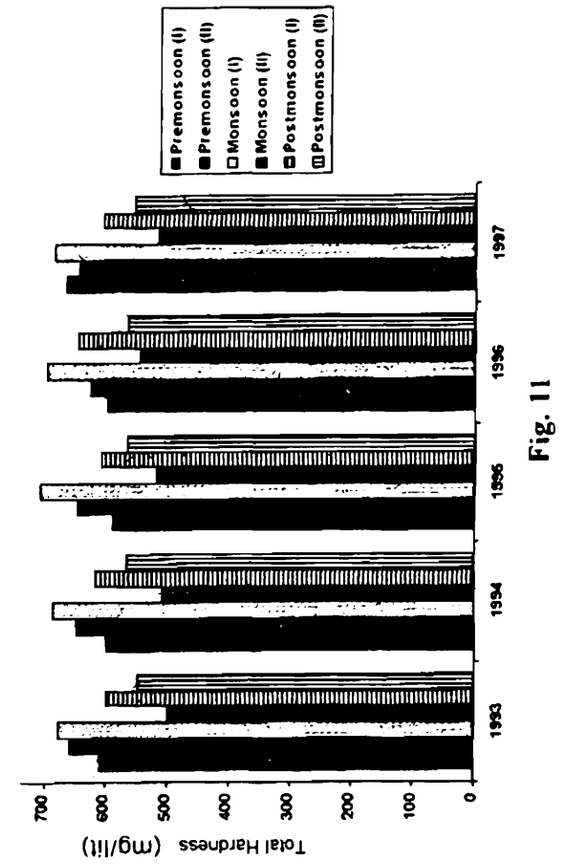

Fig. 11

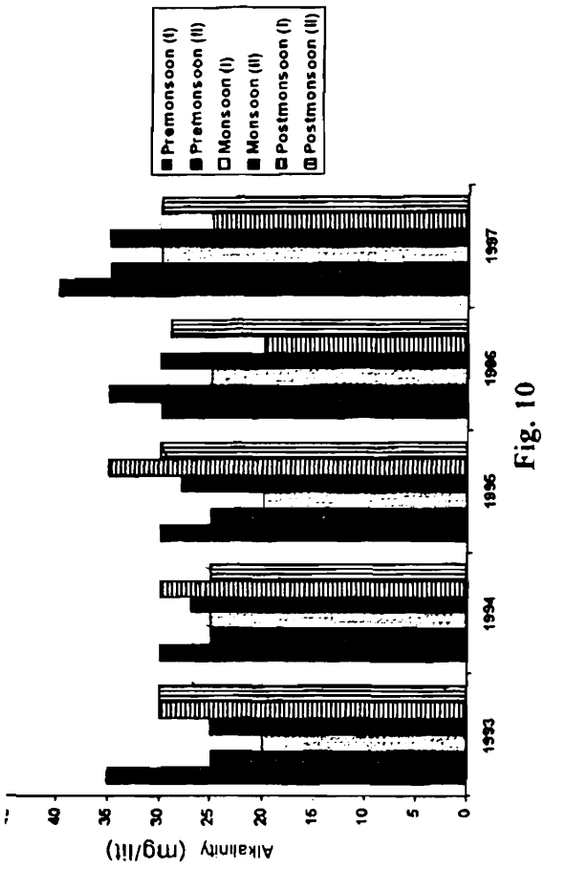

Fig. 10

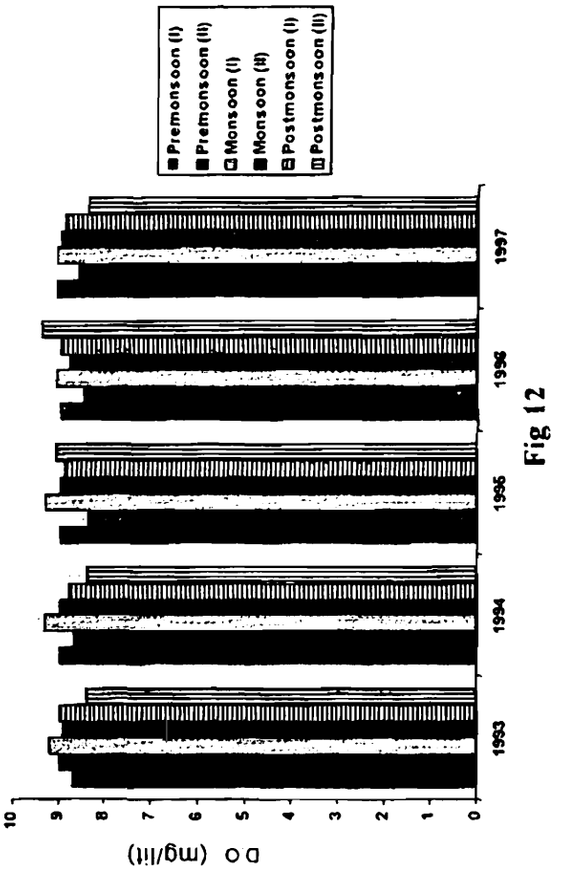

Fig 12

Fig 10 : Measured alkalinity values (mg/lit) ; **Fig 11 :** Recorded total hardness values (mg/lit) ; **Fig 12 :** Observed dissolved oxygen values (mg/lit).

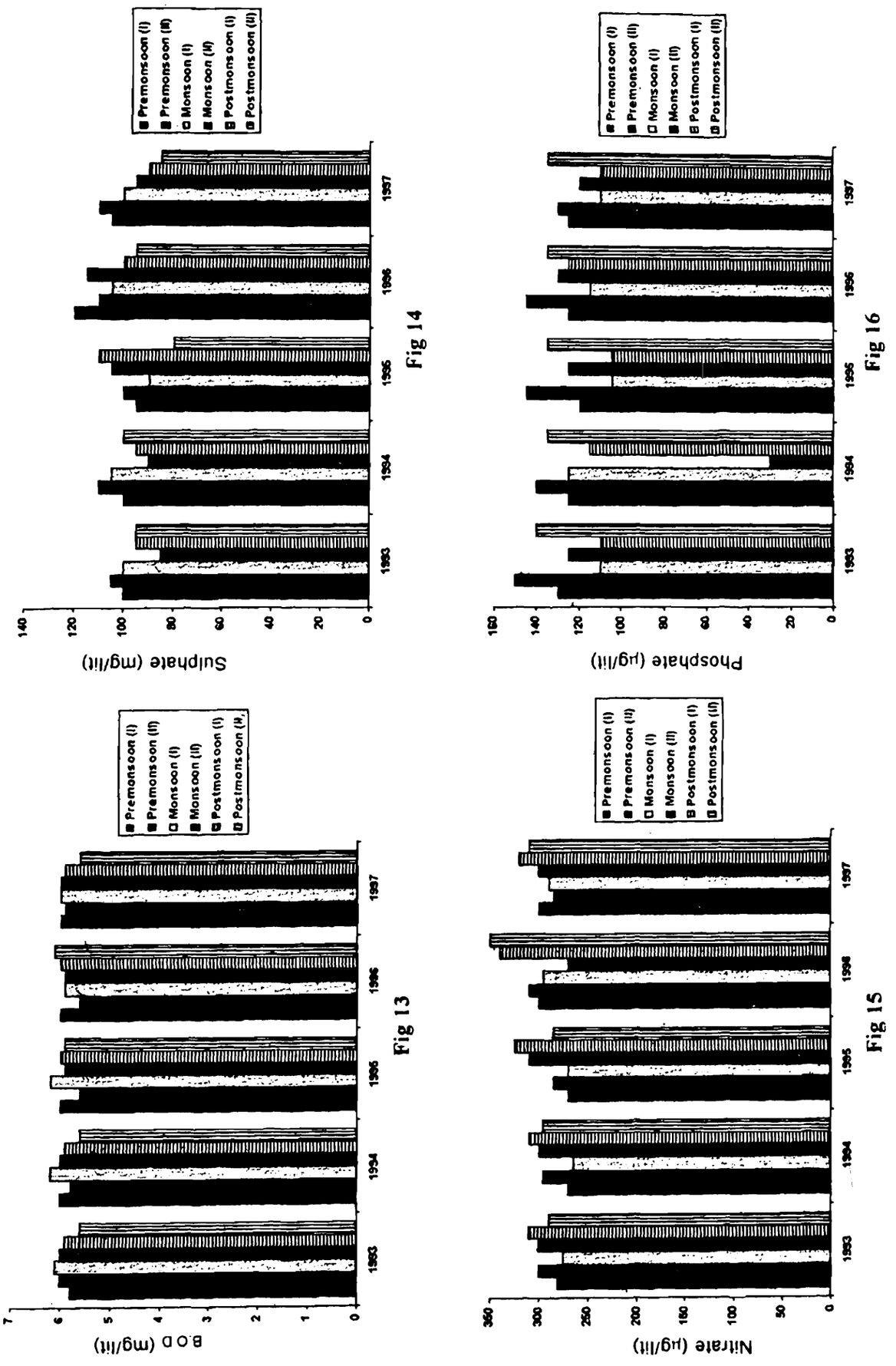

Fig 13 : Corresponding biochemical oxygen demand (mg/lit) ; **Fig 14 :** Amount of sulphate (mg/lit) ; **Fig 15 :** Amount of nitrate (µg/lit) ; **Fig 16 :** Amount of phospate (µg/lit).

resources may happen due to sudden significant changes in such parameters. Although, Digha being a silent zone, the profile of biologically important physicochemical parameters remain unaffected which is due to insignificant level of pollution load from the heavy metals, pesticides/ herbicides and hydrocarbons. But continuous and excessive exposure of such highly toxic pollutants getting accumulated in the marine system may alter the water quality upto such an extent that the very survival of some vulnerable species of fishes, shrimps, phytoplanktons and zooplanktons may be in danger. The sudden excessive changes in DO, BOD, alkalinity, salinity and pH etc. may adversely affect certain marine species upto the extent of extinction. It is with this reason that the regular monitoring of these biologically important physicochemical parameters have been taken as a priority task of this research centre.

Thus occurance and abundance pattern (monthwise, throughout the year) of these important commercial fishes around Digha coast in correlation to the physicochemical parametrs patern will serve the purpose of observations more meaningful from the Bio-ecological point of view. Hence, we are carrying out these studies as a regular monitoring and surveillance measure at this important coastal zone.

SUMMARY

Digha, a small tourist resort of West Bengal, is strategically important from the marine fishing and shrimp culture point of view. An annual profile of biologically important physicochemical parameters is reported here, which may be utilised as baseline observation, in relation to occurrence and abundance of commercially available marine fish species at this coast. Such parameters studied were : temperature, density, total dissolved solids, total suspended solids, pH, conductance, chlorinity, salinity, alkalinity, total hardness, free carbon dioxide, dissolved oxygen, biochemical oxygen demand, sulphate, nitrate, and phosphate. Attempts have been made to correlate occurrence and abundance of available commercially important thirty six marine fish species of this study area. Although, general trend of such parameters' values almost remain unaffected of seasonal or other variations, but chloronity/salinity varies significantly raising from monsoon to postmonsoon and from postmonsoon to premonsoon period. Our observations reported here for the last five years (March 1993 to Feb. 1998) merit importance from the point of view of assessing pollution threat out of ongoing agricultural and industrial activities in this area. Any kind of significant pollution may affect these parameters, which in turn will alter abruptly the survival, growth and breeding of a variety of susceptible marine organisms.

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