Records of the Zoological Survey of India

Volume 108(Part-2)

Edited by the Director, Zoological Survey of India, Kolkata

Zoological Survey of India
Kolkata
2008

CITATION

Editor—Director. 2008. *Rec. zool. Surv. India,* **108**(Part-2) : i-vi, 1-128 (Published by the Director, *Zool. Surv. India*, Kolkata)

Published – May, 2008 (April–June Issue)

PRICE

India : Rs. 250.00

Foreign : $ 20.00; £ 15.00

Published at the Publication Division by the Director, Zoological Survey of India, 234/4, A J C Bose Road, 2nd MSO Building, (13th Floor), Nizam Palace, Kolkata-700 020 and printed at East India Photo Composing Centre, Kolkata-700 006.

RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA

Vol. 108(Part-2) **2008** **Pages 1–128**

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Dr. RAMAKRISHNA
Director-in-charge
Zoological Survey of India

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Dr. RAMAKRISHNA
Director-in-charge
Zoological Survey of India

Rec. zool. Surv. India : **108**(Part–2) : 1-15, 2008

LAND AND FRESHWATER MOLLUSCS OF PONDICHERRY

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INTRODUCTION

The state of Pondicherry, having an area of 492 sq. km., is spread in four parts *viz.*, Pondicherry, Karaikal, Mahe and Yanam. The former two are situated on the coast of Bay of Bengal, south of Chennai (Madras) between Tranquebar and Nagapattinam (in the districts of South Arcot and Tanjavur) in the state of Tamil Nadu. Mahe is situated on the west coast of India between Tellicherry and Badagara in the state of Kerala; whereas 'Yanam', a land locked area is situated south of Kakinada in east Godavari district in the state of Andhra Pradesh. Before merger into Indian Republic, these were under French territory.

Our knowledge on the molluscan fauna of Pondicherry state is based on the earlier works by Blanford and Godwin-Austen (1908), Gude (1914, 1921), Preston (1915) in 'Fauna of British India, Mollusca series and also by Satyamurti (1960). Though marine molluscs of Pondicherry are well known, our knowledge on land and freshwater molluscs are very limited. The present studies were carried on the basis of recent collections made by Southern Regional Station, Zoological Survey of India, Chennai and also the literature records.

There are three species of molluscs described from the state of Pondicherry, of which two are freshwater, *viz.*, *Paludomus acutus* Reeve, 1852 (=*P. tanschauricus* Gmelin) and *Corbicula striatella* Deshayes 1854 and the other a land slug, *Laevicaulis alte* Ferussac 1821, which is the earliest known mollusc from Pondicherry.

A total of 20 species under 15 genera and 13 families of land and freshwater molluscs are recorded from Pondicherry. Freshwater molluscs are represented by 13 species under 10 genera and 8 families; whereas land molluscs are of 7 species under 5 genera and 5 families.

Area-wise, the state of Pondicherry is one of the smallest states in India, hence the number of species recorded is also very small while compared to other states. Forest cover, plays an essential

role in distribution of land molluscs. Since forest coverage is less in the state of Pondicherry that could be a reason for less number of species occurring there.

Class GASTROPODA

Order MESOGASTROPODA

1. Family ASSIMINEIDAE

*1. ***Omphalotropis aurantiaca*** (Deshayes)

2. Family PILIDAE

2. ***Pila virens*** (Lamarck)

3. Family VIVIPARIDAE

3. ***Bellamya dissimilis*** (Mueller)

4. Family BITHYNIIDAE

4. ***Gabbia stenothyroides*** (Dohrn)

5. ***Mysorella costigera*** (Kuester)

5. Family THIARIDAE

6. ***Paludomus (P.) tanschauricus*** (Gmelin)

7. ***Thiara (T.) scabra*** (Mueller)

8. ***Thiara (Melanoides) tuberculata*** (Mueller)

Order BASOMMATOPHORA

6. Family PLANORBIDAE

9. ***Indoplanorbis exustus*** (Deshayes)

Order STYLOMMATOPHORA

7. Family SUCCINEIDAE

*10. ***Succinea rugosa*** Pfeiffer

*11. ***Succinea collina*** Hanley and Theobald

8. Family ARIOPHANTIDAE

12. ***Cryptozona belangeri*** (Deshayes)

13. ***Cryptozona bistrialis*** (Beck)

9. Family CAMAENIDAE

*14. ***Planispira sordida*** (Pfeiffer)

Order SOLEOLIFERA

10. Family VERONICELLIDAE

*15. ***Laevicaulis alte*** (Ferussac)

Class BIVALVIA

Order UNIONOIDA

11. Family AMBLEMIDAE

16. ***Parreysia (P.) favidens*** (Benson)

17. ***Parreysia (Radiatula) caerulea*** (Lea)

12. Family UNIONIDAE

18. ***Lamellidens consobrinus*** (Lea)

19. ***L. corrianus*** (Lea)

Order VENEROIDA

13. CORBICULIDAE

20. ***Corbicula striatella*** Deshayes

A. Freshwater :

Key to the families

1. Shell with a single valve 2
– Shell with two valves 6

2. Shell with an operculum 3
– Shell without operculum ..... PLANORBIDAE

3. Operculum with concentric growth lines 4
– Operculum with spiral growth lines 5

4. Shell globose with ovate aperture, operculum calcareous ..... PILIDAE
– Shell pyramidal with subcircular aperture, operculum horny ..... VIVIPARIDAE

5. Shell big, above 10 mm. in length, turreted or globose, animal with brood-pouch ..... THIARIDAE
– Shell small, below 10 mm. in length, ovate, animal without brood-pouch ..... BITHYNIIDAE

6. Shell smaller, triangular, with concentric ribs ..... CORBICULIDAE
– Shell larger, elongate-elliptical, without concentric ribs 7

7. All four gills marsupial, beak sculpture radial and well developed ..... AMBLEMIDAE
– Only two outer gills marsupial, beak sculpture concentric and rudimentary ..... UNIONIDAE

*Species listed from literature only.

SYSTEMATIC ACCOUNT

Class GASTROPODA

Order MESOGASTROPODA

Family VIVIPARIDAE

Genus ***Bellamya*** Jousseaume, 1886

Shell oblong, sometimes keeled or angulate at the periphery, with more or less convex whorls; aperture sub-circular, peristome and columellar margin thin and simple. Adult shell without ridges or strong sculptures.

Ethiopean and Oriental.

Represented by a single species.

Bellamya dissimilis (Mueller)

1774. *Nerita dissimilis* Mueller, *Hist. Verm. Test.*, pt. 2 : 184.

1989. *Bellamya dissimilis* : Subba Rao in *Handbook : Freshwater Mollusca India* : 48, figs. 64-67.

Material examined : (i) 15 exs., Veerampatnam, Pondicherry, 8.3.91, coll. K.V. Lakshminarayan; (ii) 1 ex., Sumnambukalava village near Pondicherry town, 14.2.58; (iii) 19 exs., Madukarai, 21 kms. S-W. of Pondicherry, 13.3.58, coll. A.G.K. Menon; (iv) 2 exs., Canal adjoining Aragalas river, 1.6 km. from Madadi, Karaikkal, 5.2.57; (v) 25 exs., canal, bank of a paddy field, 7 km. W. of Madadi, Karaikkal; (vi) 10 exs., Tirumallar village, 7 km. W. of Karaikkal, 7.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
15.0–24.80	11.0–16.60	8.45–12.60

Distribution : INDIA : Common throughout including Pondicherry.

Elsewhere : Bangladesh, Malaysia, Myanmar, Pakistan and Sri Lanka.

Remarks : Shell conically ovate, suture deeply impressed, whorls scarcely convex, body whorl obsoletely angulate, often with a pale spiral band. Lip of aperture black. Status of the species *B. heliciformes* (Frauenfeld), reported by Preston (1915) from Pondicherry is doubtful.

Family PILIDAE

Genus ***Pila*** (Bolten) Roeding, 1798

Shell variable, large to very large, globose, perforate, bodywhorl inflated, surface smooth, aperture large, peristome a little thickened, operculum calcareous with a lateral nucleus.

Asia and Africa.

Pila virens (Lamarck)

1822. *Ampullaria virens* Lamarck, *Hist. nat. Anim. sans. Vert.*, **6**(2) : 179.

1989. *Pila virens* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 60, fig. 87.

Material examined : (i) 5 exs., Botanical Garden at Pondicherry, 29.11.94, coll. Dr. Mary Bai; (ii) 2 exs., Sumnambukalava village, near Pondicherry town, 14.2.58, coll. A.G.K. Menon; (iii) 1 ex., Tiruvattangadu village, 19.5 km. N. of Madadi, Karaikkal, 6.2.57; (iv) 4 exs., Canal adjoining Aragalas river 1.6 km. off Madadi, Karaikkal, 5.2.57; (v) 4 exs., Canal at bank of a paddy field, 7 km. W. of Madadi, Karaikkal, 11.2.57; (vi) 2 exs., Backwater near Casurina plants, 3 km. from Pondicherry, 3.11.57; (vii) 6 exs., Tirumallar village, 7 km. W. of Karaikkal, 7.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
20.8–40.50	17.45–30.30	17.70–31.0

Distribution : INDIA : South India and Maharashtra.

Remarks : Shell of this species is variable in its shape of the spire and colour. It is distinguished from the other common species *P. globosa* in being less inflated and having a narrow aperture. The whorls are rather horizontally flattened above at the sutures.

Family BITHYNIIDAE

Key to the genera

1. Shell smooth, columellar fold ridge-like ..... ***Gabbia***
– Shell with spiral sculpture, columellar fold not ridge-like ..... ***Mysorella***

Genus *Mysorella* Godwin-Austen, 1919

Shell small, depressedly conical, perforate, body whorl large and rounded, with distinct spiral sculpture, aperture oblique, subcircular, columella a little thickened; operculum calcareous, subcircular, externally concave, internally convex, smooth.

Southern India, Sri Lanka.

Mysorella costigera (Kuester)

1852. *Paludina costigera* Kuester, In Martini & Chemnitz, *Syst. Conch. Cab.*, **1**(21) : 33, pl. 7, figs. 18, 19.

1989. *Mysorella costigera* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 84, fig. 124.

Material examined : 3 exs., Rayapalayam, Karaikkal, 5.3.91, coll. K.V. Lakshminarayana.

Measurements (in mm) :

Length	Diameter	Height of the aperture
3.85–4.50	5.45–6.30	3.0–3.10

Distribution : INDIA : Pondicherry, Karnataka, Tamil Nadu.

Elsewhere : Sri Lanka.

Remarks : Shell globosely conical, perforate, with strong spiral ridges five of which are more strong with a few finer ones in between.

This species does not occur in Bengal. Its Type locality : "Bengal" reported by Preston (1915) and later by Subba Rao (1989) is also misleading.

Genus ***Gabbia*** Tryon, 1865

Shell small, globose, imperforate or subperforate, generally smooth, whorls rounded, body whorl large, aperture small, rather ovate, columellar fold ridge-like; operculum calcareous.

India, Australia, Africa.

Gabbia stenothyroides (Dohrn)

1857. *Bithynia stenothyroides* Dohrn, *Proc. zool. Soc. Lond.*, : 857.

1989. *Gabbia stenothyroides* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 77, figs. 143, 144.

Material examined : (i) 3 exs., Rayapalam, Karaikkal, 5.3.91, coll. K.V. Lakshminarayan; (ii) 71 exs., Usteri Tank, 7 kms. S.W. of Pondicherry, 12.2.58; (iii) 4 exs., Sumnambukhalava village, near Pondicherry town, 14.2.58, coll. A.G.K. Menon.

Measurements (in mm) :

Length	Diameter	Height of the aperture
4.45–5.80	4.40–5.0	3.30–3.70

Distribution : INDIA : Pondicherry, Karaikkal, Tamil Nadu, Maharashtra.

Elsewhere : Sri Lanka.

Remarks : Shell ovately globose, whorls 4–5, rounded, sutures fairly deep, body whorl proportionately large, inflated, spire short.

This species is for the first time recorded from Pondicherry.

Family THIARIDAE

Represented by three species under 2 sub-families, Thiarinae and Paludominae.

Key to the genera

Shell rounded or ovately conical, usually smooth, whorls 5–6 ..... ***Paludomus***

– Shell elongate, variously sculptured, whorls 8–12 ..... ***Thiara***

Subfamily THIARINAE

Genus ***Thiara*** Roeding, 1798

Shell elongate, moderately large being 3–6 cms. in length, conspicuously sculptured with spiral striae or nodules, sometimes with spines, aperture ovate, vertical, simple, without sinus or canals; operculum pear-shaped with a basal nucleus.

Tropical and subtropical Africa and Asia extending as far north as Formosa and the Ryu Kyu Islands and south upto Northern Australia, Malay Archipelago, Philippines and also various Pacific Islands; abundant in India.

Key to the species

Shell with spines, height of body whorl almost equal to spire, whorls angular ..... *T. scabra*

– Shell with tubercles, height of body whorl less than spire, whorls rounded ..... *T. tuberculata*

Thiara (Thiara) scabra (Mueller)

1774. *Buccinum scabrum* Mueller, *Hist. Verm. Terr. Fluv.*, **2** : 136.

1989. *Thiara (Thiara) scabra* : Subba Rao in *Handbook : Freshwater Mollusca India* : 96, figs. 185, 186, 189.

Material examined : (i) 1 ex., Rayapalayam, Karaikkal, 5.3.91, coll. K.V. Lakhsminarayan; (ii) 4 exs., Sumnambukhalava village, near Pondicherry Town, 14.2.58, coll. A.G.K. Menon.

Measurements (in mm) :

Length	Diameter	Height of the aperture
10.0–17.95	4.0–6.50	4.15–6.85

Distribution : INDIA : Common throughout including Pondicherry, except Kashmir.

Elsewhere : Coasts of Indo-Pacific, from Zanzibar to New Hebrides, north to the Philippines, also various Pacific islands.

Remarks : Shell elongate, turreted with rough spiral striae and rows of spines directed outward, whorls regularly increasing in size and shouldered above, rounded below; sutures deep, aperture ovate; operculum pear-shaped. It is a variable species.

Thiara (Melanoides) tuberculata (Mueller)

1774. *Nerita tuberculata* Mueller, *Hist. Verm. Terr. Fluv.*, **2** : 191.

1989. *Thiara (Melanoides) tuberculata* : Subba Rao in *Handbook : Freshwater Mollusca India* : 103, figs. 183, 184.

Material examined : (i) 49 exs., Rayapalayam, Karaikkal, 5.3.91, coll. K.V. Lakshminarayan; (ii) 12 exs., Sumnambukhalava village near Pondicherry town, 14.2.58, coll. A.G.K. Menon.

Measurements (in mm) :

Length	Diameter	Height of the aperture
12.40–20.50	4.0–6.15	3.90–6.60

Distribution : INDIA : Very common throughout including Pondicherry, except Kashmir.

Elsewhere : North and South Africa, Eastern Mediterranian countries, South-east Asia, Southern China, Malaysia, Malaya Archipelago, North Australia, various Pacific islands and north to the Ryu Kyu islands of Japan, also New Hebrides.

Remarks : The shell is rather variable. Elongate-turreted, whorls 10–12, well rounded with dark brownish dots and streaks, irregularly distributed. Vertical ribs crossed by spiral striae, more pronounced on upper whorls.

Growth-rates and fecundity of the species under laboratory conditions were studied by Subba Rao and Mitra (1982).

This species is for the first time recorded from Pondicherry.

Subfamily PALUDOMINAE

Genus ***Paludomus*** Swainson, 1840

Shell very thick, oblong globose, usually smooth or faintly striate, rarely with strong sculpture, body whorl large and inflated, aperture larger than the spire which is short, columella well thickened.

India (South, Southwest and Northeast), Myanmar, Sri Lanka.

Paludomus (Paludomus) tanschauricus (Gmelin)

1791. *Helix tanschauricus* Gmelin, *Syst. Nat. ed.*, **13** : 3655 (Refers to Chemnitz's *Syst. Conch. Cab.*, **9** : 174, figs. 1246, 1247.

1852. *Paludomus acutus* Reeve, *Proc. zool. Soc. Lond.*, : 127 (Type-locality : Near Pondicherry).

1989. *Paludomus (Paludomus) tanschauricus* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 118, figs. 221, 252, 253.

Material examined : (i) 1 ex., Thirumallar, Karaikkal, 5.3.91, coll. K.V. Lakshminarayana; (ii) 6 exs., Canal, bank of a paddy field, 3½ miles W. of Madadi, Karaikkal, 11.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
18.60	12.45	12.30

Distribution : INDIA : Pondicherry, Andhra Pradesh, Kerala, Maharashtra, Tamil Nadu.

Remarks : Shell conical, whorls 6–8, well rounded, upper whorls with keeled spiral ridges, yellowish brown with dark brown spots, aperture ovate, operculum with a sub-median nucleus.

P. acutus (Reeve), described from 'near Pondicherry' has been synonymised with this species.

Order BASOMMATOPHORA

Family PLANORBIDAE

Genus ***Indoplanorbis*** Annandale and Prashad, 1921

Shell moderately large, thick, discoidal (apex and whorl on same plane) sutures deeply impressed; aperture ear-shaped.

South-east Asia.

Indoplanorbis exustus (Deshayes)

1834. *Planorbis exustus* Deshayes, in *Belanger, Voy. Indes-Orientales*, p. 417, pl. 1, figs. 11-13.

1989. *Indoplanorbis exustus* : Subba Rao in *Handbook : Freshwater Mollusca India* : 142, figs. 326, 327.

Material examined : (i) 5 exs., Madukkarai, 21 miles SW. of Pondicherry, 13.2.58; (ii) 3 exs., Sumnambukhalava village, near Pondicherry Town, 14.2.58, coll. A.G.K. Menon; (iii) 2 exs., on way to Vallukuppam village, one mile N. of Pondicherry, 29.12.56; (iv) 2 exs., canal at bank of Paddy field, 3½ miles W. of Madadi, Karaikkal, 11.2.57; (v) 1 ex., Tiruvattaryadu village, 9 miles N. of Madadi, Karaikkal, 6.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
4.45–4.70	6.75–10.75	4.0–4.15

Distribution : INDIA : Common throughout including Pondicherry.

Elsewhere : Indonesia, Myanmar, Malayasia, Pakistan, Sri Lanka, Thailand, Vietnam.

Remarks : Since the genus *Indoplanorbis* is monotypic the general characters of the species are same as given for the genus. The shell is quite variable. Annandale and Prashad (1921) discussed the impact of ecological variations on the species.

Class BIVALVIA

Order UNIONOIDA

Family AMBLEMIDAE

Genus ***Parreysis*** Conrad, 1853

Shell more or less strong, inflated, rounded to subrhomboidal, distinctly sculptured with zig zag markings, cardinal teeth well developed, lamellar teeth short.

South-east Asia and Africa.

Key to the species

Shell thicker, more or less elongate, centre of ventral margin swollen, beak strongly sculptured ..... *P. favidens*

– Shell comparatively thin, more elongate, ventral margin straight, beak weakly sculptured .... *P. caerulea*

Parreysia (Parreysia) favidens (Benson)

1862. *Unio favidens* Benson, *Ann. Mag. nat. Hist.*, (3)**10** : 188.

1989. *Parreysia (Parreysia) favidens* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 180, figs. 406, 407, 484, 485.

Material examined : (i) 2 exs., Water canals adjoining banks of a paddy field, 5 kms. west of Modapi, Karakal, 11.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
31.4	21.7	14.35

Distribution : INDIA : Common throughout including Pondicherry.

Elsewhere : Bangladesh.

Remarks : Shell thick, oval, inequilateral, tumid, posteriorly angulate with strong sculpture on beak. Cardinal teeth strong and broad.

This species is for the first time recorded from Pondicherry.

Subgenus ***Radiatula*** Simpson, 1900

Parreysia (Radiatula) caerulea (Lea)

1831. *Unio caeruleus* Lea, *Trans. Amer. Phil. Soc.*, **4** : 95, pl. 13, fig. 25.

1989. *Parreysia (Radiatula) caerulea* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 188, figs. 516, 517.

Material examined : (i) 1 ex., 1 valve, water canal, adjoining banks of a paddy field, 5 kms. west of Modapi, Karaikal, 11.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
41.0	21.3	13.2

Distribution : INDIA : Common throughout including Pondicherry.

Elsewhere : Myanmar.

Remarks : Shell variable, elongate, posterior end angulate, dorsal margin rather straight, umbo prominent, in adult shell sculpture restricted to umbonal region, posterior umbonal carina distinct.

Family UNIONIDAE

Genus ***Lamellidens*** Simpson, 1900

Shell elongately elliptical, smooth without strong sculpture, anterior end narrow, posterior broad, often with a posterior ridge, umbo prominently swollen and with curved radiating ridges, periostracum shining, brown to dark brown, left valve with two elongated cardinals and two laterals, right with two lamellar cardinals and one lateral.

India, Bangladesh and Myanmar.

Key to the species

Shell broad, dorsal margin obliquely truncate at posterior end ..... *L. consobrinus*

– Shell narrow, dorsal margin almost straight, gradually sloping at posterior end ..... *L. corrianus*

Lamellidens consobrinus (Lea)

1859. *Unio consobrinus* Lea, *Proc. Acad. Nat. Sci. Philad.*, **3** : 331.

1989. *Lamellidens consobrinus* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 164, figs. 384, 385.

Material examined : (i) 1 ex., (young) water canal, adjoining banks of a paddy field, 5 kms. west of Modapi, Karaikkal, 11.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
43.5	23.3	13.6

Distribution : INDIA : Pondicherry, Tamil Nadu.

Elsewhere : Sri Lanka.

Remarks : Shell rhomboidal, thick and broad, unbones prominent, dorsal margin obliquely truncate at posterior end which is obtusely angled, anterior end rounded, biangulate posterior ridge well developed, left valve with two ragged cardinals.

This species is for the first time recorded from Pondicherry.

Lamellidens corrianus (Lea)

1834. *Unio corrianus* Lea, *Trans. Amer. Philos. Soc.*, **6**(2) : 65, pl. 9, fig. 25.

1989. *Lamellidens corrianus* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 165, figs. 386, 387.

Material examined : (i) 1 ex., Tirumallar village, 5–6 km. from Karaikkal, 7.2.57; (ii) 5 exs., Water canal, adjoining banks of a paddy field, 5 kms. west of Modapi, Karaikkal, 11.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
60.0–73.9	31.8–40	19.5–23.7

Distribution : INDIA : Common throughout, including Pondicherry.

Elsewhere : Bangladesh and Myanmar.

Remarks : Shell narrower, blackish, unbones inflated, dorsal margin straight and long sloping down at posterior end, posterior ridge not distinct, two cardinals in each valve.

This species is for the first time recorded from Pondicherry.

Order VENEROIDA

Family CORBICULIDAE

Genus ***Corbicula*** Magerle von Muehlfeld, 1811

Shell subtrigonal, thick, strongly sculptured with concentric ribs, ventral margin rounded, umbones well developed, ligament external, three cardinal teeth in each valve, lateral teeth elongate, lamelliform and finely serrated, right valve with two laterals on each side, left with one on each side.

Corbicula striatella Deshayes

1854. *Corbicula striatella* Deshayes, *Proc. zool. Soc. Lond.*, **22** : 344.

1989. *Corbicula striatella* : Subba Rao in *Handbook* : *Freshwater Mollusca India* : 204, figs. 575-576.

Material examined : 4 exs., and 9 valves, Sumnambukalava village near Pondicherry Town, 14.258, coll. A.G.K. Menon.

Measurements (in mm) :

Length	Diameter	Height of the aperture
12.10–20.80	9.80–18.50	5.70–11.40

Distribution : INDIA : Common throughout including Pondicherry.

Elsewhere : Myanmar, Pakistan, Sindh.

Remarks : Shell thick, moderately large, triangularly rounded, tumid with regular, coarse, concentric ridges, dorsal margin bluntly pointed, umbones prominent, almost central, ligament external and strongly developed, ventral margin rounded, yellowish to dark brown.

Type locality of this species is Pondicherry.

B. Land :

Though the land molluscs are represented by 6 species under 5 families in the list, only two species under Ariophantidae, the largest family of Indian land pulmonates, are studied here.

Class GASTROPODA

Order STYLOMMATOPHORA

Family ARIOPHANTIDAE

Genus ***Cryptozona*** Moerch, 1872

Shell dextral, perforate, globosely depressed, body whorl inflated, whorls rounded, obliquely striate, sometimes with coloured bands, aperture oblique, peristome simple.

India, Sri Lanka, Thailand.

Although both these species were included under the genus *Ariophanta* by Blanford and Godwin-Austen (1908), following Thiele (1931), these dextral species are treated here under the genus *Cryptozona*. Incidentally, Blanford and Godwin-Austen (1908) also recognised the system of including only the sinistral species under *Ariophanta* in 'Synopsis of genera' of the family (p. 26).

Key to the species

Shell more depressed, with two rufous spiral bands ..... *C. bistrialis*

– Shell more globose, without rufous spiral bands ..... *C. belangeri*

Cryptozona belangeri (Deshayes)

1834. *Helix belangeri* Deshayes, in *Belanger, Voy. zool.*, : 43, pl. 1, figs. 1-3.

1908. *Ariophanta belangeri* : Blanford & Godwin-Austen, *Fauna Brit. India*, Mollusca, Testacellidae and Zonitidae, : 36.

Material examined : (i) 9 exs., from the bank of a tank, 8 kms. from Pondicherry, 26.11.56; (ii) 4 exs., on way to Vaithikuppam village one mile N. of Pondicherry, 24.12.56, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
8.25–26.0	13.30–33.15	8.40–20.55

Distribution : INDIA : Southern part of the Peninsular India including Pondicherry.

Elsewhere : Maldives.

Remarks : Shell large, globose, perforate, obliquely striate, obsoletely decussate with spiral lines, body whorl large, faintly subangulate at the periphery; spire low, aperture lunate, peristome thin and simple, columellar margin slightly reflected.

Cryptozona bistrialis (Beck)

1837. *Nanina bistrialis* Beck, *Ind. Mol.*, **1** : 2.

1876. *Helix bistrialis* : Hanley and Theobald, *Conch. Indica*, pl. 29, fig. 1.

1908. *Ariophanta bistrialis* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca, : 39, text-fig. 22.

1979. *Cryptozona (Xestina) bistrialis* : Subba Rao and Mitra, *Rec. zool. Surv. India*, **75** : 14.

Material examined : (i) 7 exs., Chinnakalapet, Pondicherry Town, 10.3.91, coll. K.V. Lakhshminarayan; (ii) 1 ex., Sumnambukhalava village near Pondicherry Town, 14.2.58, coll. A.G.K. Menon; (iii) 7 exs., from bank of a tank, 8 kms. from Pondicherry, 26.12.56; (iv) 4 exs., Tiruvatangadu village, 9 miles north of Madadi Karaikkal 6.2.57; (v) 1 ex., Tirumallar village, 3½ miles west of Karaikkal, 7.2.57, coll. Pondicherry-Karaikkal Survey, 1956-57.

Measurements (in mm) :

Length	Diameter	Height of the aperture
9.56–16.25	16.20–25.50	9.90–13.30

Distribution : INDIA : Pondicherry, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu.

Remarks : Shell more depressed than in preceeding species, thin and fragile, perforate, brownish white, decussately sculptured above, body whorl convex and rather inflated, encircled by two reddish brown spiral bands, spire low; aperture large, broadly lunate, columellar margin a little reflected.

This species is for the first time recorded from Pondicherry.

SUMMARY AND DISCUSSION

Based on the present studies a total of 20 species under 15 genera and 13 families of both land and freshwater molluscs are recorded from the state of Pondicherry. Out of these, 13 species are from freshwater and only 7 species are from land. Six species *viz., Gabbia stanothyroides, Thiara tuberculata, Parraysia favidens, Lamillidens consobrinus, L. Corrianus* and *Cryptozona bistrialis* are reported for the first time from Pondicherry. The last mentioned species is a land mollusc. The material available for studies are from Pondicherry and Karaikal only. No material was available for the study from other parts of the state, 'Mahe' on west coast and 'Yanam' near Kakinada on the east coast.

Freshwater gastropods such as *Mysorella costigera, Gabbia stenothyroides* and *Paludomus tanschauricus* are restricted to Peninsular India. Rest of the species have all India range of distribution.

Pondicherry forms a part of Peninsular India which constitutes a very distinct zoo-geographical region in India. Referred as 'India Vera' (Mani, 1974) this region contains some of the relics of the Gondwana fauna. Approximately, over 200 species of land and freshwater molluscs under 70 genera are known from the plains of Peninsular India. But the number of species recorded from Pondicherry is too small and may not represent the actual figure of species occurring in that area.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India for the facilities provided to undertake the present work. They also wish to convey their thanks to the officer-in-Charge, Southern Regional Station, Chennai for the collections available for our study. Finally they are thankful to Shri P.K. Bala, for typing the manuscript.

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ON A COLLECTION OF FISH FROM NELLORE AND CHITTOOR DISTRICTS, ANDHRA PRADESH

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INTRODUCTION

In keeping with the approved annual programme of work, Nellore and Chittoor districts of Andhra Pradesh were surveyed during pre monsoon and post monsoon periods of 2002-2004 by Dr. M.B. Raghunathan (M.B.R.) and Dr. O.P. Srivastava (O.P.S.) and party. A total of 5 Surveys were carried out to 41 localities yielding 8318 specimens. A detailed study revealed the presence of 53 species belonging to 16 families and 8 orders. The specimens were registered and deposited in the Reserve Collections of the station.

A systematic list of the species along with standard data are provided, identifications being based on Day (1875-78), Talwar and Jhingran (1991) Jayaram (1999) and Menon (1999). Figures of species reported recently from Andhra Pradesh are provided (Plates I-III).

LIST OF SPECIES COLLECTED

Order CLUPEIFORMES

Family CLUPEIDAE

Subfamily PELLONULINAE

1. *Ehirava fluviatilis* Deraniyagala*

Order CYPRINIFORMES

Family CYPRINIDAE

Subfamily LEUCISCINAE

2. *Aristichthys nobilis* (Richardson)*

**Zoological Survey of India, Southern Regional Station, Chennai-600 028*

3. *Salmostoma clupeoides* (Bloch)
4. *Chela cachius* (Ham.)
5. *Chela laubuca* (Ham.)
6. *Esomus barbatus* (Jerdon)
7. *Esomus danricus* (Ham.)
8. *Esomus thermoicos* (Val.)
9. *Rasbora caverii* (Jerdon)
10. *Rasbora daniconius* (Ham.)
11. *Rasbora cf. labiosa* Mukerji*
12. *Amblypharyngodon microlepis* (Blkr.)
13. *Amblypharyngodon mola* (Ham.)

Subfamily CYPRININAE

14. *Cyprinus carpio communis* (Linne.)
15. *Puntius bimaculatus* (Bleeker)*
16. *Puntius chola* (Ham.)
17. *Puntius conchonius* (Ham.)
18. *Puntius dorsalis* (Jerdon)
19. *Puntius fraseri* Hora and Misra*
20. *Puntius sophore* (Ham.)
21. *Puntius ticto* (Ham.)
22. *Puntius vittatus* Day
23. *Puntius sarana subnasutus* (Val.)
24. *Cirrhinus mrigala* (Ham.)
25. *Cirrhinus reba* (Ham.)
26. *Catla catla* (Ham.)
27. *Labeo rohita* (Ham.)

Subfamily GARRINAE

28. *Garra mullya* (Sykes)

Family COBITIDAE

29. *Lepidocephalus thermalis* (Val.)

Order SILURIFORMES

Family SCHILBEIDAE

30. *Pseudeutropius atherinoides* (Bloch)

Family BAGRIDAE

31. *Mystus bleekeri* (Day)
32. *Mystus gulio* (Ham.)
33. *Mystus vittatus* (Bloch)

Family HETEROPNEUSTIDAE

34. *Heteropneustes fossilis* (Bloch)

Order MUGILIFORMES
Family MUGILIDAE

35. *Rhinomugil corsula* (Hamilton)

Order BELONIFORMES
Family ADRIANICHTHYIDAE

36. *Oryzias carnaticus* (Jerdon)

Order CYPRINODONTIFORMES
Family CYPRINODONTIDAE

37. *Aplocheilus parvus* Sundara Raj*
38. *Aplocheilus panchax* (Ham.)

Family POECILIDAE

39. *Gambusia affinis* (Baird & Girard)
40. *Poecilia reticulata* (Peters)

Order PERCIFORMES
Family CHANDIDAE

41. *Chanda nama* Hamilton
42. *Parambassis lala* (Hamilton)*
43. *Parambassis ranga* (Ham.)

Family CICHLIDAE

44. *Etroplus maculatus* (Bloch)
45. *Oreochromis mossambica* (Peters)
46. *Oreochromis niloticus* (Linnaeus)*

Family GOBIIDAE

47. *Glossogobius giuris* (Ham.)
48. *Pseudogobius javanicus* (Bleeker)

Family BELONTIDAE

49. *Colisa lalia* (Hamilton)*

Family CHANNIDAE

50. *Channa orientalis* (Schneider)
51. *Channa punctatus* (Bloch)

Order SYNBRANCHIFORMES
Family MASTACEMBELIDAE

52. *Macrognathus aral* (Bloch & Schneider)
53. *Macrognathus pancalus* Hamilton

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*Recent new reports from Andhra Pradesh (Rema Devi *et al.*, 2005)

1. ***Ehirava fluviatilis*** Deraniyagala

1929. *Ehirava fluviatilis*, Deraniyagala, *Spolia Zeylan.*, **15** : 35, pl. 14 (Type-locality : Western Province of Sri Lanka).

1991. *Ehirava fluviatilis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 116.

Material : 7 exs., 21.0-34.0 mm. SL., F.7143, Venad, Pulicat Lake, 12.1.2003, M.B.R.; 3 exs., 22.0-27.0 mm. SL., F.7218, Pulicat Lake, 12.01.2003, M.B.R.; 138 exs., 21.0-29.0 mm. SL., F.7569, Buchinayudu Kandriga, 16.10.2003, M.B.R.

Distribution : Coastal waters of southern India.

Elsewhere : Sri Lanka.

2. ***Aristichthys nobilis*** (Richardson)

1844. *Leuciscus nobilis,* Richardson, *Voy. H.M.S. "Sulphur"* : 140, pl. 63, fig. 3 (Type-locality : Canton, China).

1991. *Hypophthalmichthys nobilis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 332.

1991. *Aristichthys nobilis,* Rohan Pethiyagoda, *Freshwater Fishes of Sri Lanka,* p. 57.

Material : 1 ex., 120.0 mm. SL., F.7489, Maraparakandriya, Chittoor District, Sriharikota, 24.02.2004, O.P.S.

Distribution : Southern and Central China. Transplanted to North China, Japan, Taiwan, Vietnam, Thailand, Malaysia, Sri Lanka, Bangladesh and India.

3. ***Salmostoma clupeoides*** (Bloch)

1782. *Cyprinus clupeoides,* Bloch, *Naturges ausland Fische,* **12** : 49, pl. 408, fig. 2. (Type-locality : "Indian Ocean" evidently not the ocean but some freshwater).

1991. *Salmostoma clupeoides,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 323.

Material : 1 ex., 53 mm. SL., F.7454, Saidapuram, 22.02.04, O.P.S.; 1 ex., 80 mm. SL., F.7547, Rampur, 8.10.03, M.B.R.; 4 exs., 34.0-54.0 mm. SL., F.7092, Kaligiri, 17.1.03, M.B.R.; 3 exs., 29.0-34.0 mm. SL., F.7113, Pellekuru, 23.01.03, M.B.R.; 3 exs., 26.0-53.0 mm. SL., F.7169, Nalpattu Area, 14.01.03, M.B.R.; 1 ex., 39 mm. SL., F.7253, Rampur, 20.01.03, M.B.R.; 1 ex., 71 mm. SL., F.7445, Kammavari Palam, Nellore, 21.02.04, O.P.S.; 9 exs., 42.0-62.0 mm. SL., F.7550(a), Kavali, 7.10.03, M.B.R.; 10 exs., 61.0-72.0 mm. SL., F.7550(b), Kavali, 7.10.03, M.B.R.; 40 exs., 61.0-65.0 mm. SL., F.7550(C), Kavali, 7.10.03, M.B.R.; 8 exs., 25.0-50.0 mm. SL., F.7564, Pollur, 12.10.03, M.B.R.; 116 exs., 23.0-45.0 mm. SL., F.7570, Buchinayudu Kandriga, 16.10.03, M.B.R.; 131 exs., 29.0-75.0 mm. SL., F.7557, Nellore Tank (High Way), 9.10.03, M.B.R.

Distribution : India : Peninsular India.

4. ***Chela cachius*** (Hamilton)

1822. *Cyprinus (Chela) cachius,* Hamilton-Buchanan, *Fishes of Ganges* : 258, 384 (Type-locality : Ganges river about commencement of delta).

1991. *Chela cachius,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 313-314.

Material : 1 ex., 22.0 mm. SL., F.7197, Udayagiri, 16.01.03, M.B.R.; 1 ex., 31.0 mm. SL., F.7577, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

5. ***Chela laubuca*** (Hamilton)

1822. *Cyprinus (Chela) laubuca,* Hamilton-Buchanan, *Fishes of Ganges* : 260, 384 (Type-locality : Ponds in northern parts of Bengal).

1991. *Chela laubuca,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 316-317.

Material : 1 ex., 17.0 mm. SL., Venad, 12.01.03, M.B.R.; 1 ex., 40.0 mm. SL., F.7166, Nalpattu Area, 14.1.03, M.B.R.; 2 exs., 26.0-30.0 mm. SL., F.7189, Venkatagiri, 19.01.03, M.B.R.; 4 exs., 27.0-51.0 mm. SL., F.7491, Dachur, Nellore, 22.2.04, O.P.S.; 1 ex., 22 mm. SL., F.7546, Rampur, 8.10.03, M.B.R.; 2 exs., 33.0-35.0 mm. SL., F.7578, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

6. ***Esomus barbatus*** (Jerdon)

1849. *Leuciscus barbatus,* Jerdon, *Madras J. Lit. Sci.,* **15** : 322 (Type-locality : Bowany River, S. India).

1991. *Esomus barbatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 376.

Material : 1 ex., 64.0 mm. SL., F.7156, Chittoor, Vittalam, 10.09.02, O.P.S.; 25 exs., 25.0-35.0 mm. SL., F.7168, Nalpattu Area, 14.1.03, M.B.R.; 1 ex., 63.0 mm. SL., F.7175, Chittoor, Vittalam,

10.9.02, O.P.S.; 5 exs., 45.0-55.0 mm. SL., F.7180, Guntha Godantu, Chittoor, 15.9.02, O.P.S.; 1 ex., 45 mm. SL., F.7186, Balija Palle, Chittor, 5.9.02, O.P.S.; 5 exs., 45.0-52.0 mm. SL., F.7223, Nellore, Kavali, 23.9.02, O.P.S.; 2 exs., 35.0-44.0 mm. SL., F.7244, Akkurti, 25.1.03, M.B.R.; 1 ex., 50 mm. SL., F.7473, Kovur, 7.10.03, M.B.R.; 7 exs., 40.0-60.0 mm. SL., F.7587, Yempedu, 14.10.03, M.B.R.

Distribution : India : Peninsular India, Godavari, Krishna and Cauvery River Systems.

7. ***Esomus danricus*** (Hamilton)

1822. *Cyprinus danrica* Hamilton-Buchanan, *Fishes of Ganges* : 325, 390, pl. 16, fig. 88 (Type-locality : Ponds and ditches of Bengal).

1991. *Esomus danricus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 377-378.

Material : 1 ex., 27.0 mm. SL., F.7118, Pellekuru, 23.01.03, M.B.R.; 1 ex., 32 mm. SL., F.7126, Dakkili, 20.1.03, M.B.R.; 2 exs., 35.0-36.0 mm. SL., F.7144, Venad, 12.1.03, M.B.R.; 3 exs., 27.0-30.0 mm. SL., F.7171, Nalpattu Area, 14.1.03, M.B.R.; 10 exs., 21.0-28.0 mm. SL., F.7198, Udayagiri, 16.1.03, M.B.R.; 20 exs., 23.0-43.0 mm. SL., F.7231, Tada Pond, 13.1.03, M.B.R.; 4 exs., 25.0-28.0 mm. SL., F.7252, Rampur, 20.1.03, M.B.R.; 1 ex., 27.0 mm. SL., F.7255, Empedu, 21.1.03, M.B.R.; 7 exs., 32.0-37.0 mm. SL., F.7482, Renigunta, 15.10.03, M.B.R.; 1 ex., 43.0 mm. SL., F.7447, Kammavari Palam Nellore, 21.02.04, O.P.S.; 3 exs., 29.0-32.0 mm. SL., F.7492, Dachur Nellore, 22.2.04, O.P.S.; 3 exs., 33.0-40.0 mm. SL., F.7513, Kalahasti Lakshmipuram, Chittoor, 24.2.04, O.P.S.; 2 exs., 22.0-33.0 mm. SL., F.7558, Nellore Tank (High Way), 9.10.03, M.B.R.; 2 exs., 31.0-33.0 mm. SL., F.7572, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : Throughout north and eastern India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

8. ***Esomus thermoicos*** (Valenciennes)

1842. *Nuria thermoicos* Valenciennes, *Hist. nat. Poiss.,* **16** : 238, pl. 472 (Type-locality : Hot springs at Kanniya, Sri Lanka).

1991. *Esomus thermoicos,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 378-379.

Material : 1 ex., 25.0 mm. SL., F.7165, Kadevedu, Nellore Dt., 18.09.02, O.P.S.; 5 exs., 48.0-64.0 mm. SL., F.7222, Nellore Kavali, 23.09.02, O.P.S.; 7 exs., 20.0-35.0 mm. SL., F.7199, Udayagiri, 16.1.03, M.B.R.; 1 ex., 32.0 mm. SL., F.7119, Pellekuru, 23.1.03, M.B.R.; 2 exs., 40.0-60.0 mm. SL., F.7586, Yempedu, 14.10.04, M.B.R.

Distribution : India : Southern India.

Elsewhere : Sri Lanka.

Remarks : This species earlier known only from Sri Lanka is now found to be widespread in South India (Jayaram, 1999).

9. ***Rasbora caverii*** (Jerdon)

1849. *Leuciscus caverii* Jerdon, *Madras J. Lit. Sci.*, **15** : 320 (Type-locality : Cauvery River (Karnataka).

1991. *Rasbora caverii,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 388-389.

Material : 22 exs., 22.0-23.0 mm. SL., F.7125, Dakkili, 20.01.03, M.B.R..; 14 exs., 23.0-55.0 mm. SL., F.7157, Chittoor, Vittalam, 10.9.02, O.P.S.; 25 exs., 17.0-23.0 mm. SL., Nalpattu Area, 14.1.03, M.B.R.; 1 ex., 75.0 mm. SL., F.7172, Etari Ganga, Mellur, Chittoor, 7.9.02, O.P.S.; 10 exs., 23.0-47.0 mm. SL., F.7176, Vittalam, Chittoor, 10.9.02, O.P.S.; 62 exs., 24.0-61.0 mm. SL., F.7183, Malapalle, Chittoor, 9.9.02, O.P.S.; 1 ex., 39.0 mm. SL., F.7187, Balija Palle, Chittoor, 5.9.02, O.P.S.; 6 exs., 22.0-34.0 mm. SL., F.7190, Venkatagiri, 19.1.03, M.B.R.; 1060 exs., 14.0-16.0 mm. SL., F.7196, Udayagiri 16.1.03 M.B.R.; 7 exs., 35.0-43.0 mm. SL., F.7208, Doracharu, Palamaner, 5.09.02, O.P.S.; 19 exs., 29.0-61.0 mm. SL., F.7224, Nellore, Kavali, 23.9.02, O.P.S.; 1 ex., 23.0 mm. SL., Tada Pond, 13.1.03, M.B.R.; 23 exs., 24.0-42.0 mm. SL., F.7245, Akkurti, 25.1.03, M.B.R.; 1 ex., 32.0 mm. SL., Varadee Eru, Nellore, 21.2.04, O.P.S.; 3 exs., 23.0-28.0 mm. SL., F.7528, Empedu, Kalahasti, 25.2.04, O.P.S.; 42 exs., 22.0-29.0 mm. SL., F.7556, Pollur, 12.10.03, M.B.R.; 2 exs., 42.0-58.0 mm. SL., F.7573, Buchinayudu Kandriga, 16.10.03, M.B.R.; 3 exs., 23.0-52.0 mm. SL., F.7588, Yempedu, 14.10.03, M.B.R.

Distribution : India : Southern India, Notably Karnataka, especially the Cauvery Basin, Javadi Hills, Eastern Ghats.

Elsewhere : Sri Lanka.

10. ***Rasbora daniconius*** (Hamilton)

1822. *Cyprinus danricus* Hamilton-Buchanan, *Fishes of Ganges* : 327, 391, pl. 15, fig. 89 (Type-locality : rivers of southern Bengal).

1999. *Rasbora daniconius,* Jayaram, *The Freshwater Fishes of the Indian Region* : 82-83.

Material : 45 exs., 21.0-37.0 mm. SL., F.7097, Kaligiri, 17.01.03, M.B.R..; 30 exs., 11.0-57.0 mm. SL., F.7105, S.R. Puram, 16.1.03, M.B.R.; 3 exs., 22.0-27.0 mm. SL., F.7114, Pellekuru, 23.1.03, M.B.R.; 12 exs., 25.0-28.0 mm. SL., F.7124, Dakkili, 20.1.03, M.B.R.; 1 ex., 17.0 mm. SL., Venad, 12.1.03, M.B.R.; 29 exs., 29.0-52.0 mm. SL., F.7251, Rampur, 20.1.03, M.B.R.; 1 ex., 45.0 mm. SL., F.7484, Nellore Dam, 9.10.03, M.B.R.; 2 exs., 40.0-42.0 mm. SL., F.7472, Kovur, 7.10.03, M.B.R.; 32 exs., 26.0-40.0 mm. SL., F.7479, Renigunta, 15.10.03 M.B.R.; 8 exs., 33.0-49.0 mm. SL., F.7420, Kwalaghata, Nellore, 21.02.04, O.P.S.; 35 exs., 27.0-48.0 mm. SL., F.7430, Varadee Eru, Nellore, 21.2.04, O.P.S.; 62 exs., 29.0-47.0 mm. SL., F.7436, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 16 exs., 32.0-54.0 mm. SL., F.7446, Kammavari palam, Nellore, 21.2.04, O.P.S.; 1 ex., 29.0 mm. SL., Saidapuram, 22.2.04, O.P.S.; 2 exs., 21.0-58.0 mm. SL., F.7493, Dachur, Nellore, 22.2.04, O.P.S.; 1 ex., 30.0 mm. SL., F.7504, Venkatagiri, Srikalahasthi, Chittoor, 25.2.04, O.P.S.; 1 ex., 30.0 mm. SL., F.7527, Empedu, Srikalahasthi, 25.2.04, O.P.S.; 21 exs., 25.0-45.0 mm. SL., F.7545, Rampur, 8.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Malay Archipelago, Myanmar, Nepal, Pakistan, Sri Lanka, Zanzibar.

11. ***Rasbora cf. labiosa*** Mukerji

1935. *Rasbora labiosa* Mukerji, *Rec. Indian Mus.*, **37**(3) : 376, Fig. 1, 2 (Type-locality : Deolali, Nasik Dist., Maharashtra).

1999. *Rasbora labiosa,* Jayaram, *The Freshwater Fishes of the Indian Region* : 83.

Material : 3 exs., 24.0-29.0 mm. SL., F.7591, Etteri, 28.2.04, O.P.S.

Distribution : India : Maharashtra, Karnataka.

Remarks : The specimens are under study for confirming its identity.

12. ***Amblypharyngodon microlepis*** (Bleeker)

1853. *Leuciscus microlepis* Bleeker, *Verh. batav. Genoot. Wet.*, **25** : 141 (Type-locality : Bengal).

1991. *Amblypharyngodon microlepis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 337-338.

Material : 58 exs., 21.0-30.0 mm. SL., F.7167, Nalpattu Area, 14.01.03, M.B.R..; 1 exs., 24.0mm. SL., Guntha Godantu, Chittoor, 15.9.02, O.P.S.; 5 exs., 21.0-28.0 mm. SL., F.7204, Udayagiri, 16.1.03, M.B.R.; 3 exs., 43.0-53.0 mm. SL., F.7221, Nellore, Kavali, 23.9.02, O.P.S.; 88 exs., 25.0-41.0 mm. SL., F.7227, Bakrapet, 13.9.02, O.P.S.; 1 ex., 28.0 mm. SL., F.7563, Pollur, 12.10.03, M.B.R.; 1 ex., 25.0 mm. SL., F.7571, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : India : Bengal through Chota-Nagpur to Peninsular India, except the west face of the Western Ghats.

13. ***Amblypharyngodon mola*** (Hamilton)

1822. *Cyprinus mola* Hamilton-Buchanan, *Fishes of Ganges* : 334, 392, pl. 38, fig. 92 (Type-locality : ponds and rivers of Gangetic provinces).

1991. *Amblypharyngodon mola,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 338.

Material : 3 exs., 34.0-36.0 mm. SL., F.7096, Kaligiri, 17.01.03, M.B.R.

Distribution : India : Throughout except Kerala.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

14. ***Cyprinus carpio communis*** (Linnaeus)

1758. *Cyprinus carpio* Linnaeus *Systema Naturae,* ed. 10, **1** : 320 (Type-locality : Europe).

1991. *Cyprinus carpio communis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 184-186.

Material : 2 exs., 85.0-104.0 mm. SL., F.7490, Marapara kandriga, Srikalahasthi, 24.2.04, O.P.S.

Distribution : Naturally found all through America, China, Europe, Japan, Korea, Taiwan. Introduced into India in 1939.

15. ***Puntius bimaculatus*** (Bleeker)

1864. *Gnathopogon bimaculatus* Bleeker, *Verh. Nat. Holl. Maatsch. Haarlem,* (2)**20** : 17, pl. 4, fig. 1 (Type-locality : Ceylon).

1991. *Puntius bimaculatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 259-260.

Material : 50 exs., 22.0-47.0 mm. SL., F.7184, Mala palli, Chittoor, 9.9.02, O.P.S.; 2 exs., 35.0-40.0 mm. SL., F.7226, Kavali, Nellore, 23.9.02, O.P.S.; 6 exs., 25.0-41.0 mm. SL., F.7158, Vittalam, Chittoor, 10.9.03, O.P.S.; 2 exs., 19.0-22.0 mm. SL., F.7554, Pulicat Pond, 11.10.03, M.B.R.; 1 ex., 49.0 mm. SL., F.7589, Yempedu, 14.10.03, M.B.R.; 2 exs., 24.0-26.0 mm. SL., F.7246, Akkurti, Nellore, 25.1.03, M.B.R.; 2 exs., 24.0 and 32.0 mm. SL., F.7592, Etteri, Chittoor, 28.2.2004, O.P.S.

Distribution : Southern India.

Elsewhere : Sri Lanka.

16. ***Puntius chola*** (Hamilton)

1822. *Cyprinus chola* Hamilton-Buchanan, *Fishes of Ganges* : 312, 389 (Type-locality : Northeastern parts of Bengal).

1991. *Puntius chola,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 263-265.

Material : 1 ex., 40.0 mm. SL., F.7095, Kaligiri, 17.01.03, M.B.R..; 1 ex., 28.0 mm. SL., F.7104, S.R. Puram, 16.1.03, M.B.R.; 1 ex., 52.0 mm. SL., F.7136, Kavali Tank, 17.1.03, M.B.R.; 1 ex., 76.0 mm. SL., F.7159, Vittalam, Chittoor, 10.9.02, O.P.S.; 2 exs., 28.0-35.0 mm. SL., F.7233, Tada Pond, 13.1.03, M.B.R.; 2 exs., 50.0-52.0 mm. SL., F.7431, Varadee Eru, Nellore, 21.2.04, O.P.S.; 2 exs., 42.0-45.0 mm. SL., F.7437, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 1 ex., 45.0 mm. SL., F.7448, Kammavaripalam, Nellore, 21.2.04, O.P.S.; 1 ex., 79.0 mm. SL., F.7520, Pallamala, Sri Kalahasthi, 26.2.04, O.P.S.; 3 exs., 45.0-46.0 mm. SL., F.7529, Empedu, Kalahasthi, 25.02.04, O.P.S.; 2 exs., 35.0-36.0 mm. SL., F.7576, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

17. ***Puntius conchonius*** (Hamilton)

1822. *Cyprinus conchonius,* Hamilton-Buchanan, *Fishes of Ganges* : 317, 389 (Type-locality : ponds of northeast Bengal; Kosi river and Ami river).

1991. *Puntius conchonius,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 266.

Material : 1 ex., 30.0 mm. SL., F.7115, Pellekuru, 23.01.03, M.B.R..; 3 exs., 38.0-40.0 mm. SL., F.7122, Dakkili, 20.1.03, M.B.R.; 1 ex., 29.0 mm. SL., F.7456, Saidapuram, 22.2.04, O.P.S., 15 exs., 17.0-30.0 mm. SL., F.7575, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Nepal, Pakistan : Punjab.

Remarks : Earlier reported only from Assam, North Estern Bengal, U.P. and Cauvery in the South. Now it is found to be widespread in Peninsular India : Tamil Nadu, Kerala, Karnataka & Maharashtra. It is reported to be widespread and common in Andhra Pradesh (Barman, 1993). Its distribution in Pennar river in Nellore & Chittor in Andhra Pradesh is an additional record.

18. ***Puntius dosalis*** (Jerdon)

1849. *Systomus dorsalis* Jerdon, *Madras J. Lit. Sci.,* **15** : 314 (Type-locality : tanks and rivers in neighbourhood of Madras).

1991. *Puntius dorsalis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 268.

Material : 8 exs., 73.0-90.0 mm. SL., F.7101, Duttaluru, 18.01.03, M.B.R..; 1 ex., 40.0 mm. SL., F.7505, Venkatagiri, Srikalahasthi, Chittoor, 25.2.04, O.P.S.

Distribution : India : Cauvery and Krishna river systems in Andhra Pradesh, Karnataka, Tamil Nadu & Kerala, Rivers of Orissa, Madhyapradesh.

Elsewhere : Sri Lanka.

19. ***Puntius fraseri*** Hora and Misra

1838. *Barbus fraseri* Hora and Misra, *J. Bombay nat. Hist. Soc.*. **40**(1) : 29, pl. 3, fig. 2 and text fig. 4. (Type-locality : Darna river at Deolali, Maharashtra).

1991. *Puntius fraseri,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 272.

Material : 2 exs., 29.0-33.0 mm. SL., F.7566, Pollur, 12.10.03, M.B.R..; 39 exs., 13.0-20.0 mm. SL., F.7200, Udayagiri, Nellore, 16.1.03, M.B.R.; 3 exs., 30.0-32.0 mm. SL., F.7496, Dachur, Nellore, 22.2.04, O.P.S.; 2 exs., 21.0-22.0 mm. SL., F.7538, Parosalli, Kalahasthi, Chittoor, 26.2.04, O.P.S.

Distribution : India : Dharna River, Maharashtra; Pennar River, Nellore, Andhra Pradesh.

20. ***Puntius sophore*** (Hamilton)

1822. *Cyprinus sophore* Hamilton-Buchanan, *Fishes of Ganges* : 310, 389, (Type-locality : ponds and rivers in Gangetic provinces).

1991. *Puntius sophore,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 288-289.

Material : 12 exs., 27.0-40.0 mm. SL., F.7093, Kaligiri, 17.1.03, M.B.R..; 2 exs., 73.0-74.0 mm. SL., F.7102, Duttaluru, 18.1.03, M.B.R.; 1 ex., 40.0 mm. SL., F.7137, Kavali Tank, 17.1.03, M.B.R..; 3 exs., 38.0-50.0 mm. SL., F.7160, Chittoor, Vittalam, 10.9.02, O.P.S.; 9 exs., 44.0-64.0 mm. SL.,

F.7181, Guntha Godantu, Chittoor, 15.9.02, O.P.S.; 44 exs., 14.0-21.0 mm. SL, F. 7201, Udayagiri, 16.1.03, M.B.R.; 1 ex., 35.0 mm. SL., F.7225, Kavali, Nellore, 23.9.03, O.P.S.; 3 exs., 21.0-40.0 mm. SL., F.7232, Tada Pond, 13.1.03, M.B.R.; 5 exs. 34.0.-37.0 mm. SL., F.7480, Renigunta, 15.10.03, Coll. M.B.R.; 1 ex., 45.0 mm. SL., F.7421, Kwalaghata, Nellore, 21.2.04, O.P.S.; 3 exs., 21.0-24.0 mm. SL., F.7457, Saidapuram, 22.2.04, O.P.S.; 2 exs., 21.0-58.0 mm SL., F.7494, Dachur, Nellore, 22.2.04, O.P.S.; 1 ex., 35.0 mm. SL, F.7506, Venkatagiri, Sri Kalahasthi, Chittoor, 25.2.04, O.P.S., 1 ex., 60.0 mm. SL., F.7521, Pallamala, Sri Kalahasthi, 26.2.04, O.P.S.; 20 exs., 20.0-33.0 mm. SL, F.7526, Telukamande, Chittoor, 29.2.04, O.P.S.; 3 exs., 24.0-45.0 mm. SL., F.7530, Empedu, Sri Kalahasthi, 25.2.04, O.P.S.

Distribution : Throughout India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

21. ***Puntius ticto*** (Hamilton)

1822. *Cyprinus ticto* Hamilton-Buchanan, *Fishes of Ganges* : 314, 398, (Type-locality : South-eastern parts of Bengal).

1991. *Puntius ticto,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 291-292.

Material : 1 ex., 30.0 SL., F.7574, Buchinayudu Kandriga, 16.10.03, M.B.R..; 1 ex., 25.5 mm. SL., F.7094, Kaligiri, 17.1.03, M.B.R.; 5 exs., 17.0-19.5 mm. SL., F.7191, Venkatagiri, 19.1.03, M.B.R..; 107 exs., 10.0-16.0 mm. SL., F.7202, Udayagiri, 16.1.03, M.B.R.; 3 exs., 22.0-29.0 mm. SL., F.7247, Akkuriti, 25.1.03, M.B.R.; 1 ex., 40.0 mm. SL., F. 7471, Kovur, 7.10.03, M.B.R.; 2 exs., 28.0-32.0 mm. SL., F.7438, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 2 exs., 18.0-19.0 mm. SL., F.7458, Saidapuram, 22.2.04, O.P.S.; 1 ex. 41.0 mm. SL., F.7495, Dachuru, Nellore, 22.2.04, O.P.S.; 1 ex., 25.0 mm. SL., F.7514, Kalahasti, Laxhmipuram, Chittoor, 24.2.04, O.P.S.; 1 ex., 45.0 mm. SL., F.7522, Pallamala, Sri Kalahasti, 26.2.04, O.P.S.; 1 ex., 25.0 mm SL., F.7531, Empedu, Sri Kalahasthi, 25.2.04, O.P.S.; 1 ex., 22.0 mm. SL, F.7565, Pollur, 12.10.03, M.B.R.

Distribution : India : Throughout, except Kerala and South Tamil Nadu.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

22. ***Puntius vittatus*** Day

1865. *Puntius vittatus* Day, *Proc. zool. Soc. Lond.,* 303 (Type-locality : Cochin, Kerala).

1991. *Puntius vittatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 293-294.

Material : 3 exs., 21.0-26.0 SL., F.7123, Dakkili, 20.1.03, M.B.R..; 3 exs., 26.0-33.0 mm. SL., F.7161, Chittoor, Vittalam, 10.9.02, O.P.S.; 3 exs., 22.0-36.0 mm. SL., F.7178, Chittoor, Vittalam, 10.9.02, O.P.S.; 6 exs., 22.0-26.0 mm. SL., F.7192, Venkatagiri, 19.1.03, M.B.R.; 1 ex., 28.0 mm. SL., F.7213, Venad, 12.1.03, M.B.R.; 81 exs., 16.0-35.0 mm. SL., F. 7485, Nellore Dam, 9.10.03, M.B.R.; 1 ex., 16.0 mm. SL., F.7559, Nellore Tank, High Way, 9.10.03, M.B.R.

Distribution : India : Peninsular India.

Elsewhere : Pakistan, Sri Lanka.

23. ***Puntius sarana subnasutus*** (Valenciennes)

1842. *Barbus subnasutus* Valenciennes, *Hist. nat. Poiss.*, **16** : 154 (Type-locality : Pondicherry).

1991. *Puntius sarana subnasutus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 285-286.

Material : 1 ex., 110.0 SL., F.7422, Kwalaghata, Nellore, 21.2.04, O.P.S.

Distribution : India : Peninsular India, south of Krishna river system.

24. ***Cirrhinus mrigala*** (Hamilton)

1822. *Cyprinus mrigala* Hamilton-Buchanan, *Fishes of Ganges* : 279, 386, pl. 6, fig. 79 (Type-locality : ponds and freshwater rivers of Gangetic provinces).

1999. *Cirrhinus mrigala,* Jayaram, *The Freshwater Fishes of the Indian Region* : 130-131.

Material : 2 exs., 142.0-146.0 SL., F.7486, Marapara Kandriga, Sri Kalahasti, Chittoor, 24.2.04, O.P.S.

Distribution : Throughout India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan.

25. ***Cirrhinus reba*** (Hamilton)

1822. *Cyprinus reba* Hamilton-Buchanan, *Fishes of Ganges* : 280, 386 (Type-locality : rivers and ponds of Bengal and Bihar).

1991. *Cyprinus reba,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 173-174.

Material : 1 ex., 56.0 mm. SL., F.7423, Kwalaghata, Nellore, 21.2.04, O.P.S.; 1 ex., 49.0 mm. SL, F.7585, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Nepal, Pakistan.

26. ***Catla catla*** (Hamilton)

1822. *Cyprinus catla* Hamilton-Buchanan, *Fishes of Ganges* : 287, pl. 13, fig. 81 (Type-locality : rivers and tanks of Bengal).

1991. *Catla catla,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 163-165.

Material : 2 exs., 100.0-114.0 mm. SL., F.7487, Marapara Kandriga, Sri Kalahasthi, 24.2.04, O.P.S.

Distribution : Throughout North India upto Krishna river, but introduced into the Cauvery river system.

Elsewhere : Bangladesh, Nepal, Pakistan, Thailand.

27. ***Labeo rohita*** (Hamilton)

1822. *Cyprinus rohita* Hamilton-Buchanan, *Fishes of Ganges* : 301, 388, pl. 36, fig. 85 (Type-locality : Freshwater rivers of Gangetic provinces).

1991. *Labeo rohita,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. I : 219-220.

Material : 1 ex., 127.0 mm. SL., F.7488, Marapara Kandriga, Sri Kalahasthi, Chittoor, 24.2.04, O.P.S.

Distribution : India : Throughout.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

28. ***Garra mullya*** (Sykes)

1841. *Chondrostoma mullya* Sykes, *Trans. zool. Soc. Lond.*, **2** : 359, pl. 62, fig. 3. (Type-locality : Bheema river at Daunde, *nr.* Poona).

1991. *Garra mullya,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 429.

Material : 12 exs., 20.0-39.0 SL., F.7128, Dakkili, 20.1.03, M.B.R..; 1 ex., 95.0 mm. SL., F.7179, Chittoor, Vittalam, 10.9.02, O.P.S.; 1 ex., 51.0 mm. SL., F.7182, Guntha Godantu, Chittoor, 15.9.02, O.P.S.

Distribution : Throughout India except Assam and the Himalaya.

29. ***Lepidocephalus thermalis*** (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. nat. Poiss.*, **18** : 78 (Type-locality : Malabar).

1991. *Lepidocephalus thermalis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **I** : 527-528.

Material : 12 exs., 37.0-45.0 mm. SL., F.7593, Ettari, Chittoor, 28.2.04, O.P.S.; 18 exs., 31.0-49.0 mm. SL., F.7098, Kaligiri, 17.1.03, M.B.R.; 1 ex., 37.0 mm. SL., F.7116, Pellakuru, 23.1.03, M.B.R..; 8 exs., 25.0-44.0 mm. SL., F.7127, Dakkili, 20.1.03, M.B.R.; 1 ex., 45.0 mm. SL., F.7138, Kavali Tank, 17.1.03, M.B.R.; 6 exs., 16.0-43.0 mm. SL, F. 7164, Nellore, Kadevedu, 18.9.02, O.P.S.; 5 exs., 30.0-39.0 mm. SL., F.7170, Nalpattu Area, 14.1.03, M.B.R.; 1 ex., 29.0 mm. SL., F.7193, Venkatagiri, 19.1.03, M.B.R.; 72 exs. 16.0-28.5 mm. SL., F.7203, Udayagiri, 16.1.03, M.B.R.; 2 exs., 28.0-33.0 mm. SL., Tada Pond, 13.1.03, M.B.R.; 4 exs., 23.0-29.0 mm. SL., F.7248, Akkuriti, 25.1.03, M.B.R.; 7 exs., 24.0-30.0 mm SL., F.7256, Empedu, 21.1.03, M.B.R.; 1 ex., 34.0 mm. SL, F.7475, Kovur, 7.10.03, M.B.R.; 1 ex., 39.0 mm. SL, F.7497, Dachur, Nellore, 22.2.04, M.B.R.; 1 ex., 39.0 mm. SL., F.7507, Venkatagiri, Sri Kalahasthi, Chittoor, 25.2.04, O.P.S.; 2 exs., 33.0-42.0 mm SL., F.7515, Kalahasthi, Lakshmipuram, Chittoor, 24.2.04, O.P.S.; 4 exs., 31.0-35.0 mm. SL, F.7590, Empedu, 14.10.03, M.B.R.

Distribution : India : Peninsular India.

Elsewhere : Sri Lanka.

30. ***Pseudeutropius atherinoides*** (Bloch)

1794. *Silurus atherinoides* Bloch, *Naturges. ausland. Fische,* **8** : 48, pl. 371, fig. 1 (Type-locality : Tranquebar, Tamil Nadu).

1991. *Pseudeutropius atherinoides,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 606-607.

Material : 1 ex., 45.0 mm. SL., F.7425, Kwalaghata, Nellore, 21.2.04, O.P.S.

Distribution : India : Throughout, except Kerala and Assam.

Elsewhere : Pakistan, Nepal, Bangladesh.

31. ***Mystus bleekeri*** (Day)

1846. *Bagrus keletius* (nec. Valenciennes), Bleeker, *Nat. Geneesk. Arch. Ned.-Indie,* (2)**3** : 135 (Type-locality : Bengal).

1877. *Macrones bleekeri* Day, *Fishes of India* : 451, pl. 101, fig. 1. (Replacement name for ***Bagrus keletius*** Bleeker, 1846).

1991. *Mystus bleekeri,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 558-559.

Material : 1 ex., 35.0 mm. SL., F.7234, Tada Pond, 13.1.03, M.B.R., 3 exs., 97.0-110.0 mm. SL., F.7523, Sri Kalahasthi, Pallamala, 26.2.04, O.P.S.

Distribution : Throughout India.

Elsewhere : Pakistan, Nepal, Bangladesh, Myanmar, Malaya.

32. ***Mystus gulio*** (Hamilton)

1822. *Pimelodus gulio* Hamilton-Buchanan, *Fishes of Ganges* : 201, 379, pl. 23, fig. 66 (Type-locality : higher parts of Gangetic estuaries).

1991. *Mystus gulio,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 560-561.

Material : 7 exs., 28.0-38.0 mm. SL., F.7109, Venad, 12.1.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Pakistan, Bangladesh, Sri Lanka, Myanmar, Thailand, Malaysia, Java, Sumatra, Borneo.

33. ***Mystus vittatus*** (Bloch)

1797. *Silurus vittatus* Bloch, *Ichthyol. Hist. Nat.,* 11 : 40, pl. 371, fig.2 (Type-locality : Tranquebar, Tamil Nadu).

1991. *Mystus vittatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 573-574.

Material : 13 exs., 31.0-75.0 mm. SL., F.7450, Kammavaripalam, Nellore, 21.2.04, O.P.S.; 5 exs., 23.0-37.0 mm. SL., F.7106, S.R.Puram, 16.1.03, M.B.R.; 32 exs., 33.0-63.0 mm. SL., F.7139, Kavali Tank, 17.1.03, M.B.R.; 1 ex., 28.0 mm. SL., Venad, 12.1.03, M.B.R.; 29 exs., 36.0-52.0 mm. SL., F.7249, Akkurti, 25.1.03, M.B.R.; 3 exs., 72.0-76.0 mm. SL, F. 7424, Kwalaghata, Nellore, 21.2.04, O.P.S.; 4 exs., 33.0-76.0 mm. SL., F.7434, Varadee Eru, Nellore, 21.2.04, O.P.S.; 14 exs., 35.0-71.0 mm. SL., F.7439, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 2 exs. 63.0.-67.0 mm. SL., F.7498, Dachur, Nellore, 22.2.04, O.P.S.; 2 exs., 36.0-50.0 mm. SL., F.7533, Empedu, Kalahasthi, 25.2.04, O.P.S.; 2 exs., 77.0-78.0 mm. SL., F.7524, Nallamala, Sri Kalahasthi, 26.2.04, O.P.S.; 1 ex., 58.0 mm SL., F.7548, Rampur, 8.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

34. ***Heteropneustes fossilis*** (Bloch)

1794. *Silurus fossilis* Bloch, *Naturges. ausland Fische.,* **8** : 46, pl. 370, fig. 2 (Type-locality : Tranquebar, Tamil Nadu).

1991. *Heteropneustes fossilis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 689-690.

Material : 1 ex., 54.0 mm. SL., F.7140, Kavali Tank, 17.1.03, M.B.R.

Distribution : India.

Elsewhere : Bangladesh, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

35. ***Rhinomugil corsula*** (Hamilton)

1822. *Mugil corsula* Hamilton-Buchanan, *Fishes of Ganges* : 221, 381, pl. 9, fig. 97 (Type-locality : Ganges river).

1991. *Rhinomugil corsula,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 897-898.

Material : 1 ex., 16.0 mm. SL., F.7433, Varadee Eru, Nellore, 21.2.04, O.P.S.; 1 ex., 53.0 mm. SL., F.7442, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 2 exs., 57.0-62.0 mm. SL., F.7453, Kammavaripalam, Nellore, 21.2.04, O.P.S.

Distribution : India.

Elsewhere : Bangladesh, Nepal and Myanmar.

36. ***Oryzias carnaticus*** (Jerdon)

1848. *Aplocheilus carnaticus* Jerdon, *Madras J. Lit. Sci.,* **15** : 331 (Type-locality : the River that passes by Waniambaddy in the Carnatic.)

1998. *Oryzias carnaticus,* Tyson R. Roberts, *Ichthyological Research. The Ichthyological Society of Japan,* **45**(3) : 213-224.

Material : 1 ex., 23.0 mm. SL., F.7463, Nellore Dam, 9.10.03, M.B.R.; 3 exs., 18.0-26.0 mm. SL., F.7099, Kaligiri, 17.1.03, M.B.R.; 27 exs., 12.0-22.0 mm. SL., F.7110, Venad, 12.1.03, M.B.R.; 10 exs., 19.0-30.0 mm. SL., F.7130, Dakkili, 20.1.03, M.B.R.; 575 exs., 10.0-31.0 mm. SL., F.7142, Venad, 12.1.03, M.B.R.; 51 exs., 17.0-26.0 mm. SL, F. 7194, Venkatagiri, 19.1.03, M.B.R.; 1 ex., 11.0 mm. SL., F.7207, Udayagiri, 16.1.03, M.B.R.; 770 exs., 10.5-27.0 mm. SL., F.7215, Venad, 12.1.03, M.B.R.; 8 exs. 18.0-24.0 mm. SL., F.7477, Kovur, 7.10.03, M.B.R.; 5 exs., 18.0-25.0 mm. SL., F.7461, Saidapuram, 22.2.04, O.P.S.; 1 ex., 22.0 mm. SL., F.7508, Venkatagiri, Sri Kalahasthi, Chittoor, 25.2.04, O.P.S.; 2 exs., 16.0-18.0 mm SL., F.7517, Sri Kalahasthi, Lakshmipuram, 24.2.04, O.P.S.; 2 exs., 23.0-24.0 mm. SL, F.7534, Empedu, Kalahasthi, 25.2.04, O.P.S.; 34 exs., 15.0-22.0 mm. SL, F.7539, Parosalli, Sri Kalahasthi, 26.2.04, O.P.S.; 46 exs., 19.0-25.0 mm. SL., F.7562, Nellore Tank, High Way, 9.10.03, M.B.R.; 9 exs., 19.0-28.0 mm SL., F.7567, Pollur, 12.10.03, M.B.R.; 22 exs., 16.0-24.0 mm SL., F.7581, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : India. Widely distributed in eastern India.

Elsewhere : Bangladesh.

37. ***Aplocheilus parvus*** Sundara Raj

1916. *Panchax parvus* Sundara Raj, *Rec. Indian Mus.,* **12** : 268 (Type-locality : Madras).

1999. *Aplocheilus parvus,* Menon, *Check list–Freshwater Fishes of India,* P. 269-270.

Material : 7 exs., 20.0-27.0 mm. SL., F.7129, Dakkili, 20.1.03, M.B.R.; 1 ex., 18.0 mm. SL., F.7206, Udayagiri, 16.1.03, M.B.R.; 1 ex., 17.0 mm. SL., F.7214, Venad, 12.1.03, M.B.R.; 2 exs., 18.0-32.0 mm. SL., F.7464, Nellore Dam, 9.10.03, M.B.R.; 5 exs., 18.0-27.0 mm. SL., F.7478, Kovur, 7.10.03, M.B.R.; 13 exs., 16.0-23.0 mm. SL, F. 7459, Saidapuram, 22.2.04, O.P.S.; 2 exs., 23.0-28.0 mm. SL., F.7499, Dachur, Nellore, 22.2.04, O.P.S.; 1 ex., 28.0 mm. SL., F.7509, Venkatagiri, Sri Kalahasthi, 25.2.04, O.P.S.; 3 exs. 16.0-22.0 mm. SL., F.7516, Kalahasthi, Lakshmipuram, Chittoor, 24.2.04, O.P.S.; 2 exs., 23.0-24.0 mm. SL., F.7534, Empedu, Sri Kalahasthi, 25.2.04, O.P.S.; 1 ex., 28.0 mm. SL., F.7549, Rampur, 8.10.03, M.B.R.; 11 exs., 16.0-24.0 mm SL., F.7561, Nellore Tank, High Way, 9.10.03, M.B.R.; 1 ex., 25.0 mm. SL, F.7580, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : India : Peninsular India : Coromandal Coast.

Elsewhere : Sri Lanka.

38. ***Aplocheilus panchax*** (Hamilton)

1822. *Esox panchax* Hamilton-Buchanan, *Fishes of Ganges* : 211, 380, pl. 3, fig. 69 (Type-locality : Bengal).

1991. *Aplocheilus panchax,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 752-753.

Material : 1 ex., 36.0 mm. SL., F.7107, R.S. Puram, 16.1.03, M.B.R.

Distribution : India : Naturally in N. India; Andaman Islands.

Elsewhere : Bangladesh, Malayan Archipelago.

39. ***Gambusia affinis*** (Baird & Girard)

1853. *Heterandria affinis* Baird and Girard, *Proc. Acad. Nat. Sci. Philad.,* **6** : 390 (Type-locality : San Antanio river drainage, Texas).

1991. *Gambusia affinis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 756-758.

Material : 5 exs., 28.0-34.0 mm. SL., F.7162, Chittoor, Vittalam, 10.9.02, O.P.S.; 31 exs., 11.0-30.0 mm. SL., F.7230, Bakrapet, 13.9.02, O.P.S.; 2 exs., 11.5-16.0 mm. SL., Rampur, 20.1.03, M.B.R..; 1 ex., 28.0 mm. SL., F.7257, Empedu, 21.1.03, M.B.R.; 1 ex., 20.0 mm. SL., F.7518, Kalahasthi, Lakshmipuram, Chittoor, 24.2.04, O.P.S.

Distribution : South eastern United States of America. Introduced into India.

40. ***Poecilia reticulata*** (Peters)

1859. *Poecilia reticulata* Peters, *K. Preussischen Akad. Wiss.,* Berlin : 412 (Type-locality : Venezuela).

1991. *Poecilia reticulata,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 758-759.

Material : 4 exs., 12.0-26.0 mm. SL., F.7174, Etari Ganga, Mellur, Chittor, 7.9.02, O.P.S.; 1 ex., 36.0 mm. SL., Chittoor, Vittalam, 10.9.02, O.P.S.; 671 exs., 9.0-30.0 mm. SL., F.7188,

Balijapalle, Chittoor, 5.9.02, O.P.S.; 2850 exs., 8.5-32.0 mm. SL., F.7209, Doracharu, Palmaner, 5.9.02, O.P.S.; 5 exs., 13.0-25.0 mm. SL., F.7229, Kavali, Nellore, 23.9.02, O.P.S., 6 exs., 14.0-20.0 mm. SL., F.7460, Saidapuram, 22.2.04, O.P.S.

Distribution : Originally from Tropial America. Introduced into India.

41. ***Chanda nama*** Hamilton

1822. *Chanda nama* Hamilton-Buchanan, *Fishes of Ganges* : 109, 371, pl. 39, fig. 37 (Type-locality : Ponds throughout Bengal).

1991. *Chanda nama,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 799-800.

Material : 151 exs., 18.0-31.0 mm. SL., F.7560, Nellore Tank, High Way, 9.10.03, M.B.R.; 9 exs., 18.0-31.0 mm. SL., F.7979, Buchinayudu Kandriga, 16.10.03, M.B.R.; 35 exs., 16.0-31.0 mm. SL., F.7117, Pellekuru, 23.1.03, M.B.R.; 1 ex., 19.0 mm. SL., F.7133, Dakkili, 20.1.03, M.B.R.; 14 exs., 22.0-48.0 mm. SL., F.7474, Kovur, 7.10.03, M.B.R.; 3 exs., 20.0-40.0 mm. SL., F.7481, Renigunta, 15.10.03, M.B.R.; 1 ex., 38.0 mm. SL., F.7440, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 2 exs., 18.0-31.0 mm. SL., F.7551, Kavali, 7.10.03, M.B.R.; 1 ex., 22.0 mm. SL., F.7553, Pulicat Pond, 11.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Nepal, Pakistan, Myanmar.

42. ***Parambassis lala*** (Hamilton)

1822. *Chanda lala* Hamilton-Buchanan, *Fishes of Ganges* : 114, pl. 21, fig. 39 (Type-locality : Gangetic Provinces).

1991. *Pseudambassis lala,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : P 804.

Material : 16 exs., 22.0-25.0 mm. SL., F.7466, Nellore Dam, 9.10.03, M.B.R.

Distribution : India : Brahmaputra, Ganga and Mahanadi basin.

Elsewhere : Myanmar : Irrawaddy.

43. ***Parambassis ranga*** (Hamilton)

1822. *Chanda ranga* Hamilton-Buchanan, *Fishes of Ganges* : 113, 371, pl. 16, fig. 38 (Type-locality : freshwaters of all parts of Gangetic Provinces).

1999. *Parambassis ranga,* Jayaram, *The Freshwater Fishes of the Indian Region* : 370-371.

Material : 2 exs., 21.0-22.0 mm. SL., F.7134, Dakkili, 20.1.03, M.B.R.; 1 ex., 19.0 mm. SL., F.7510, Venkatagiri, Kalahasthi, Chittoor, 25.2.04, O.P.S.; 1 ex., 18.0 mm. SL., F.7537, Empedu, Kalahasthi, 25.2.04, O.P.S.; 31 exs., 19.0-21.0 mm. SL., F.7540, Parosalli, Sri Kalahasthi, 26.2.04, O.P.S.

Distribution : India.

Elsewhere : Bangladesh, Malaysia, Thailand, Myanmar, Pakistan.

44. ***Etroplus maculatus*** (Bloch)

1785. *Chaetodon maculatus* Bloch, *Syst. Ichth.* : pl. 427, fig. 2 (Type-locality : India).

1991. *Etroplus maculatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 885.

Material : 9 exs., 18.0-48.0 mm. SL., F.7535, Empedu, Kalahasthi, 25.2.04, O.P.S.; 4 exs., 18.0-43.0 mm. SL., F.7131, Dakkili, 20.1.03, M.B.R.; 1 ex., 17.0 mm. SL., F.7205, Udayagiri, 16.1.03, M.B.R.; 4 exs., 18.0-25.0 mm. SL., F.7469, Nellore Dam, 9.10.03, M.B.R.; 9 exs., 29.0-33.0 mm. SL., F.7428, Kwalaghata, Nellore, 21.2.04, O.P.S.; 13 exs., 28.0-47.0 mm. SL, F. 7435, Varadee Eru, Nellore, 21.2.04, O.P.S.; 32 exs., 29.0-40.0 mm. SL., F.7444, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 3 exs., 32.0-32.5 mm. SL., F.7451, Kammavaripalam, Nellore, 21.2.04, O.P.S.; 2 exs. 25.0-49.0 mm. SL., F.7501, Dachur, Nellore, 22.2.04, O.P.S.; 3 exs., 29.0-31.0 mm. SL., F.7511, Venkatagiri, Kalahasthi, Chittoor, 25.2.04, O.P.S.

Distribution : Peninsular India.

Elsewhere : Sri Lanka.

45. ***Oreochromis mossambica*** (Peters)

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

1991. *Oreochromis mossambica,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 887-888.

Material : 2 exs., 48.0-68.0 mm. SL., F.7427, Kwalaghata, Nellore, 21.2.04, O.P.S.; 1 ex., 55.0 mm. SL., F.7502, Dachur, Nellore, 22.2.04, O.P.S.; 2 exs., 13.0-15.0 mm. SL., Tulukamandi, Chittoor, 29.2.04, O.P.S.; 1 ex., 39.0 mm. SL., F.7568, Pollur, 12.10.03, M.B.R.; 5 exs., 28.0-44.0 mm. SL., F.7584, Buchinayudu Kandriga, 16.10.03, M.B.R.; 2 exs. 18.0-18.5 mm. SL, Tada Estuary, 13.1.03, M.B.R.; 18 exs., 35.0-105.0 mm. SL., F.7254, Rampur, 20.1.03, M.B.R..; 4 exs., 16.0-18.0 mm. SL., Empedu, 21.1.03, M.B.R.; 3 exs. 60.0-67.0 mm. SL., F.7525, Pallamala, Sri Kalahasthi, 26.2.04, O.P.S.; 1 ex., 48.0 mm. SL., F.7468, Nellore Dam, 9.10.03, M.B.R.; 3 exs., 10.0-30.0 mm. SL., Duttaluru, 18.1.03, M.B.R.; 79 exs., 19.0-40.0 mm. SL., F.7112, Venad, 12.1.03, M.B.R.; 7 exs., 15.0-28.0 mm. SL., F.7132, Dakkili, 20.1.03, M.B.R.; 23 exs., 18.0-29.0 mm. SL., Venad, 12.1.03, M.B.R.; 5 exs., 25.0-108.0 mm. SL., F.7163, Chittoor, Vittalam, 10.9.02, O.P.S.; 39 exs. 33.0-100.0 mm. SL, F.7173, Etari Ganga, Melur, Chittoor, 7.9.02, O.P.S.; 25 exs., 12.0-21.0 mm. SL., F.7195, Venkatagiri, 19.1.03, M.B.R.; 1 ex., 33.0 mm. SL., F.7210, Doracharu, Palmaner, 5.9.02, M.B.R.; 200 exs., 17.5-49.0 mm. SL., F.7211, Venad, 12.1.03, M.B.R.; 1 ex., 39.0 mm. SL., F.7228, Kavali, Nellore, 23.9.02, O.P.S.

Distribution : Widely introduced in India.

Elsewhere : Bangladesh, Pakistan, Sri Lanka, East Africa to Natal.

46. ***Oreochromis niloticus*** (Linnaeus)

1757. *Labrus niloticus* Linnaeus in Hasselquist, *Iter. Palae t.* p. 346.

1999. *Oreochromis niloticus,* Rema Devi and Raghunathan, *Rec. Zool. Surv.* India : **97**(1) : 163-177.

Material : 2 exs., 49.0-50.0 mm. SL., F.7467, Nellore Dam, 9.10.03, M.B.R.

Distribution : Natural range includes Nile basin, Rift Valley lakes and certain West African rivers. Introduced into India in West Bengal around 1988.

47. ***Glossogobius giuris*** (Hamilton)

1822. *Gobius giuris* Hamilton-Buchanan, *Fishes of Ganges* : 51, pl. 33, fig. 15 (Type-locality : Gangetic Provinces).

1991. *Glossogobius giuris,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 936.

Material : 1 ex., 94.0 mm. SL., F.7103, Duttaluru, 18.1.03, M.B.R.; 13 exs., 20.0-51.0 mm. SL., F.7121, Pellekuru, 23.1.03, M.B.R.; 1 ex., 67.0 mm. SL., F.7250, Akkuriti, 25.1.03, M.B.R.; 4 exs., 30.0-66.0 mm. SL., F.7426, Kwalaghata, Nellore, 21.2.04, O.P.S.; 2 exs., 31.0-58.0 mm. SL., F.7432, Varadee Eru, Nellore, 21.2.04, O.P.S.; 6 exs. 26.0-41.0 mm. SL, F.7441, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.; 4 exs., 40.0-50.0 mm. SL., F.7449, Kamavaripalam, Nellore, 21.2.04, O.P.S.; 2 exs., 63.0-97.0 mm SL., F.7500, Dachur, Nellore, 22.2.04, O.P.S., 1 ex., 60.0 mm. SL., F. 7583, Buchinayudu Kandriga, 16.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka. It has a wide range of distribution from the East Coast of Africa to Japan, Australia and South Pacific.

48. ***Pseudogobius javanicus*** (Bleeker)

1856. *Gobius javanicus* Bleeker, *Natuurk, Tijdschr. Ned.-Indie,* **11** : 88 (Type-locality : Java).

1953. *Stigmatogobius javanicus* Koumans, *Fish. Indo. Australian Arch.,* **10** : 122.

1984. *Pseudogobius javanicus*, Masuda *et al.*, *The Fishes of the Japanese Archipelago,* p. 268, pl. 247-S.

Material : 46 exs., 12.0-17.5 mm. SL., F.7141, Venad, 12.1.03, M.B.R.; 36 exs., 14.0-20.0 mm. SL., F.7212, Venad, 12.1.03, M.B.R.

Distribution : India.

Elsewhere : Through the East Indies to the Philippines and Australia.

49. ***Colisa lalia*** (Hamilton)

1822. *Trichopodus lalius* Hamilton-Buchanan, *Fishes of Ganges* : 120, 372 (Type-locality : Gangetic Provinces).

1991. *Colisa lalia,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 1007.

Material : 2 exs., 28.0-29.0 mm. SL., F.7465, Nellore Dam, 9.10.03, M.B.R.; 1 ex., 23.0 mm. SL., F.7443, River Ram Kalwa, Rampur, Nellore, 21.2.04, O.P.S.

Distribution : India : Ganga, Yamuna river systems.

Elsewhere : Pakistan : Punjab, Sind. Bangladesh. It is widely distributed in Southern India (Ranjit Daniels, 2002).

50. ***Channa orientalis*** (Schneider)

1801. *Channa orientalis* Bloch and Schneider, *Syst. Ichth.* : 496, pl. 90, fig. 2 (Type-locality : India).

1991. *Channa orientalis,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 1019-1020.

Material : 15 exs., 20.0-43.0 mm. SL., F.7185, Malapalla, Chittoor, 9.9.02, O.P.S.; 1 ex., 85.0 mm. SL., F.7429, Kwalaghata, Nellore, 21.2.04, O.P.S.

Distribution : Throughout India.

Elsewhere : Afghanistan, Bangladesh, Borneo, Iran, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand.

51. ***Channa punctatus*** (Bloch)

1793. *Ophiocephalus punctatus,* Bloch, *Naturges. ausland. Fische,* (7) : 139, pl. 358 (Type-locality : rivers and lakes of Coromandel coast.)

1991. *Channa punctatus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 1020-1021.

Material : 2 exs., 55.0-85.0 mm. SL., F.7512, Venkatagiri, Sri Kalahasthi, Chittoor, 25.2.04, O.P.S.; 2 exs., 35.0-42.0 mm. SL., F.7519, Kalahasthi, Lakshmipuram, Chittoor, 24.2.04, O.P.S.; 1 ex., 25.0 mm. SL., Tulukamandi Chittoor, 29.2.04, O.P.S.; 6 exs., 30.0-112.0 mm. SL., F.7536, Empedu, Sri Kalahasthi, 25.2.04, O.P.S.; 1 ex., 37.0 mm. SL., F.7541, Parosalli, Sri Kalahasthi, 26.2.04, O.P.S.; 3 exs. 42.0-55.5 mm. SL., F.7552, Pulicat Pond, 11.10.03, M.B.R.; 1 ex., 45.0 mm. SL., F.7582, Buchinayudu Kandriga, 16.10.03, M.B.R..; 5 exs., 28.0-48.0 mm. SL., F.7462, Saidapuram, 22.2.04, O.P.S.; 11 exs. 37.0-65.0 mm. SL., F.7503, Dachur, Nellore, 22.2.04, O.P.S.; 5 exs., 35.0-110.0 mm. SL., F.7100, Kaligiri, 17.1.03, M.B.R.; 7 exs., 30.0-83.0 mm. SL., F.7108, R.S.Puram, 16.1.03, M.B.R.; 1 ex., 95.0 mm. SL., F.7120, Pellekuru, 23.1.03, M.B.R.; 1 ex., 35.0 mm. SL., F.7135, Dakkili, 20.1.03, M.B.R.; 1 ex., 46.0 mm. SL., F.7235, Tada Pond, 13.1.03, M.B.R.; 2 exs., 71.0-72.0 mm. SL., F.7470, Nellore Tank, 9.10.03, M.B.R.; 1 ex., 55.0 mm. SL, F.7476, Kovur, 7.10.03, M.B.R.

Distribution : Throughout India.

Elsewhere : Afghanistan, Bangladesh, China, Malaysia, Myanmar, Nepal, Pakistan, Polynesia, Sri Lanka.

52. ***Macrognathus aral*** (Bloch & Schneider)

1801. *Rhynchobdella aral* Bloch & Schneider, *Syst. Ichth.* : 479, pl. 89 (Type-locality : Tranquebar, Tamil Nadu).

1991. *Macrognathus aral,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 1026.

Material : 1 ex., 159.0 mm. SL., F.7111, Venad, 12.1.03, M.B.R.

Distribution : India.

Elsewhere : Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka.

53. ***Macrognathus pancalus*** Hamilton

1822. *Macrognathus pancalus* Hamilton-Buchanan, *Fishes of Ganges* : 30, 364, pl. 22, fig. 7, (Type-locality : Tanks of Gangetic Provinces).

1991. *Macrognathus pancalus,* Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries,* Vol. **II** : 1027-1028.

Material : 1 ex., 101.0 mm. SL., F.7452, Kammavaripalam, Nellore, 21.2.04, O.P.S.

Distribution : India.

Elsewhere : Bangladesh, Pakistan.

DISCUSSION

Nellore & Chittoor districts of Andhra Pradesh are drained by the River Pennar. It is worthwhile to mention here that late Shri T. Venkateswarlu Scientist D, made a thorough survey and study of the Fishes of Pennar during 1983-1986. The manuscript comprising 86 species is pending publication. A recent survey and report on fishes of Andhra Pradesh by Barman (1993) details 158 species. The present collection includes 53 species from Chittoor and Nellore Districts with 9 additional records (Rema Devi *et al.*, 2005).

SUMMARY

The study on a collection of fish from Chittoor and Nellore District has yielded 53 species under 16 families and 8 orders of which nine species *viz.*, *Ehirava fluviatilis* Deraniyagala, *Aristichthys nobilis* (Richardson), *Esomus thermoicos* (Valenciennes), *Rasbora cf. labiosa* Mukerji, *Puntius bimaculatus* (Blkr.), *Puntius fraseri* Hora & Misra, *Oreochromis niloticus* (Linnaeus), *Parambassis lala (*Ham.*), Colisa lalia* (Ham.), have been reported recently by the authors as additional records to the state of Andhra Pradesh.

ACKNOWLEDGEMENTS

We wish to thank the Director, Zoological Survey of India and the Officer in-Charge, Southern Regional Station, Zoological Survey of India for providing necessary facilities.

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Rec. zool. Surv. India : **108**(Part–2) : 39-45, 2008

DIVERSITY OF SPIDER FAUNA OF BORTIBEEL NORTH 24 PARGANAS, WEST BENGAL, THEIR POSSIBLE UTILITIES AS SIGNIFICANT BIOLOGICAL PESTCONTROL IN THE PADDY FIELD-ECOSYSTEM

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INTRODUCTION

Information on spiders from Bortibeel wetland area was first reported by Talukdar and Majumder (2006) by their studies on web-building and food and feeding behavior of two araneid spiders. Taxonomic studies on paddy field spiders are lacking from this potential wetland. Reports on population fluctuation of spiders from wetland agriculture fields are very scanty. However, Alam *et al.* (1981), Chawdhury & Nagari (1981), Chawdhury & Pal (1984), Kamal *et al.* (1999 and 1992), Biswas (1990), Biswas *et al.* (1993) enlighted the studies of spiders in paddy field ecosystem.

During last 5 years while executing the ecological investigations on the wetland of Bortibeel, a 13 km stretched isolated Gangetic marsh land covering about 300 thousand bighas of cultivated land comprising several agricultural farms and fishing villages situated between 88.29–88.38 degree east and 22.80–23.00 degree north of West Bengal, the authors came across 3000 Acres and 1500 Acres of land for cultivation of paddy in Kharif and Boro seasons respectively yielding at least an average of 3.6 lack metric tones of paddy every year. During the study period 5507 specimens of spiders belonging to 39 families under 16 genera were recorded from the paddy plants, border weeds and ratoons as three micro habitats to predate about 10 potential destructors of paddy crop of the wetland during pre and post monsoon cultivations.

The present paper deals with the seasonal fluctuations of populations in different micro-habitats of paddy field spiders especially in the breeding seasons of insect and during the application of pesticide in the field thus left significant recommendation regarding awareness on environmental hazards and its natural control through conservation of spider population.

MATERIALS AND METHOD

Bortibeel : A 13 km stretch of marsh land crept up on several agricultural and fishing villages covering about 300000 bighas of cultivated land situated between 22.8–23.0 digree Latitude and 88.29–88.38 degree Longitude in 5 assembly segment of Jagaddal, Khardah, Amdanga, Naihati and Barasat. The study area is situated between the 87/A bus root and Nilganj road in North-South and between NH34 and Kalyani high way in East-West. Several rail stations like Halisahar, Naihati, Kankinara, Jagaddal, Shyamnagar, Ichhapur, Palta, Barrackpur and Barasat connect the large wetland area. Many villages like Ratanpur, Taraberia, Beharia, Boseganchia, Baraganchia, Kushdanga, Tapanpur and Tentulia are bordering the east while Dogachi Panpur, Mukundapur, Uchhegarh, Mahakaltala, Basudevpur, Kadamtala, UttarHansia, Dashgaria, Kaliaghata and Mathurapur are bordering the West of the Wetland. The most important thing of this wetland is the network of several canals namely Ichhapur Khal, Pancha khal, Trimohini khal, Koirapur khal, Basudevpur khal, Hanjana khal and Pakhimara Khal etc. are connecting Noai Khal (or Noai River) which was previously connecting the Vidyadhari River and also included in the riverine net work of GANGA which is now almost disconnected.

Climate : Monsoon prevails for about four months from mid of June to mid of October with high humidity. Annual range of humidity is between 85–95%. July-August are the heavy rainfall months with precipitations as high as 400 mm. Occasional rains are also encountered throughout the year. Pre-monsoon is dry and warm with thunder storms. Post-monsoon is apparently cold with negligible rainfall. Maximum temperature reaches up to 45°C in May while the mean maximum temperature is 30°C. observed in June. On the other hand the minimum temperature drops up to 8°C in January and the mean minimum temperature is 20°C.

Agriculture : Several paddy fields have grown in this wetland that are accessible only in the dry season up to early monsoon till the heavy rain stops and the stagnant water have dried up considerably. Rice of different varieties, Jute, Sugarcane and vegetable of almost all varieties possible to cultivate in this type of environment (on the comparatively uplands besides the fishery ponds) and are grown in this wetland. In Kharif season about 3000 Acres of total 6000 Acres of cultivated land of the wetland and 1500 Acres in Boro season produce approximately about 3.6 lacks metric tonne of paddy every year. Collections were made only from the paddy field in different seasons. Presence of wandering and sedentary spider species were recorded from the paddy foliage and from the Ratoons after harvesting the crop.

Aquaculture : Hundreds of reservoirs have been developed within the wetland area for the purpose of irrigation and aquaculture. Besides canal fisheries fishermen also developed the art of captive aquaculture with those man made and natural reservoirs.

Border weeds : Land scape of Bortibeel covers different types of vagetations. Paddy fields are scattered throughout the wetland mainly along the both sides of the canals. Unlike other rice

field these cultivated grounds are surrounded by bushy vagitations of different varieties of wild terrestrial and amphibious plants. A very good number of spiders were reported from these adjacent areas.

Instruments : Collections were performed by an inverted umbrella, forceps with soft-tension, small brush and with a standard hand sweeping net (129 cm in diameter). Sunca electronic emergency lamp was used during collection. Taxonomic studies have been made by a Olympus dissecting type binoculer microscope with ocular micrometer while behavioral observations were done by a Samsung's field binocular (B-10 × 25N), an electronic stop watch. Black velvet paper and tabulated data sheets were used.

Collections : Spiders were collected from the selected plots of rice fields, associated host plants on border weeds and ratoons after harvesting the crops. They were simultaneously collected by hand picking and standered hand sweeping net (29 cm in diameter) and by dusting the nearby bushes into an inverted umbrella from the study areas directly from the webs and other habitats during pre and post monsoon paddy cultivations. The random sampling was done making 100 sweeps in each sampling site twice a month from paddy plants and border weed while only two sampling from ratoons considering early days and later days after harvesting the crops. The volume of collection was restricted by noting down the numbers against species after gathering morpho-taxonomical knowledge through early studies. Paddy pest insects also simultaneously collected from the study areas and incorporated in a table (Table 2) for better understanding.

Preservation : Collected spider specimens were anaesthetized, killed in a killing jar and finally preserved in Oudman's preservative (90 parts 70% ethanol, 5 parts glycerol and 5 parts glacial acetic acid) in glass vials.

Identification : Well preserved spider specimens were sorted transferred in ethyle alcohol and studied under binocular microscope in a petridish. The specimens were identified upto species level.

OBSERVATIONS

A total of 39 species under 8 families were recorded from the rice plants, border weeds and ratoons after harvesting the crops. The occurrence of a total of 5507 spider specimens of 39 species were recorded in which 1223 examples from paddy field itself, 3855 from adjacent wild border weeds and 429 examples from the ratoon included 39 species altogether throughout the study period during Kharif and Boro seasons broadly as pre and post monsoon varieties of rice from Bortibeel and charted in Table 1. In other hand two species of Orthoptera, three species of Hemiptera, two species of Diptera, one species of Lepidoptera and two species of Coleoptera were recorded populations of which were incorporated in the table (Table 2).

Table 1.: Showing the list of spiders and their patern of abundance in different micro habitats of paddy field ecosystem of Borti Beel among the pre and post monsoon varieties of rice during 2001-2005.

Name of the Species	Family	Pre-monsoon rice field			Post-monsoon rice field		
		Rice plant	Border weeds	Ratoons	Rice plant	Border weeds	Ratoons
Argiope sillongensis	ARANEIDAE	11	27	00	19	33	00
A. pulchella	"	14	36	00	17	46	00
A. anasuja	"	00	25	08	09	35	07
Neoscona nautica	"	12	61	03	26	68	00
N. rumpfi	"	03	29	06	11	39	00
N. elliptica	"	10	26	09	19	36	00
N. mukerjei	"	18	59	02	25	49	06
N. bengalensis	"	03	23	00	11	35	04
Neoscona sp.	"	11	20	05	21	45	03
Leucauge decorate	"	14	63	08	18	53	08
Leucauge sp.	"	02	32	00	13	37	05
Larinia phtistica	"	11	51	01	16	53	06
Cyrtophora cicatrosa	"	24	96	10	31	76	08
C. bidenta	"	15	85	08	18	55	05
Tetragnatha mandibulata	TETRAGNATHIDAE	17	58	11	14	52	15
Lycosa kempi	LYCOSIDAE	16	95	04	21	85	06
L. choudhuryi	"	14	79	11	18	54	10
Hippasa holmerae	"	11	58	07	13	47	04
Pardosa kupupa	"	22	86	12	16	89	09
P. leucopalpis	"	06	61	05	31	65	00
Arctosa indica	"	13	42	03	18	34	02
Oxyopes sunandae	OXYOPIDAE	25	58	11	24	47	12
O. shweta	"	14	63	00	37	89	03
O ratnae	"	33	43	00	39	65	10
O. sakuntalae	"	26	29	12	25	34	00
Cheiracanthium trivialis	CLUBIONIDAE	06	25	12	12	32	00
C. melanostoma	"	10	16	14	15	21	12
Cheiracanthium sp.	"	09	06	05	13	08	07

Table 1. : *(Cont'd.).*

Name of the Species	Family	Pre-monsoon rice field			Post-monsoon rice field		
		Rice plant	Border weeds	Ratoons	Rice plant	Border weeds	Ratoons
Phidippus indicus	SALTICIDAE	07	88	14	21	82	08
P. bengalensis	"	13	76	07	19	43	03
Marpissa bengalensis	"	08	59	09	26	36	06
M. decorate	"	00	51	08	49	64	09
M. tigrina	"	14	28	05	13	35	02
M. calcutensis	"	13	26	11	30	53	00
Salticus ranjitus	"	12	55	16	23	63	05
S. sp.	"	10	21	04	12	48	00
Thomisus pugilus	THOMISIDAE	06	25	03	03	26	02
T. projectus	"	02	20	06	06	49	00
Uloborus sp.	ULOBORIDAE	15	32	04	11	41	03
Number of examples		**460**	**1933**	**249**	**763**	**1902**	**180**
Number of Species		**37**	**39**	**33**	**39**	**39**	**28**

Table 2. : Showing the list of insect pestes and their patern of abundance in different micro habitats within the paddy plant ecosystem as the area of destruction in Borti Beel among the pre and post monsoon varieties of rice during 2001-2005.

Sl. No.	*Scientific Name/* Common Name	Systematic position	No. of insect observed in pre-monsoon crop	No. of insect observed in post-monsoon crop	Area of Destruction
1.	*Oxya velox*/ Paddy grass hoper	Order ORTHOPTERA Family ACRIDIDAE	+++	++	Leaves and ear
2.	*Hierolyphus banion*/ Rice grass hopper	Order ORTHOPTERA Family ACRIDIDAE	++	+	Leaves and ear
3.	*Leptocorisa acuta*/ Rice bug	Order HEMIPTERA Family ATYDIDAE	+++	++	Milky grain and leaf sheath
4.	*Nilaparvata lugens*/ Brown plant hopper	Order HEMIPTERA Family DELPHACIDAE	++	++	Chaffy ear
5.	*Nephottetix virescens*/ Green leaf hopper	Order HEMIPTERA Family CICADELLIDAE	+++	+	Suck sap from the leaf

Table 2. : *(Cont'd.).*

Sl. No.	*Scientific Name/* Common Name	Systematic position	No. of insect observed in pre-monsoon crop	No. of insect observed in post-monsoon crop	Area of destruction
6.	*Orseolis oryzae*/ Paddy gall fly	Order DIPTERA Family CECIDOMYIIDAE	+	0	Seedling which fails to bear ears
7.	*Atherigona oryzae*/ Paddy stem fly	Order DIPTERA Family ANTHOMYIIDAE	+++	++	Seedling
8.	*Scirpophaga incertulus*/ White leaf hopper	Order LEPIDOPTERA Family PYRALIDAE	++	+	Sucking the green tissues
9.	*Anomala dimidiate*/ Shining beetle	Order COLEOPTERA Family RUTELIDAE	+++	++	Cut ear
10.	*Dicadispa armigera*/ Rice hispa	Order COLEOPTERA Family HISPIDAE	+++	++	Green matter of leaves

Maximum = +++; Optimum = ++; Nil = 0

DISCUSSION AND SIGNIFICANCE

It is revealed from this study that spiders are commonly observed in all the three micro habitats in the paddy fields of Bortibeel in both the crops of pre and post monsoon. In border plants the population is higher than the paddy plants might be due to restrictions of feeding habit, less diversity in foliage habitat, variation in intensity of light (which help the spiders to hidebefore attack), higher influx of pesticide in paddy plants and higher availability of prey in border plants In pre-monsoon paddy crops 460 spiders from 37 species of 16 genera were recorded from the rice plant itself whereas 1933 number of individual from 39 species of 16 genera were recorded from the border weeds. The picture is same in other season crops also.

Though post monsoon crop, spider population is almost two fold higher *i.e.*, 763 individuals from 39 species of 16 genera in paddy plants and 1922 number of individuals from 39 species of genera have been recorded may be due to lower temperature and rainfall, less pesticide influx greater availability of prey population. About the population of spiders in ratoons the picture is almost same. In pre-monsoon crop the post harvesting environment instead of decresing spider habitat the ratoons grow once again due to presence of water in the field and increase the habitat. The number of spiders recorded are 249 and 180 in pre and post monsoon ratoons respectively. The 10 insect species belonging to Orthoptera (Acrididae), Hemiptera (Atydidae, Delphacidae and Cicadellidae), Diptera (Cecidomyiida and Anthomyiidae), Lepidoptera (Pyralidae) and Coleoptera (Rutelidae and Hispidae) which destruct different parts of paddy have been recorded in the field

were devoured by the spider species indicating that the spiders have significant potentiality as biological pest controlling agent in the paddy fields of Bortibeel wetland.

ACKNOWLEDGEMENTS

Authors are thankful Dr. Ramakrishna, Director-in-Charge and all supporting personel of Zoological Survey of India, for providing facilities and encouragement to carryout the work.

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PLATE I

Fig. 1. : Genus *Argiope*

Fig. 2. : Genus ***Neoscona***

PLATE II

Fig. 3. : Genus ***Leucauge***

Fig. 4. : Genus ***Larinia***

PLATE III

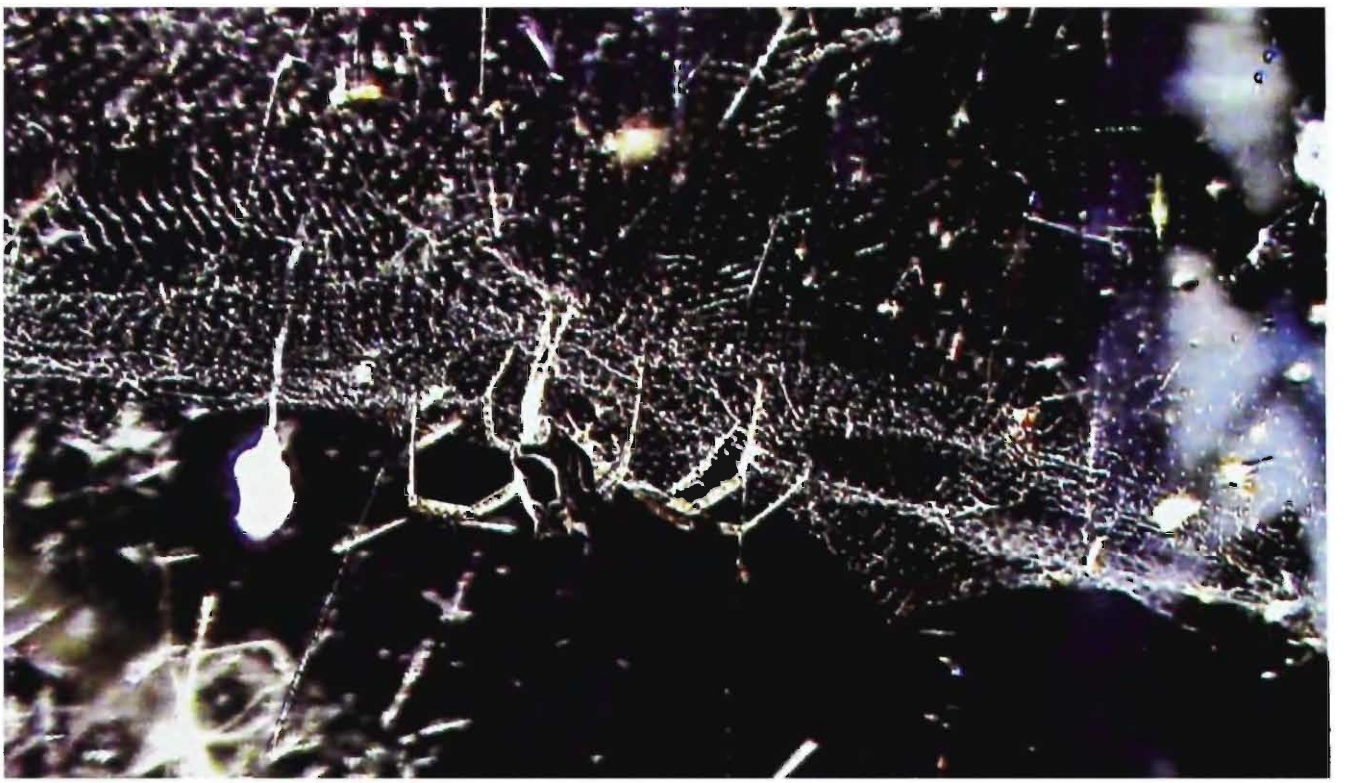

Fig. 5. : Genus ***Cyrtophora***

Fig. 6. : Genus ***Cyrtophora***

PLATE IV

Fig. 7. : Genus ***Lycosa***

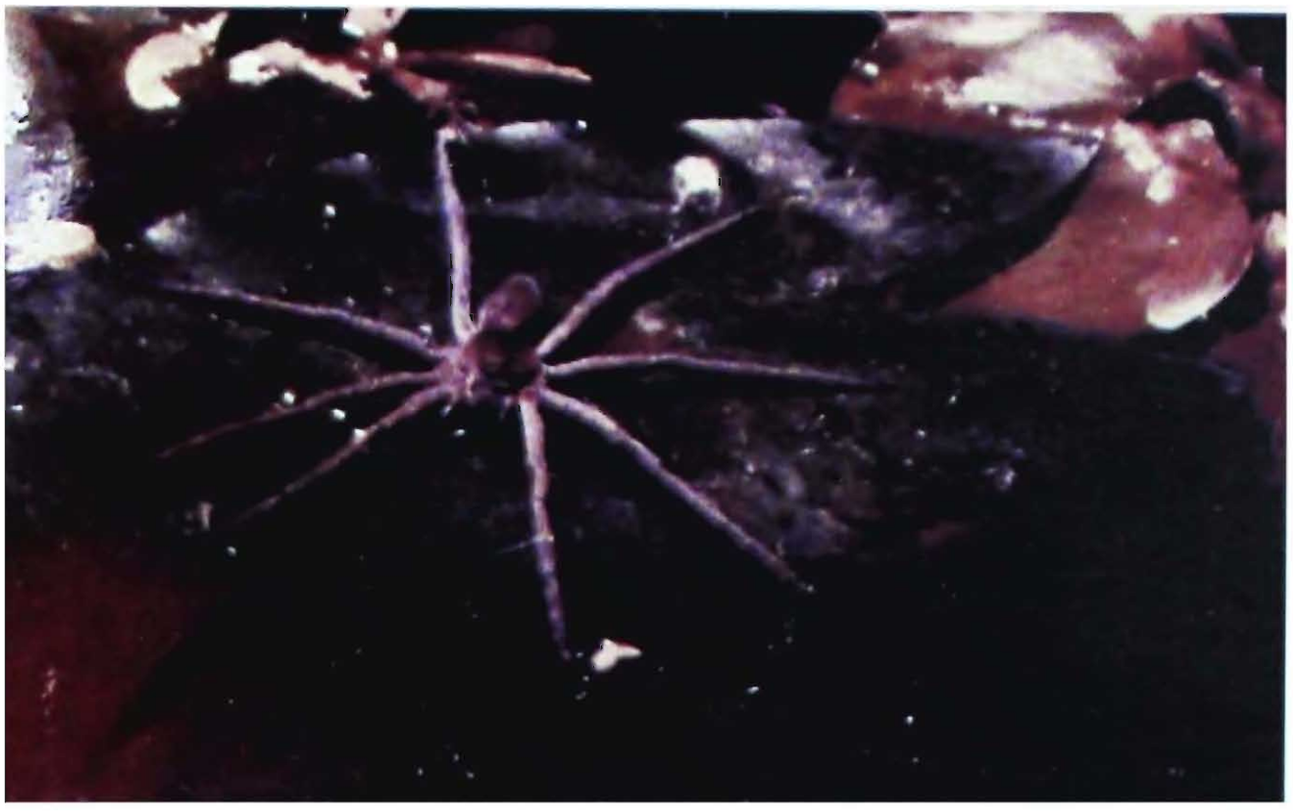

Fig. 8. : Genus ***Licosa***

PLATE V

Fig. 9. : Genus ***Pardosa***

Fig. 10. : Genus ***Arctosa***

PLATE VI

Fig. 11. : Genus ***Oxyopes***

Fig. 12. : Genus ***Uloborus***

PLATE VII

Fig.15. : Genus ***Cheiracanthium***

Fig. 14. : Genus ***Marpisa***

PLATE VIII

Fig. 15. : Genus ***Phidippus***

Fig. 16. : Genus ***Thomisus***

PLATE IX

Fig.17. : Genus ***Salticus***

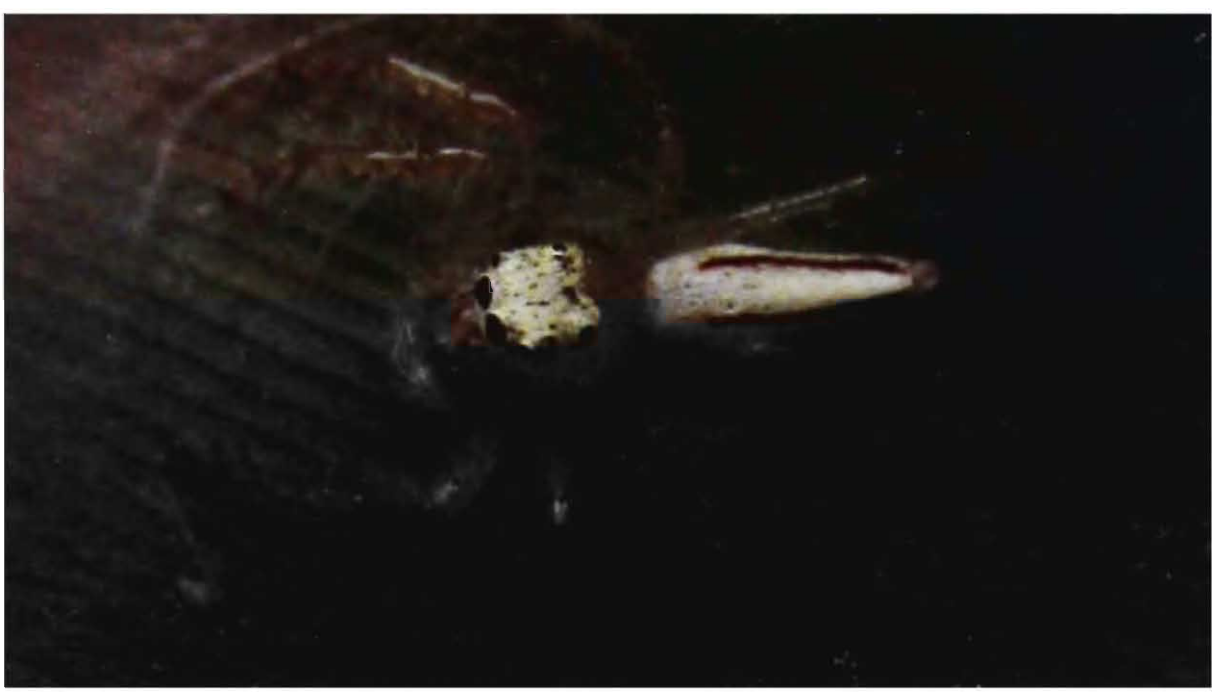

Fig. 18. : An interesting Salticus spider.

Rec. zool. Surv. India : **108**(Part–2) : 47-50, 2008

HABITS, FOOD PREFERENCE AND FAMILY LIFE OF THE MARSH MONGOOSE (*HERPESTES PALUSTRIS* GHOSE, 1965) IN THE SALT LAKE SWAMPS NEAR CALCUTTA, WEST BENGAL

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INTRODUCTION

A new species of mongoose, *Herpestes palustris,* was described from Nalban bheri in the Salt lake swamps near Calcutta, West Bengal (Ghose, 1965). This endemic mongoose was later called as the Marsh mongoose and was thereafter reported only from the North and South 24 Parganas district of West Bengal (Ghose & Chaturvedi, 1972). Apart from only a couple of points on the habits of this mongoose in the original description, nothing was published on its biology or ecology in the next forty years. To find out something more on its habits, food preference and family life surveys of different areas of the Salt lake swamps were conducted during all the seasons in the year 2005.

STUDY AREA

The Salt lake swamps in the eastern fringe of Calcutta is a group of shallow sewage-fed fish culture ponds locally called bheries. The largest is Nalban bheri (152 hectares) adjoining which are Sukantanagar, Char Number, Sardar Singh, Chinta Singh, Goltala, Nantur and Captain bheries. These bheries are 1-2 metres in depth with few natural vegetation still left in the form of submerged or emergent (*Typha*) reeds. Floating vegetation in the form of water hyacinth (*Eichorrnia crassipes*) are kept lining the periphery to prevent theft of the cultured fishes. Sewage from Calcutta city is released into these wetlands through a series of channels and lock gates. This supplies the food necessary for the growth of fishes, the fries of which are released into these fish-culture bheries every year before the monsoon season, after their bottom have been leveled and the silt removed when most of these wetlands dry up in summer or the water is drained out. This sustainable use of the sewage-fed East Calcutta wetlands has earned the reputation as a Ramsar Site.

The shallow wetlands are lined by narrow mud banks on which grow grasses and a few stunted trees. These mud-banks are the haunts of the Marsh mongoose (*Herpestes palustris*).

METHODOLOGY

Throughout the year (2005) a systematic vigil was kept along the mud-banks in all the bheries mentioned above especially in the mornings and afternoons. Direct sightings of mongooses were made; their habits, activity pattern, feeding behaviour and family group structure were observed. Some burrows in which they dwelled were dug up to reveal the contents inside.

OBSERVATIONS

Habits and Activity Pattern :

The Marsh mongoose was found to be diurnal and more active during the early morning and late afternoon. During morning hours, it was active between 6–8 a.m. during summer and 7–10 a.m. during winter. During the afternoon it was active between 4–5 p.m. during summer and 3–5 p.m. during winter.

The Marsh mongoose was found to be very shy, generally keeping to the cover behind grasses and shrubs. It is quite cautious, running away into its burrow when approached. It lives inside burrows dug on the sides of the mud-banks near the water's edge. Its presence could be detected by the worn-out tracks left at the mouth of the burrow.

The burrows were mainly found in different secluded portions of the bheries, areas of the mud-banks less frequented by man. In a 50 meter secluded portion of the mud-bank between Sukantanagar and Char Number bheri, about 20 mongooses were found living closely in a number of burrows dug near to each other. Some had young ones which followed their mother when she emerged out of her burrow. When out for hunting the mongoose sat up on its haunches or stood up on its hind legs to take a good look around. This habit increased the area of vision of the very inquisitive animal.

Food Preference :

These mongooses were found to hunt during daytime, usually early in the mornings and in the late afternoons. The prey when caught were bitten and crunched to death and consumed. The food items mainly included bivalve molluscs like *Lamillidens marginalis* and gastropod molluscs like *Bellamya bengalensis, Lymnaea* spp. which were commonly found at the water's edge. The broken shells of these molluscs were seen lying scattered at the mouth of the burrows. Besides various aquatic Hemipteran bugs and Coleopteran. beetles, dragonfly nymphs, terrestrial grasshoppers, crickets, centipedes, crabs etc. are taken. The method of hunting was direct, open headlong attack.

However, they were never seen trying to capture fish. After the meal the mongooses were sometimes seen using one of the long claws of the forefeet to clean the teeth like a toothpick.

Family Life :

The Marsh mongoose seems to breed just after winter in the months of January-March when pairs could be easily seen. The male was often seen chasing the female along the mud-banks during this period. Although mating was not observed, it seems that most of the births took place just before the monsoon between April-June. The female has a litter of 2-3 young ones inside a burrow dug by herself at the base of a tree or in the mud-bank along the edge of the water. Sometimes she excavates and enlarges her own burrow before giving birth to the young ones.

The male takes no part in the care of the young but the mother guards and protects her cubs ferociously. She does not hesitate to attack Yellow Monitor lizards (*Varanus flavescens*) which try to attack and steal her cubs.

The cubs grow rapidly within 2-3 months and by August-September they are able to come out of the burrow for hunting with the mother. They feed on various terrestrial insects and small molluscs (*Lymnaea* spp) and soon become independent of their mother. Just after the monsoons, in September-October 2-3 cubs were often seen playing with each other during the evening period between 4-5 p.m. They nibble at each other's tail and run helter-skelter near the mouth of the burrow. They are very inquisitive animals and often approached very near to new objects like my camera without hesitation.

DISCUSSION

The Marsh mongoose (*Herpestes palustris*) was found to have quite similar habits as the Small Indian mongoose (*Herpestes auropunctatus*) but is more active during the early mornings and late afternoons, whereas the Small Indian mongoose hunts throughout the day. The Marsh mongoose is also very shy and cautious like the Small Indian mongoose and lives in burrows in the ground. Its ecological niche is slightly different in that the burrows are on the mud-banks of the East Calcutta swamps near the water's edge. Like the Small Indian mongoose, the Marsh mongoose also has the habit of standing up on its hind legs for better vision.

In the original description of *H. palustris* the author reported that they fed on fishes and the pond snail (*Pila globosa*). However, the marsh mongoose was never seen trying to capture fish. No pond snails were seen or collected from the Salt lake swamps. On the contrary, they were seen biting and crunching bivalve shells (*Lamilledens marginalis*) and gastropod molluscs (*Bellamya bengalensis*). In the original description of the species it was mentioned that the specimens had strong cusps in their molar teeth while their premolars were less pointed. This adaptation is more

suitable for crunching and grinding hard-shelled molluscs and crabs. They were also seen taking Giant water bugs and diving beetles which possess hard elytra and wing membranes.

The Marsh mongoose gives birth before the monsoon between April-June. This is probably because the cubs after being weaned, feed on small insects and molluscs which become abundant during the monsoon. In the original description it was also mentioned that a lactating female was collected in June. Like the Small Indian mongoose, the Marsh mongoose also has a litter of 2-3 inside a burrow. Only females take care of young ones protecting them fiercely against predators like monitor lizards.

DEDICATION & ACKNOWLEDGEMENTS

This paper is dedicated in the memory of Dr. R.K. Ghose, former Scientist of Zoological Survey of India, Calcutta, who described this species of mongoose. I thank the Director, ZSI for permission to carry out this study. I am grateful to Dr. R.A. Khan, Dr. N.C. Nandi, Dr. Sujit Chakraborty, Mr. Subhendu Sekhar Saha and Mr. Srikumar Chattopadhyay of ZSI, Calcutta for their valuable suggestions. Thanks are also due to Mr. Partho Ghose and Mr. Shyamal Mukherjee for accompanying me in two of the field trips.

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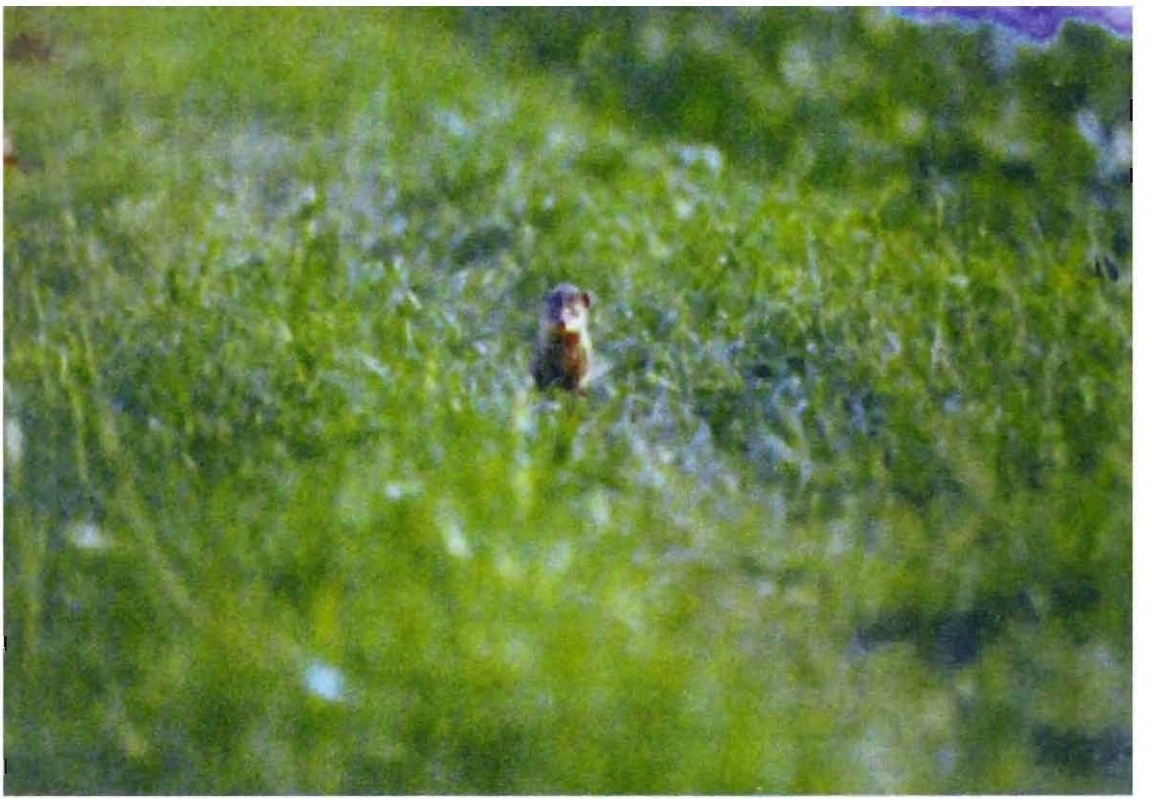
PLATE I



Marsh mongoose (Juvenile)

Marsh mongoose (Adult)

Rec. zool. Surv. India : **108**(Part–2) : 51-65, 2008

FISH FAUNAL DIVERSITY IN A PADDY FIELD FROM TAMILNADU

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INTRODUCTION

Paddy fields are widespread and are integral parts of the landscape, especially in India. Standing water is more important to rice than most other cultivated plants. Although biological cycles are interrupted by cultivation, colonization in the aquatic phase can be rapid by zooplankton, benthos and nektonic animals along with phytoplankton and macrophytes. There is a rapid buildup of diversity of aquatic organisms after the planting of rice. Although this profusion of species may be short-lived their production biologically can be very high. Many attempts are known to have been made earlier to culture prawn and fish in the rice fields. As for the agricultural pests many studies have been conducted. But no detailed account is available on the fish faunal composition of paddy fields during aquatic and semiaquatic phases. Hence studies pertaining to aquatic and semiaquatic phases of rice fields were undertaken with special reference to fish faunal composition.

MATERIAL AND METHODS

From April 1998 to March 2000, regular monthly collections were made from a paddy field near Chennai in Singaperumalkoil. Though the studies were carried out in an area of 4.5 ha of paddy field behind Singaperumalkoil railway station, yet they were confined mostly to an easily accessible plot of $100m^2$. Fishes were mostly collected by using fish traps and bag nets besides cast-nets. A total of 2,866 specimens belonging to 35 species were collected and detailed in the paper. The list provides relevant references, material collected which included, length range and register numbers in parenthesis followed by size attained and habitat.

PISCES

Though fishes were the most dominant group in this ecosystem they were not collected during certain months when only fry and juveniles were present. The following 35 species were recorded during the study period.

Division TELEOSTEI
Subdivision OSTEOGLOSSOMORPHA
Order OSTEOGLOSSIFORMES
Suborder NOTOPTEROIDEI
Family NOTOPTERIDAE

1. ***Notopterus notopterus*** (Pallas)

Subdivision EUTELEOSTEI
Superorder OSTARIOPHYSI
Order CYPRINIFORMES
Family CYPRINIDAE
Subfamily DANIONINAE
Tribe OXYGASTERINI

2. ***Salmostoma clupeoides*** (Bloch)

Tribe DANIONINI

3. ***Amblypharyngodon microlepis*** (Blkr.)
4. ***Chela cachius*** (Ham.)
5. ***Chela laubuca*** (Ham.)
6. ***Esomus danricus*** (Ham.)
7. ***Esomus thermoicos*** (Val.)
8. ***Rasbora caverii*** (Jerdon)
9. ***Rasbora daniconius*** (Ham.)

Subfamily CYPRININAE
Tribe SYSTOMINI
Subtribe SYSTOMI

10. ***Puntius amphibius*** (Val.)
11. ***Puntius chola*** (Ham.)
12. ***Puntius conchonius*** (Ham.)
13. ***Puntius dorsalis*** (Jerdon)
14. ***Puntius melanostigma*** (Day)
15. ***Puntius sharmai*** Menon & Rema Devi
16. ***Puntius sophore*** (Ham.)
17. ***Puntius vittatus*** (Day)
18. ***Puntius ticto*** (Ham.)

Family COBITIDAE
Subfamily COBITINAE

19. ***Lepidocephalus thermalis*** (Val.)

Order SILURIFORMES
Family BAGRIDAE
Subfamily BAGRINAE

20. ***Mystus bleekeri*** (Day)
21. ***Mystus gulio*** (Ham.)
22. ***Mystus vittatus*** (Bloch)

Family SCHILBEIDAE
Subfamily SCHILBEINAE

23. ***Pseudeutropius atherinoides*** (Bloch)

Family HETEROPNEUSTIDAE

24. ***Heteropneustes fossilis*** (Bloch)

Superorder ACANTHOPTERYGII
Series ATHERINOMORPHA
Order BELONIFORMES
Suborder ADRIANICHTHYOIDEI
Family ADRIANICHTHYIDAE
Subfamily ORYZINAE

25. ***Oryzias carnaticus*** (Jerdon)

Order CYPRINODONTIFORMES
Family POECILIDAE
Subfamily POECILINAE

26. ***Gambusia affinis*** (Baird & Girard)

Series PERCOMORPHA
Order SYNBRANCHIFORMES
Suborder MASTACEMBELOIDEI
Family MASTACEMBELIDAE
Subfamily MASTACEMBELINAE

27. ***Macrognathus pancalus*** (Ham.)

Order PERCIFORMES
Suborder PERCOIDEI
Family CHANDIDAE

28. ***Chanda nama*** (Ham.)
29. ***Parambassis ranga*** (Ham.)

Suborder LABROIDEI
Family CICHLIDAE

30. ***Etroplus maculatus*** (Bloch)
31. ***Oreochromis mossambica*** (Peters)

Suborder GOBIOIDEI
Family GOBIIDAE
Subfamily GOBIINAE

32. ***Glossogobius giuris*** (Ham.)

Suborder ANABANTOIDEI
Family BELONTIDAE
Subfamily MACROPODINAE

33. ***Pseudosphromenus cupanus*** (Val.)

Subfamily TRICHOGASTERINAE

34. ***Colisa fasciatus*** (Schn.)

Suborder CHANNOIDEI
Family CHANNIDAE

35. ***Channa punctatus*** (Bloch)

DETAILS OF COLLECTION

1. ***Notopterus notopterus*** (Pallas)

1769. *Gymnotus notopterus* Pallas, *Spicil. Zoologica*, Part 7, p. 40 Pl. 6, Fig. 2.
1999. *Notopterus notopterus*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 9-10.

Material : 1 ex., 26.x.99, (162) (F 6340).

Size : 6.1 cm T.L. usually much smaller upto 25 cm.

Habitat : Throughout India, fresh (Rivers, swamps, canals) and brackish water.

2. ***Salmostoma clupeoides*** (Bloch)

1782. *Cyprinus clupeoides* Bloch, *Naturges Ausland, Fische.* 12, p. 49, pl. 408.

1999. *Salmostoma clupeoides*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 27.

Material : 1 ex., 28.x.98, (88), (F 6259); 1 ex., 21.ix.99, (101), (F 6275); 1 ex., 24.vi.99, (81), (F 6307); 2 exs., v.99, (70-110), (F 6508).

Size : 15.0 cm T.L.

Habitat : Usually upper drainages of large rivers (Peninsular India).

3. ***Amblypharyngodon microlepis*** (Bleeker)

1853. *Leuciscus microlepis* Bleeker, *Verh. Batav. Genoot. Kunst. Wet.*, 25, p. 141.

1991. *Amblypharyngodon microlepis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 337-338.

Material : 5 exs., 16.vii.98, (31-46), (F 5578); 2 exs., 28.i.99, (33-34), (F 6231); 5 exs., 28.x.98, (19-40), (F 6263); 3 exs., 24.vi.99, (23-34), (F 6298); 4 exs., 24.viii.99, (28-33), (F 6461); 1 ex., 7.iii.00, (62), (F 6472); 1 ex., i.00, (25); 1 ex., iii.00, (30), (F 6547).

Size : 10.0 cm T.L.

Habitat : Ponds, ditches, nullahs, slow moving streams.

4. ***Chela cachius*** (Hamilton)

1822. *Cyprinus (Chela) cachius* Hamilton, *Fishes of Ganges*, pp. 258, 384.

1991. *Chela cachius*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 313-314.

Material : 4 exs., i.00, (8), (F 6518); 8 exs., 16.vii.98, (8), (F 5582); 1 ex., 28.viii.98, (31), (F 5598); 4 exs., 8.x.98, (29-33), (F 6036); 4 exs., 24.viii.99, (20-35.5), (F 6463); 2 exs., 21.ix.99, (25-26), (F 6485); 85 exs., 28.xii.99, (17-39), (F 6492); 2 exs., v.99, (32-33), (F 6505); 1 ex., 25.xii.98, (22), (F 6213); 5 exs., 28.i.99, (22-24), (F 6227); 42 exs., 28.x.98, (20-28), (F 6257); 1 ex., 24.vi.99, (38), (F 6289); 1 ex., 26.x.99, (35), (F 6341); 1 ex., 26.x.99, (30), (F 6350).

Size : 6.0 cm T.L.

Habitat : Ponds, ditches and rivers in plains (Throughout India).

5. ***Chela laubuca*** (Hamilton)

1822. *Cyprinus laubuca* Hamilton, *Fishes of Ganges*, pp. 260, 384.

1991. *Cyprinus laubuca*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 316-317.

Material : 36 exs., 16.vii.98, (33-40), (F 5581); 4 exs., 8.x.98, (27-36), (F 6035); 1 ex., 25.xi.98, (38), (F 6197); 11 exs., 24.xii.98, (25-41), (F 6212); 20 exs., 28.i.99, (34-56), (F 6226); 10 exs., 26.ii.99, (28-33), (F 6247); 28 exs., 28.x.98, (20-42), (F 6258); 37 exs., 24.vi.99, (29-44), (F 6290); 2 exs., 26.x.99, (40-42), (F 6342); 29 exs., 24.viii.99, (18.5-43), (F 6462); 227 exs., 28.xii.99, (17-48), (F 6491); 6 exs., v.99, (32-47), (F 6504); 3 exs., i.00, (29-39), (F 6519).

Size : 5.5 cm T.L.

Habitat : Streams both shallow and relatively deeper areas, shallow clear freshwater ponds, canals, ditches (Throughout India).

6. ***Esomus danricus*** (Hamilton)

1822. *Cyprinus danrica* Hamilton, *Fishes of Ganges,* pp. 325-390, pl. xvi, fig. 88.

1991. *Esomus danricus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries,* Vol. **I** : 377-378.

Material : 4 exs., 25.xi.98, (37-58), (F 6200); 52 exs., 24.xii.98, (36-49), (F 6215); 10 exs., 28.i.99, (35-69), (F 6230); 32 exs., 26.ii.99, (30-47), (F 6244); 7 exs., 28.x.98, (32-42), (F 6260); 21 exs., 24.vi.99, (39-67), (F 6291); 7 exs., 28.vii.99, (21.5-55), (F 6458); 150 exs., 28.xii.99, (15-28), (F 6493); 6 exs., i.00, (21.5-38), (F 6520).

Size : 12.5 cm T.L.

Habitat : Ponds, ditches and irrigation canals (Throught India).

7. ***Esomus thermoicos*** (Valenciennes)

1842. *Nuria thermoicos* Valenciennes, *Hist. nat. Poiss.,* **16** : 238, pl. 472.

1991. *Esomus thermoicos*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 378-379.

Material : 96 exs., 16.vii.98, (35-48), (F 5579); 22 exs., 28.viii.98, (23-48), (F 5593); 16 exs., 25.xi.98, (25-46), (F 6199); 172 exs., 24.xii.98, (32-48), (f 6214); 30 exs., 28.i.99, (36-41), (F 6229); 144 exs., 26.ii.99, (30-41), (F 6245); 43 exs., 28.x.98, (32-46), (F 6261); 5 exs., 21.ix.99, (22-37), (F 6277); 7 exs., 24.vi.99, (27-35), (F 6291); 56 exs., 28.vii.99, (30-44), (F 6352); 1 ex., iii.00, (35), (F 6543).

Size : 12.7 cm T.L. usually 6.0-10.0 cm.

Habitat : More common in muddy ditches, ponds and canals (Peninsular India).

8. ***Rasbora caverii*** (Jerdon)

1849. *Leuciscus caverii* Jerdon, *Madras J. Sci. and Lit.*, **15**, p. 320.

1991. *Rasbora caverii*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 388-389.

Material : 16 exs., 16.vii.98, (25-38), (F 5580); 11 exs., 28.viii.98, (25-37), (F 5594); 13 exs., 28.vii.99, (27-50), (F 6364); 2 exs., i.00, (34-35), (F 6522).

Size : 7.0 cm T.L.

Habitat : Lowland forest streams and ponds to mountain streams (Peninsular India).

9. ***Rasbora daniconius*** (Hamilton)

1822. *Cyprinus daniconius* Hamilton, *Fishes of Ganges,* p. 327, pl. 15, fig. 89.

1999. *Rasbora daniconius*, Jayaram, *The Freshwater Fishes of the India Region* : 82-83.

Material : 10 exs., 25.xi.98, (31-43), (F 6198); 10 exs., 24.xii.98, (33-44), (F 6211); 39 exs., 28.i.99, (26-50), (F 6228); 11 exs., 26.ii.99, (20-45), (F 6246); 32 exs., 28.x.98, (21-43), (F 6262); 3 exs., 21.ix.99, (47-50), (F 6276); 104 exs., 24.vi.99, (19-42), (F 6308); 1 ex., 26.x.99, (49), (F 6353); 12 exs., 28.vii.99, (42-56), (F 6353); 24.viii.99, (23-40); (F 6460).

Size : 10.0 cm T.L.

Habitat : Clear but slow flowing streams, ponds and ditches in the plains chiefly with sandy substrate. (Throughout India)

10. ***Puntius amphibius*** (Valenciennes)

1842. *Capoeta amphibia* Valenciennes, *Hist. Nat. Poiss.*, **16** : p. 282, pl. 478.

1999. *Puntius amphibius*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 85-86.

Material : 1 ex., 16.vii.98, (45), (F 5583); 1 ex., 26.ii.99, (44), (F. 6249); 1 ex., 21.ix.99, (60), (F 6278); 1 ex., 24.vi.99, (34), (F 6294); 1 ex., 28.xii.99, (28).

Size : 9.0 cm T.L.

Habitat : Streams and ponds in the plains (Peninsular India).

11. ***Puntius chola*** (Hamilton)

1822. *Cyprinus chola* Hamilton, *Fishes of Ganges*, pp. 312.

1991. *Puntius chola*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 363-365.

Material : 1 ex., 21.ix.99, (40), (F 6279); 1 ex., 24.vi.99, (48), (F 6295); 2 exs., 24.viii.99, (21-41), (F 6464); 1 ex., v.99, (60), (F 6509).

Size : 15.0 cm T.L., commonly 12.0 cm.

Habitat : Rivers, streams and tanks in the plains.

12. ***Puntius conchonius*** (Hamilton)

1822. *Cyprinus conchonius* Hamilton, *Fishes of Ganges,* pp. 317-389.

1991. *Puntius conchonius*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 266.

Material : 1 ex., 21.ix.99, (56), (F 6280).

Size : 12.5 cm T.L.

Habitat : Fast flowing hill streams.

13. ***Puntius dorsalis*** (Jerdon)

1849. *Systomus dorsalis* Jerdon, *Madras J. Lit. & Sci.*, **15** : 314.

1991. *Puntius dorsalis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 368-369.

Material : 1 ex., 26.ii.99, (35), (F 6250); 1 ex., 21.ix.99, (24), (F 6480).

Size : 25.0 cm T.L., commonly 12 to 15 cm.

Habitat : Rivers and streams, particularly pebbly substrate (Peninsular India).

14. ***Puntius melanostigma*** (Day)

1878. *Barbus melanostigma* Day, *Fishes of India*, p. 573, pl. 143, fig. 1.

1999. *Puntius melanostigma*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 96-97.

Material : 1 ex., 24.vi.99, (24), (F 6309).

Size : 10.0 cm T.L.

Habitat : Hill streams (Peninsular India).

15. ***Puntius sharmai*** Menon and Rema Devi

1992. *Puntius sharmai* Menon and Rema Devi, *J. Bombay nat. Hist. Soc.*, **89**(3): 353-354.

1999. *Puntius sharmai*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 100.

Material : 10 exs., 17.vii.98, (22-23), (F 5585); 9 exs., 28.viii.98, (35-50), (F 5595); 13 exs., 8.x.98, (25-29), (F 6033); 3 exs., 24.xii.98, (20-22), (F 6217); 6 exs., 28.i.99, (18-23), (F 6233); 1 ex., 26.ii.99, (23), (F 6248); 55 exs., 28.x.98, (21-24), (F 6264); 3 exs., 28.vii.99, (28-31), (F 6355); 4 exs., 24.vi.99, (18-21), (F 6299); 4 exs., 24.viii.99, (18-25).

Size : 2.7 cm S.L.

Habitat : Freshwater ponds, Tamilnadu.

16. ***Puntius sophore*** (Hamilton)

1822. *Cyprinus sophore* Hamilton, *Fishes of Ganges,* pp. 310, 389, pl. 129, fig. 86.

1991. *Puntius sophore*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 288-289.

Material : 2 exs., 16.vii.98, (44-45), (F 5584); 7 exs., 28.viii.98, (22-60), (F 5596); 4 exs., 25.xi.98, (32-36), (F 6201); 2 exs., 29.i.99, (41-42), (F 6232); 1 ex., 26.ii.99, (42), (F 6252); 1 ex., 28.x.98, (36), (F 6265); 3 exs., 21.ix.99, (22-46), (F 6282); 15 exs., 24.vi.99, (28-42), (F 6296); 3 exs., 26.x.99, (21-60), (F 6345); 14 exs., 28.vii.99, (28-44), (F 6354); 12 exs., 24.viii.99, ((24-46), (F 6465); 12 exs., 21.ix.99, (20-38), (F 6479); 7 exs., 28.xii.99, (25-50), (F 6496); 25 exs., v,99, (15.5-23), (F 6510); 4 exs., i.00, (43-59), (F 6523).

Size : 18.0 cm T.L.

Habitat : Rivers, streams and ponds in the plains (Throughout India).

17. ***Puntius vittatus*** Day

1865. *Puntius vittatus* Day, *Proc. zool. Soc. Lond.*, p. 303.

1991. *Puntius vittatus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 293-294.

Material : 2 exs., 24.vi.99, (63-66), (F 6301); 5 exs., 28.vii.99, (18-22), (F 6357); 1 ex., iii.00, (20), (F 6546).

Size : 5.0 cm T.L., commonly 3.5 cm.

Habitat : Pond, streams, lakes in the plains, common in paddy fields (Peninsular India).

18. ***Puntius ticto*** (Hamilton)

1822. *Cyprinus ticto* Hamilton, *Fishes of Ganges,* pp. 314, 398, pl. 8, figs. 87.

1991. *Puntius ticto*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 291-292.

Material : 20 exs., 16.vii.98, (29-36), (F 5586); 5 exs., 28.viii.98, (42-48), (F 5597); 2 exs., 8.x.98, (29-33), (F 6034); 50 exs., 25.xi.98, ((17-38), (F 6202); 2 exs., 21.xii.98, (27-31), (F 6216); 6 exs., 28.i.99, (30-36), (F 5234); 7 exs., 26.ii.99, (24-32), (F 6251); 3 exs., 28.x.98, (18-30), (F 6266); 15 exs., 21.ix.99, (21-37), (F 6281); 13 exs., 24.vi.99, (18-31), (F 6297); 8 exs., 26.x.99, (36-39), (F 6344); 27 exs., 28.viii.99, (25-38), (F 6356); 17 exs., 24.viii.99, (19-41), (F 6466); 20 exs., 21.ix.99, (18-28), (F 6478); 13 exs., 28.xii.99, (16.5-19), (F 6497); 21 exs., v.99, (25-39), (F 6512); 19 exs., i.00, (32-40), (F 6524); 6 exs., ii.00, (22-25), (F 6534); 4 exs., iii.00, (25-28), (F 6545).

Size : 20.0 cm T.L.

Habitat : Rivers, streams, ponds in clear waters chiefly with muddy substrate (Throughout India).

19. ***Lepidocephalus thermalis*** (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. Nat. Poiss.*, **18** : 78.

1991. *Lepidocephalus thermalis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **I** : 527-528.

Material : 2 exs., 16.vii.98, (34-35), (F 5587); 1 ex., 25.xi.98, (41), (F 6203); 2 exs., 24.xii.98, (31.5-32), (F 6218); 5 exs., 28.i.99, (35-45), (F 6235); 1 ex., 26.ii.99, (34), (F 6253); 1 ex., 28.x.98, (30), (F 6267); 2 exs., 24.vi.99, (26-31), (F 6300); 1 ex., 28.vii.99, (40), (F 6358); 1 ex., 21.ix.99, (40), (F 6482); 2 exs., 28.xii.99, (23-25); 1 ex., i.00, (35.5), (F 6525); 3 exs., ii.00, (29-31), (F 6535); 2 exs., iii.00, (30-34), (F 6548).

Size : 5.8 cm S.L.

Habitat : Clear slow streams with sandy bottom (Peninsular India).

20. ***Mystus bleekeri*** (Day)

1877. *Macrones bleekeri* Day, *Fishes of India* : 451, pl. 101, fig. 1.

1991. *Mystus bleekeri*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 558-559.

Material : 3 exs., v.99, (91-96), (F 6513); 1 ex., 21.ix.99, (87), (F 6283); 4 exs., 26.x.99, (88-98), (F 6346); 1 ex., 24.viii.99, (59), (F 6467); 1 ex., 21.ix.99, (122), (F 6489).

Size : 13.5 cm T.L.

Habitat : Upper reaches of rivers Northern India : Southern limit upto Mahanadi rivers (New record for T.N.).

21. ***Mystus gulio*** (Hamilton)

1822. *Pimelodus gulio* Hamilton, *Fishes of Ganges,* pp. 201, 379, pl. 23, fig. 66.

1991. *Mystus gulio*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 560-561.

Material : 1 ex., 21.x.99, (78), (F 6240).

Size : 46.0 cm T.L.

Habitat : Estuaries, tidal rivers and lakes ascending to freshwaters and entering the sea (Throughout India).

22. ***Mystus vittatus*** (Bloch)

1797. *Silurus vittatus* Bloch, *Ichth. Hist. Nat.*, **11** : 40, pl. 371, fig. 2.

1991. *Mystus vittatus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 573-574.

Material : 1 ex., i.00, (15).

Size : 21.0 cm T.L.

Habitat : Rivers, streams, ponds and lakes in the plains (Throughout India).

23. ***Pseudeutropius atherinoides*** (Bloch)

1794. *Silurus atherinoides* Bloch, *Natuges ausland Fische.*, **8** : 48, pl. 371, fig. 1.

1991. *Pseudotropius atherinoides*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 606-607.

Material : 3 exs., 28.x.98, (19-21), (F 6268); 1 ex., 21.ix.99, (58), (F 6490); 5 exs., 28.xii.99, (19-21); 3 exs., ii.00, (28-31), (F 6536).

Size : 15.0 cm T.L.

Habitat : Rivers and estuaries (Throughout India except Kerala).

24. ***Heteropneustes fossilis*** (Bloch)

1794. *Silurus fossilis* Bloch, *Naturges ausland Fische*, **8** : 46, pl. 370, fig. 2.

1991. *Heteropneustes fossilis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 689-690.

Material : 1 ex., 28.viii.98, (111), (F 5599); 4 exs., 25.xi.98, (77-115), (F 6204); 1 ex., 26.x.99, (110), (F 6347); 3 exs., 21.ix.99, (71-101), (F 6488).

Size : 30.0 cm T.L.

Habitat : Ponds, ditches, jheels, swamps, marshes and muddy rivers (Throughout India).

25. ***Oryzias carnaticus*** (Jerdon)

1848. *Aplocheilus melastigmus* Jerdon, *Madras J. Lit. & Sci.*, **15** : 331.

1998. *Oryzias carnaticus*, Tyson R, Roberts, *Ichthyological Research.* The Icthyological Society of Japan : 213-224.

Material : 2 exs., 16.vii.98, (22-23), (F 5588); 1 ex., 28.viii.98, (F 5601); 1 ex., 28.i.99, (21), (F 6243).

Size : 4.0 cm T.L.

Habitat : Brackish water and estuaries, shallow lagoons, swamps, mangroves, readily adapt to freshwater conditions and breed in freshwater (Peninsular India).

26. ***Gambusia affinis*** (Baird and Girard)

1853. *Heterandia affinis* Baird and Girard, *Proc. Acad. Nat. Sci. Philad.*, **6** : 390.

1991. *Gambusia affinis*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 756-757.

Material : 1 ex., 28.viii.98, (17), (F 5600); 41 exs., 25.xi.98, (14-29), (F 6205); 16 exs., 24.xii.98, (15-27), (F 6219); 24 exs., 28.i.99, (18-35), (F 6238); 21 exs., 26.ii.99, (16-24), (F 6254); 3 exs., 28.x.98, (20-43), (F 6269); 2 exs., 24.vi.99, (20-34), (F 6293); 3 exs., 24.viii.99, (28-36), (F 6470).

Size : 6.0 cm T.L.

Habitat : Throughout India.

27. ***Macrognathus pancalus*** (Hamilton)

1822. *Macrognathus pancalus* Hamilton, *Fishes of Ganges*, pp. 30, 364, pl. 22, fig. 7.

1991. *Macrognathus pancalus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 1027-1028.

Material : 1 ex., 26.ii.99, (35), (F 6250); 1 ex., 21.ix.99, (24), (F 6480).

Size : 18.0 cm T.L.

Habitat : Freshwater rivers of plains and estuaries (Throughout India).

28. ***Chanda nama*** (Hamilton)

1822. *Chanda nama* Hamilton, *Fishes of Ganges*, pp. 109, 371, pl. 39, fig. 37.

1991. *Chanda nama*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 799-800.

Material : 6 exs., 8.x.98, (30-33), (F 6038); 2 exs., 24.xii.98, (25-35), (F 6223); 22 exs., 28.i.99, (22-30), (F 6236); 4 exs., 28.x.98, (22-30), (F 6271); 8 exs., 21.ix.99, (28-30), (F 6285); 5 exs., 24.vi.98, (25-30), (F 6303); 5 exs., 24.viii.99, (19-21); 1 ex., v.99, (59), (F 6538); 16 exs., ii.99, (18-27), (F 6538); 23 exs., iii.00, (20-26), (F 6553).

Size : 11.0 cm T.L.

Habitat : Freshwater (Both standing and running waters), Brackish waters (Throughout India).

29. ***Parambassis ranga*** (Hamilton)

1822. *Chanda ranga* Hamilton, *Fishes of Ganges*, pp. 113, 371, pl. 6, fig. 38.

1999. *Parambassis ranga*, Jayaram, *The Freshwater Fishes of the Indian Region* : 370-371.

Material : 26 exs., 8.x.98, (27-30), (F 6037); 28 exs., 25.xi.98, (27-32), (F 6207); 1 ex., 24.xii.98, (22), (F 6224); 1 ex., 28.i.99, (35), (F 6237); 3 exs., 26.ii.99, (26-30), (F 6255); 11 exs., 28.x.98, (20-32), (F 6272); 1 ex., 21.ix.99, (51), (F 6286); 4 exs., 24.vi.99, (20-24), (F 6304); 7 exs., 28.vii.99, (24-30), (F 6363); 7 exs., 24.viii.99, (23-28), (F 6471); 23 exs., 21.ix.99, (26-31), (F 6476).

Size : 7.0 cm T.L., usually 5 cm.

Habitat : Fresh and brakish waters (Throughout India).

30. ***Etroplus maculatus*** (Bloch)

1785. *Chaetodon maculatus* Bloch, *Syst. Ichth.*, pl. 427, fig. 2.

1991. *Etroplus maculatus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 885.

Material : 1 ex., 24.xii.98, (41), (F 6220); 1 ex., 24.vi.99, (30), (F 6302); 1 ex., 28.vii.99, (59), (F 6360); 1 ex., 28.xii.99, (31), (F 6500); 1 ex., iii.00, (34), (F 6489).

Size : 7.5 cm T.L.

Habitat : Coastal freshwater, common in paddy fields, tanks, occasionally in backwaters with tidal influence. (Peninsular India).

31. ***Oreochromis mossambica*** (Peters)

1852. *Chromis mossambicus* Peters, *Montab. Akad. Wiss. Berlin*, p. 681.

1991. *Oreochromis mossambica*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 887-888.

Material : 7 exs., 16.vii.98, (35-63), (F 5592); 2 exs., 28.viii.98, (15-17); 5 exs., 25.xi.98, (50-60), (F 6210); 21 exs., 28.i.99, (27-35), (F 6239); 3 exs., 28.x.98, (32-54), (F 6270); 23 exs., 21.ix.99, (58-90), (F 6288); 2 exs., 26.x.99, (69-110), (F 6348); 2 exs., 28.vii.99, (53-68), (F 6361); 1 ex., 24.viii.99, (27); 17 exs., 7.iii.00, (29-103), (F 6473); 13 exs., 21.ix.99, (69-82), (F 6474); 5 exs., 21.ix.99, (68-83); 1 ex., 28.xii.99, (37), (F 6501); 4 exs., v.99, (15.5-52), (F 6517).

Size : Exotic species, widely distributed.

Habitat : Throughout India.

32. ***Glossogobius giuris*** (Hamilton)

1822. *Gobius giuris* Hamilton, *Fishes of Ganges*, pp. 51, pl. 33, fig. 15.

1991. *Glossogobius giuris*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 936.

Material : 1 ex., 28.i.99, (67), (F 6240); 2 exs., 21.i.99, (108-111), (F 6475).

Size : 30.0 cm T.L., usually 15.0 cm.

Habitat : Freshwaters, estuaries (Throughout India).

33. ***Pseudosphromenus capanus*** (Valenciennes)

1831. *Polycanthus cupanus* Cuvier (in C & V), *Hist. Nat. Poiss.*, **7** : 357.

1999. *Pseudosphromenus cupanus*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 300.

Material : 13 exs., 16.vii.98, (27-34), (F 5590); 25 exs., 25.xi.98, (28-31), (F 6208); 7 exs., 24.xii.98, (23-29), (F 6221); 3 exs., 26.ii.99, (20-28), (F 6250); 1 ex., 28.x.98, (28), (F 6274); 3 exs., 24.vi.99, (20-24), (F 6305); 4 exs., 24.viii.99, (21-25), (F 6468); 1 ex., 21.ix.99, (39), (F 6481); 1 ex., 28.xii.99, (16).

Size : 7.5 cm T.L.

Habitat : Fresh (Lentic condition with thick vegetation and floating plants) and brackish waters (Peninsular India).

34. ***Polycanthus fasciatus*** (Bloch and Schneider)

1801. *Trichogaster fasciatus* Bloch and Schneider, *Syst. Ichth.*, p. 164, pl. 36.

1999. *Polycanthus fasciatus*, Menon, *Rec. zool. Surv. India, Occ. Paper No.* **175**, p. 297-298.

Material : 6 exs., 16.vii.98, (28-30), (F 5589); 3 exs., 25.xi.98, (20-23), (F 6209); 1 ex., 24.xii.98, (25), (F 6222); 9 exs., 28.i.99, (27-39), (F 6241); 6 exs., 21.ix.99, (32-35), (F 6287); 3 exs., 26.x.99, (29-30), (F 6349); 7 exs., 28.vii.99, (29-38), (F 6362); 6 exs., 21.ix.99, (25-38), (F 6477); 17 exs., v.99, (28-30), (F 6514); 1 ex., iii.00, (30), (F 6551).

Size : 12.5 cm T.L.

Habitat : Freshwater rivers, lakes and estuaries free floating weedy environment (Throughout India).

35. ***Channa punctatus*** (Bloch)

1793. *Ophiocephalus punctatus* Bloch, *Naturges ausland. Fische*, **7** : 139, pl. 358.

1991. *Channa punctatus*, Talwar and Jhingran, *Inland Fishes of India and Adjacent countries*, Vol. **II** : 1020-1021.

Material : 4 exs., 16.vii.98, (63-83), (F 5591); 12 exs., 25.xi.98, (53-110), (F 6206); 8 exs., 24.xii.98, (52-96), (F 6225); 2 exs., 28.x.98, (58-110), (F 6273); 10 exs., 24.vi.99, (24-81), (F 6306); 1 ex., 28.vii.99, (90), (F 6359); 6 exs., 24.viii.99, (52-104), (F 6469); 3 exs., 21.ix.99, (41-98), (F 6487).

Size : 30.4 cm T.L., commonly but only up to 11 cm in the plains.

Habitat : Large freshwater tanks, ponds, swamps (Throughout India).

DISCUSSION

From the paddy field ecosystem a total of 35 species under 14 families and 7 orders were collected and their frequency of abundance and occurrence are as follows. Most of the species encountered are known to inhabit quite flowing or stagnant shallow waters with vegetation and

with the sandy or muddy substrates in the low lands. Some are known to occur in coastal marshes also. Species which were encountered almost throughout or for most part of the year are the following in their order of occurrence viz., *Puntius ticto, Esomus thermoicos, Parambassis ranga, Rasbora daniconius, Chela cachius, Chela laubuca, Puntius sharmai, Puntius sophore, Gambusia affinis, Lepidocephalus thermalis, Oreochromis mossambica, Esomus danricus, Chanda nama, Colisa fasciatus, Pseudosphronemus cupanus, Channa punctatus* and *Amblypharyngodon microlepis.* However species which are known to inhabit fast flowing and deeper upland waters where also occasionally encountered in the paddy fields viz. *Rasbora caverii, Salmostoma clupeoides, Puntius conchonius, Puntius dorsalis, Puntius melanostigma* and *Mystus bleekeri.* The occurrence of these species could be due to waters flooding the paddy fields from a perennial tank situated not far off.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, Kolkata and to the Officer-in-charge Southern Regional Station, Zoological Survey of India, Chennai for encouragement and facilities. The help rendered by Miss. K. Valarmathi, S.R.F. is greatly acknowledged.

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Rec. zool. Surv. India : **108**(Part–2) : 67-73, 2008

OBSERVATIONS ON THE LIFE HISTORY AND CHAETOTAXY OF *STREPSICRATES RHOTHIA* (MEYRICK) (MICROLEPIDOPTERA : TORTRICIDAE : EUCOSMINI)

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INTRODUCTION

Strepsicrates rhothia (Meyrick) was formerly placed under the genus *Spilonota* Hubner by Meyrick (1910) and Diakonoff (1950). Later Clark (1958) after examination of the male genitalia suggested a new combination of the species under genus *Strepsicrates* Meyrick. Fletcher (1914) reported *Eugenia jambolana* as its larval food plant from India whereas Clarke (1958) reported *Psidium guava* as its larval food plant from Sri Lanka. During the course of present studies, the larval food plant of *Strepsicrates rhothia* has been recorded as *Woodfordia fruticosa* (Linnaeus) (Lyrthraceae) (Plate -1, Fig. 5) from Sekhupur, Khalian, Sahni, Phagwara (Distt. Kapurthala, Punjab, India). The life history as well as chaetotaxy of the speices under reference has been studied for the first time on *Woodfordia fruticosa.*

Methodology : Survey were conducted in different localities of Punjab from 2001-2004 to collect immature stages of *Strepsicrates rhothia* Meyrick. The eggs and different larval instars brought from field were kept in circular transparent containers, (each measuring 10 cm in diameter and 4.5 cm in depth). Subsequently, the later instars were shifted to relatively larger transparent containers (12 × 7 cm, 15 × 20 cm and 18 × 23 cm) furnished with fresh clippings of the food plants. The mature larvae nearing pupation were then shifted to still bigger rearing containers (18.5 cm in diameter and 12.5 cm depth) for pupation. The freshly emerged adults were transferred to the insect breeding cages of varied sizes. The rearing boxes were carefully examined twice a day in order to make observations on different life history aspects. The rearing boxes were cleaned at regular intervals by removing the faecal matter, dead insect stages and left over food plant clippings etc. for maintaining proper hygienic conditions. The fresh host plant cuttings were provided to the larvae for their proper development and also to minimize the mortality rate due to starvation.

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The gross morphology, colouration and measurements of the eggs, different larval instars and the pupae were recorded with the help of occulometer, taking a mean of 5 specimens of each stage. The newly emerged adults were kept on an artificial diet consisting of 10% sugar solution to record their longevity. For the purpose of examination of chaetotaxy, the last instar larvae were first killed by dipping in boiling hot water before preserving them in nine parts of 75% ethyl alcohol and one part of glycerine (Stehr, 1987). Some of the individuals were also killed in KAAD solution (10 ml kerosene, 90 ml 95% ethyl alcohol, 20 ml glacial acetic acid and 10 ml dioxane) to preserve the original colouration of the larvae, as advocated by Peterson (1948). The larvae were kept in this solution for a few minutes to half an hour depending upon the size of the larva for full distension, before storing the same in 95% ethyl alcohol. After dehydration, the chaetotaxy of the head was examined by placing the same in glycerine in a cavity slide. For skin preparation, the body of each larva was stained in 1% eosin solution, followed by dehydration and clearing in xylene before mounting it permanently on a glass slide in Canada balsam. For naming the setae and pores, the nomenclature proposed by Heinrich (1916), Hinton (1946) and Stehr (1987) has been followed. The terminology for naming the setae of the A_{10} segment has been adopted from Allyson (1976) and Stehr (1987).

OBSERVATIONS

Life History Stages and Developmental time :

Egg (Plate-1, Fig. 2) : Incubation period : 3.75 ± 0.35 days.

Length 0.57 ± 0.03, width 0.48 ± 0.10; scale-like, somewhat oval in shape, chorion rough with minute small reticulations; cream, turns dark orange-red after two days, three black spots appear on egg surface prior to hatching; laid singly or in a batch of 2 to 4 on both lower and upper sides of leaf.

Larva : Number of instars : 04.

Larval duration : 17.25 ± 1.75 days.

First instar : Duration : 4.25 ± 0.35 days.

Head : Width 0.15 ± 0.03 mm, black, hypognathus.

Body : Length 1.25 ± 0.20 mm, width 0.18 ± 0.02 mm; pale cream, thoracic shield brownish-black; prolegs and thoracic legs of body colour.

Second instar : Duration : 3.50 ± 0.70 days.

Head : Width 0.30 ± 0.00 mm; light brown.

Body : Length 3.30 ± 0.96 mm, width 0.38 ± 0.10 mm; pale-brown; thoracic shield shinning pale-brown; segmentation clear, intersegmental region white, intestine green, visible through transparent skin.

Third instar : Duration : 3.25 ± 0.35 days.

Head : Width 0.63 ± 0.10 mm; same as above.

Body : Length 6.00 ± 1.00 mm, width 0.59 ± 0.19 mm; pale cream; otherwise same as in second instar.

Fourth instar (Plate-1, Fig. 3) : Duration : 6.25 ± 0.35 days.

Head : Width 1.00 ± 0.00 mm; light brown.

Body : Length 12.30 ± 2.58 mm, width 1.28 ± 0.03 mm; colour of larva light brownish-green, middorsal and subdorsal blackish-brown stripes appear; anal shield broadly black at posterior and lateral margins, otherwise shiny watery-white.

Pupa (Plate-1, Fig. 4) : Duration : 7.00 ± 1.00 days.

Length 8.50 ± 0.50 mm; width 2.75 ± 0.50; newly formed pupa cream, after 4 to 5 hours turns brown, approaching eclosion it becomes black; mesothorax with median carinate ridge usually extending along the cephalic half, indistinct on metathorax; second abdominal segment with two rows of spines distinct.

Adult longevity : 7.00 ± 1.00 days.

Adult (Plate-1, fig. 1) : Alar expanse : 12-14 mm.

Vertex and frons decorated with long, dark, fuscous scales; labial palpi fuscous with some ochreous scales, porrect, second segment long, slender, third segment minute, drooping; antennae filiform, dark fuscous in colour, about 3/4th length of forewing; forewing with costa arched, apex rounded, termen oblique, tornus obtuse, anal margin straight, greyish fuscous in colour, with light greyish-brown and creamy suffusion, dark oblique area from apex towards anal margin, costa with fine costal strigulae, anal and termen margin with cilia greyish-fuscous in colour; hindwing quadrate, grey scale, fringes grey with dark sub-dorsal shade; legs whitish-ochreous in colour, tarsal segment with yellow and fuscous band.

OBSERVATIONS ON BEHAVIOUR

Larval behaviour : The entire egg-shell is almost consumed by the first instar, leaving behind only a minute scar-like portion. The first instar larva folds the margins of the tender leaf with the help of silken threads to make a concealment, which is formed by joining 3-5 leaves together in the later instars. The first instar larva feeds on the upper epidermis and chlorophyll of the leaf, leaving behind the vein network and lower epidermis. The succeeding two instars follow the same pattern and mode of feeding except that they do so on rather older leaves. The last instar consumes all layers and vein network of the leaf leaving behind the midrib alone. The faecal matter is always thrown out of the concealment in older instars. All instars, when disturbed, show drop off behaviour

by silken threads or express splashing movements. The last instar when pinched with forceps exhibits spasmodic quick movements.

Moulting behaviour : It takes about 10-11 hours by the larva to shed off its skin.

Pupation : While attaining maturity, the larva stops feeding and remains in concealment. The colour of larva changes to orangish-brown, which turns maroonish-pink after 4-5 hours. The prepupa is brownish-green and this stage lasts for two days. The pupa is formed inside the leaf fold. The body moult remians at the pointed anal end of the pupa.

Pupal parasitoid : The different larval instars brought from field for further rearing in the laboratory undergo normal process of pupation. In many cases adult Hymenopteran parasitoids emerged after 4-5 days of the pupation instead of adult moth.

Eclosion : It is observed that eclosion takes place in the morning hours between 6.00 a.m. to 9.00 a.m.

Adult behaviour : The adult moths were seen emerging from the pupae in captivity and they mated on second day of emergence in the morning hours. The end to end mating lasts about 45 minutes to 1 hour. After twenty-four hours of mating, it was observed that the female laid single eggs on either surface of the leaf. A few eggs were also noticed on the bottom and walls of the glass jar.

Chaetotaxy of Last Instar :

Cephalic chaetotaxy (Plate-2, Figs. 1, 2) : Cranium moderately sclerotized, golden brown; median epicranial suture much shorter in length than lateral adfrontal suture; frontoclypeus longer than broad; ecdysial line close to lateral adfrontal suture at base, otherwise well apart; stemmatal area not well differentiated from rest of cranium, beset with six stemmata, 1-6 stemmata arranged in a semicircle; in all 17 tactile setae, 4 proprioceptors and 8 pores present on each half of head capsule; all setae spine-like, arise from pinacula.

Frons comprised seta F_1 and pore Fa; F_1 closer to lateral margin of frons, directly posterad to C_2; puncture Fa beset near median longitudinal line of head capsule, present anterodorsad to F_1. Clypeal group comprises setae C_1 and C_2; C_1 close to epicondyle, shorter than C_2; C_2 shifted towards median longitudinal line. Afrontal group bears two setae AF_1, AF_2 and one pore AFa; AF_2 longer than AF_1, situated in level to point where lateral adfrontals join median epicranial suture, AF_1 anterad and mesad to AF_2; pore AFa close to AF_1 than AF_2. Anterodorsal area present inbetween stemmata and adfrontal area, bears setae A_1, A_2, A_3 and pore Aa; A_1 in level of stemmata 3, lies towards median longitudinal line; A_2 posterolaterad to A_1, but slightly anterad to A_3; A_3 situated above the stemmata 2 and posterolaterad to A_2; $A_3 > A_1 > A_2$ lengthwise; pore Aa lies close and posteromesad to A_2. Posteriodorsal group compires setae P_1 and P_2 along with pores Pa and Pb; P_1 longer than P_2 and anterolaterad to AF_2; P_2 posterolaterad to P_1; pore Pa nearly equidistant from P_1

and P_2 and lies anterolaterad to P_1; pore Pb situated near P_1, but lies in level of P_2. Seta L_1 represents lateral group; L_1 anterolaterad to P_2. Stemmatal area decorated with setae S_1, S_2 and S_3; S_1 situated inside the stemmatal semicircle, close but dorsocaudad to stemmata 3; S_2 dorsolaterad to stemmata 1; S_3 anterocaudad to S_2; $S_3 > S_2 > S_1$ lengthwise. Substemmatal area studded with setae SS_1, SS_2 and SS_3 with pore SSa; SS_1 ventrad to stemma 6; SS_2 caudad to stemma 6; SS_3 posterad to SS_2; $SS_3 > SS_2 > SS_1$ lengthwise; pore SSa close and anterodorsad to SS_3. Genal group represented by seta MG_1 and pore MGa; MG_1 lies at lower and rear portion of head; pore MGa lies anteroventrad to MG_1. Dorsal epicranial area graced with proprioceptor setae MD_1, MD_2, MD_3 and pore MDa; MD_1 dorsad to P_2; MD_2 lies in middle of MD_1 and MD_3; MD_3 posterodorsad to MD_2; pore MDa lie posterodorsad to MD_2.

Thoracic chaetotaxy (Plate-2, Fig. 5) : XD, dorsal, subdorsal, subventral, ventral groups and proprioceptors mounted on pinacula.

T_1 (Plate-2, Fig. 3) : Prothoracic shield brown, well sclerotized, elongated, roughly trough shaped, anterior margin straight, posterior margin with edges rounded; each half comprises six setae and two pores; XD group lie near anterior margin of shield; XD_1 anterodorsad to XD_2; XDa present posterodorsad to XD_1; pore XDb dorsad to XD_2; XDa and XD_1 situated close to each other. Dorsal group present near posterior margin of shield; D_1 posterodorsad to XD_1 and close to middorsal line; D_2 anterolaterad to D_1; D_1 and D_2 closer than XD_1 and XD_2; D_2 longer than D_1. Setae SD_1 and SD_2 of subdorsal group lying near lateral margin of shield; SD_1 anterolaterad to and longer than SD_2; latter anterolaterad to D_2. Lateral group trisetose, composed of setae L_1, L_2 and L_3 raised on common long pinaculum, present anterior to spiracle; L_1 and L_2 lie close to each other than L_3; L_1 ventrad to SD_2; L_2 anterad to L_1; L_3 posteroventrad to L_1; $L_1 > L_3 > L_2$ lengthwise. Subventral group located above leg base, bisetose, beset on common pinaculum; SV_2 shorter and anterad to SV_1. Ventral seta V_1, present below coxa near midventral line. Microscopic setae comprises two groups MXD and MV; MXD_1 close to D_1 and D_2 and lie close to anterior margin of thoracic shield; MV_3 posteroventrad to MV_2.

T_2 and T_3 (Plate-2, Fig. 4) : Dorsal group represented by two setae D_1 and D_2 raised on common rounded pinaculum; D_1 anterodorsad to and smaller than D_2. Subdorsal group bisetose with setae SD_1 and SD_2; SD_1 and SD_2 beset on common oblong pinaculum, present anterolaterad to dorsal pinaculum; SD_1 posterolaterad to SD_2; SD_1 much longer than SD_2. Lateral group composed of setae L_1, L_2 and L_3; L_1 and L_2 lie on common pinaculum and close to each other; L_1 anteroventrad to SD_1; L_2 anteroventrad to L_1; L_3 posterodorsad to L_2; $L_1 > L_2 = L_3$ lengthwise. Subventral group comprises only single seta SV_1, posteroventrad to L_3. Seta V_1 situated ventrad to base of leg near midventral line. Microscopic seta MD_1 situated close to anterior margin of segment and anterolaterad to D_2; proprioceptors MSD_1 and MSD_2 lie anterad to subdorsal pinaculum; MSD_1 anterodorsad to MSD_2; microsetae MV_1, MV_2 and MV_3 lie opposite leg; MV_3 posteroventrad to MV_1 and latter anteroventrad to MV_2.

Abdominal Chaetotaxy :

A_1, A_2, A_7, A_8 (Plate-2, Figs. 8, 10, 11) : Setae of dorsal group D_1 and D_2 lie near middorsal line of segment; D_1 lies near middorsal line of segment and anterodorsad to D_2; latter longer and posteroventrad to D_1; in segment A_8, D_2 almost posterad to D_1. Subdorsal group represented by setae SD_1 and SD_2; SD_1 longer than SD_2; SD_2 microscopic in segments A_1 and A_2; SD_1 posterodorsad to spiracle; SD_2 anterodorsad to spiracle; in segment A_7, SD_1 lies directly above spiracle; SD_2 anterodorsad to spiracle; in segment A_8, SD_1 anterodorsad to spiracle; SD_2 anteroventrad to SD_1; latter and SD_2 lie on common oval pinaculum. Lateral group trisetose, represented by setae L_1, L_2 and L_3; L_1 and L_2 lie on common pinaculum and lie all apart from L_1; $L_3 > L_1 > L_2$ lengthwise; L_1 anteroventrad to spiracle; L_2 anterodorsad to L_1; L_3 posteroventrad to L_1. Setae SV_1, SV_2 and SV_3 subventral group; in segments A_1 and A_2 subventral group trisetose, anteroventrad to L_3; SV_2 anteroventrad to SV_1; SV_3 anterodorsad to SV_1; $SV_1 > SV_3 > SV_2$ lengthwise; in segments A_7 and A_8, subventral group bisetose with setae SV_1 and SV_2; SV_1 anteroventrad to L_3; SV_2 smaller and anteroventrad to SV_1. Ventral seta V_1 present near midventral line. Proprioceptors MD and MV present; MD_1 lie close to anterior margin of segment and anterolaterad to D_1; in segment A_7 and A_8, MV_3 lies anteroventrad to SV_2.

A_3, A_4, A_5 and A_6 (Plate-2, Figs. 7, 9) : Prolegs present on these segments. Setae D_1 and D_2 comprise dorsal group; D_2 posteroventrad and longer than D_1. Setae SD_1 and SD_2 make up subdorsal group; SD_1 situated above spiracle and anteroventrad to D_2; seta SD_2 very minute and anteroventrad to SD_1. Lateral group comprises three setae L_1, L_2 and L_3; L_1 and L_2 lie on common pinaculum and close to each other; L_2 anterolaterad to spiracle; L_1 posteroventrad to L_2; L_3 wide apart and posteroventrad to L_1; $L_3 > L_1 > L_2$ lengthwise. Subventral group trisetose with setae SV_1, SV_2 and SV_3 situated on dorsal area of proleg; SV_1 anteroventrad to L_3; SV_2 lies inbetween SV_1 and SV_3 and anteroventrad to SV_1; SV_3 anteroventrad to SV_2; $SV_1 > SV_2 > SV_3$ lengthwise. Towards ventral meson, lies seta V_1 of ventral group. Proprioceptor MD_1 present anterolaterad to D_1; microscopic seta MV_3 present infront of coxa. Crochets biordinal and arranged in circle.

A_9 (Plate-2, Fig. 12) : Dorsal group representated by setae D_1 and D_2; latter lies near middorsal line of segment and longer and posterodorsad to D_1; D_2 setae of both sides share common oval pinaculum. Subdorsal group unisetose with seta SD_1 lying on oblong pinaculum with seta D_1; SD_1 posterolaterad to D_1. Lateral group trisetose with setae L_1, L_2 and L_3 lying on oblong common pinaculum; L_2 posteroventrad to SD_1; L_1 posteroventrad to L_2; L_3 posteroventrad to L_1; $L_1 > L_2 > L_3$ lengthwise. Subventral group bisetose; SV_1 posterodorsad to SV_2. Seta V_1 lies near midventral line. Microscopic setae MD and MV present; MD_1 anterolaterad to D_2; MV_3 anteroventrad to SV_2.

A_{10} (Plate-2, Figs. 6, 13) : Anal shield well developed; oblong; anal fork present; D_1 present near anterior margin of shield; D_1 longer than D_2 in length; D_2 lies at distal margin of shield. SD_1

anteroventrad to D_2; SD_2 beset near lateral margin of shield, anteroventrad to SD_1; SD_2 longer than SD_1. Lateral group lies at dorsal margin of anal leg with seta L_1 being anteriormost; L_2 posteroventrad to L_1; L_3 closer and dorsad to L_2; a pore present anterad to L_3. Subventral group comprised of setae SV_1, SV_2, SV_3 and SV_4; SV_1 lies posteroventrad to L_3; SV_2 ventrad to SV_1; SV_3 anteroventrad to L_2; SV_4 posteroventrad to SV_3. Ventral seta V_1 lies near midventral line.

Remarks : The species *Strepsicrates rhothia* (Meyrick) is available during the months of October and November in Kapurthala district of Punjab. The damage done by the species to its food plant is moderate. The species is previously reported from India (Bengal), Sri Lanka and Mauritius (Clarke, 1958). The present record from Kapurthala district of Punjab forms the second report of the species from India.

ACKNOWLEDGEMENTS

The authors are grateful to Ministry of Environment and Forests, Govt. of India, New Delhi for providing financial assistance to undertake the present studies under the project, Monitoring the status of moth component (Lepidoptera : Heterocera) in the biodiversity of North-Western Himalayan Ecosystem. Thanks are due to Dr. M. Sharma, Retd. Professor, Department of Botany, Punjabi University, Patiala for identification of the host plant. Thanks are also due to the Director, Zoological Survey of India for providing facilities in preparing and finalizing the manuscript.

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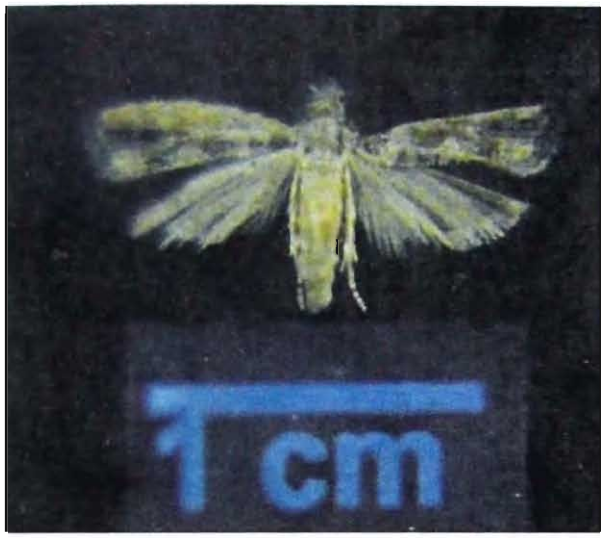
PLATE I



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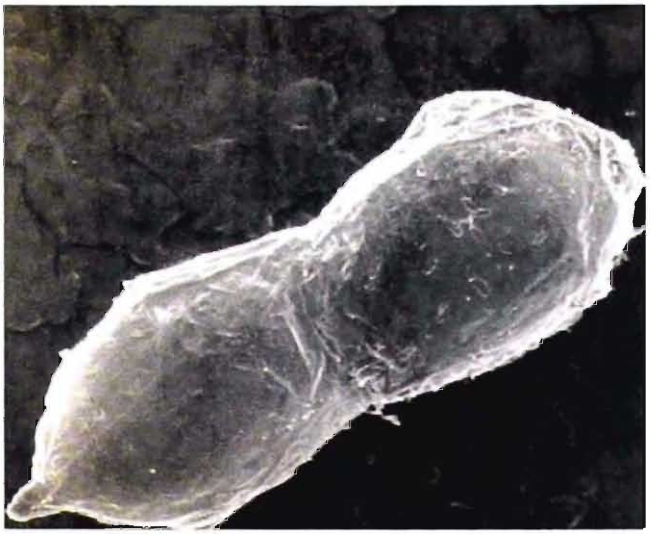

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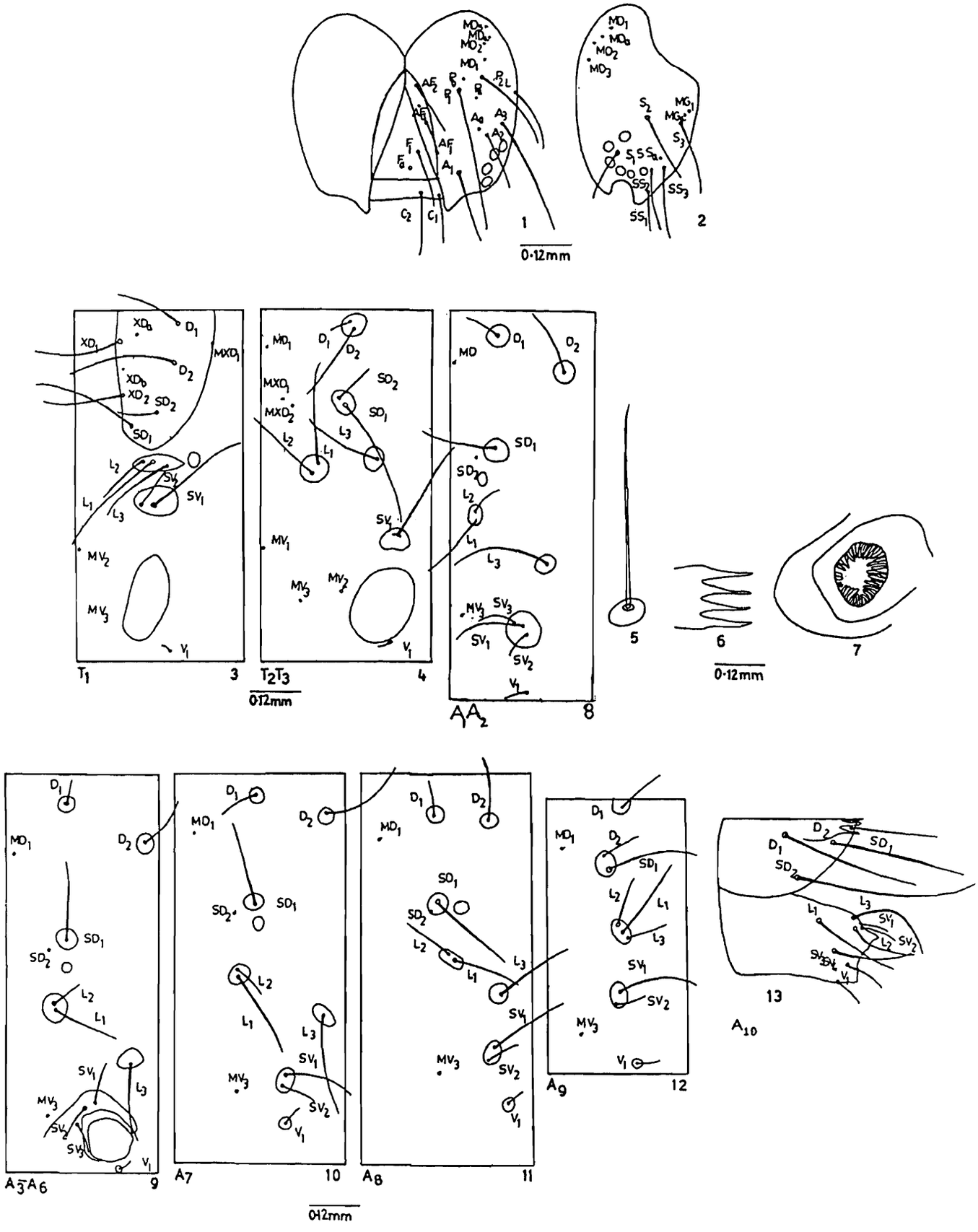
Figs. 1-5 : Life history stages of *Strepsicrates rhothia* Meyrick
1. Adult; 2. Egg; 3. Last Instar Larva; 4. Pupa; 5. Larval Host Plant.

PLATE II



Figs. 1-13.

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POPULATION FLUCTUATION OF *HELICOTYLENCHUS* STEINER, 1945 IN RELATION TO SOIL TEMPERATURE, MOISTURE AND pH IN GUAVA ORCHARD AT SOUTH 24 PARGANAS, WEST BENGAL, INDIA.

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INTRODUCTION

Since the nematodes inhabit the soil microenvironment, the soil factors like temperature, moisture and pH have an important role to influence them, even in managing the nematode population. Jairajpuri *et al.* (1974) studied the effect of pH and salt concentration on the survivality of different nematodes. Rao and Swarup (1975) reported the factors those affect the reproduction, population development and survivality of *Helicotylenchus dihystera.* Jairajpuri and Azmi (1978) showed the aggregation and repulsiveness of nematodes at pH gradient. Shukla *et al.* (1986) studied the population dynamics of *Helicotylenchus* related to soil temperature and moisture. Kamra and Sharma (2000) recorded the distribution of some plant parasitic nematodes in different states of India depending upon the temperature. Influence of soil temperature, moisture and pH on nematodes in various fruit orchards have been studied by Dwivedi *et al.* (1987), Dwivedi, Malhotra and Mishra (1987), Khan and Sharma (1990). Seasonal population fluctuation of nematodes have been reported by Khan *et al.* (1980), Chowdhury and Phukan (1990) and Srivastava *et al.* (2000).

In the present study, the monthly population fluctuation of *Helicotylenchus* Steiner, 1945 was observed in relation to soil temperature, moisture and pH in a guava (*Psidium guajava* L.) orchard, the fruit with immense economic importance in the area of work. The objective of the study is to understand the influence and effect of these soil abiotic factors on the population of this plant parasitic nematodes.

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MATERIALS AND METHODS

The study was carried out in a guava orchard of Experimental Agricultural Farm of Calcutta University, situated at Baruipur Subdivision, South 24 Parganas district. Five soil samples of 250 gm each from five different fixed spots were collected at a depth of 5 to 20 cms from the rhizosphere at monthly interval from May 2004 to April, 2006. The soil samples were processed by sieving and decanting and nematodes were extracted by modified Baermann's funnel technique (Christie and Perry, 1951). Among other different nematodes, the numbers of juveniles and adults of *Helicotylenchus* were counted under low power binocular microscope in a counting dish. Monthly variations of soil temperature, moisture and pH were also recorded for the same period by soil thermometer, moisture meter and pH meter respectively. The average of population obtained from five samples were statistically analysed to determine the correlation between *Helicotylenchus* and the mentioned soil factors.

RESULTS

The most abundant population densities of *Helicotylenchus* occurred in the months of June and July when the soil temperature, moisture and pH were ranging between 31–36°C, 15–30% and 5.6–5.8 respectively. They reached the lowest level of their abundance in September, April and May when the soil factors ranged between 31 to 37°C, 11.2 to 27.5% and 5.7 to 6.2 respectively (Fig. 1). In the other months the population fluctuated without following any definite pattern with an abrupt peak in November, 2004, '05 and January, 2005, '06 with low temperature and moisture but comparatively high pH. In rest of the months the population fluctuated without any abrupt increase or decrease in presence of comparatively lower temperature, and moisture with higher pH.

The relationship of *Helicotylenchus* with soil temperature, moisture and pH can be represented by the following regression equations in the total period of study: $Y = -0.0162X + 31.421$ ($r = -0.155$; $P > 0.10$), $Y = 0.0328X + 14.828$ ($r = 0.188$; $P > 0.10$) and $Y = -0.0025X + 6.2528$ ($r = -0.33$; $P > 0.10$) respectively (Fig. 2 A-C).

DISCUSSION

The maximum abundance of *Helicotylenchus* in June and July may be due to their active breeding, substantiated by the presence of huge number juveniles in these months indicating a suitable soil temperature of 31 to 36°C, soil moisture of 15 to 30% and that of soil pH 5.6 to 5.9. On the contrary, the minimum population abundance occurred in September, 2004, '05 and April, 2005, '06 in the presence of higher soil temperature and pH but with lower soil moisture which is undoubtedly overlapping, except the range of pH with the conditions of maximum population density. But an abrupt population peak in November, 2004, '05 and in January, 2005, '06 can not be explained

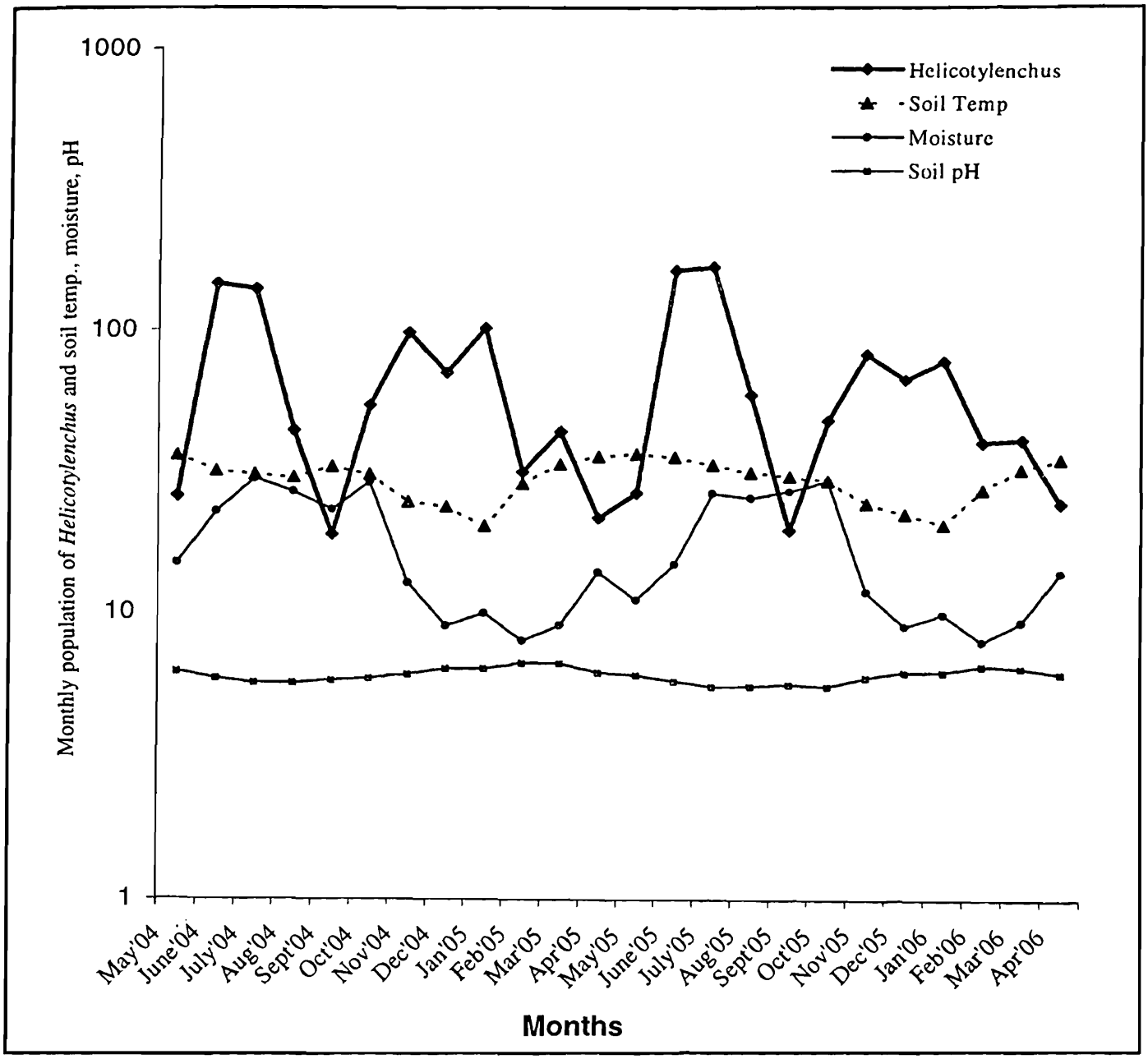
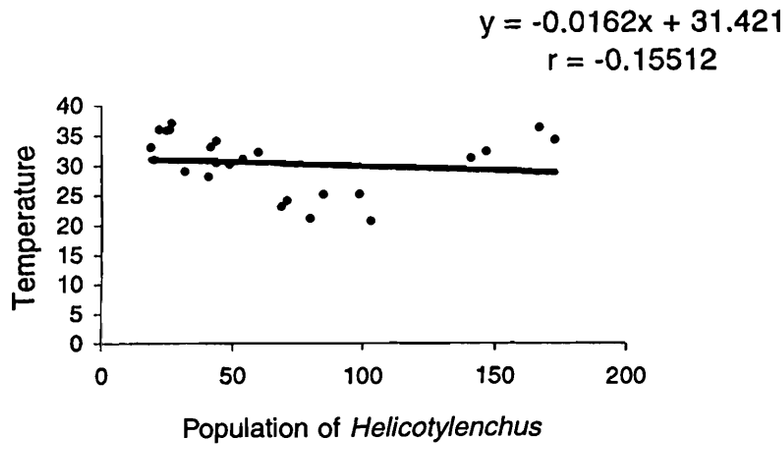


Fig. 1 : Monthly population fluctuation of *Helicotylenchus* Steiner, 1945 in relation to soil temperature, moisture and pH.

when the soil temperature and moisture remained low with higher soil pH. This may be due to their active breeding twice a year.

In the present investigation, high population density was observed in higher soil temperature and moderate to higher soil moisture with an exception in January, 2005, 06 and November, 2004, 06 but Khan *et al.* (1971) reported the optimum temperature of 25°C for population growth of nematodes with no significant effect of rainfall on population change. Ramana *et al.* (1978) also showed 21 to 26°C soil temperature to be most favorable for lance nematodes in monsoon areas which contradicts the present investigation. Chawla and Sharma (1984) also reported 20°C as optimum temperature for the maximum recovery of second stage larva of *Tylenchulus semipenetrans.*



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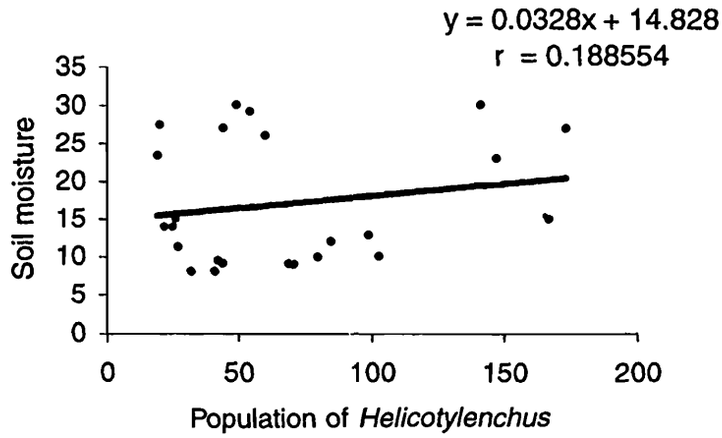

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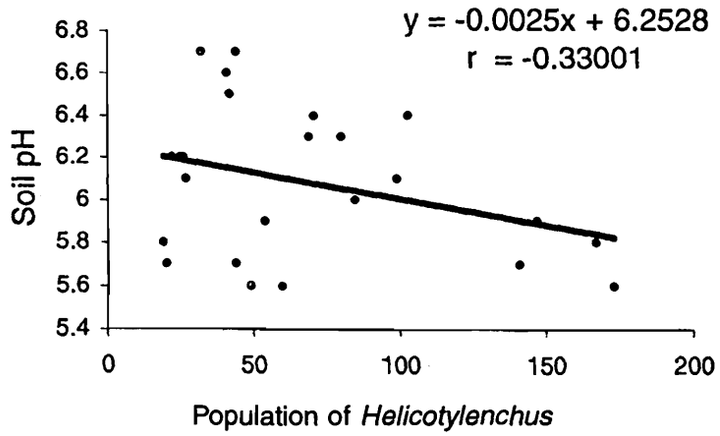

C

Fig. 2 (A-C) : Relation between population of *Helicotylenchus* and soil abiotic factors. (A) with soil temperature, (B) with soil moisture and (C) with soil pH.

Khan and Sharma (1990) correlated the fluctuation of population densities of *Helicotylenchus dihystera* and *Meloidogyne incognita* more with the temperature than with soil moisture, whereas, the variation in the population densities of Tylenchorhynchus *mashhoodi* and *Pratylenchus pratensis* was not explained by the variation in temperature and moisture which is also somewhat true in case of the present study. Sabir (2000) reported the maximum population density of some ecto- and endoparasitic nematodes during the monsoon time (July-August) with a maximum ambient temperature of around 24-37°C, which shows consistency with the present investigation.

The nematodes generally prefer soil pH between 5.0–6.0 and cannot survive in extreme acidic or alkaline soil (Naseem and Jairajpuri, 1982), which is consistent with the present finding. Jairajpuri *et al.* (1974) observed that *Hoplolaimus indicus* and *Helicotylenchus indicus* have a wide range of optimum pH (5.8 to 9.0) for survivality, which can not be substantiated by the present study, done in natural field condition with available pH range in the soil. Chowdhury and Phukan (1995) recorded the maximum population density of some plant parasitic nematodes at a pH level of 5.0 to 5.9, which is logically compatible with the present study.

The regression analyses (Fig. 2 A-C) show a trend of inverse relationship between fluctuations of population density of *Helicotylenchus* with that of soil temperature and pH in the total period of study with an insignificant negative correlation (in both the cases $P > 0.10$). On the other hand, a directly proportional relation found between the population abundance and soil moisture with insignificant positive correlation ($r = 0.188$; $P > 0.10$). Although, some insignificant relationships have been estimated by statistical analysis for the total period of investigation, yet no definite, consistent and constant pattern of monthly population fluctuation of *Helicotylenchus* was observed in relation to the mentioned soil abiotic factors in guava orchard.

SUMMARY

The pattern of monthly population fluctuation of *Helicotylenchus* Steiner, 1945 was observed for two years from May, 2004 to April, 2006 in a guava orchard at South 24 Parganas, West Bengal to explore the influence and effect of some soil abiotic factors on this plant-parasitic nematode. Monthly soil temperature, moisture and pH were recorded to correlate these with the population abundance of the spiral nematode. The highest population was observed in June and July and that of the lowest in April and September. There was no definite, consistent and constant pattern of monthly population fluctuation in relation to these soil abiotic factors. The regression analysis showed insignificant negative correlation between the population of *Helicotylenchus* with soil temperature and pH. An insignificant positive correlation was found with soil moisture.

ACKNOWLEDGEMENT

Authors are grateful to the Director, Zoological Survey of India and to Dr. A.K. Sanyal, Joint Director in Charge, LID (A) to provide all sorts of facilities and to allow to carry out the investigation.

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Rec. zool. Surv. India : **108**(Part–2) : 83-93, 2008

LIMNOLOGICALLY IMPORTANT PHYSICOCHEMICAL PARAMETERS OBSERVED IN MARINE WATER SAMPLES AROUND DIGHA COAST IN BAY OF BENGAL

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INTRODUCTION

Sea water, in addition to containing substantial amount of salt (sodium chloride) contains a variety of important chemical constituents like nitrate, phosphate, sulphate, silicate, chloride of Sodium, Potassium, Magnesium, Iron, Zinc, Nickel, Cobalt, Copper, Lead *etc.* It is well-established fact that the survival and normal well being/viability of the entire Faunal Diversity in an ecosystem depends on composition of such parameters. Any significant alteration in such Chemical and Physical parameters (collectively called as Limnological parameters) as the component of Marine Environment may significantly affect the entire chain and even be catastrophic to a few susceptible living organisms up to the extent of extinction. It is with this view point that we had monitored/ analyzed the associated water samples in respect of important Physical and Chemical parameters as components of limnogical constituent. Such important Physical parameters arc namely : Temperature, Density, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), pH, Conductance, Turbidity *etc.* The Chemical parameters include : Chlorinity, Salinity, Alkalinity, Free Carbon Dioxide, Total Hardness, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Sulphate, Nitrate, Oxylate, Phosphate *etc.*

Although similar studies on such aspects at different places of Indian Ocean as well as Bay of Bengal has been widely carried out by variety of researchers, but very little work at the coastal area surrounding this important tourist place has been carried out. Hence, we are regularly monitoring such water quality parameters as a baseline data for the past fifteen years (ever since the establishment of this centre). As experimental strategy, the water samples collected fortnightly and periodically throughout the year for the consecutive five years (March 1998 to February 2004) have been studied and reported through data vide Table nos. 1-6 respectively.

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Table 1. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 1998 to February 1999.

	Premonsoon		Monsoon		Postmonsoon	
	I	II	I	II	I	II
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	28	30	30	29	27	25
pH	8.00	8.10	7.90	7.80	8.00	8.10
Density	1.018	1.020	1.015	1.012	1.016	1.018
TDS (g/l)	100	110	130	120	110	115
TSS (g/l)	100	105	125	115	105	110
Cond. (mho)	42.80	41.60	40.50	38.00	42.00	40.00
Chlorinity (g/l)	16.00	16.50	13.50	11.50	13.20	14.00
Salinity (g/l)	28.80	29.70	24.30	20.70	23.70	25.20
Alkalinity	28	25	27	26	30	25
Total hardness	600	640	670	525	610	590
Free CO_2	Nil	Nil	Traces	Nil	Nil	Nil
D.O.	9.00	8.70	9.30	9.00	8.90	8.40
B.O.D.	6.00	5.80	6.20	6.00	5.90	5.60
Sulphate	270	300	275	300	310	305
Nitrate (µg/l)	100	110	105	95	100	105
Phosphate (µg/l)	120	145	130	125	120	125

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

Table 2. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 1999 to February 2000.

	Premonsoon		Monsoon		Postmonsoon	
	I	II	I	II	I	II
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	28	30	31	30	27	25
pH	8.05	8.10	8.15	7.90	7.95	8.10
Density	1.015	1.018	1.017	1.016	1.015	1.017
TDS (g/l)	36.10	37.00	30.45	26.00	29.00	31.90
TSS (g/l)	100	110	125	120	110	115
Cond. (mho)	42.00	41.50	40.50	38.50	41.50	40.00
Chlorinity (g/l)	16.00	17.00	15.00	12.00	14.00	15.50

Table 2. : *(Cont'd.).*

Salinity (g/l)	28.50	30.60	27.00	21.60	25.20	27.90
Alkalinity	35	25	20	30	25	25
Total hardness	610	650	670	500	610	590
Free CO_2	Nil	Nil	Nil	Traces	Nil	Nil
D.O.	8.70	9.10	9.00	8.90	9.00	8.50
B.O.D.	5.80	6.00	6.00	5.90	6.00	5.80
Sulphate	290	300	280	310	300	295
Nitrate (µg/l)	100	110	100	90	95	100
Phosphate (µg/l)	125	140	120	130	115	125

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

Table 3. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 2000 to February 2001.

	Premonsoon		**Monsoon**		**Postmonsoon**	
	I	**II**	**I**	**II**	**I**	**II**
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	29	30	30	28	25	26
pH	8.00	8.05	7.95	7.90	8.00	8.05
Density	1.016	1.015	1.018	1.014	1.016	1.017
TDS (g/l)	36.00	35.50	31.50	28.10	30.10	32.00
TSS (g/l)	100	110	120	125	115	110
Cond. (mho)	41.00	41.50	40.00	39.50	40.10	41.50
Chlorinity (g/l)	16.00	16.50	15.50	12.00	13.50	14.50
Salinity (g/l)	28.80	29.70	27.90	21.60	24.30	26.10
Alkalinity	30	25	20	27	35	30
Total hardness	590	600	650	700	620	590
Free CO_2	Nil	Nil	Nil	Nil	Nil	Nil
D.O.	9.00	8.40	9.30	9.00	9.00	8.80
B.O.D.	6.00	5.60	6.20	5.90	6.00	5.80
Sulphate	275	285	275	300	320	290
Nitrate (µg/l)	95	100	90	105	115	95
Phosphate (µg/l)	125	135	110	120	110	130

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

Table 4. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 2001 to February 2002.

	Premonsoon		Monsoon		Postmonsoon	
	I	II	I	II	I	II
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	28	29	30	29	27	26
pH	8.10	7.90	8.00	7.95	8.05	8.00
Density	1.016	1.017	1.018	1.017	1.018	1.016
TDS (g/l)	37.20	38.50	31.50	27.00	30.00	32.50
TSS (g/l)	105	110	125	120	110	105
Cond. (mho)	43.50	42.00	41.50	39.00	42.20	41.00
Chlorinity (g/l)	17.00	18.20	14.50	12.00	14.00	15.00
Salinity (g/l)	30.60	32.70	26.10	21.60	25.20	27.00
Alkalinity	30	35	25	30	20	30
Total hardness	600	630	700	650	645	610
Free CO_2	Nil	Nil	Traces	Nil	Nil	Nil
D.O.	9.00	8.50	9.10	8.80	9.00	9.30
B.O.D.	6.00	5.60	5.90	5.90	6.00	6.10
Sulphate	300	310	295	270	340	350
Nitrate (µg/l)	120	110	105	110	115	95
Phosphate (µg/l)	130	135	120	125	110	130

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

Table 5. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 2002 to February 2003.

	Premonsoon		Monsoon		Postmonsoon	
	I	II	I	II	I	II
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	29	30	31	30	28	25
pH	8.10	8.00	7.90	7.80	8.00	8.05
Density	1.016	1.017	1.018	1.016	1.017	1.018
TDS (g/l)	37.20	38.00	31.00	32.00	31.00	36.00
TSS (g/l)	105	110	105	120	125	130
Cond. (mho)	42.00	41.00	40.60	39.60	39.00	40.60
Chlorinity (g/l)	16.00	17.50	14.00	15.00	16.50	17.00

Table 5. : *(Cont'd.).*

Salinity (g/l)	30.20	32.50	26.00	21.30	25.10	27.20
Alkalinity	28.80	31.50	25.20	27.00	29.70	30.60
Total hardness	650	640	675	550	620	595
Free CO_2	Nil	Nil	Traces	Nil	Nil	Nil
D.O.	9.00	8.70	9.30	9.10	8.90	9.20
B.O.D.	6.00	5.80	6.20	6.00	6.00	6.10
Sulphate	300	290	295	310	305	310
Nitrate (µg/l)	105	112	110	95	98	100
Phosphate (µg/l)	130	125	110	120	115	125

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

Table 6. : Observed Physicochemical values for the sea water samples collected periodically from Digha coast for the period March 2003 to February 2004.

	Premonsoon		**Monsoon**		**Postmonsoon**	
	I	**II**	**I**	**II**	**I**	**II**
Parameter	**Mar–Apr**	**May–Jun**	**Jul–Aug**	**Sep–Oct**	**Nov–Dec**	**Jan–Feb**
Temperature °C	30	31	29	30	27	26
pH	8.00	8.00	7.50	8.00	8.50	8.00
Density	1.017	1,018	1.019	1.015	1.017	1.019
TDS (g/l)	37.00	40.00	35.00	34.00	30.00	38.00
TSS (g/l)	110	115	105	125	120	127
Cond. (mho)	41.50	41.50	40.00	39.00	39.50	40.50
Chlorinity (g/l)	16.50	18.00	15.00	15.50	16.50	17.50
Salinity (g/l)	29.70	42.40	27.00	27.90	29.70	31.50
Alkalinity	28.00	32.50	25.50	25.00	29.00	30.00
Total hardness	655	645	675	540	610	605
Free CO_2	Nil	Nil	Traces	Nil	Nil	Nil
D.O.	9.00	8.50	9.20	9.00	8.80	9.00
B.O.D.	6.00	5.80	6.10	6.00	5.90	6.00
Sulphate	310	295	290	300	325	300
Nitrate (µg/l)	102	110	100	90	105	100
Phosphate (µg/l)	125	135	115	120	125	115

All the values are in mg/l, unless otherwise mentioned—T.D.S. = Total Dissolved Solids; T.S.S. = Total Suspended Solids; D.O. = Dissolved Oxygen; B.O.D. = Biochemical Oxygen Demand.

The seasonal occurrence of commercial sea fish species in this coastal zone is given through Table no. 7. Such data were collected from the Drag net catches by random sampling.

Table 7. : Seasonal abundance of Commercial sea fish species at Digha coastal zone (during the study period : March 1998 to February 2004).

Fish groups	No. of spp. (available in the region)	Season		
		Pre Monsoon	Monsoon	Post Monsoon
Sharks	7	4	7	6
Rays	6	3	6	4
Clupeids	5	5	5	5
Engrualids	3	3	3	3
Sardines	2	1	–	2
Ariids	2	2	2	2
Chirocentrid	1	1	1	2
Harpodon	1	–	1	1
Sillaginids	2	1	2	3
Lates	1	–	1	1
Carangids	3	3	3	3
Serranids	5	3	5	4
Pomfrets	3	3	3	3
Lutjanids	4	4	4	3
Lethrinids	3	3	3	2
Sciaenids	7	4	4	3
Serombrid	1	1	1	1
Trichiurids	3	1	3	3
Leiognathids	2	1	2	4
Mugilids	5	4	5	4

DESCRIPTION OF THE STUDY AREA

Studies observed during the period (March 1998 to February 2004} had been done from the water samples collected around Digha sea beach which is situated close to the Gangetic mouth of the east coast of India at latitude 21°36" N and longitude 87°30" E. The coastline is straight and the beach is flat and compact. Marine water samples were collected in sterile glass bottles at the distance of 10–20 meters inside from the sea surface both at the low and high tides in a stretch of 500 meters on either side of the beach near our Research Centre.

MATERIALS AND METHODS

The physical and chemical parameters like temperature, pH and Dissolved Oxygen were measured immediately after the sampling in the field only. The samples were generally collected regularly once or twice a week throughout the study period for carrying out measurements in the laboratory for both the Physical and Chemical parameters. Surface water temperature, density, total dissolved solids and total suspended solids were measured through conventional means. However, pH and conductance were measured by the Elico pH meter (model No. LI–120) and Elico conductivity meter (model No C.M. 180) respectively. The Chemical parameters like chlorinity/salinity were measured by Argentometric titration. Modified Winkler's method was used for the estimation of Dissolved Oxygen and the Biochemical oxygen Demand (incubating the water sample at 20 +1° C in a BOD incubator model No. C.L. 65, Remi cooling incubator (for five days). Phosphate and Nitrate were determined by Grashoft (1976) method. The remaining chemical parameters like total hardness, free carbon dioxide, alkalinity and sulphate were computed by the estimations developed and defined by Martin (1970), Wilson (1975), Atson (1978), NEERI (1988), Lewis publishers (1990), Nemerow & Dasgupta (1991), APHA (1998).

Because of significant role of monsoon in deciding the general physicochemical composition of Marine water and also in commercial activity of marine living resources, the data are demarcated in three distinct parts; **pre monsoon, monsoon** and the **post monsoon** period. Each season was further subdivided into early and late parts, each representing the block of two months duration.

RESULTS

The mean values for such Limnologically important physicochemical parameters for every two months of interval distinct to pre and post periods of a particular season for all the three climatic conditions are expressed here through the Tables namely no. 1-6, respectively for the period (March 1998–February 2004). The occurrence of free carbon dioxide was distinctly reported only during the monsoon period that too in the traces, The significance of mean values of different parameters reported was analyzed using one way analysis of variance technique : Snecedar and Cochran (1967) for each parameter separately.

From the results observed here, it appears that except the temperature, chlorinity/salinity, conductance as well as dissolved solids, all other parameters remain almost constant to the seasonal/diagonal variations, which depict the normalcy in the general water quality parameters of our study samples taken from around Digha sea beach. The significance of the variation of chlorinity/salinity data with regard to monsoonal change is such that such values increase moderately to significant to higher range from monsoon to post monsoon and further to pre monsoon respectively.

DISCUSSION

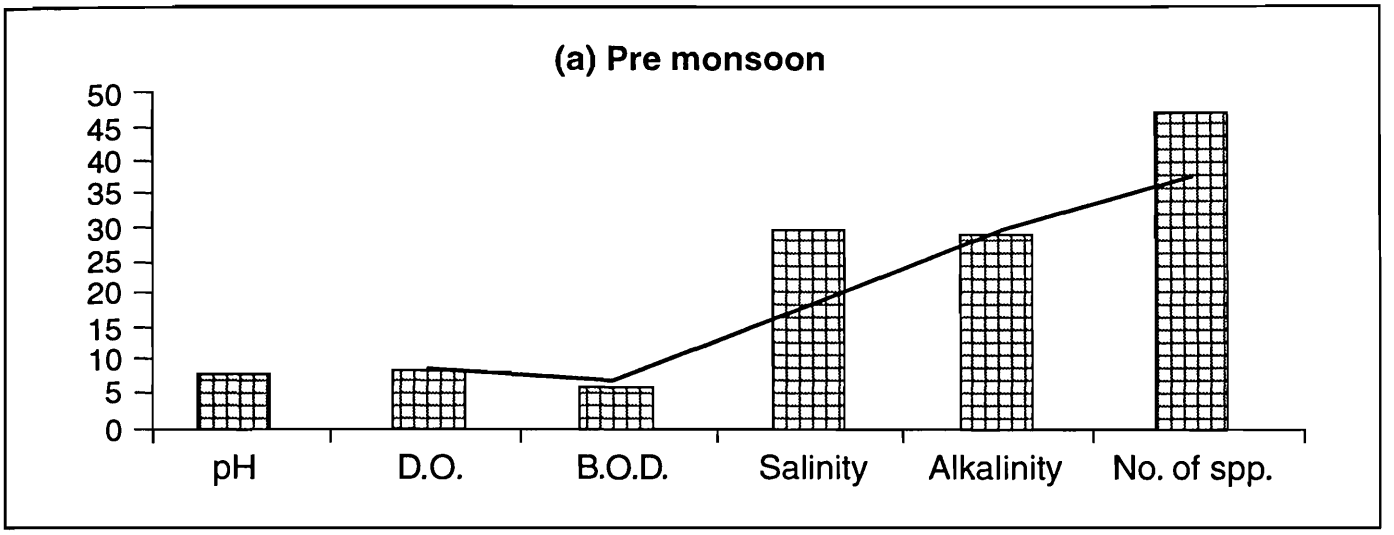
The significance of the present work is highlighted here with the fact that similar studies at various riverine and marine points had been undertaken by sufficient number of workers such as in India by Zingde *et al.* (1980), Mathur *et al.* (1986), Malik *et al.* (1995), Srivastava *et al.* (1996), Elango *et al.* (1992) as well as by ourselves (1999). The significance of such work can be understood with the apprehension that any significant alteration in such physicochemical values may cause catastrophic situation for a large variety of associated marine fauna. Although Digha being a relatively pollution free zone where the general profile of such limnologically important physicochemical parameters remain static, which is due to very insignificant level of contaminants/ pollutants like-heavy metals, pesticides, insecticides/herbicides as well as hydrocarbons in the sea water composition. But our ongoing activity in this regard is of great significance from the pollution measuring as well as limnological observations point of view to prepare a baseline data for further studies.

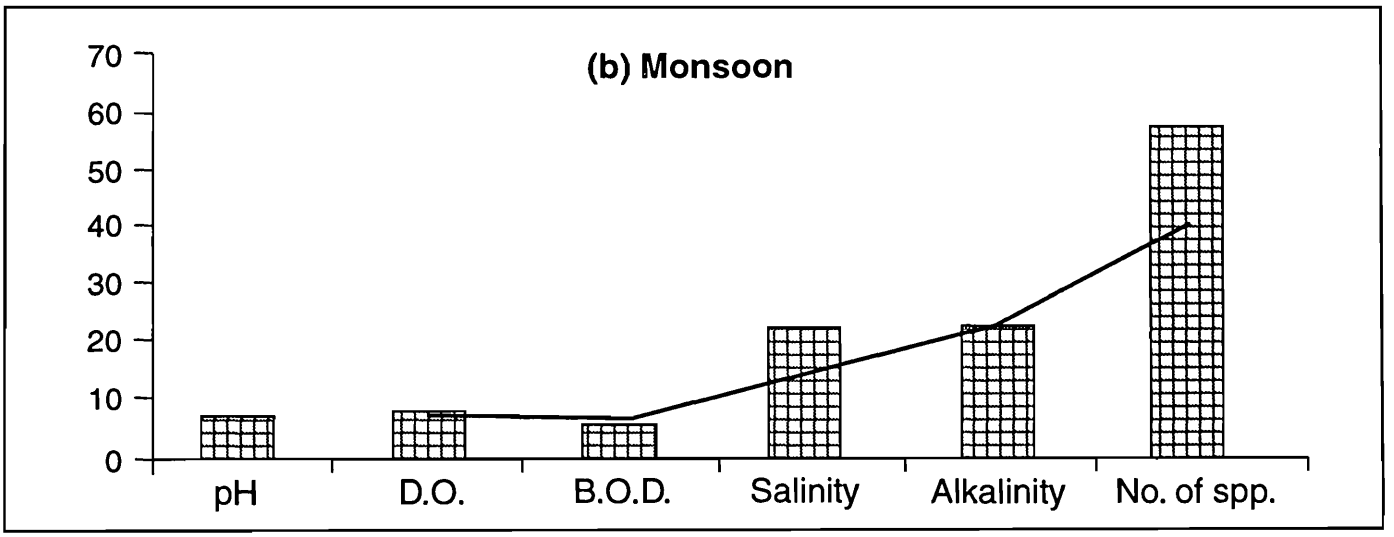
In this regard, it is worth to mention that continuous and indiscriminate use and exposure of such highly toxic substances in and around sea coast will damage the fabric of marine flora and faunal diversity at a very large scale up to the extent of the extinction of certain vulnerable species of fishes, shrimps, phytoplanktons and zooplanktons etc. It is well established fact that the sudden and excessive changes in Dissolved Oxygen, Biochemical Oxygen Demand (BOD), alkalinity, salinity and pH etc. may adversely affect a large number of marine species up to the extent of total disappearance in the chain process. A comparison of the number of fish species available during the pre monsoon, monsoon and post monsoon periods in relation to these Physico-chemical factors is expressed through Figures no. 1 (a-c). From the trend lines, the relationship between dissolved oxygen, alkalinity and the availability of species is evidenced.

It is with this logic that the regular monitoring of such biologically important physicochemical parameters from the coastal marine water samples is being carried out as a broad objective of our laboratory at this center for establishing a database as well as estimating the actual potential and the associated threat of environmental impact from the ongoing hotel as well as agricultural and other miscellaneous activities around this beautiful sea beach which has to be protected at any cost both from the heritage as well as from the commercial fishing point of view as marine commercial fishing is a major source of common people livelihood and also earning potential foreign money. Therefore, ever since the establishment of this laboratory (in 1992), we are regularly monitoring such parameters as ongoing project of immense utility.

SUMMARY

Digha, the small but aesthetically very important place in Eastern Coast is of immense potential value both from tourism as well as commercial fishing point of view. The same is evident from





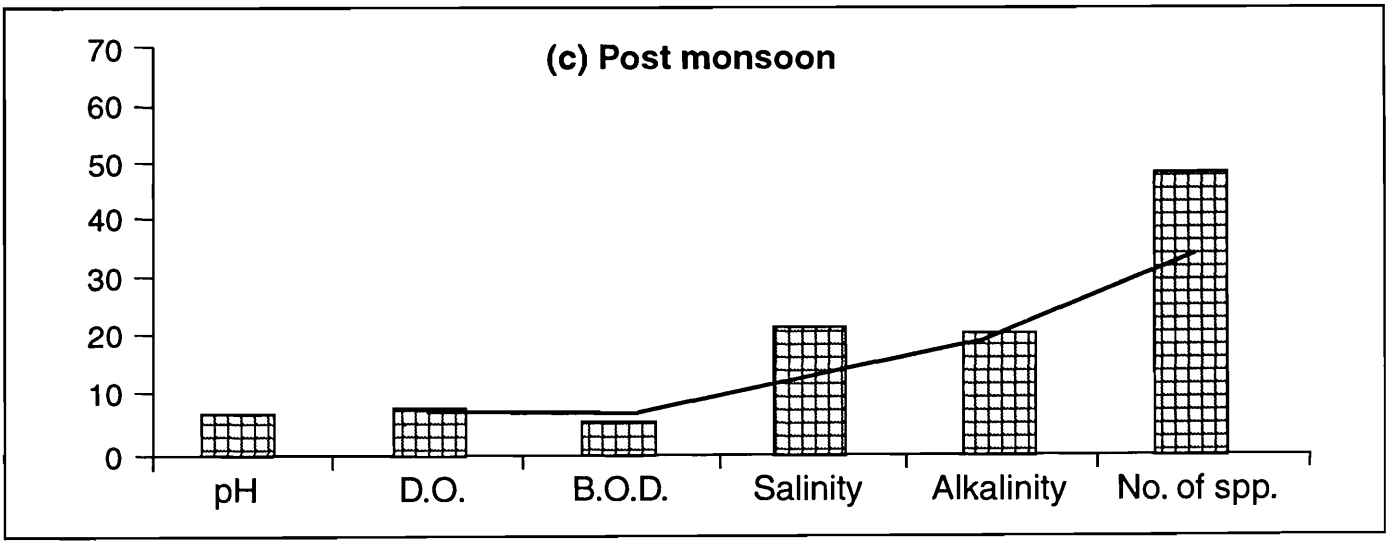


Fig. 1. (a-c) : Comparison of number of fish species available during pre monsoon, monsoon and post monsoon periods in relation to physico-chemical factors.

documented reports of the hotel/tourism as well as marine fish products' commercial venture. For preparing annual profile of limnologically important physicochemical parameters, sea water samples were analyzed as an ongoing project/activity of our Laboratory for furnishing baseline data for industry as well as researchers, which had been the theme of our study for consecutive six years period (March 1998 to Feb. 2004). Such data are very useful for correlating the occurrence and abundance of a particular marine sp. important from the Biological researchers or for the commercial viability point of view. It is scientifically well established fact that sea water quality affects survival and development of diversified faunal asses,

It is with this reason that we had undergone such study to record important physical data like : Temperature, Density, pH, Total Dissolved Solids, Total Suspended Solids, Conductance and Chemical parameters like : Chlorinity, Salinity, Alkalinity, Total hardness, Free Carbon Dioxide, Dissolved Oxygen, Biochemical Oxygen Demand Sulphate, Nitrate, Phosphate. Although general trend of such parameters' constancy is maintained throughout the year except in case of chlorinity/ salinity, which varies significantly raising from monsoon to post monsoon and from post monsoon to pre monsoon period. Our observations reported here for these physicochemical parameters (for past six years-March 1998 to February 2004) merit from the point of view of assessing expected pollution threat from ongoing Agriculture and Hotel activities which release significant amount of harmful pollutants like pesticides/insecticides, hydrocarbons, detergents etc. A small amount of pollution in sea water may alter these vital physicochemical parameters, which in turn may hamper the viability of entire marine faunal diversity affecting the commercial fish product, and livelihood of large number of associated fishermen.

ACKNOWLEDGEMENT

The authors are grateful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata for cooperation and valued suggestions during the course of such study and also for his stewardship in establishing this laboratory and designing this project (as the then Officer-in-Charge of this centre) of ongoing nature of immense utility.

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MOTHS OF BANDHAVGARH NATIONAL PARK, MADHYA PRADESH

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ABSTRACT

The paper deals with the study of 48 species of moths belonging to 42 genera under 10 families collected from different localities of Bandhavgarh National Park by the survey team of Zoological Survey of India, Jabalpur. All the species are reported for the first time from this National Park.

INTRODUCTION

Bandhavgarh National Park (BNP) is located in the Satpura hill ranges of Umaria district. The park lies between 80°57'30"-80°06'15" E longitudes and 23°36'30"-23°42'30" N latitudes. The BNP was notified vide no. 2977/X/68 on 23rd March, 1968. The main entry to the park is through Tala village, which is 35km. north of Umaria town. The park is more or less rectangular in shape and covers an area of 105 sq. km., ranging in altitude from 440.00 meters in the valleys to 811.40 metres on the highest ridge top. The area consists of mainly hillocks of varying sizes interspersed with large number of varying sized valleys. The ground is undulating; the hill tops are flat while the lower portions of valleys are grassy meadows locally called Bah. Most of these Bahs are marshy lands with seepages from ground. The BNP is one of well known National Park in Madhya Pradesh, famous for the healthy population of tigers and variety of herbivores. The vegetation of the National Park is tropical moist deciduous type. Depending upon the main forests species, the forests of BNP may be classified into Sal forests, mixed forests and grasslands.

Order LEPIDOPTERA

Suborder HETEROCERA

I. Family SPHINGIDAE

1. ***Clanis*** sp.

1822. *Clanis* Hubner : 138.

1937. *Clanis*, Bell & Scott, *Fauna Brit. India,* Moths, **5** : 139.

1997. *Clanis*, Mandal & Maulik, *Fauna of West Bengal,* Zool Surv. India, 7 : 622.

Material examined : Umaria, BNP, Tala, 3.10.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 130 mm.

Distribution : India : Throughout including Madhya Pradesh (Umaria). *Elsewhere* : Oriental extending into the Palaearctic and Ethiopian Regions.

2. ***Hippotion boerhaviae*** (Fabricius)

1775. *Sphinx boerhaviae* Fabricius, *Syst. Ent. P.*, : 542.

1937. *Hippotion boerhaviae*, Bell & Scott, *Fauna Brit. India,* Moths, **5** : 424.

1997. *Hippotion boerhaviae,* Mandal & Maulik, *Fauna of West Bengal, zool Surv. India*, **7** : 637.

Material examined : Umaria, BNP, Tala, 3.10.2002, (2ex.), Coll. R. K. Singh.

Wing expanse : 52 mm.

Distribution : India : Madhya Pradesh (Indore, Seoni and Umaria), West Bengal, Andhra Pradesh, Gujarat, Orissa, Sikkim, Southern Peninsula, West Himalaya and Maharashtra. *Elsewhere* : Pakistan, Sri Lanka, Bhutan, South China, Malaya and Philippines.

3. ***Marumba dyras dyras*** (Walker)

1869. *Smerinthus dyras* Walker, *Cat. Lep. Het. Brit. Mus.*, **8** : 250.

1937. *Marumba dyras dyras,* Bell & Scott, *Fauna Brit. India,* Moths, **5** : 179.

Material examined : Umaria, BNP, Tala, 26.9.2002 (2ex.), Coll. M. L. Koshta.

Wing expanse : 92 mm.

Distribution : India : Madhya Pradesh (Hoshangabad and Umaria), Western and Eastern Himalayas, South India and Andaman Islands. *Elsewhere* : Southeast Asia.

4. ***Nephele didyma*** (Fabricius)

1777. *Sphinx didyma* Fabricius, *Syst. Ent.*, : 543.

1937. *Nephele didyma*, Bell & Scott, *Fauna Brit. India,* Moths, **5** : 325.

Material examined : Umaria, BNP, Tala, 19.9.2002, (1ex.), Coll. M. L. Koshta.

Wing expanse-72 mm.

Distribution : India : Madhya Pradesh (Indore, Seoni, Shivpuri, Umaria). Western and Eastern Himalayas, South India, Andaman Islands. *Elsewhere* : Southeast Asia, Pakistan, Afghanistan, New Guinea and Northern Australia.

5. ***Oxyambulyx* sp.**

1903. *Oxyambulyx* Rothschild & Jordan : 192.

1937. *Oxyambulyx,* Bell & Scott, *Fauna Brit. India,* Moths, **5** : 109.

Material examined : Umaria, BNP, Tala, 27.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 120 mm.

Distribution : India including Madhya Pradesh (Umaria). *Elsewhere* : Palaearctic Region to the Philippines.

6. ***Psilogramma menephron menephron*** (Cramer)

1780. *Sphinx menephron* Cramer, *Pap. Exot.,* **3** : 164.

1937. *Psilogramma menephron menephron,* Bell & Scott, *Fauna Brit. India,* Moths, **5** : 77.

Material examined : Umaria, BNP, Tala, 19.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 110 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Nepal, Sri Lanka, China and eastwards to the Solomon Islands and Eastern Australia.

7. ***Rhyncholaba acteus*** (Cramer)

1779. *Sphinx acteus* Cramer, *Pap. Exot.* Ii : 93.

1937. *Rhyncholaba acteus*, Bell & Scott, *Fauna Brit. India*, Moths, **5** : 462.

1982. *Rhyncholaba acteus*, Barlow, *An Introduction to the Moths of South East Asia* : 60.

Material examined : Umaria, BNP, Tala, 30.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 72 mm.

Distribution : India : Madhya Pradesh (Mandla and Umaria), Western and Eastern Himalayas and South India. *Elsewhere* : Sri Lanka, Myanmar to the Moluccas and China.

8. ***Theretra alecto alecto*** (Linnaeus)

1758. *Sphinx alecto* Linnaeus, *Syst. Nat. Ed.*, **10** : 492.

1937. *Theretra alecto alecto,* Bell & Scott, *Fauna Brit. India,* Moths, **5** : 440.

Material examined : Umaria, BNP, Tala, 29.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 80 mm.

Distribution : India : Madhya Pradesh (Indore, Jabalpur, Hoshangabad, Umaria), Western and Eastern Himalayas, and South India. *Elsewhere* : Myanmar, Northward to Formosa, and Eastward to the Key Islands.

9. ***Theretra boisduvali*** (Bugnion)

1839. *Sphinx boisduvali* Bugnion, *Ann. Soc. ent. France*, F : 115.

1937. *Theretra boisduvali*, Bell & Scott, *Fauna Brit. India*, Moths, **5** : 433.

1987. *Theretra boisduvali*, Holloway, *The Moths of Borneo*, Part, **3** : 174.

Material examined : Umaria, BNP, Tala, 25.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 106 mm

Distribution : India : Madhya Pradesh (Seoni and Umaria), Chhattisgarh (Bilaspur) and Sikkim. *Elsewhere* : Sri Lanka, South-west Asia to Sundaland and Lesser Sundas.

10. ***Theretra oldenlandiae oldenlandiae*** (Fabricius)

1775. *Sphinx oldenlandiae* Fabricius, *Syst. Ent.*, : 542.

1937. *Theretra oldenlandiae oldenlandiae*, Bell & Scott, *Fauna Brit. India*, Moths, **5** : 448.

Material examined : Umaria, BNP, Tala, 1.10.2002 (3ex.), Coll. R. K. Singh.

Wing expanse : 70 mm.

Distribution : India : Madhya Pradesh (Indore, Hoshangabad, Umaria), Western and Eastern Himalayas, South India. *Elsewhere* : Sri Lanka, Myanmar to Japan and New Guinea.

II. Family GEOMETRIDAE

11. ***Antitrygodes cunceilinea*** (Walker)

1863. *Geometra cunceilinea* Walker, *Cat. Lep. Het. Brit. Mus..*, **xxvi**, : 1752.

1895. *Trygodes cunceilinea*, Hampson, *Fauna Brit. India*, Moths, **3** : 461.

1982. *Antitrygodes cunceilinea*, Barlow, *An introduction to the Moths of South East Asia* : 124.

Material examined : Umaria, BNP, Tala, 29.9.2002 (1ex.), Coll. R. K. Singh.

Wing expanse : 32 mm.

Distribution : India : Madhya Pradesh (Hoshangabad, Seoni and Mandla, Umaria). *Elsewhere* : Myanmar, Thailand and Malaya.

12. ***Godonela translineata*** Walker.

1866. *Macaria translineata* Walker, *List Specimens lipid. Insects Colln Br. Mus.*, 35: 1658.

1997 *Godonela translineata*, Holloway, *The Moths of Borneo, The Malayan Nature Journal*, **47**(12) : 166.

Material examined : Umaria, BNP, Tala, 21.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 32 mm.

Distribution : India : Madhya Pradesh (Umaria). *Elsewhere* : Borneo, Sumatra, Thailand and Sulawesi.

13. ***Hyposidra talaca*** (Walker)

1860. *Lagyra talaca* Walker, *Cat. Lep. Het. Brit. Mus.*, **20** : 59.

1895. *Hyposidra talaca,* Hampson, *Fauna Brit. India*, Moths, **3** : 213.

Material examined : Umaria, BNP, Tala, 30.9.2002 (2ex.), Coll. M. L. Koshta.

Wing expanse : 44 mm.

Distribution : Throughout India including Madhya Pradesh (Hoshangabad and Umaria) and Andamans. *Elsewhere* : Myanmar, Java, Sri Lanka, Borneo, Celebes, and Philippines.

III. Family NOTODONTIDAE

14. ***Antheua servula*** (Drury)

1773. *Phalaena servula* Drury, *Ins Exot.* **ii** : 20.

1887. *Antheua discalis,* Cotes & Swinhoe, *Cat. Moths of India*, **II** : 171.

1892. *Antheua servula,* Hampson, *Fauna Brit. India*, Moths, **1** : 145.

Material examined : Umaria, BNP, Tala, 29.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 45 mm.

Distribution : India : Madhya Pradesh (Indore, Umaria), Maharashtra, Himachal Pradesh and Tamil Nadu. *Elsewhere* : Sri Lanka, Myanmar and Java.

15. ***Cerura liturata*** Walker

1859. *Cerura liturata* Walker, *Cat. Lep. Het. Brit. Mus.*, **v** : 988.

1892. *Cerura liturata,* Hampson, *Fauna Brit. India*, Moths, **1**: 155.

Material examined : Umaria, BNP, Tala, 20.9.2002, (2ex.), Coll. M. L. Koshta

Wing expanse : Male-46 mm.

Distribution : India : Madhya Pradesh (Seoni and Umaria), Maharashtra, Tamil Nadu, Assam and Sikkim. *Elsewhere* : Sri Lanka and China.

16. ***Phalera raya*** Moore

1859. *Phalera raya* Moore, *Cat. Lep. Mus. E. I. C.*, ii : 434.

1892. *Phalera raya,* Hampson, *Fauna Brit. India*, Moths, **1** : 134.

Material examined : Umaria, BNP, Tala, 26.9.2002 (4ex.), Coll. M. L. Koshta.

Wing expanse : 78 mm.

Distribution : India : Madhya Pradesh (Seoni, Hoshangabad, Umaria), Maharashtra, Himachal Pradesh, West Bengal, Tamil Nadu, Nagaland and Sikkim. *Elsewhere* : Sri Lanka and China.

17. ***Spatalia argentifera*** (Walker)

1862. *Allata argentifera* Walker, *J. Linn. Soc. Lond. Zool.*, **6** : 140.

1892. *Spatalia argentifera*, Hampson, *Fauna Brit. India*, Moths, **1** : 169.

Material examined : Umaria, BNP, Tala, 24.9.2002, (6ex.), Coll. M. L. Koshta.

Wing expanse : 50-54 mm.

Distribution : India : Madhya Pradesh (Seoni and Umaria), Sikkim and Karnataka. *Elsewhere* : Myanmar.

IV. Family URANIIDAE

18. ***Micronia aculeata*** Guenee

1857. *Micronia aculeata* Guenee, *Hist. Nat. Des. Ins.*, : 26.

1895. *Micronia aculeata*, Hampson, *Fauna Brit. India*, Moths : 117.

Material examined : Umaria, BNP, Tala, 27.9.2002 (2ex.), Coll. M. L. Koshta.

Wing expanse : 42mm.

Distribution : Throughout India including Madhya Pradesh (Hoshangabad, Seoni, Umaria), and Andaman's. *Elsewhere* : China, Formosa, Myanmar, Java, Sri Lanka and Borneo.

V. Family SATURNIIDAE

19. ***Actias selene*** (Hubner)

1806. *Echidna caudate selene* Hubner, *Samml. Exot. Schmett.*,**1**: 3 pl. : 172(M), 174 (F)

1892. *Actias selene*, Hampson, *Fauna Brit. India*, Moths, **1** : 13.

Material examined : Umaria, BNP, Tala, 2.10.2002 (5ex.), Coll. R. K. Singh.

Wing expanse : 132-140 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Sri Lanka, Myanmar and China.

VI. Family PYRALIDAE

20. ***Cirrhochrista brizoalis*** (Walker)

1859. *Margaronia brizoalis* Walker, *Cat.*, **xix**: 976.

1896. *Cirrhochrista brizoalis*, Hampson, *Fauna Brit. India*, Moths, **iv**: 50.

Material examined : Umaria, BNP, Tala, 3.10.2002, (3ex.), Coll. R. K. Singh.

Wing expanse : Male: 22-28 mm.

Distribution : India: Madhya Pradesh (Seoni and Umaria), Maharashtra, Tamil Nadu, and N. W. Himalayas. *Elsewhere* : Australia, Borneo, Celebes, China, Japan and Taiwan.

21. ***Cnaphalocrocis medinalis*** (Guenee)

1854. *Salbia medinalis* Guenee, *Delt & Pyral.*, : 201.

1896. *Cnaphalocrocis medinalis,* Hampson, *Fauna Brit. India*, Moths, **4** : 275.

1980. *Cnaphalocrocis medinalis*, Mandal & Bhattacharya, *Rec. zool. Surv. India,* **77**(1-4) : 306.

Material examined : Umaria dist. BNP, Tala, 25.9.02, (2ex), Coll. R. K. Singh. Mandla dist.Kisli, 8.9.2003 (1ex), Coll. D. K. Nema.

Wing expanse : 20-22 mm.

Distribution : Throughout India including Madhya Pradesh (Umaria and Mandla). *Elsewhere* : Japan; throughout the Oriental and Australian regions.

22. ***Diaphania bivitralis*** (Guenee)

1854. *Glyphodes bivitralis* Guenee, *Delt. Edt. Pyral.*, : 293.

1896. *Glyphodes bivitralis*, Hampson, *Fauna Brit. India*, Moths, **4**: 355.

1980. *Diaphania bivitralis*, Mandal & Bhattacharya, *Rec. zool. Surv. India,* **77**(1-4): 324.

Material examined : Umaria, BNP, Tala, 2.10.02 (1ex), coll. R. K. Singh.

Wing expanse : 34 mm.

Distribution : India : Madhya Pradesh (Umaria), Himachal Pradesh (Simla), Sikkim, West Bengal (Kolkata) Maharashtra (Mumbai), Tamil Nadu, Uttaranchal and Andamans & Nicobar Island. *Elsewhere* : Australia, Borneo, Myanmar, Java, Malaya, Philippines and Sri Lanka.

23. ***Euclasta defamatalis*** (Walker)

1859. *Ilurgia defamatalis* Walker, *Cat. Lep. Het. Brit. Mus.* **xviii** : 544.

1896. *Euclasta defamatalis,* Hampson, *Fauna Brit. India*, Moths, **4**: 364.

Material examined : Umaria, BNP, Tala, 3.10.02 (2ex), coll. R. K. Singh

Wing expanse : 24-30 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Sri Lanka and Myanmar.

24. ***Hymenia recurvalis*** (Fabricius)

1782. *Phalaena recurvalis* Fabricius, *Ent. Syst. iii*, pt. **2** : 237.

1896. *Zinckenia fascialis*, Hampson, *Fauna Brit. India*, Moths, **4** : 262.

1980. *Hymenia recurvalis*, Mandal & Bhattacharya, *Rec. zool. Surv. India*, **77**(1-4) : 303.

Material examined : Umaria, BNP, Tala, 21.9.2002 (1ex.). Patour, 23.9.02 (1ex) Coll. M. L. Koshta.

Wing expanse : 24 mm.

Distribution : Throughout India including Madhya Pradesh (Hoshangabad, Seoni, Jabalpur, Umaria). *Elsewhere* : Syria, Japan, and Australia.

25. ***Maruca testulalis*** (Geyer)

1832. *Crochiphora testulalis* Geyer, *Hubn. Sammal. Exot. Schmett*, **4** (4) : 12.

1896. *Maruca testulalis* Hampson, *Fauna Brit. India*, Moths, 4 : 393.

Material examined : Umaria, BNP, Tala, 29.9.2002 (4ex.), Coll. M. L. Koshta.

Wing expanse : 26-30 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria), *Elsewhere* : Australian, Oriental Neotropical and Ethiopian regions.

26. ***Nymphula fluctuosalis*** (Zeller)

1852. *Nymphula fluctuosalis* Zeller, *K. Vet* : *AK. Handl.*, : 27.

1896. *Nymphula fluctuosalis*, Hampson, *Fauna Brit. India*, Moths, **4** : 193.

Material examined : Umaria dist. Tala, BNP, 20.9.02(2ex), 26.9.02 (1ex), Coll. R. K. Singh.

Wing expanse : 18 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Throughout the tropical and subtropical zones, on the north to Formosa and the Sandwich Islands, on the south to Australia.

27. ***Sameodes cancellalis*** (Zeller)

1852. *Botys cancellalis* Zeller, *K. Vet. A. K. Handl. P.* : 34.

1896. *Sameodes cancellalis*, Hampson, *Fauna Brit. India*, Moths, **4** : 375.

Material examined : Umaria, BNP, Tala, 2.10.2002 (2ex.), Coll. M. L. Koshta.

Wing expanse : 22 mm.

Distribution : Throughout India including Madhya Pradesh (Hoshangabad, Seoni and Umaria). *Elsewhere* : Sri Lanka, Africa, Australia, Myanmar, Fiji, and Java.

28. ***Synclera traducalis*** (Zeller)

1852. *Eudioptis traducalis* Zeller, *kgl. Vet. Akad. Handl. Lep. Micropt. Caffr.*, : 54.

1896. *Pagyda traducalis*, Hampson, *Fauna Brit. India*, Moths, **4** : 272.

1980. *Synclera traducalis*, Mandal & Bhattacharya, *Rec. zool. Surv. India*, 77 : 327.

Material examined : Umaria dist. BNP, Tala, 29.9.02 (1ex), R. K. Singh.

Wing expanse : 22 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : S. America, S. Africa, Aden, Syria, Palestine, Sri Lanka and Myanmar.

29. ***Tyspanodes linealis*** (Moore)

1867. *Propachys linealis* Moore, *Proc. Zool. Soc. Lond.*, : 665.

1896. *Tyspanodes linealis*, Hampson, *Fauna Brit. India*, Moths, **4** : 298.

Material examined : Umaria, BNP, Tala, 3.10.2002 (4ex.), Coll. R. K. Singh.

Wing expanse : 28 mm.

Distribution : Throughout India including Madhya Pradesh (Umaria, Jabalpur), Sikkim, Himachal Pradesh and Andamans.

VII. Family LASIOCAMPIDAE

30. ***Estigena pardalis*** Walker

1856. *Estigena pardalis* Walker, *Cat. Lep. Het. Brit. Mus.*, **vi**: 1435.

1892. *Estigena pardalis*, Hampson, *Fauna Brit. India*, Moths, **1**: 424.

Material examined : Umaria dist. BNP, Tala, 3.10.02, (1ex), Coll. D. K. Nema.

Wing expanse : 45 mm.

Distribution. : Throughout India including Madhya Pradesh (Mandla, Umaria). *Elsewhere* : Sri Lanka.

31. ***Lebeda* sp.**

1855. *Lebeda* Walker, *Cat. Lep. Het. Brit. Mus.*, **vi** : 1453.

1892. *Lebeda*, Hampson, *Fauna Briti. India*, Moths, **1** : 407.

Material examined : Umaria, BNP, Tala, 22.9.2002 (1ex.), Coll. M. L. Koshta.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria), Himalayas, Assam hills and Sylhet.

VIII. Family ARCTIDAE

32. ***Creatonotus gangis*** (Linnaeus)

1764. *Phalaena gangis* Linnaeus, *Amoen. Acad.*, **6**: 410.

1991. *Creatonotus gangis*, Mandal & Ghosh, *Fauna of Tripura, Rec. zool. Surv. India,* **88** (3&4): 313-314.

Material examined : Umaria, BNP, Tala, 29.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 40mm.

Distribution : Throughout India including Madhya Pradesh (Indore, Hoshangabad, Chhindwara and Umaria), West Bengal, Maharashtra, Gujarat, Andhra Pradesh, Kerala, Tamil Nadu, Assam, Meghalaya, Arunachal Pradesh and Tripura. *Elsewhere* : Myanmar, Sri Lanka, Western Malaysia, Java, Australia, China, Pakistan and Nepal.

33. ***Creatonotus lactineus*** Cramer

1777. *Creatonotus lactineus* Cramer, *Pap. Exot.*, **2** : 133.

1894. *Creatonotus lactineus*, Hampson, *Fauna Brit. India,* Moths, **2** : 27.

Material examined : Umaria, BNP, Tala, 25.9.2002 (6ex.), Coll. M. L. Koshta.

Wing expanse : 56-66 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Myanmar, Sri Lanka, China and Java.

34. ***Olepa ricini*** (Fabricius)

1775. *Bombyx ricini* Fabricius, *Syst. Ent.*, : 583.

1894. *Arctia ricini*, Hampson, *Fauna Brit. India*, Moths, **2** : 17.

1982. *Olepa ricini*, Arora & Chauchury, *Arctiidae of North-East India, Zoological Survey of India, Technical Monograph* No. 6 : 21.

Material examined : Umaria, BNP, Tala, 30.9.2002, (6ex.), Coll. R. K. Singh.

Wing expanse : 38-48 mm.

Distribution : Throughout India including Madhya Pradesh (Mandla, Umaria). *Elsewhere* : Sri Lanka and Bangladesh.

IX. Family HYPSIIDAE

35. ***Asota caricae*** (Fabricius)

1792. *Noctua caricae* Fabricius, *Syst. Ent.*, **3**, 2 : 27.

1892. *Hypsa alciphron*, Hampson, *Fauna Brit. India*, Moths, **1** : 502.

1982. *Asota caricae*, Barlow, *An introduction to the Moths of South East Asia* : 77.

Material examined : Umaria, BNP, Tala, 26.9.2002, (1ex.), Coll. R. K. Singh.

Wing expanse : 68 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Myanmar, Sri Lanka, Penang, Java, Amboina, Ceram, New Guinea, New Hebrides, Solomons, and New Ireland.

X. Family NOCTUIDAE

36. ***Cetola dentata*** Walker

1855. *Cetola dentata* Walker, *Cat. Lep. Het. Brit. Mus.*, **V** : 1016.

1886. *Cetola dentata*, Cotes & Swinhoe., *Cat. Moths of India* : 174.

1894. *Cetola dentata,* Hampson, *Fauna Brit. India*, Moths, **2** : 434.

Material examined : Umaria dist. BNP, Tala, 27.9.02 (2ex), R. K. Singh.

Wing expanse : 46 mm.

Distribution : Throughout India including Madhya Pradesh (Indore and Umaria). *Elsewhere* : Nepal.

37. ***Chrysodeixis eriosoma*** (Doubleday)

1843. *Plusia eriosoma* Doubleday, *Dieffenbach's New Zealand*, **2** : 285.

1894. *Plusia eriosoma*, Hampson, *Fauna Brit. India*, Moths, **2** : 569-570.

1985. *Chrysodeixis eriosoma,* Holloway, *The Moths of Borneo, The Malayan Nature Journal*, **38**(3&4) : 289.

Material examined : Umaria, BNP, Tala, 23.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 42 mm.

Distribution : Throughout India including Madhya Pradesh (Jabalpur, Seoni and Umaria). *Elsewhere* : North and South America, Japan, China, and Australasian regions.

38. ***Episparis varialis*** Walker

1858. *Episparis varialis* Walker, *Cat. Lep. Het. B. M.*, **xvi** : 7.

1888. *Episparis varialis*, Cotes & Swinhoe, *Cat. Moths of India,* : 435.

1894. *Episparis varialis,* Hampson, *Fauna Brit. India*, Moths, **2** : 543.

Material examined : Umaria, BNP, Tala, 25.9.2002, (2ex.), Coll. R. K. Singh.

Wing expanse : 60 mm.

Distribution : Peninsular India including Madhya Pradesh (Indore, Seoni and Umaria) and Andamans. *Elsewhere* : Sri Lanka.

39. ***Ercheia multilinea*** Swinhoe

1902. *Ercheia multilinea* Swinhoe, *Ann. Mag. Nat. Hist.*, **7** : 84.

1985. *Ercheia multilinea*, Lutz & Kobes, *Heterocera Sumatrana,* Band, 4 : 38.

Material examined : Umaria dist. BNP, Tala, 3.10. 2002(1ex.), Coll. R. K. Singh.

Wing expanse : 50 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Malaya, Borneo, Sumatra and Philippines.

40. ***Grammodes geometrica*** (Fabricius)

1775. *Noctua geometrica* Fabricius, *Syst. Ent.*, : 599.

1991. *Grammodes geometrica,* Mandal and Maulik, *Fauna of Orissa*, Zool. Surv. India, **3** : 219.

Material examined : Umaria dist. BNP, Tala, 28.9.02 (1ex) Coll. R. K. Singh.

Wing expanse : 45 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni, Mandla, Umaria), Orissa, West Bengal, Sikkim, Assam, Uttar Pradesh, Maharashtra, Andman & Nicobar Islands, Punjab, Karnataka and Tamil Nadu. *Elsewhere* : Bangladesh, Southern Myanmar, Sri Lanka, Singapore, Java, Pulo Lant and Taiwan.

41. ***Helicoverpa armigera*** (Hubner)

1804. *Noctua armigera* Hubner, *Samml. Eur. Schmett. Noct.*, **ii** : 180.

1896. *Heliothis armigera*, Hampson, *Fauna Brit. India*, Moths, **2** : 174-175.

1989. *Helicoverpa armigera,* Holloway, *The Moths of Borneo, Malayan Nature Journal*, **42**(2&3) : 75.

Material examined : Umaria dist. BNP, Tala, 26.9.02 (3ex) Coll. R. K. Singh.

Wing expanse : 31-41 mm.

Distribution : Throughout India including Madhya Pradesh (Jabalpur, Shivpuri and Umaria). *Elsewhere* : Universally distributed.

42. ***Helicoverpa assulta*** Guen'ee

1852. *Heliothis assulta* Guen'ee, *Hist. Nat. Insectes, Spec. gen. lipid*, **6** : 178.

1989. *Helicoverpa assulta, Holloway, The Malayan Nature Journal, Malayan Nature Society,* Malaysia, **42** (2&3) : 75.

Material examined : Umaria, BNP, Tala, 26.9.02 (1ex) Coll. R. K. Singh.

Wing expanse : 22 mm.

Distribution : Throughout India including Madhya Pradesh (Chhindwara, Umaria and Mandla). *Elsewhere* : Old World tropics.

43. ***Ophiusa honesta*** (Hubner)

1806. *Thyas honesta* Hubner, *Samml. Exot. Schmett.* II Index, : 4.

1888. *Thyas honesta,* Cotes & Swinhoe, *Cat. Moths of India,* : 398.

1894. *Ophiusa honesta,* Hampson, *Fauna Brit. India*, Moths, **2** : 504.

Material examined : Umaria, BNP, Tala, 24.9.2002 (1ex.), Gate of BNP, 22.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 98 mm.

Distribution : Throughout India including Madhya Pradesh (Umaria) and Chhattisgarh. *Elsewhere* : Sri Lanka.

44. ***Ophiusa joviana*** (Cramer)

1782. *Phalaena joviana* Cramer, *Pap. Exot.* **iv,** : 399.

1888. *Ophiusa joviana,* Cotes & Swinhoe, *Cat. Moths of India,* : 410.

1894. *Ophiusa joviana,* Hampson, *Fauna Brit. India*, Moths, **2** : 499.

Material examined : Umaria, Tala, BNP, 21.9.2002 (1ex.), Coll. M. L. Koshta.

Wing expanse : 54 mm.

Distribution : Throughout India including Madhya Pradesh (Indore, Chhindwara and Umaria) *Elsewhere* : Sri Lanka, Myanmar and Java.

45. ***Ophiusa triphaenoides*** Walker

1858. *Ophiusa triphaenoides* Walker, *Cat. Lep. Het. Brit. Mus.*, **xiv** : 1358.

1888. *Minucia triphaenoides*, Cotes & Swinhoe, *Cat. Moths of India,* : 400.

1894. *Ophiusa triphaenoides,* Hampson, *Fauna Brit. India*, Moths, **2** : 505.

Material examined : Umaria, BNP, Tala, 30.9.2002 (1ex.), Coll. R.K. Singh.

Wing expanse : 60 mm.

Distribution : Throughout India including Madhya Pradesh (Indore and Umaria). *Elsewhere* : Taiwan.

46. ***Spirama retorta*** Cramer

1779-83. *Spirama retorta* Cramer, *Pap Exot.*, **2** : 116.

1894. *Spirama retorta,* Hampson, *Fauna Brit. India*, Moths, **2** : 553.

Material examined : Umaria, BNP, Tala, 29.9.02 (1ex), Coll. R. K. Singh.

Wing expanse : 66 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Sri Lanka, Myanmar, China, Japan, and Java.

47. ***Spodoptera litura*** Fabricius

1775. *Noctua litura* Fabricius, *Syst. Ent.*, : 601.

1991. *Prodenia litura*, Mandal and Maulik, *Fauna of Orissa, Zool. Surv. India,* **3** : 212.

1989. *Spodoptera litura,* Holloway, *The Malayan Nature journal, Malayan Nature Society, Malaysia,* **42** (2&3) : 136.

Material examined : Umaria, BNP, Tala, 21.9.2002 (4ex.), Coll. M. L. Koshta.

Wing expanse : 36-40 mm.

Distribution-Throughout India including Madhya Pradesh (Hoshangabad, Umaria), West Bengal, Sikkim, Orissa, Tripura, Himachal Pradesh, Uttar Pradesh, Punjab, Maharashtra, Karnataka, Tamil Nadu and Kerala. *Elsewhere* : Nepal, Southern Myanmar, Sri Lanka, Singapore, Borneo Java and Taiwan of oriental and also Australo-Papuan, Ethiopian, Palaearctic and Hawaiian Regions.

48. ***Trigonodes hyppasia*** (Cramer)

1775. *Phalaena (Noctua) hyppasia,* Cramer, *Pap. Exot.,* **3** : 250.

1888. *Trigonodes hyppasia,* Cotes & Swinhoe, *Cat. Moths of India,* : 413.

1894. *Trigonodes hyppasia*, Hampson, *Fauna Brit. India*, Moths, **2** : 527.

Material examined : Umaria, BNP, Tala, 19.9.2002, (5ex.), Coll. M. L. Koshta.

Wing expanse : 40-46 mm.

Distribution : Throughout India including Madhya Pradesh (Seoni and Umaria). *Elsewhere* : Africa, Mauritius, Madagascar, China, Taiwan, Sri Lanka, Myanmar, Java and Australasia.

SUMMARY

The paper deals with systematic account of 48 species of moths belonging to 42 genera and 10 families from Bandhavgarh National Park. Of these, 2 species (*Diaphania bivitralis* (Guen'ee) *Ophiusa honesta* (Hubner)) are reported for the first time from Madhya Pradesh.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Kolkata, for providing the necessary facilities and encouragement.

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LIST OF MOTHS OF BANDHAVGARH NATIONAL PARK, UMARIA (M. P.)

S.N.	Scientific Name	S.N.	Scientific Name
	Order LEPIDOPTERA Suborder HETEROCERA I. Family SPHINGIDAE		
1.	*Clanis sp.*	25.	*Maruca testulalis* (Geyer)
2.	*Hippotion boerhaviae* (Fabricius)	26.	*Nymphula fluctuosalis* Zeller
3.	*Marumba dyras dyras* (Walker)	27.	*Sameodes cancellalis* Zeller
4.	*Nephele didyma* (Fabricius)	28.	*Synclera traducalis* (Zeller)
5.	*Oxyamabalyx sp.*	29.	*Tyspanodes linealis* Moore
6.	*Psilogramma menephron menephron* (Cramer)		VII. Family LASIOCAMPIDAE
7.	*Rhyncholaba acteus* (Cramer)	30.	*Estigena pardalis* Walker
8.	*Theretra alecto alecto* (Linnaeus)	31.	*Lebeda Sp.*
9.	*Theretra boisduvali* (Bugnion)		VIII. Family ARCTIIDAE
10.	*Theretra oldenlandiae oldenlandiae* (Fabricius)	32.	*Creatonotus gangis* (Linnaeus)
	II. Family GEOMETRIDAE	33.	*Creatonotus lactineus* Cramer
11.	*Antitrygodes cunceilinea* (Walker)	34.	*Olepa ricini* (Fabricius)
12.	*Godonela translineata* Walker		IX. Family HYPSIIDAE
13.	*Hyposidra talaca* (Walker)	35.	*Asota caricae* (Fabricius)
	III. Family NOTODONTIDAE		
14.	*Antheua servula Drury*		X. Family NOCTUIDAE
15.	*Cerura liturata* Walker	36.	*Cetola dentata* Walker
16.	*Phalera raya* Moore	37.	*Chrysodeixis eriosoma* (Doubleday)
17.	*Spatalia argentifera* (Walker)	38.	*Episparis varialis* (Walker)
	IV. Family URANIIDAE	39.	*Ercheia multilinea* Swinhoe
18.	*Micronia aculeata* Guen'ee	40.	*Grammodes geometrica* (Fabricius)
	V. Family SATURNIIDAE	41.	*Helicoverpa armigera* (Hubner)
19.	*Actias selene* (Hubner)	42.	*Helicoverpa assulta* Guen'ee
	VI. Family PYRALIDAE	43.	*Ophiusa triphaenoides* Walker
20.	*Cirrhochrista brizoalis* (Walker)	44.	*Ophiusa honesta* (Hubner)
21.	*Cnaphalocrocis medinalis* (Guen'ee)	45.	*Ophiusa joviana* (Cramer)
22.	*Diaphania bivitralis* (Guen'ee)	46.	*Spirama retorta* Cramer
23.	*Euclasta defamatalis* Walker	47.	*Spodoptera litura* (Fabricius)
24.	*Hymenia recurvalis* (Fabricius)	48.	*Trigonodes hyppasia* (Cramer)

PLATE I

1. *Clanis* sp.

2. *Hippotion boerhaviae* (Fabricius)

3. *Marumba dyras dyras* (Walker)

4. *Nephele didyma* (Fabricius)

5. *Oxyambulyx* sp.

6. *Psilogramma menephron menephron* (Cramer)

PLATE II

7. *Rhycholaba acteus* (Cramer)

8. *Theretra alecto alecto* (Linnaeus)

9. *Theretra boisduvali* (Bagnion)

10. *Theretra old oldenlandiae* (Fabricius)

11. *Antitrygodes cuceilinea* (Walker)

12. *Godonela translineata Walker*

PLATE III

13. *Hyposidra talaca* (Walker)

14. *Antheus servula* (Drury)

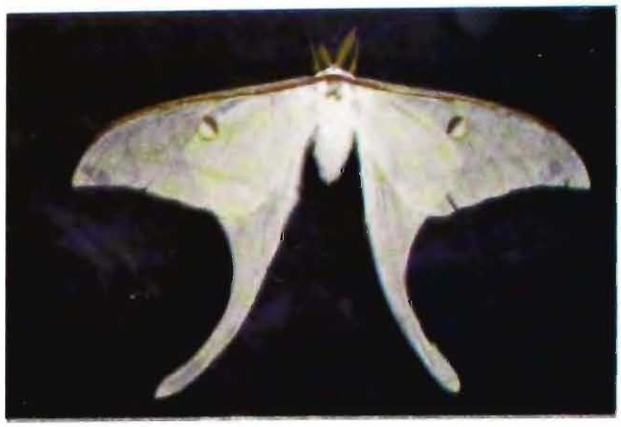
15. *Cerura liturata* Walker

16. *Phalera raya* Moore

17. *Spatalia argentifera* (Walker)

18. *Micronia aculeata* Guen'ee

PLATE IV



19. *Actias selene* (Hubner)

20. *Cirrhochrista brizoalis* (Walker)

21. *Cnaphalocrocis medinalis* (Guen'ee)

22. *Diaphania bivitralis* (Guen'ee)

23. *Euclasta defamatalis* Walker

24. *Hymenia recurvalis* Walker

PLATE V

25. *Maruca testulalis* (Geyer)

26. *Nymphula fluctuosalis* Zeller

27. *Sameodes cancellallis* (Zeller)

28. *Synclera traducalis* (Zeller)

29. *Tyspanodes linealis* Moore

30. *Estigena pardalis Walker*

PLATE VI

31. *Lebeda* sp.

32. *Creatonotus gangis* (Linnaeus)

33.. *Creatonotus lactineus* Cramer

34. *Olepa ricini* (Fabricius)

35. *Asota caricae* (Fabricius)

36. *Cetola dentala* Walker

PLATE VII

37. *Chrysodeixis eriosoma* (Doubleday)

38. *Episparis varialis* (Walker)

39. *Ercheia multilinea* Swinhoe

40. *Grammodes geometrica* (Fabricius)

40. *Helicoverpa armigera* (Hubner)

41. *Helicoverpa assulta* Guen'ee

PLATE VIII

43. *Ophiusa honesta* (Hubner)

44. *Ophiusa joviana* (Cramer)

45. *Ophiusa triphaenoides* Walker

46. *Spirama retorta* Cramer

47. *Spodoptera litura* (Fabricius)

48. *Trigonodes hyppasia* (Cramer)

Rec. zool. Surv. India : **108**(Part–2) : 111-122, 2008

NOTES ON SOME RARE AND INTERESTING CLADOCERANS (CRUSTACEA : BRANCHIOPODA) FROM MEGHALAYA

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INTRODUCTION

The systematic studies on Freshwater Cladocera of India were initiated by Baird (1860). Since then these micro-crustaceans have been recorded from various localities in different states of the country (Sharma and Michael, 1987; Michael and Sharma, 1988; Sharma, 1991). Investigations on Cladoceran fauna of Meghalaya began in the last quarter of twentieth century and the related contributions are those of Patil (1976), Biswas (1980), Michael and Sharma (1988) and Sharma and Sharma (1999).

While working on zooplankton samples collected from the state of Meghalaya, the author came across seven interesting species of Cladocera including two new records from India, four new records from North-Eastern region and one new record from Meghalaya. The present report provides descriptions and illustrations of the recorded cladocerans and remarks are made on their distribution.

METERIALS AND METHODS

The present observations are based on plankton samples collected during 2003-2005, and also those collected earlier (during 1988-1990) for the "State Fauna of Meghalaya : Zooplankton Survey", from localities in different districts of Meghalaya state. The examined material include samples deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong and those in the holdings of the Eastern Regional Station, Zoological Survey of India, Shillong.

The examined samples were collected with an nylobolt plankton net (No. 25) and preserved in 5% formalin. Various cladocerans and their disarticulated appendages were mounted in Polyvinyl

alcohol-lectophenol mixture. The details of head pores and their arrangements in the Chydorids were studied following the technique given by Megard (1965). Various taxa were identified following Smirnov (1971, 1996), Michael and Sharma (1988) and Korovchinsky (1992). Drawings were made with Leitz-Dialux phase contrast microscope using a drawing-tube attachment and the measurements were indicated in millimeters (mm).

LIST OF THE EXAMINED TAXA

Super class CRUSTACEA
Class BRANCHIOPODA
Super order CLADOCERA (*s. str.*)
Order CTENOPODA
Family SIDIDAE

1. ***Diaphanosoma volzi*** Stingelin, 1905**

Order ANOMOPODA
Family CHYDORIDAE
Subfamily CHYDORINAE

2. ***Alonella clathratula*** Sars, 1896**

Subfamily ALONINAE

3. ***Alona guttata tuberculata*** Kurz, 1875*
4. ***A. macronyx*** Daday, 1898**
5. ***A. monacantha tridentata*** (Stingelin, 1905)***
6. ***Camptocercus uncinatus*** Smirnov, 1971*
7. ***Graptoleberis testudinaria*** (Fischer, 1851)**

*New records from India, **New records from N. E. region, ***New record from Meghalaya.

TAXONOMIC NOTES

Diaphanosoma volzi Stingelin, 1905

(Figs. 1-3)

1905. *Diaphanosoma sarsi* var. *volzi* Stingelin, *Zool. Jb. Syst. Okol. Geogr.*, **21**, p. 339, Taf. 11, figs. 6-8.

1956. *Diaphanosoma aspinosum* Chiang, *Acta Hydrobiol. Sin.* **2**, p. 309-312, PI. 1, figs. 1-4, PI. 2. figs. 7-9; Idris & Fernando, 1981, *Hydrobiologia,* **77**, p. 236-237, Figs 5-7.

1981. *Diaphanosoma volzi* Stingelin : Korovchinsky, *Aust. J. mar. Freshwat. Res.*, **32**, p. 822-825, Figs. 6, 7.

Characters : Body massive and high. Head small, bent down and with convex ventral side. Eye large. Distal segment of antennal exopodite with only seven swimming setae and a long apical sensory seta. Ventral valve margins of carapace inflexed, forming a broad free flap. Postero-ventral and posterior margin of valves without denticles or setules. One large lanceolate dorsal spine near posterior margin of each valve. Postabdomen claw relatively short and massive; with three long basal spines.

Distribution : N. E. India–new record. India-Kerala.

Elsewhere : Tropical and subtropical parts of Australasia and in Africa (Sudan).

Alonella clathratula Sars, 1896

(Figs. 4-6)

1896. *Alonella clathratula* Sars, *Arch. Math. Naturvidensk. Christinia,* **18**, p. 43-45, figs. 7-8; Sharma & Sharma, 2001, *Rec. zool. Surv. India* **99**, p. 37, Figs. 16-19.

Characters : Body relatively more elongated; length : height ratio 1.8. Valves with polygons with longitudinal striations. Antennae and antennules do not reach the tip of rostrum. Valves with blunt indentation at posterior-ventral corner. Labral plate cuneiform and with blunt apex. Postabdomen elongated and with small irregular anal teeth. Claw with two basal spines, the proximal spine smallest.

Differential diagnosis : This species can be differentiated from the closely related *A. excisa* in having more elongated body; valves with polygons and longitudinal striations; posterior margin of valves almost straight and at right angle with the ventral margin.

Distribution : N. E. India–new record, India-Bihar.

Elsewhere : Australian, Ethiopian and Neotropical regions, and Java

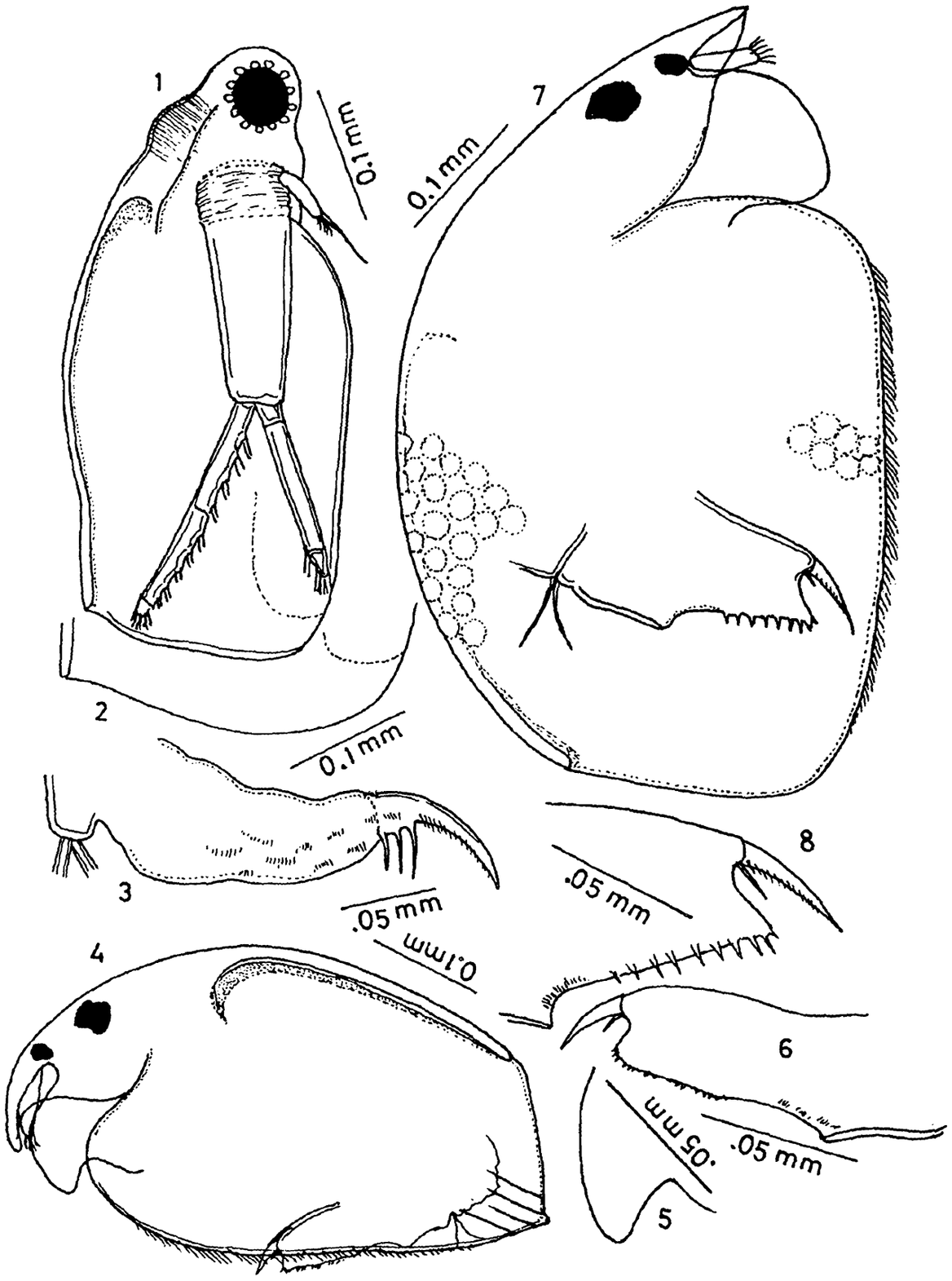
Alona guttata tuberculata Kurz, 1875

(Figs. 7-8)

1875. *Alona tuberculata* Kurz, *Sitz. Ber. Math. Naturw. Kl. K.k. Akad. Wissench,* **70**, p. 51, Plate II, Fig. 1.

1971. *Alona guttata tuberculata* Kurz : Smirnov, *The World Chydorid Fauna.* USSR Acad. Sci. Zool. Inst. Nova ser. **101**, p. 468, Fig. 456, 457.

Characters : Body almost oval with maximum height in the middle. Head shield with rounded posterior margin. Three main head pores with a narrow connection between them. Valves with rounded postero-dorsal and postero-ventral corners. Head shield and valves with rounded pits. Antennules reaching apex of rostrum. Labral plate rounded. Ocellus smaller than eye and situated halfway between eye and apex of rostrum. Postabdomen with projecting pre-anal corner; distal



Figs. 1-8 : *Diaphanosoma volzi* Stingelin; 1. parthenogenetic female, 2. armament on posterior valve margin, 3. postabdomen. *Alonella clathratula* Sars; 4. parthenogenetic female, 5. Labral plate, 6. postabdomen. *Alonella guttata tuberculata* Kurz; 7. parthenogenetic female, 8. postabdomen.

dorsal end pointed and projecting beyond base of claws. Postabdomen with 8-10 anal spines. Claw with a basal spine and setae on its concave margin.

Distribution : India–new record.

Elsewhere : Europe, Columbia and USSR (Kunashir island).

Alona macronyx Daday. 1898
(Figs. 9-11)

1898. *Alona macronyx Daday, Termes. Füzetek,* Anhangesheft, **21**, p. 35-37, Fig. 15.

1971. *Indialona macronyx* (Daday) : Smirnov, *The World Chydorid Fauna.* USSR Acad. Sci. Zool Inst. Nova ser. **101**, p. 618-619, Fig. 644, 646.

Characters : Body globular-oval in outline. Valves with lines; postero-ventral corner rounded, postero-dorsal corner distinct. Ventral margin of valves slightly concave and with setae. Antennules not reaching apex of rostrum. Labral plate with convex anterior margin and truncate apex. Postabdomen narrowing distally; with 12-14 large anal denticles. Claw with a basal spine and setae on concave margin.

Distribution : N. E. India–new record. India-Madhya Pradesh.

Elsewhere : The Indo-Malayan region.

Alona monacantha tridentata (Stingelin, 1905)
(Figs. 12-14)

1905. *Alona acuticostata* var. *tridentata* Stingelin, Zool. *Jb. Abt. Syst. Geogr und Biol.*, **21**, p. 349-350, Pl. 12, Figs 18-19

1971. *Alona monacantha tridentata* Stingelin : Smirnov, *The World Chydorid Fauna.* USSR Acad. Sci. Zool. Inst. Nova ser., **101**, p. 440, Fig. 413.

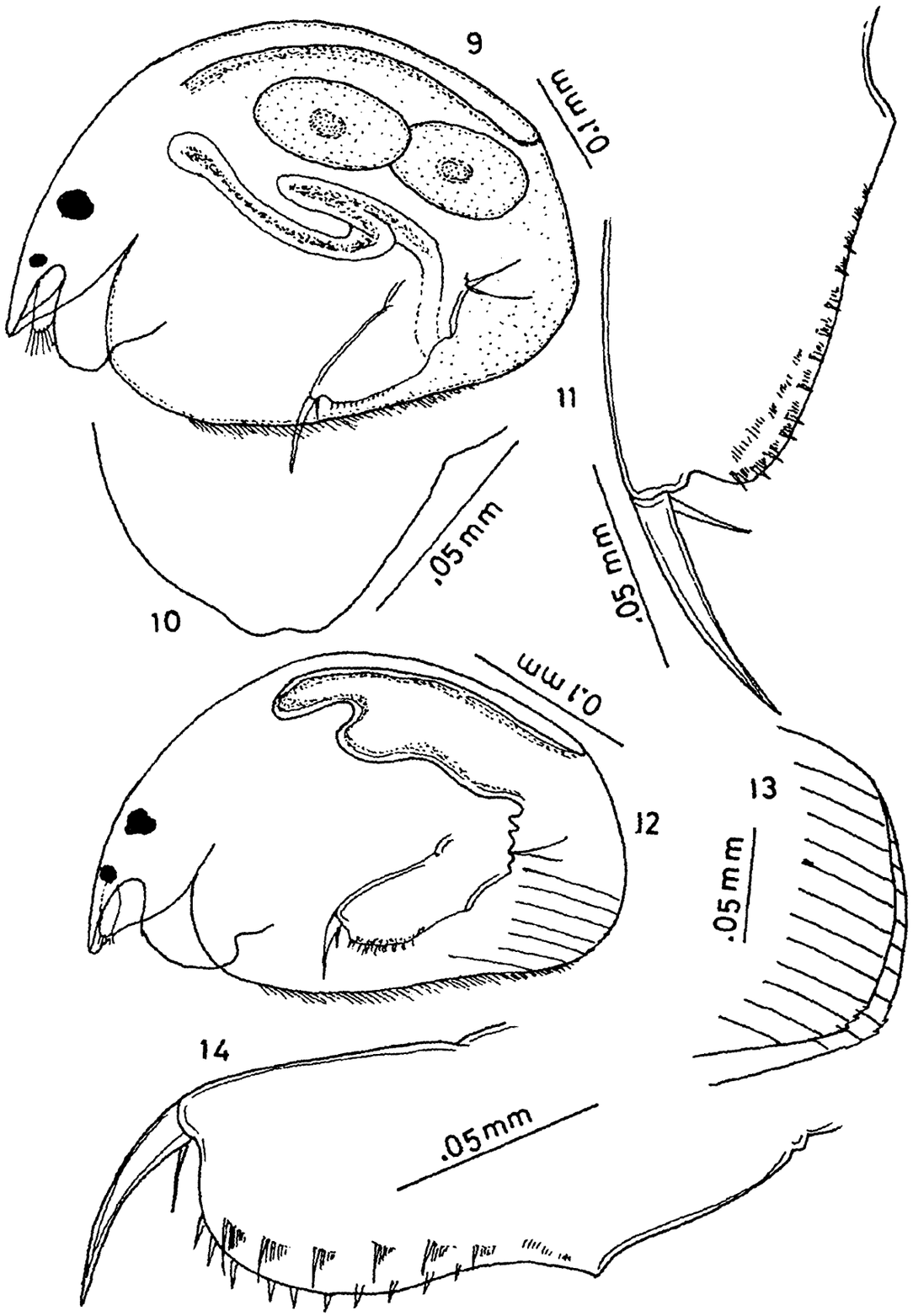
Characters : Body oval in outline, valves marked with longitudinal lines; postero-ventral corner of valves with 2-3 denticles. Rostrum long and blunt, antennules not reaching apex of rostrum. Postabdomen with distinct preanal corner, with about 10 anal spines and groups of lateral setae; distal seta in each group longest and a few distal setae projecting beyond dorsal margin of postabdomen. Claw with a basal spine and setae on concave margin.

Distribution : N. E. India–Tripura. India-Tamil Nadu and Bihar.

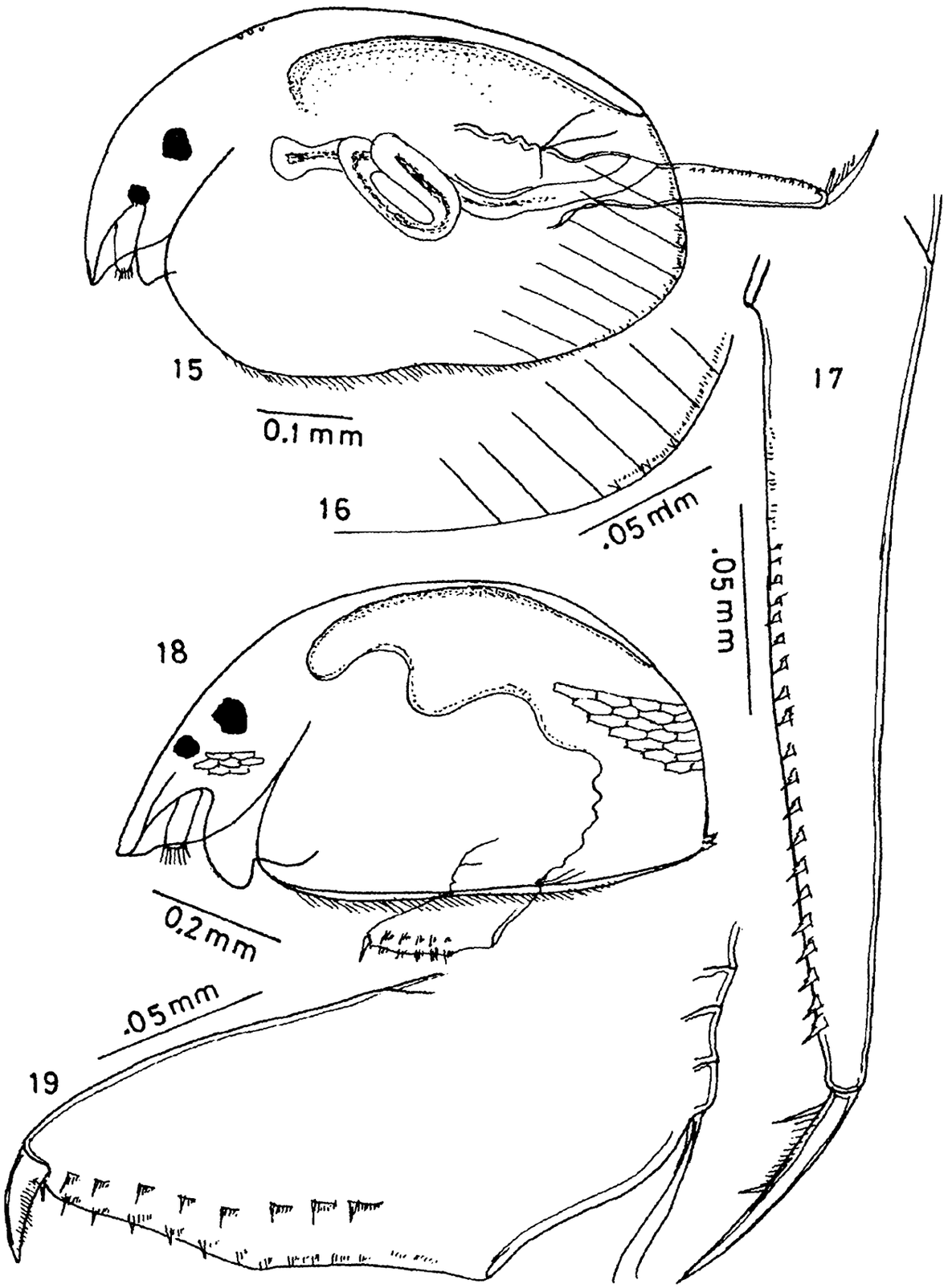
Elsewhere : Thailand.

Camptocercus uncinatus Smirnov, 1971
(Figs. 15-17)

1971. *Camptocercus uncinatus* Smirnov, *The World Chydorid Fauna.* USSR Acad. Sci. Zool. Inst. Nova ser., **101**, p. 436-438, Fig. 128, 532; Smirnov, 1998, *Hydrobiologia,* **386**, p. 76-77, Figs. 51-57.



Figs. 9-14 : *Alona macronyx* Daday; 9. parthenogenetic female, 10. Labral plate, 11. postabdomen. *A. monacantha tridentata* (Stingelin); 12. parthenogenetic female, 13. postero-ventral corner of valves, 14. postabdomen.



Figs. 15-19 : *Camptocercus uncinatus* Smirnov; 15. parthenogenetic female, 16. postero-ventral corner of valve, 17. postabdomen. *Graptoleberis testudinaria* (Fischer); 18. parthenogenetic female, 19. postabdomen.

1985. *Camptocercus latikae* Rane, *Crustaceana,* **48**, p. 113-116, Figs. 1-8.

1990. *Camptocercus rectirostris s. lato :* Sharma and Sharma, *Rev. Hydrobiol trop.,* **23**(2), p. 106-110, 112, Figs. 16-22.

Characters : Body elongated, postero-ventral corner of valves with 2-5 denticles distinctly separated by margin of valves. Rostrum acute, directed downwards. Valves with longitudinal lines. Antennules almost reaching apex of rostrum. Postabdomen with 19-20 anal denticles and a row of lateral groups of setae. Claw with setae on concave margin and with a basal spine at some distance from the base of each claw.

Distribution : India new record.

Elsewhere : Romania, S. W. Africa, Israel; Iraq, Ethiopia, Guatemala and Egypt.

Graptoleberis testudinaria (Fischer, 1851)
(Figs. 18-19)

1851. *Lynceus testudinarius* Fischer, *Mem. Acad. Imp. Sci. St. Petersburg,* **6**, p. 191, PI. IX, Fig. 12.

1896. *Graptoleberis testudinaria* (Fischer) : Sars, *Arch. Math. Naturvidensk. Christiania,* **11**, p. 13.

1971. *Graptoleberis testudinaria testudinaria* (Fischer) : Smirnov, *The World Chydorid Fauna.* USSR Acad. Sci. Zool. Inst. Nova ser., **101**, p. 544-546, Fig. 545-549.

Characters : Body oblong, maximum height in the middle; dorsal margin of body convex, ventral margin nearly straight and with setae decreasing in size. Postero-ventral corner of values with variable number of teeth. Head shield and valves with tetragonal, pentagonal or hexagonal cells. Rostrum broad and its ventral margin almost at level of ventral margin of valves. Labral plate with rounded apex. Ocellus situated nearer to eye than to apex of rostrum. Postabdomen tapering distally and with distinct preanal corner. Anal margin with row of anal spines increasing in size distally and groups of lateral setae. Claw with small basal spine and seta on concave margin.

Distribution : N. E. India–new record. India-Kashmir, Uttaranchal and Andhra Pradesh.

Elsewhere : Cosmopolitan.

REMARKS

Seven species of Cladocera belonging to two families and five genera are recorded from Meghalaya. *Camptocercus uncinatus* and *Alona guttata tuberculata* are new records from India; the former even represents a new record from the Oriental region. Four species namely *Diaphanosoma volzi, Alonella clathratula, Alona macronyx* and *Graptoleberis testudinaria* are new to Northeastern India while *Alona monacantha tridentata* is a new record from Meghalaya. All the stated taxa, except *C. uncinatus,* are rare elements in this study. The present report raises the known species richness of Cladocera from Meghalaya to 58 species which, in turn, nearly

equals the highest Indian report of 59 species from the state of Jammu and Kashmir (Prof. B. K. Sharma, personal communication).

Smirnov (1971) described *Camptocercus uncinatus* from Lake Nikolaevskoe (Russia) and it has since been reported from Romania, S.W. Siberia, Israel, Iraq, Ethiopia, Egypt and Guatemala. Smirnov (1998) again provided a detailed description of this species to resolve taxonomic anomalies, anticipated its wider occurrence and remarked on need for re-examination of the reports supposed to be that of *C. australis* in particular. The present record is apparently the first confirmed record of *C. uncinatus* from the Indian subcontinent as well as the Oriental region. C. *latikae* described by Rane (1985) from Madhya Pradesh and subsequently treated as C. *rectirostris s. lato* by Sharma and Sharma (1999) are presently confirmed as cases of mistaken identity of C. *uncinatus* and is, therefore, proposed as its synonyms. This chydorid is relatively widely distributed in the examined samples and has been observed from several localities in East Khasi Hills, West Khasi Hills, Rhi Bhoi, South and West Garo Hills districts of Meghalaya state.

Alona guttata tuberculata is yet another new record from India. This chydorid, treated as a subspecies of *A. guttata* by Smirnov (1971), is distinctly characterized by rounded pits or tubercles on its head shield and valves. It is a rare element in the examined material and has been observed only in one locality each in West Khasi Hills and South Garo Hills districts. It is recorded so far only from Europe, Columbia and USSR as against the nominate *Alona guttata guttata* which apparently shows cosmopolitan distribution.

Diaphanosoma volzi was originally described from Thailand as *D. sarsi* var. *volzi* and was subsequently reported from Indonesia. No further records were published for a long time, until substantiation of its specific status and its conspecificity with *D. aspinosum* described by Chiang (1956) from China. On the other hand, it was treated as a distinct species by Korovchinsky (1981). Korovchinsky (1995), however, re-described *D. volzi* in view of its confusion with *D. sarsi* Richard and *D. celebensis* Stingelin based on populations from Thailand, Southern India, Philippines, Indonesia, Malaysia, Australia and Sudan. In spite of its increasing distributional reports, it is still considered as a rare species (Korovchinsky, 1995). It is known to inhabit shallow vegetated habitats and often co-occurs with *D. sarsi.* The remarks relating to rare nature are also true as only four parthenogenetic females of *D. volzi* are examined presently from a shallow wetland in East Garo Hills district which, in turn, incidentally also occurred with *D. sarsi.* Further, this second report of *D. volzi* from India significantly extends its distributional range to Northeastern region.

Alonella clathratula was described (Sars, 1896) from its type locality in neighborhood of Sydney. It was considered as a subspecies of *A. excisa* by Smirnov (1971) while he later (Smirnov, 1996) resurrected its specific status. *A. clathratula* clearly differs from the closely related *A. excisa* in distinct morphological attributes as well as in distributional ranges. The former species occurs in Australia, the Ethiopian and Neotropical regions and, Java while the later is a cosmopolitan species.

A. clathratula is so far reported from India only from Bihar (Sharma and Sharma, 2001) and the present report, therefore, extends its distributional range to N. E. region. Smirnov and Timms (1983) reported its occurrence in acidic waters in Australia. This species is also presently collected from an acidic wetland (pH : 6.0) from South Garo Hills district of Meghalaya.

Petkovski (1966) described the monotypic genus *Indialona* including *I. ganapati* from Baroda (Gujarat). Smirnov (1971), however, included *Alona macronyx* Daday and A. *globulosa* Daday. A recent redescription of *Indialona,* however, transfers the remaining two species to *Alona.* Among these, *A. macronyx* is so far recorded in India from Madhya Pradesh only; it was described as a new species *Indialona jabalpurensis* by Rane (1983) which was treated as a synonym of *A. macronyx* by Sharma and Sharma (1990). The material examined presently from only one locality of Rhi Bhoi district of Meghalaya, therefore, extends its occurrence to Northeastern India.

The cosmopolitan *Graptoleberis testudinaria* is examined from a shallow wetland in Rhi Bhoi district and located near Meghalaya-Assam border. This species shows disjunct occurrence in India, with earlier records from Kashmir, Uttaranchal and Andhra Pradesh. The present study extends its distributional range to Northeastern region. *Alona monacantha tridentata,* a new record from Meghalaya, has been reported from this region from Tripura (Venkataraman and Das, 2000). The stated species apparently identified as *A. monacantha* in fact actually refers to *A. monacantha tridentata* as per the details given by Michael and Sharma (1988).

SUMMARY

The collections examined from Meghalaya reveal seven species of rare and interesting Cladocera belonging to two families under five genera. Among these, *Camptocercus uncinatus* and *Alona guttata tuberculata* are new records from India; the former in fact represents a new record from the Oriental region. Four other species namely *Diaphanosoma volzi, Alonella clathratula, Alona macronyx* and *Graptoleberis testudinaria* are new records to N. E. India while *Alona monacantha tridentata* is the sole new record from Meghalaya. This report raises the species richness of Cladocera known from Meghalaya to 58 species. All the recorded taxa, except C *uncinatus,* exhibit rare occurrence in the examined collections.

ACKNOWLEDGEMENTS

The author is thankful to the Director, Zoological Survey of India, Kolkata and the Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong for kind permission and necessary facilities for the project on Zooplankton Fauna of Meghalaya" under the "State Fauna Series" during which the present study was initiated. Thanks are also due to Prof. B. K. Sharma, Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong for allowing me to examine plankton collections deposited in his laboratory.

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Rec. zool. Surv. India : **108**(Part–2) : 123-128, 2008

A STUDY ON THE TAXONOMY OF THE RARE GENUS *PHILOMIDES* HALIDAY (HYMENOPTERA : PERILAMPIDAE) OF INDIAN SUBCONTINENT

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INTRODUCTION

Haliday (1862) erected the genus *Philomides* based on the type species *Philomides paphius* Haliday. This rare genus comes under the subfamily Philomidinae. Boucek (1978) included Philomidinae under Eucharitidae. But Heraty (2002) excluded it from Eucharitidae *s. s.* According to the latest classification (Noyes, 2006) Philomidinae comes under Perilampidae. They are parasites of ground or twig-nesting bees (Michener, 1969; Darling, 1992). The genus *Philomides* Haliday consists of 8 species from all over the world of which 2 species were reported from Oriental Region including one species from Indian subcontinent. These 8 species are *P. abercomensis* Risbec and *P. matallicus* Risbec from Zambia, *P. aethiopicus* Masi from Ethiopia, *P. flavicollis* Cameron from Gibraltar, *P. frater* Masi from Taiwan, *P. gigantea* (Risbec) from Senagal, *P. hoggariensis* Ferriere from Algeria, and *P. paphius* Halidae from Albania, Caucasus (Kavkaz), Cyprus, Europe, Greece, India (Karnataka), Italy (Sicily), Kazakhistan, Russia (Daghestan ASSR), Spain, Turkmenistan and Jugoslavia (Noyes, 2006). In this paper one new species is described from India (Kerala). Holotype is deposited at the Western Ghats Field Research Station, Zoological Survey of India, Kozhikode (ZSIK).

The following abbreviations are used in the text : MV-Marginal vein; NZSI-'National Zoological Collections' of Zoological Survey of India, Kolkata; OOL-Ocellocular distance; PMV-Postmarginal vein; POL-Postocellar distance; ZSIK-Western Ghats Field Research Station, Zoological Survey of India, Kozhikode.

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1. *Philomides paphius* Haliday

(Fig. 1)

1862. *Philomides paphius* Haliday. *Ann. de la Soc. Ent. De France,* (4) **2** : 116.

1891. *Sternodes pusateri* De Stefani. *Naturalista Siciliano* 10 : 118. Synonymised by Ruschka (1924) : 82-96.

1898. *Destefania pusateri* (De Stefani). Dalla torre; *Cat. Hym. Hucusque des. syst. et. Syn. V. Chalc. et Proct.* 359. new comb. Synonymised by Ruschka (1924) : 82-96. Additional citation : 1989. *Philomides paphius* Haliday. Narendran *et al. J. Bombay Nat. Hist.* Soc., **86**(2) : 263-266. Redescription, female. (Plesiotype examined).

Diagnosis : Female : Ochraceous yellow, with following parts otherwise : a patch near and in between ocelli black; eyes black; small black patch on each side of mesoscutum, a small black patch on mesoscutum posteriorly; a black patch on base of scutellum; scutellar horn black; metanotum, propodeum, propleuron and metapleuron completely black; mesopleuron black except anterodorsal area; black patches on ventral middle regions and dorsal middle regions of gaster; scrobe with median black colour. Antennal scape not reaching front ocellus; mesonotum with parallel notaulices; scutellum projecting posteriorly; punctures close and interstices smooth on mesoscutum and carinate on scutellum; forewing with a brown infuscation near apical region; hind femora sparsely pitted; gaster distinctly shorter than thorax; apical tergites with microsculptures.

Biology : Unknown.

Material examined : Plesiotype Female : INDIA : Karnataka, Bangalore; 20.vi.1976; Coll. Unknown; 10071/H3 (NZSI).

2. *Philomides indicus* Girish Kumar and Narendran sp. nov.

(Figs. 2-4)

Holotype : Female : Length 7.50 mm.; body ochraceous yellow with following parts otherwise : mandibles black except at middle brown; lower face including clypeus, passing through middle to inner surface of anterior scrobe, encircles ocellar areas to vertex and occiput black; eyes pale black; antenna yellowish brown; sides of temple, mesoscutum except lateral side, scutellum including scutellar horn except a narrow portion on lateral part of scutellum, metanotum and propodeum complete, at lateral and lower margins of prepectus, propleuron, mesopleuron and metapleuron complete, a broad band on dorsal and ventral regions of gaster black except lateral and anterior portions; fore coxa yellowish brown; meso and metatibial spur and claws brown; wings yellowish hyaline with pale brown infumation on distal half; venation brown, pubescence golden yellow.

Head : Relative measurements of OOL : POL = 64 : 60 (Fig. 4); frontogenal sulcus distinct but not carinate; frons convex on anterior dorsal part; antennal scape not reaching front ocellus (Fig. 3); antenna short and very much thickened.

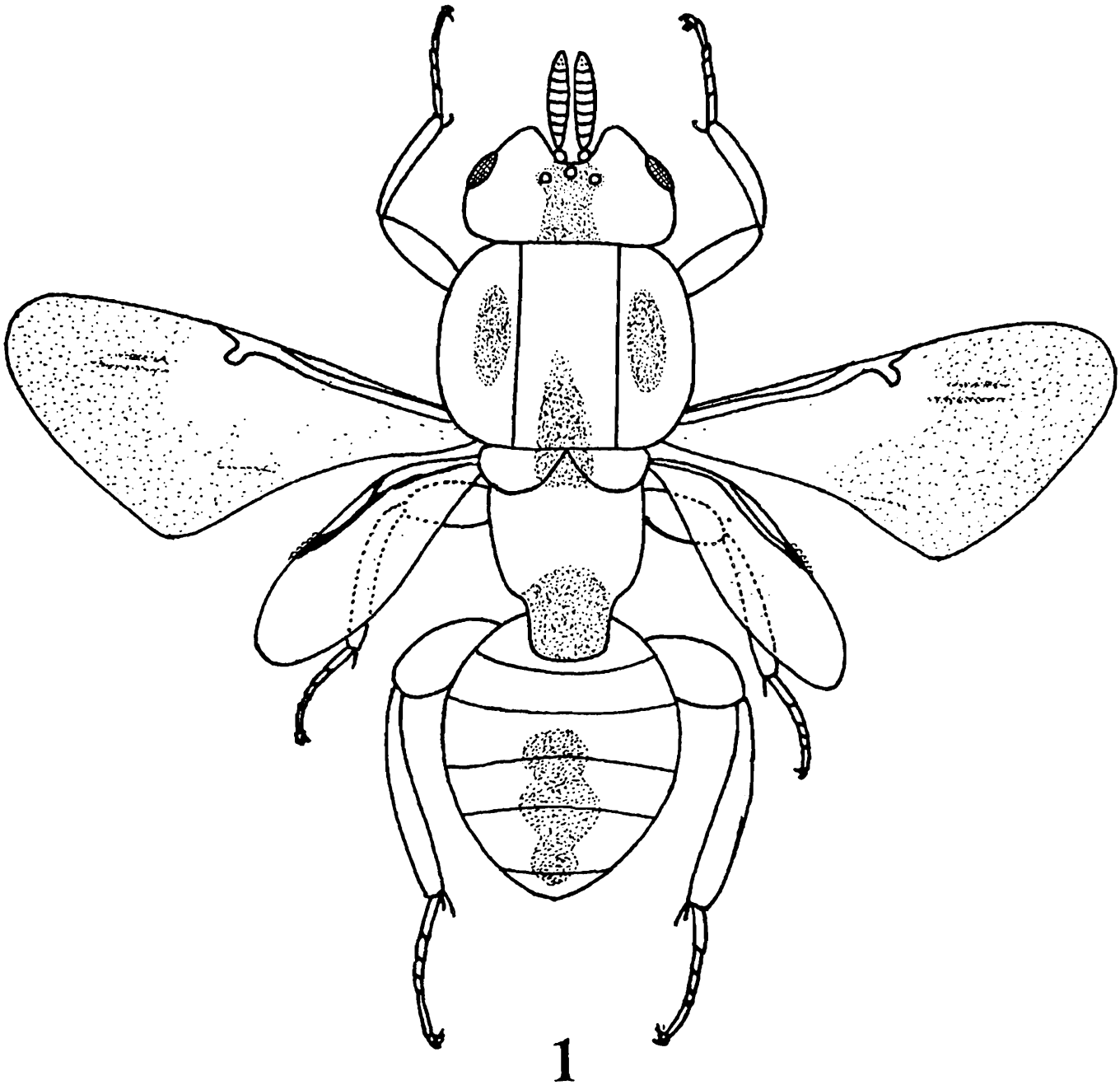
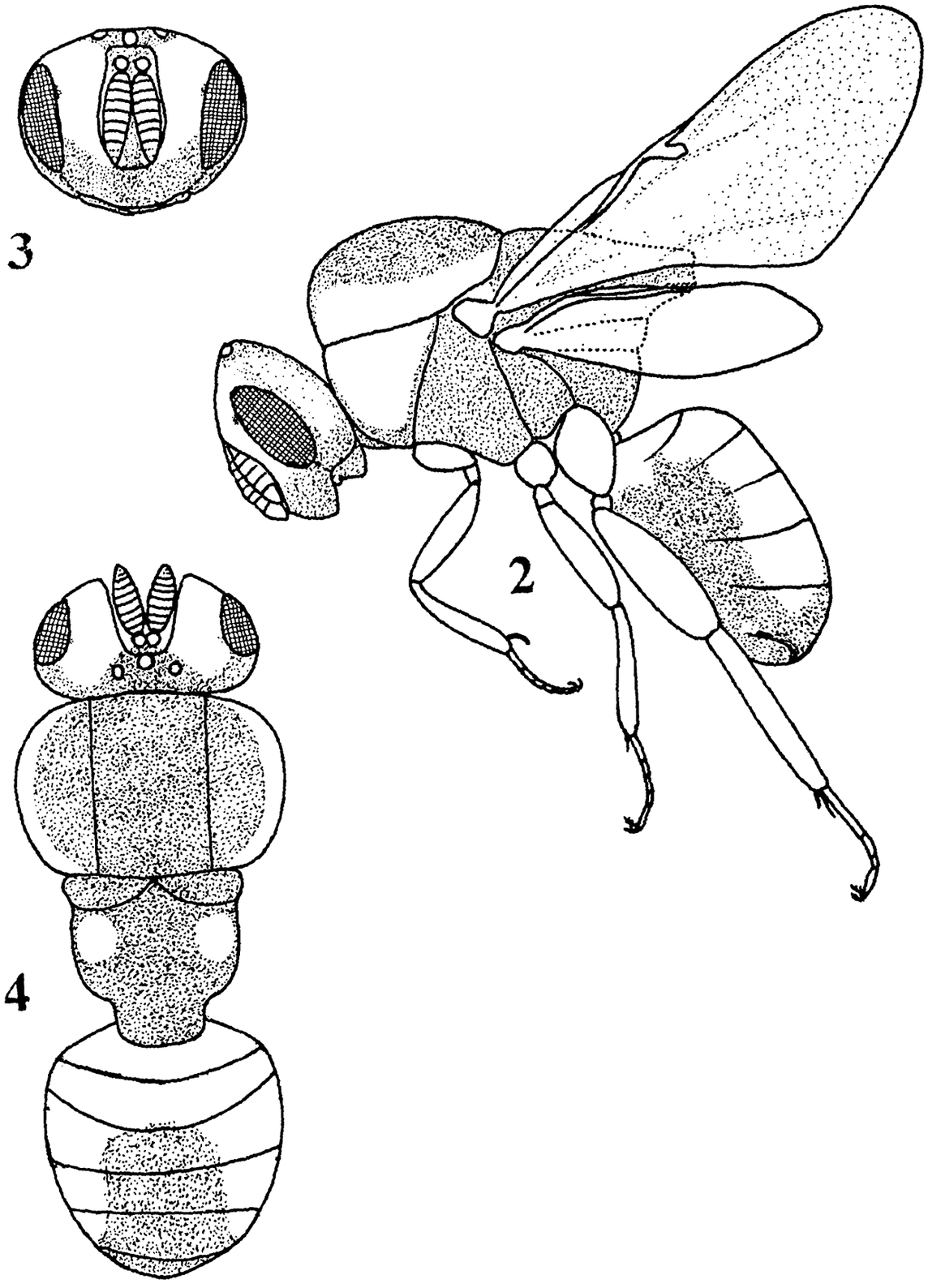


Fig. 1 : *Philomides paphius* Haliday Female. Body profile.

Thorax : Extremely wide and convex, pronotum not visible from above; mesonotum with parallel notaulices; scutellum projecting posteriorly; punctures close and interstices smooth on mesoscutum and carinate on scutellum; relative measurements of veins : PMV : MV = 30 : 45; stigmal 30. Hind femora 3.30x its maximum width, sparsely pitted, interstices smooth, pits rather deep.

Gaster : Distinctly shorter than thorax (35 : 45) (Fig. 4), first two tergites smooth, rest with microsculptures, ovipositor sheath and epipygium not visible from dorsal side.

Male : Unknown.



Figs. 2-4 : *Philomides indicus* Girish Kumar and Narendran sp. nov. Female.
2. Body profile; 3. Head front view; 4. Head, thorax and Gaster dorsal view.

Host : Unknown.

Biology : Unknown.

Distribution : India (Kerala).

Etymology : The species is named after the country from where the type specimen is collected.

Material examined : *Holotype* : Female, INDIA : Kerala; Kozhikode Dt.; Cheruvannur; Rajmohana, K.; 27.xii.2005 (ZSIK).

Discussion : This new species is similar to *P. paphius* Haliday but distinctly different in colour patterns as follows : (1). Lower face including clypeus black (In *P. paphius* lower face including clypeus ochraceous yellow); (2). Occiput entirely black (In *P. paphius* occiput ochraceous yellow except a small portion near ocellar area); (3). Mesoscutum black except lateral sides (In *P. paphius* small black patches on each side and posterior portion of mesoscutum); (4). Scutellum including scutellar horn black except a narrow portion on lateral parts of scutellum (In *P. paphius* black patches on base of scutellum and scutellar horn only); (5). Lateral and lower margins of prepectus black (In *P. paphius* prepectus completely ochraceous yellow); (6). Mesopleuron completely black (In *P. paphius* mesopleuron black except anterodorsal area).

SUMMARY

The genus *Philomides* Haliday is represented by two species in Indian subcontinent. They are *P. paphius* Haliday and *P. indicus* Girish Kumar and Narendran sp. nov. and commented on.

ACKNOWLEDGEMENTS

We are grateful to the authorities of University of Calicut for providing facilities. The first and third authors are also grateful to Dr. Ramakrishna, Director-in-charge, Zoological Survey of India, Kolkata and Shri C. Radhakrishnan, Officer-in-Charge, Western Ghats Field Research Station, Zoological Survey of India, Kozhikode for providing facilities and encouragements.

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