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Dr. J. R. B. ALFRED
Director
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RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

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ON SOME COLLECTION OF COLLEMBOLA (APTERYGOTA : INSECTA) FROM UTTARANCHAL, INDIA

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INTRODUCTION

A faunistic survey was undertaken during the month October–November, 2000 to ascertain the anthropogenic impact on type localities of a number of species described by Mitra (1966 a,b, 1967, 1973 a,b,c, 1974 a,b, 1975, 1992, 1993), from this region more than three decades ago along with making general collections. Topotypes of the most of the species could be collected in spite of drastic habitat changes along with the change of the vegetation of some type localities even after nearly three decades. This indicates the great resilience of Collembola even though such intrinsic habitat changes have taken place over years.

Altogether 12 species were collected representing 9 genera and 2 families. Out of 12 species, five species are represented by topotypes which are marked with asterix.

SYSTEMATIC ACCOUNT

Order COLLEMBOLA

Suborder ARTHROPLEONA

Key to the Super families of ARTHROPLEONA

- First thoracic segment dorsally distinct with dorsal setae PODUROIDEA, Womersley, 1933.
First thoracic segment without dorsal setae and frequently more or less reduced or hidden dorsally by mesothoracic segment ENTOMOBRYOIDEA, Womersley, 1933.

Key to the families of ENTOMOBRYOIDEA

1. Hind coxae usually with trochanteral. Abdomen IV appreciably longer than abdomen III. Scales present or absent, often ciliated. Furcula well developed. ENTOMOBRYIDAE, Tomosvary, 1882.
2. Hind coxae without trochanteral organ. Abdomen III and IV usually subequal; the abdomen IV never more than one and half times as long as the abdomen III, the other posterior abdominal segments often fused, scales usually not present ISOTOMIDAE, Börner, 1993.

Key to the subfamilies of ENTOMOBRYIDAE

1. Dentes dorsally crenulated and curving upwards basally in the line with manubrium Entomobryinae, Schaeffer, 1896
- Dentes not crenulated, straight and usually forming a basal angle with manubrium 2
2. Serrated or coarsely ciliated dental spine is absent 3
- Serrated or coarsely ciliated dental spine present on the basal portion of the dentes only Tomocerinae, Schaeffer, 1896
3. Eyes and pigment present; dentes without dorsal scale and with apical lobe Paronellinae, Börner, 1913

Family ENTOMOBRYIDAE

Subfamily ENTOMOBRYINAE, Schaeffer, 1896

Dentes crenulated dorsally. Mucrone fulcate with basal spine. Short and hook-like. Body with hairs or scales or both. The chaetotaxy of head and trunk and eye numbers are useful in identifying the members of this family.

Genus *Lepidocyrtus* Bourlet, 1839

The genus represented by single species.

1. *Lepidocyrtus (Acrocyrtus) heterolepis* Yosii, 1959

1959. *Lepidocyrtus (Acrocyrtus) heterolepis* Yosii, *Contr. Biol. Lab. Kyoto. Univ.*, **10** : 33.

Material examined : Lacchiwala Forest Range, Dehradun distt., 28.10.2000, Coll. S. K. Mitra, 23 exs.

Diagnostic characters : Length upto 1.6 mm. Antennae uniformly bluish pigmented. A transverse stripe along the fore margin of head. Eyes black. Ant. segment ratio as 15 : 30 : 48 : Th. II is slightly protruded over the Head. Th. II, III as 75 : 25. Abd. III : IV as 3 : 12. Manubrium : dens as 24 : 18. Mucro bidentate, two teeth subequal and with a basal spine.

Distribution : INDIA : Uttaranchal, Manipur, SINGAPORE, MALAY

Genus *Homidia* Börner, 1906

The genus represented by single species.

2. *Homidia cingula* Börner, 1906

Material examined : Herbertpur, Alt. 2500', Dehradun distt., 30.10.2000, Coll. S. K. Mitra, 22 exs.

Diagnostic characters : Back ground yellowish. Blue black pigment forming transverse band on the III-rd and IV-th abdominal segments. Body not compressed. Dental spine '33' in numbers. Apical mucronal tooth smaller than anteapical.

Distribution : INDIA : Uttaranchal, Manipur, Sikkim.

Subfamily TOMOCERINAE

Fourth antennal segment shorter than the third this character easily separates this subfamily from all other Entomobryids.

Genus *Tomocerus* Nicolet, 1842

The genus represented by single species.

3. *Tomocerus (s. str) mitrai* Prabhuo, 1980

1980. *Tomocerus (S. str.) mitrai* Prabhuo and Murlidharan, *Entomort.*, 5(3) : 207-210.

Material examined : Khirsu, coniferous forest floor, Pauri Garhwal Distt., 6.11.2001, Coll. S. K. Mitra, 26 exs.; Jwalpa Devi, Pauri Garhwal Distt., 5.11.2001, Coll. S. K. Mitra, 32 exs.

Diagnostic characters : Ground colour yellowish-white with blue pigment towards lateral margin of thorax and Ant. II–III. Ocellar field deep blue. Body clothed with brownish blunt scales with prominent striation and finely ciliated setae. Dentes with scales on ventral side, towards the distal half two rows of unilaterally plumose setae 8–10 in a rows. Ocelli 6 + 6, unguis of usual type with 5 to 6 teeth. Dental spine brown in color, finely striated longitudinally in a single row as 3, 1.5, 1. Mucro elongated 4 intermittent teeth on outer lamella and two basal teeth. Outer basal tooth of mucro with a comer toothlet.

Distribution : INDIA : Uttaranchal, Arunachal Pradesh, Sikkim, Himachal Pradesh.

Subfamily PARONELLINAE Börner, 1913.

This subfamily can be distinguished from other Entomobryids by the rigid and short dentes, presence of dental scale appendage on the terminal part of dentes. The mucrones is majority cases are plump, lobed into several teeth and is different in shape from the members of subfamily Entomobryinae.

Key to genera of subfamily PARONELLINAE from Uttaranchal

1. Body covered with scales 2
- Body not covered with scales 3
2. Dental scale appendage and 4 + 4 frontal spines present, antennal segments without thick outstanding brush setae *Callyntrura* Börner

- Dental scale appendage and 4 + 4 frontal spines absent, antennal segments with thick outstanding brush setae *Dicranocentroides* Schött.
3. Mucro well developed, stout, bidantate or tridentate, dental scale appendage equal or subequal to mucronal length 4
- Mucro vestigial in the form of a hook, dental scale appendage highly enlarged *Yosiia* Mitra
4. Mucro with 2 apical teeth; ventral tube anteriorly on anterior face with 5 + 5 macrochaetae; 1 + 1 frontal spines reduced *Pseudosalina* Mitra
- Mucro with 3 apical teeth; ventral tube anteriorly on anterior face with 4 + 4 macrochaetae; 1 + 1 frontal spines well developed *Salina* MacGillivray

Genus *Pseudosalina*, Mitra 1966

The genus represented by three species.

*4. *Pseudosalina nigrocephala* (Mitra, 1966)

1966. *Salina nigrocephala* Mitra, *Indian J. Ent.* **28** : 70-72.

1973. *Pseudosalina nigrocephala* Mitra, *Rev. Ecol. Biol. Sol.*, **10** : 359-377.

Material examined : Sahasradhara Hills, Dehradun distt., Uttarakhand, Coll. S. K. Mitra, 26.10.2000, 22 exs. (*Topotypes*)

Diagnostic characters : Ground colour pale green in spirit, general surface of body clothed with slender acuminate setae; each ocellar field contains 8 ocelli, arranged in two longitudinal parallel rows. Relative length index of Ths. II : III = 18 : 9. Relative length index of Abds. I : II : III : IV : V : VI = 9 : 14 : 4 : 40 : 9 : 5; ventral tube well developed. Relative length index of manubrium : mucrodens = 50 : 59 : mucro stout, with two prominent leg like teeth, dental scale appendage well developed; dental spines absent. Body length (excluding appendages) : 1.6–2 mm.

Distribution : INDIA : Uttarakhand (Dehradun distt.).

*5. *Pseudosalina multiformis*, Mitra, 1973

1966. *Pseudosalina multiformis* Mitra, *Rev. Ecol. Biol. Soc.*, **10**(3) : 359-377.

Material examined : Sahasradhara Hills, Dehradun distt., Uttarakhand, Coll. S. K. Mitra, 26.10.2000, 15 exs. (*Topotypes*).

Diagnostic character : General ground colour of head and body varies from white to pale yellow, darker patches present on Ths. II, III and anteriorly as Abd. I; body clothed with micro and macrochaetae; microchaetae acuminate and form the general clothing of the body; 8 + 8 ocelli in dark pigmented ocellar fields; relative length index of Ants I : II : III : IV = 13 : 8 : 7 : 18;

Relative length index of Ths. II : III = 26 : 17; Relative length index of Abds. I : II : III : IV : V : VI = 14 : 21 : 8 : 75 : 7; relative length index of manubrium : mucroden = 59 : 66; mucro bidentate; dental scale appendage faintly striated. Body length (excluding appendages) : 1.29–2 mm.

Distribution : INDIA ; Uttaranchal (Dehradun distt.).

***6. *Pseudosalina christianseni* Mitra, 1973**

1973. *Pseudosalina christianseni* Mitra, *Rev. Ecol. Biol. Soc.* 10(3) : 359-377.

Material examined : Rajaji National Park, Saharanpur distt., Uttaranchal, Coll. S. K. Mitra, 16 exs. (*Topotypes*).

Diagnostic characters : Ground colour of head and body pale yellow; violet to blue black patches present on III, Abd. I and Abd. II. General surface of body uniformly clothed with ciliated microchaetal interspersed with flexed, obliquely truncated, ciliated macrochaetae on vertex. 2 dark ocellas fields, containing 8 ocelli; relative length index of Ants. I : II : III : IV = 40 : 43 : 41 : 55; Th. I reduced; relative length index of Ths. II : III = 34 : 30; Relative length index of Abds. I : II : III : IV : V : VI = 12 : 17 : 10 : 57 : 11 : 7; ventral tube moderately long. Manubrium : mucrodens = 49 : 62; mucro broad with two teeth and a ridge like thickening on inner lateral surface; dental scale appendage simple, with a basal plate and apically striated. Length (excluding appendages) : 0.6–1.1 mm.

Distribution : INDIA : Uttaranchal (Saharanpur distt.).

Genus *Yosii* Mitra, 1967.

***7. *Yosii dehradunia* Mitra 1967**

1967. *Yosii dehradunia* Mitra, *Proc. Zool. Soc, Calcutta*, 20 : 43-47.

Material examined : Motichur Forest Range, Hardwar Distt. 3900', 8.11..2000, Coll. S. K. Mitra, 18 exs.; Rajaji National Park, Dehradun Distt., Uttaranchal, 27.X.2000, Coll. S. K. Mitra, 12 exs. (*Topotypes*).

Diagnostic characters : Ground colour pale yellow, dusted with blue pigment all over the body. Clothed with slender acuminate setae. Dens crenulated, mucro falsiform, some time perceptible in the form of a booklet, not demarcated from dens. Dental appendage highly enlarged. Pear shaped head, 8 + 8 ocelli. Ant. III and IV faintly annulated, relative length index of Ants. I : II : III : IV = 32 : 46 : 48 : 70. Th. I reduced, the relative length index of Th. II : III = 23 : 11. Each tibiotarsus with two large tibio-tarsal lobes. The relative length index of Abd. I : II : III : IV : V : VI = 6 : 15 : 4 : 67 : 9 : 6. Ventral tube short. Body length 1.14 mm.

Distribution : INDIA : Uttaranchal, Sikkim, Tripura (West Distt.), West Bengal.

Genus *Callyntrura* Börner, 1906

Two species are recorded from present survey.

*8. *Callyntrura variabilis* Mitra, 1974

1974. *Callyntrura (callyntrura) variabilis* Mitra, *Rev. Ecol. Biol. Soc.*, **11**(3) : 397-439.

Material examined : Nepalifarm, Dehradun distt. Uttaranchal, 29.10.2000. Coll. S. K. Mitra, 16 exs., Golatappar Forest Block, Dehradun distt. 30.X.2000, Coll. S. K. Mitra, 22 exs. (*Topotypes*).

Diagnostic characters : General ground colour of body yellow to brown with variable dark blue-black patches; body clothed VI = 17 : 24 : 8 : with scales and flexed setae; 8 + 8 ocelli in pigmented ocellar fields; relative length index of Ants. I : II : III : IV = 18 : 17 : 11 : 27; relative length index of ths. II : III = 42 : 25; legs all similar; relative length index of Abds. I : II : III : IV : V : VI = 17 : 24 : 8 : 94 : 10 : 4; relative length index of manubrium : microdens = 23 : 29.5; micro with 6 teeth; dental scale appendage absent. Body length (excluding appendages) : 2 mm.

Distribution : India : Uttaranchal (Dehradun distt).

9. *Callyntrura (Handschinphysa) lineata* (Parona) 1892 *sensu* Mitra, 1973

1892. *Entomobrya lineata* Parona. *Ann. Soc. Hal. Milano* **34** : 132-135.

1912. *Paronella borneri* Imms. *Proc. Zool. Soc. London* pp. 80-125.

1912. *Paronella phanolepis* : Imms, *Proc. Zool. Soc. London*, pp. 80-125.

1957. *Handschinphysa lineata* Salmon, *Acta. Zool. Cracov* **11**(14) : 313-362.

1973. *Callyntrura (Handschinphysa) lineata* Mitra, *Rev. Ecol. Biol. Sol.*, **11** : 397-439.

Material examined : Sahasradhara Hills, Dehradun distt., Uttaranchal, 26.10.2000, Coll. S. K. Mitra, 13 exs.; Tehri, Tehri Garhwal distt., 2700', 02.11.2000, Coll. S. K. Mitra 8 exs.

Diagnostic characters : Pale to deep yellow with deep blue-black ocellar fields; antennae little longer than body. And ratio as 75 : 80 : 85 : 55 : 125. Manubrium to dens to mucro as 105 : 130 : 718; mucro with two apical teeth, two plate-like teeth and a spine-like tooth on the posterior face and one or two lateral teeth. Body length upto 3.75 mm.

Distribution : INDIA : Uttaranchal, Manipur, Sikkim.

Genus *Salina* MacGillivray 1894

The genus is represented only single species.

10. *Salina indica* (Imms 1912)

1912. *Cremastocephalus indicus* Imms, *Proc. Zool. Soc. London*, : 80-125.

1957. *Salina indica* Salmon, *Acta. Zool. Cracov.*, **11**(14) : 313-362 (In part).

1973. *Salina indica* Mitra, *Oriental Insects.*, **7**(2) : 159-202.

Material examined : Lacchiwala forest Range, 2500', Dehradun distt., Uttaranchal, 28.10.2000, Coll. S. K. Mitra, 15 exs.

Diagnostic characters : Ground colour yellowish, overlaid irregularly by violet pigment which usually follows a lateral edges of the terga. Ocelli on black fields 8 + 8. General clothing of short to medium length ciliated setae with some long, stout, lightly flexed ciliated setae at the apex of mesotergum & along the dorsal surface of the thorax. Apex of dens with scale like appendage. Mucro bearing three plain teeth.

Distribution : INDIA : Uttaranchal, Manipur, Sikkim, Tripura, West Bengal, U.P.

Genus *Dicranocentroides* (Imms, 1912)

11. *Dicranocentroides flavescens* Yosii, 1966

1966. *Dicranocentroides fasciculatus f.n. flavescens* Yosii, *Res. Kyoto. Um. Sci. Exped. Karakoram and Hindukush*, 1955, 8 : 333-405.

Material examined : Herbertpur, 2500', Dehradun distt. 30.10.2000, Coll. S. K. Mitra, 14 exs.

Diagnostic characters : A dark patch characteristic of the species present on vertex in between two ocellar fields. Dark patches absent on body. Ocelli 8 + 8. Relative length index of Ant. I : II : III : IV = 15 : 17 : 12 : 19. Relative length of Th. II : III = 14 : 8.5. Legs all similar, unguiculus lanceolate, acuminate with 2 external teeth. Relative length index of Abds I : II : III : IV : V : VI = 5 : 6 : 4 : 39 : 5.5 : 2. Ventral tube long with a row of macrochaetal anteriorly. Relative length of manubrium : mucrodens = 28 : 38, dentes armed with two closely opposed rows of spines on inner margin; mucro large, parallel sided with 6 teeth. Body length 2–3.5 mm.

Distribution : INDIA : Sikkim, Tripura (West Distt.), Uttaranchal, West Bengal, Maharashtra, U.P.

Family ISOTOMIDAE Börner, 1913

Subfamily ISOTOMINAE, Schaeffer, 1896

Head prognathus, tracheae absent. Antennae inserted in front half of head. P.AO. usually present, always simple, mucrones short.

Genus *Isotomurus* Börner, 1906

12. *Isotomurus balteatus* (Reuter, 1876)

1876. *Isotomurus balteatus* Reuter, *Med. Soc. Fauna. Et. Flora. Fenn.*, 1 : 82.

1963. *Isotomurus balteatus* : Yosii, *Contr. Biol. Lab. Kyoto. Univ.*, 15 : 4.

Material examined : Sahasradhara Hills, Deradun distt., Uttaranchal, 26.X.2000, Coll. S. K. Mitra, 12 exs., Nepali farm, Dehradun Distt., 29.X.2000. Coll. S. K. Mitra, 10 exs.

Diagnostic character : Colour with a violettish black pigment which form distinct transverse band on the anterior margin of tergites. Ant. Ratio = 10 : 15 : 16 : 26; ant. IV with two short subapical sense rods. P.A.O. as large as anterior ocellus. Ocelli 8 + 8. Furcula reaches forward to the ventral tube furculor segments related as 5 : 12 : 1. Dens distinctly annulated on dorsal side; mucro with a small apical, 2 large subapical and a large external lateral teeth.

Distribution : INDIA : Uttaranchal, Manipur, Tripura, Arunachal Pradesh, Kerala.

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SOME HITHERTO UNKNOWN MITES (ACARI) FROM BANGLADESH

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INTRODUCTION

Mite fauna of Bangladesh is very poorly known. One of the authors (MZRM) while examining some plant parts for quarantine purpose collected mites either infesting the plant parts directly or were found associated with some of the insect pests which occurred on those plants. The present paper is based upon this collection and it reports 10 species belonging to 10 families and 10 genera under 3 orders. Incidentally all form new reports from Bangladesh. The entire collection was made by one of the authors (MZRM).

SYSTEMATIC ACCOUNT

Order I. PROSTIGMATA

Family 1. TETRANYCHIDAE Donnadieu, 1875

1. *Tetranychus urticae* Koch

1836. *Tetranychus urticae* Koch, *Deu. Crust. Myr. Arach. Fasc.*, 1 : 10.

Material examined : 2 females, Bangladesh, Dhaka, ex Jute (*Corchorus capsularis* Linn.), 6.9.2000.

Distribution : Bangladesh (Dhaka). Elsewhere : Cosmopolitan.

Remarks : It is a serious pest of a number of agricultural crops throughout the world. Its occurrence has also been recorded on jute in India (Gupta, 1985). This is the first record on jute in Bangladesh.

Family 2. BDELLIDAE Duges, 1834

2. *Bdella maldahensis* Gupta

1992. *Bdella maldahensis* Gupta, In : *State Fauna Ser. 3, Fauna of West Bengal, Part 3*, p. 12.

Material examined : 2 females, Bangladesh, Savar, on rose (*Rosa centrifolia* Linn.) leaf feeding upon *Oligonychus biharensis* (Hirst), 21.8.2000.

Distribution : Bangladesh (Dhaka). Elsewhere : India.

Family 3. TARSONEMIDAE Kramer, 1877

3. *Tarsonemus granarius* Lindquist

1972. *Tarsonemus granarius* Lindquist, *Can. Ent.*, **104** : 1699.

Material examined : 2 males, Bangladesh, Dhaka, Savar, ex coconut (*Cocos nucifera* Linn.) leaf, 21.8.2000; 2 females, Savar, ex rose leaf infested with round scale insect, 27.9.2000.

Distribution : Bangladesh (Dhaka). Elsewhere : India, British Isls., Canada, Japan.

Remarks : The earlier reports indicate its feeding upon decaying grains, humus, grass, fungi, etc. (Hughes, 1976). However, its occurrence on rose leaf infested by scale insect appears to be interesting.

Family 4. TYDEIDAE Kramer, 1877

4. *Pronematus fleschneri* Baker

1968. *Pronematus fleschneri* Baker, *Ann. Ent. Soc. Am.*, **61**(5) : 1092.

Material examined : 1 female, Bangladesh, Dhaka, Savar, ex coconut (*Cocos nucifera* Linn.) infested with mealy bug, 20.7.2000.

Distribution : Bangladesh (Dhaka). Elsewhere : India.

Remarks : In India, it has been recorded on a number of plants feeding upon several species of spider mites, mostly their eggs (Gupta, 2002). However, its association with mealy bug is interesting. Might be, it fed upon eggs of mealy bugs.

Family 5. CHEYLETIDAE Leach, 1915

5. *Hemicheyletia* sp.

Material examined : 3 females, Bangladesh, Dhaka, Savar, ex rose (*Rosa centrifolia* Linn.) infested with round scale insect, 26.9.2000.

Remarks : The occurrence of this species on rose leaf infested with scale insect is interesting in the sense that so far no species of this genus has been recorded from such habitat. Due to the damaged condition of the species, the specific identity could not be ascertained.

Family 6. PYGMEPHORIDAE Cross, 1965

6. *Siteroptes* sp.

Material examined : 1 female, Bangladesh, Dhaka, Savar, ex rose (*Rosa centrifolia* Linn.) infested with round scale insect, 18.10.2001.

Remarks : Due to having inadequate literature, the specific identity could not be ascertained.

Family 7. MICRODISPIDAE

7. *Brennandania* sp.

Material examined : 2 females, Bangladesh, Dhaka, Savar, ex rose (*Rosa centrifolia* Linn.) infested with round scale insect, 18.10.2001.

Remarks : Due to paucity of literature, the specific identity could not be made.

Order II. ASTIGMATA

Family 8. ACARIDAE Leach, 1806

8. *Tyrophagus putrescentiae* (Schrank)

1781. *Acarus putrescentiae* Schrank, *Enum. Inst. Aust. Indig.*, 521.

Material examined : 1 female, Bangladesh, Dhaka, Savar, ex coconut infested with mealy bug (?), 20.8.2000; several females, savar, ex guava, associated with white mealy bug (?), 11.12.20002.

Distribution : Bangladesh (Dhaka). Elsewhere : Cosmopolitan.

Remarks : The occurrence of this mite on coconut and guava infested with mealy bug is rather interesting as because all the past records of this species were from habitats having mainly fungal infestation and no record is available where this mite has been collected in association with insects.

Order III. CRYPTOSTIGMATA

Family 9. GALUMNIDAE Jacot, 1925

9. *Galumna* sp.

Material examined : 6 females, Bangladesh, Dhaka, Savar, ex water hyacinth (*Eichornea crassipes* Solms.), 3.11.2001.

Family 10. ORIBATULIDAE Thor, 1929

10. *Oribatula* sp.

Material examined : 1 female, Bangladesh, Dhaka, Savar, ex coconut (*Cocos nucifera* Linn.) leaf, 21.8.2000; 5 females, Savar, ex books, 29.5.2001.

Remarks : The mites of this genus are known to inhabit soil and plants but none has so far been recorded within books and therefore, it is an interesting habitat for this mite wherefrom the present record has been made.

Keys to orders, families, genera and species treated in this paper
(Partly based on Meyer *et al.*, 1973)

1. Ambulacra of legs comprising a median claw with a prominent pre-tarsus or an associated membranous pad or a stalked-sucker-like organ, chelicerae invariably chelate, trichobothria never present on idiosoma, stigma and tracheae absent
..... *Astigmata* (*Tyrophagus putrescentiae*)
- Ambulacra of legs not as above, chelicerae chelate or variously modified into piercing stylets or hook-like organ, idiosoma often with trichobothria, a respiratory system usually present 2
2. Propodosomal trichobothria, when present, usually with conspicuous pseudostigmata, chelicerae rarely chelate dentate; pedipalps various, often tibia and tarsus forming thumb-claw complex, tracheae when present opening by paired stigmata situated between the chelicerae or on the dorsal surface of propodosoma and often with associated peritremes, usually weakly sclerotized mites *Prostigmata*, 3
- One pair of propodosomal trichobothria almost invariably present and comprising piliformed, barbed or clavate pseudostigmatid organ arising from conical depressions, the pseudostigmata, chelicerae typically chelate dentate, pedipalps simple, tibia never with a distal claw, tracheal system when present, opening to the exterior in the acetabular cavities of legs I and II or in the form of brachytracheae opening to the legs I & II or pseudostigmata, idiosoma normal, well sclerotized mites *Cryptostigmata*, 9
3. Gnathosoma with minute palpi lying closely appressed laterally, chelae tiny and stylet like, with 4 pairs of legs, stigma of female opening behind gnathosoma or propodosoma, male without stigma or tracheae, usually a membranous flap-like organ attached to claws 4
- Gnathosoma usually conspicuous, with large chelicerae; palpi usually well developed, rarely without 4 pairs of legs, stigma opens at base of chelicerae, empodium free, pad-like or claw-like arising from tarsus 6

4. Leg IV of female with separate femora and genua, often with claws and membranous empodia, leg IV of male 5 segmented Pygmephoridea, 5
- Leg IV of female when present with fused femora and genua and without claws and empodia; leg IV of male when present usually 4 segmented with a sessile claw Tarsonemoidea*
- * Leg IV of female ending in terminal and subterminal whip-like setae Tarsonemidae**
- ** Pedipalps never prolonged to form snout-like beaks, inner margins of femora IV not modified, tibiotarsus IV not conspicuously incurved, leg IV with terminal claw and 4 pairs of dorsopropodosomal setae *Tarsonemus****
- *** Gnathosoma longer than wide, palps cylindrical, nearly parallel, dorsal propodosomal shield triangular, apodemes of leg I meet to form sternum, those of legs II, III free, stigmata open at base of Leg I *T. granarius*
5. Propodosoma with 2–3 pairs of setae, femora I with 3–5 setae Pygmephoridae (*Siteroptes* sp.)
- Propodosoma with only one pair of setae, femur I with 3 setiform setae Microdispidae (*Brennandania* sp.)
6. Without a palpal thumb-claw complex 7
- With a palpal thumb-claw complex 8
7. Cheliceral bases fused or if not fused, not capable of lateral scissors-like motion over gnathosoma Tydeidae*
- * Femer III and IV without forked seta *Pronematus***
- ** Solenidion on tarsus I distal *P. fleschneri*
- Chelicerae free, attached at base and free to move scissors-like laterally across gnathosoma Bdellidae*
- * Six pairs of ventral hysterosomal setae, 4 pairs of trichobothria and undeveloped genital tracheae, expanded palpal tibiotarsus *Bdella***
- ** Hysterosoma with 7 pairs of setae including humeral, palp tibiotarsus with 5 setae *B. maldahensis*
8. Cheliceral bases closely fused with gnathosoma and without indication of suture; peritremes usually M-shaped, may be present on gnathosoma*
- * Comb-like and sickle-like setae may or may not be present on palp, tarsi II, III, IV and usually I with claws and empodia Cheyletidae**
- ** Pedicel of tarsus I normal, about as long as any seta arising on it, claws on tarsus I smaller than those on tarsus II, but not difficult to discern, mesal paraterminal sensillus of tarsus I setiform not overhanging tips of claws *Hemicheyletia*

- Cheliceral bases fused with each other but not with gnathosoma, having suture conspicuous, peritremes usually present on anterior portion of propodosoma*
- * Tarsi I and II with specialized duplex setae, female genitalia wrinkled, stylophore relatively broad *Tetranychidae***
- ** Empodia splits distally usually into 3 pairs of hairs, duplex setae on tarsus I separated *Tetranychus****
- *** Anterior and posterior projections of aedeagal knob similar *T. urticae*
9. Pteromorphae movable or not movable but never articulate, genital setae 4–5 pairs.....
..... *Oribatulidae**
- * Dorsosejugal suture present, 10 pairs of notogastral setae, 4 pairs of genital setae, legs tridactylous *Oribatula*
- Pteromorphae movable, articulate or semicircular, 6 pairs of genital setae present
..... *Galumnidae**
- * Lamellar line *L* present, lamellar setae originate between lines *L* and *S* **
- ** Mites with specialised tarsal setae *Galumna*

SUMMARY

The present paper reports 10 species of mites belonging to as many families and genera occurring on rose, jute, coconut, guava and also from some unusual habitat like book, etc. Incidentally all the species form new records from Bangladesh.

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SOME NEW RECORDS OF MITES (ACARI) FROM BANGLADESH

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INTRODUCTION

The published reports on mite fauna of Bangladesh in general and that on fruit trees and ornamental plants in particular are scanty though it is a fact that due to rich floral wealth of the country, the mite fauna is also likely to be rich there. One of the authors (MZRMR), while examining various plants, flowers, etc. sent to him for routine examination in connection with quarantine purpose, collected a good number of mites from such habitat and the present paper is based upon those material. It reports a total of 12 species belonging to 9 families and 12 genera under 4 orders and all appear to be new records from Bangladesh.

SYSTEMATIC ACCOUNT

Order I. PROSTIGMATA

Family 1. TETRANYCHIDAE Donnadieu, 1875

1. *Eutetranychus orientalis* (Klein)

1936. *Anychus orientalis* Klein, *Agric. Res. Stn. Rehovoth*, 21 : 3.

1960. *Eutetranychus orientalis*; Baker & Pritchard, *Hilgardia*, 29 : 464-467.

Material examined : 5 females, Bangladesh, Dhaka, Savar, ex rotten rose (*Rosa centrifolia* Linn.) leaf, 18.5.1996.

Distribution : Bangladesh (Dhaka). Elsewhere : India, Pakistan, Tiwan, Israel, Turkey, Jordan, Afghanistan, Cyprus, South Africa, East Transvaal.

Remarks : This species is recorded for the first time from Bangladesh. It is a serious pest of a number of fruit trees and ornamental plants throughout the world of which citrus is the most

important on which it causes substantial damage. All the previous records of this species were from leaves of various plants (Gupta & Gupta, 1994) but not on any rotten material like rotten rose leaf, as has been recorded here.

2. *Oligonychus biharensis* (Hirst)

1925. *Paratetranychus biharensis* Hirst, *Bull. zoll. Soc. Lond.*, p. 69.

1955. *Oligonychus biharensis*; Pritchard & Baker, *Pacific Coast Ent. Soc. Mem. Ser.*, 2 : 364-365.

Material examined : 6 females, Bangladesh, Dhaka, Savar, ex rose (*Rosa centrifolia* Linn.) leaf, 22.6.1993.

Distribution : Bangladesh (Dhaka). Elsewhere : India, Philippines, Mauritius, Hawaii, Brazil, Antigua.

Remarks : Earlier this species has been recorded from a number of plants including rose (Gupta, 1985) but its record in Bangladesh was hitherto unknown.

3. *Tetranychus urticae* Koch

1836. *Tetranychus urticae* Koch, *Deu. Crust. Myr. Arch. Fasc.* 1 : 10.

Material examined : Several females & males, Dhaka, Savar, ex *Zinia* (*Zinia elegans* Linn.) flower, 30.6.1996.

Distribution : Bangladesh (Dhaka). Elsewhere : Cosmopolitan.

Remarks : This is a polyphagous species and has been recorded earlier on over 300 host plants (Gupta, 1985; Gupta & Gupta, 1994; Meyer, 1974; Smith-Meyer, 1987). It is a serious pest of a number of vegetables, fruit trees, oilseeds, spices, pulses and ornamental plants and the damage done by this mite causes serious economic loss to the growers.

Family 2. TARSONEMIDAE Kramer, 1877

4. *Tarsonemus* sp.

Material examined : 5 females, Bangladesh, Dhaka, Savar, ex *Zinia* (*Zinia elegans* Linn.) flower, 19.5.1993.

Remarks : The species of this genus has so far not been recorded from Bangladesh. Due to non-availability of male specimen, the specific identity could not be determined.

Family 3. CHEYLETIDAE Leach, 1915

5. *Cheyletus malaccensis* Oudemans

1903. *Cheyletus malaccensis* Oudemans, *Ent. Ber.*, 1(2) : 88.

Material examined : 4 females, Bangladesh, Dhaka, Savar, ex coriander (*Coriandrum sativum* Linn.) 10.5.1997.

Distribution : Bangladesh (Dhaka). Elsewhere : India, Peru, Mexico, Europe, China, Malayasia, Philippines, Japan, USA.

Remarks : Originally, this species was described from Malacca straits on skin of the bird, *Psittinus cyanurus* and also was recorded in debris of leg horn. In India, it has been recorded to feed upon eggs of *Rhizopertha* on paddy, *Michelia champaca*, guava (*Psidium guajava* Linn.) and as predator. This species also predate on *Rhizopertha* and *Togoderma* eggs (Gupta, 2002).

Family 4. CUNAXIDAE Thor, 1902

6. *Cunaxa bambusae* Gupta & Ghosh

1980. *Cunaxa bambusae* Gupta & Ghosh, *Rec. zool. Surv. India*, **77** : 198-199.

Material examined : 6 females, Bangladesh, Dhaka, Savar, ex rose (*Rosa centrifolia* Linn.) leaf, 22.6.1993.

Distribution : Bangladesh (Dhaka). Elsewhere : India.

Remarks : Many species of this genus are efficient predators of plant feeding mites. However, in the present case, such observation has not been made.

Order II. MESOSTIGMATA

Family 5. PARASITIDAE Oudemans, 1901

7. *Parasitus* sp.

Material examined : 4 females, Bangladesh, Dhaka, Savar, ex rotten gourd (*Cucurbita pepo* D.C.), 9.11.1998.

Remarks : The damaged condition of the specimens stood on the way of its specific identification.

Family 6. UROPODIDAE Berlese, 1917

8. *Fuscuropoda marginata* (Koch)

1839. *Notaspis marginata* Koch, In : Hughes (1976), *The mites of stored food and houses*, p. 366-368.

Material examined : 3 females, Bangladesh, Dhaka, Savar, ex rotten sweet gourd (*Cucurbita maxima* Duchesne), 7.7.1995.

Distribution : Bangladesh (Dhaka). Elsewhere : India, Holland, Germany, Yugoslavia, England.

Remarks : The occurrence of the species in rotten sweet gourd is quite obvious because of the fact that it is commonly available in rotten plant material as well as in manure. It has also been recorded in cucumber house (Hughes, 1976). It probably fed on fungi grown on rotten material.

Order III. ASTIGMATA

Family 7. SAPROGLYPHIDAE Oudemans, 1924

9. *Calvolia* sp.

Material examined : 1 female, Bangladesh, Dhaka, Savar, ex *D. macutin*, 15.5.1998.

Remarks : This is the first record of this genus from Bangladesh.

Family 8. ACARIDAE Leach, 1806

10. *Rhizoglyphus robini* Claparede

1869. *Rhizoglyphus robini* Claparede, In : Hughes, 1976, *The mites of stored food and houses*, p. 116-122.

Material examined : 6 females, Bangladesh, Dhaka, Savar, ex rotten zinger (*Zingiber officinale* Roscoe), 10.5.1997.

Distribution : Cosmopolitan.

Remarks : This mite is called the bulb mite as they commonly infest bulbs of potato (Hughes, 1976). It is also available on decaying plants. The occurrence of this mite on zinger is, therefore, nothing surprising. As per published information, it is more common on live bulbs than on decaying ones but in the present observation, the case was just the reverse. It also attacks onion, tulip, dahlia tubers, etc. in the field or in storage. The extent of damage sometimes may be serious (Gupta, 1985).

11. *Tyrophagus putrescentiae* (Schrank)

1781. *Acarus putrescentiae* Schrank, *Enun. Inst. Amst. Indig.*, 521.

Material examined : 5 females, Bangladesh, Dhaka, Savar, ex tuber rose (*Polyanthes tuberosa* Linn.), 7.8.1995; 7 females, Savar, ex rotten rose (*Rosa centrifolia* Linn.) leaf, 18.5.1996; 16 females, Savar, ex dried fruits, 15.10.1995; 12 females, Savar, ex nuts, 3.6.2000.

Distribution : Bangladesh (Dhaka). Elsewhere : Cosmopolitan.

Remarks : This species occurs in varied habitats but most common in laboratory fungal culture, stored food with high fat and protein content, dried eggs, ham, copra, cheese, different kinds of nuts, various kinds of seeds, banana, barley, tobacco, wheat flour, rotten flowers, etc. This is the first record of this species from Bangladesh.

Order IV. CRYPTOSTIGMATA

Family 9. AUSTRACHIPTERIIDAE Luxton, 1985

12. *Lamellobates palustris* Hammer

1958. *Lamellobates palustris* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, 10(1) : 100.

Material examined : 4 females, Bangladesh, Dhaka, Savar, ex dung beetle, 23.10.1993.

Distribution : Bangladesh (Dhaka). Elsewhere : India, Pakistan, Indonesia, Seycheles, Thailand, Tonga, Tapu Isl., Fiji, Argentina.

Remarks : This species was earlier recorded from soil, litter, dung as well as on plants but so far it was not recorded from dung beetle as phoretic association. Hence, the present habitat appears to be interesting. Hitherto this species was unrecorded from Bangladesh.

**Keys to the orders, families, genera and species treated in this paper
(Partly based upon Meyer *et al.*, 1973)**

1. Pedipalp apotele represented by a tined seta situated near inner basal angle of tarsus, stigma situated dorsal to coxae II–IV and usually with elongated peritreme, tritosternum usually with lacineae, tectum present roofing gnathosoma Mesostigmata, 4
— Apotele completely absent on pedipalp, stigma never situated dorsal to coxae II–IV 2
2. Ambulacra of legs comprising of a median claw with a prominent pre-tarsus or an associated membranous pad or a stalked sucker-like organ, chelicera invariably chelate, trichobothria never present on idiosoma, stigma and tracheae absent..... Astigmata, 10
— Ambulacra of legs not as above, chelicerae chelate or variously modified into piercing stytels or hook-like organ, idiosoma often with trichobothria, a respiratory system usually present 3
3. Propodosomal trichobothria when present usually without conspicuous pseudostigmata, chelicerae rarely chelate, dentate, pedipalps various, often with tibia and tarsus forming thumb claw complex, tracheae when present opening by paired stigmata situated between the chelicerae or on to the dorsal surface of propodosoma and often with associated peretremes, usually weakly sclerotized mite Prostigmata, 5
— One pair of propodosomal trichobothria almost invariably present and comprising piliform, barbed or clavate pseudostigmatid organ arising from conical depressions, the pseudostigmata, chelicerae typically chelata, dentate, pedipalps simple, tibia never with distal claw, tracheal system when present, opening to the exterior in the acetabular cavities of legs I and II or in the form of brachytracheae opening to the legs I and II or the pseudostigmata, idiosoma normal, well sclerotized mites Cryptostigmata*

- * Notogaster pronotic *i.e.* area porosae, sacculi or pori present; pteromorphae immovable, prodorsum with tutorium immovable, lamellae broad, sometimes synlamellata type, usually with 6 pairs of genital setae Austrachipteriidae**
- ** Lamellae broad, situated close together, completely separated as far as the transversal ridge which connects the lamellae basally, anterior border of lamellae without free tips, notogastral setae situated not only along the borders but also on the middle part
..... *Lamellobates****
- *** Other lamellar cuspides short and narrow, sensillus with long stalk, club-shaped, head beset with fine setae, notogastral setae 9 pairs, genital setae 6 pairs
..... *Lamellobates palustris*
- 4. Hypostomal setae 2 and 3 forming a transverse row posterior to hypostomal setae I, tritosternum usually removed from coxae I *Gamasina**
- * Metasternal shields in the female large, flanking the anterior portion of genital shield, spermatophoral process of movable digit of male chelicera fused with the digit distally *Parasitus (Parasitus sp.)*
- Hypostomal setae 1, 2, 3 in linear series, tritosternum usually partially or completely covered by the enlarged flattened coxae I, leg grooves usually developed Uropodina*
- * Tibia I with 3 dorsal seta (1-½-2-1) genu I with one anterolateral seta, femoral ridges usually present on all legs, base of tritosternum usually longer than wide and often covered by enlarged coxae I, leg depressions shallow or lacking Uropodidae**
- ** The distal surface covered by a shield enlarged by a continuous marginal shield with smooth inner border, from it arises a number of setae which are characteristically bent at an angle near their base, but a few terminal ones, straight, pectinate
..... *Fuscuropoda marginata*
- 5. Gnathosoma with a minute palpi lying closely appressed laterally, chelae tiny and stylet-like with 4 pairs of legs, stigma of female opening behind gnathosoma on propodosoma, male without stigma or tracheae, empodium without a membranous flap-like organ attached to claws Tarsonemidae*
- * Leg IV of male with distinct tibia and tarsus, their combined length being less than ½ of femur and less than 3 times the basal width of femur IV *Tarsonemus sp.*
- Gnathosoma usually conspicuous, with large chelicerae, palpi usually well developed, rarely without 4 pairs of legs, stigma opens at base of chelicerae, empodium free, pad-like or claw-like arising from tarsus 6
- 6. Without palpal thumb-claw complex*
- * With 2 pairs of genital suckers, the relatively long palpi turned inward distally
..... Cunaxidae**

- ** Palp genu apically without elongate apophysis, tarsi I–IV long, slender and attenuate, without conspicuous lateral bilobed flanges terminally *Cunaxa* sp.
- With a palpal thumb-claw complex, in some cases the claw may be small or obsolete, if obsolete, it is replaced by a relatively long seta 7
- 7. Cheliceral bases closely fused with gnathosoma and without indication of suture, peritreme usually M-shaped, may be present on gnathosoma *Cheyletidae**
- * Setae on margins of dorsal plates acicular, fusiform or narrow, spatulate, conspicuously barbed, no fan-shaped anal setae, dorsomedian setae when present, few in number, tiny and simple in structure *Cheyletus***
- ** Femur IV with 1 seta *Cheyletus malaccensis*
- Cheliceral bases fused with each other but not with gnathosoma, having setae conspicuous; peritremes usually present on anterior portion of propodosoma*
- * Tarsi I, II with specialised duplex setae, female genitalia wrinkled, stylophore relatively broad *Tetranychidae*, 8
- 8. Tarsus I dorsally with a single pair of usually associated duplex setae, empodium claw-like or rudimentary*
- * With 2 pairs of anal setae *Eutetranychus***
- ** 3rd and 4th dorsocentral hysterosomal setae forming a square *Eutetranychus orientalis*
- Tarsus I dorsally with 2 pairs of closely associated duplex setae, empodium claw-like or splits distally 9
- 9. Empodium claw-like with proximoventral hairs, duplex setae on tarsus I distal and approximate *Oligonychus**
- * Tarsi I with 3 pairs of proximoventral hairs on empodium *Oligonychus indicus*
- Empodium splits distally usually into 3 pairs of hairs, duplex setae on tarsus I well separated *Tetranychus*, (*Tetranychus* sp.)
- 10. Claw attached to apex of tarsus by a pair of short, thick condylophores; with claw and condylophores surrounded by a short cushion-like pulvillus, which is broadly attached to the tarsus, propodosoma and hysterosoma separated by a sejugal furrow; female genital opening without a paragenital sclerite *Acaridae*, 11
- Claw free in pulvillus and condylophores absent or claw attached to a pair or long, thin condylophores, pulvillus also elongated but still broadly attached to tarsus*
- * Body setae fine, hair-like, mostly quite long, never strongly pectinate or foliate, nor with forked or truncated ends; sejugal furrow always present; female genital opening very large, usually between coxae III and IV; cuticle transparent, finely striated of delicate membranous consistency, never bearing papillae *Saproglyphidae* (*Calvolia* sp.)

11. Opisthosoma with long whip-like setae *Tyrophagus**
- * Supracoxal setae expanded bearing fairly long pectinations, supporting arms of penis point outwards, penis curved twice like a coffee spot spout *Tyrophagus putrescentiae*
- Opisthosoma without such setae *Rhizoglyphus**
- * Setae sc i represented by microsetae, shorter than the supracoxal setae
..... *Rhizoglyphus robini*

SUMMARY

The present paper deals with 12 species of mites belonging to 9 families and 12 genera under 4 orders, collected on flowering plants, spices, vegetables, etc. from Bangladesh and all of those appear to be new records from the area.

ACKNOWLEDGMENTS

The authors are thankful to the Director, Zoological Survey of India, Kolkata, for the facilities.

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RECORD OF NEW LOCALITIES AND A NATURAL SANCTUARY FOR *HORAICHTHYS SETNAI* KULKARNI (PISCES : BELONIFORMES : ADRIANICHTHYIDAE) FROM KERALA

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INTRODUCTION

Horaichthys setnai Kulkarni (subfamily : Horaichthyinae), generally known as Thready Killifish, is the smallest known fish in India. The fish, hardly 3 cm long, is an estuarine form, also living temporarily in freshwater, inhabiting the quiet rocky corners and creeks of backwaters (Talwar and Jhingran, 1991). Kulkarni (1940) described this fish from the backwaters and tanks along the West Coast (type locality : Navalaki, Kathiawar coast), about 160 Km north and south of Bombay, Maharashtra. The fish is very characteristic with its body thin, translucent and elongate; dorsal fin small, near caudal fin; anal fin elongate; right pelvic fin absent in females; maxilla absent *etc.* Unlike all other indigenous fishes in the country, the fish is unique in its distinct sexual dimorphism : in adult male, the anterior part (the first six rays) of anal fin is separated off and modified into an independent gonopodium for transferring spermatophores upto the genital aperture of female during courtship. This fish is the only atherinomorph (the series Atherinomorpha comprising of the orders Beloniformes, Atheriniformes and Cyprinodontiformes) to produce spermatophores or encapsulated sperm bundles (Grier, 1984).

H. setnai, frequently found in the puddles and pools of stagnant brackish waters, swims in swarms near surface of water, mostly in midst of aquatic plants (Jayaram, 1999). Job (1940) reported this species from the shallow inlets, within tidal influence, of the coastal backwaters of Cochin and Trivandrum (localities : Cheranellore and Manummel). As a larvicidal surface feeder, destroying the early instars of mosquitoes and other insects, *H. setnai* is considered to be a 'valuable adjunct' to the other major larvivores like *A. lineatus* and *A. panchax* (Job, *op. cit.*).

Job (*op. cit.*), Hubbs (1941) and Silas (1959) reported the presumable distribution of this fish along the West Coast of India, from near the Gulf of Kutch (Gujarat) to Trivandrum (Kerala) near the southern tip of the west coast. The extension of its range of distribution to Narmada and Tapi Rivers was later confirmed by Karamchandani and Pandit (1971). By collecting the specimens from Narmada river at Jhanor located as far inland as 64 Km from the sea, and from the freshwater

*National Fish Seed Farm, Malampuzha. P.O., Palakkad District, Kerala.

sites of Tapti River at Kathor and Bodhan, both located far interior from the sea, they also observed the tendency of the fish to ascend the rivers to the freshwater zones, even against the fast current during monsoon-season floods, or feeble current in summer months. Kulkarni (*op. cit.*) while reporting this species from Mahad in Kolaba district (Maharashtra) remarked about this fish as being a hardy species capable of withstanding a wide range of salinity.

As regards the distribution of this species along the Kerala coast, its occurrence is reportedly so far confined to the coastal backwaters of the southern part of the state, notably Cochin, Valiathura and Trivandrum coastal areas (Job, *op. cit.*; Silas, *op. cit.*). The present record deals with the detection of new localities, including a natural sanctuary of *H. setnai*, supported with the collection of a good number of specimens, 14–20 mm TL, from the coastal brackish waters of the west flowing Kuppam and Peruvamba Rivers in the northern part of Kerala, South India.

A sample-collection of ichthyofauna made, during August 2001, from the paddy floodplains of Ezhome village (lat. 12°15' N and long. 75°16' E) in the coastal plains of Kannur District in northern Kerala, was observed to contain the specimens of *H. setnai* (Fig. 1). Subsequent faunal explorations of the mangrove-growing wetlands as well as the paddy-cultivable flood plains in and around the 'Ezhome' village, associated with the Kuppam River in the coastal plains of the district revealed the sporadic occurrence of *H. setnai*.

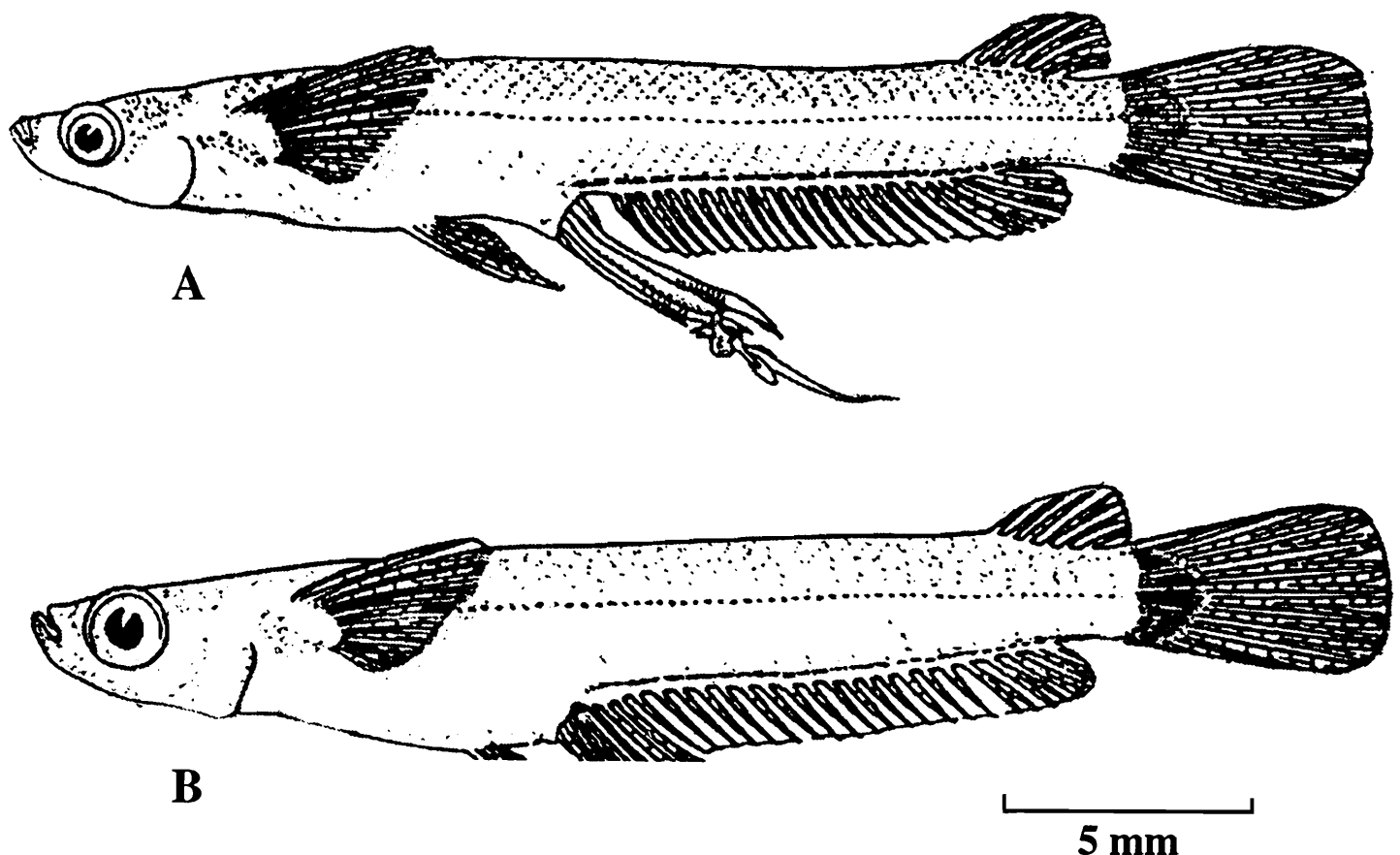


Fig. 1. *Horaichthys setnai* Kulkarni. A. Male; B. Female.

The floodplains which remains almost in close proximity to the broad channel of Kuppam River is a fertile ground for the so-called 'pokkali' or wet season paddy cultivation in the plains during the period from June to September. The floodplains during this period also becomes an ideal breeding ground for a variety of aquatic faunal communities, since the area is lying close to the highly productive, mangrove-rich marsh-wetland zone associated with the river channel. The season-based collection-surveys in the areas revealed the occurrence of the species in abundance during the monsoon months, June–August, when maximum inflow of freshwater reached the floodplains. Periodic collections also corroborated the salinity tolerance of the species, with the salinity levels recorded ranging from as low as nearly 1‰ of the floodplain waters during June–July of peak monsoon period, to as high as 33‰ of the estuarine waters, during April–May of summer.

A notable observation made during the wetland-cum-mangrove survey was the detection of a habitat site, serving as a natural sanctuary, of this fish species in a small island namely 'Thekkumbad' (lat. 11°57' N and long. 75°20' E) located in the estuarine waters of Kuppam River. A small patch of mangroves, predominated with the species like *Aegiceras corniculatum*, *Bruguiera cylindrica*, etc., forming an integral part of a sacred grove of this small island was explored, during December, 2002, for the collection of aquatic faunal samples. This mangrove patch growing on a mudflat extension of the island which remains continually inundated with shallow brackish waters in the tidal influence, was found to be an ideal habitat wherein the population of *H. setnai* could easily thrive camouflaging themselves in the reclusive shades, amidst the mangroves. While using plankton nets in the shallow waters, amidst the mangroves, a good number of specimens of *H. setnai* could be collected. Further, this mangrove cum sacred grove falls in the precinct of a religious deity of the island inhabiting people and, therefore, remains protected without any human interference.

A small stretch of paddy cultivable land separates the protected mangrove-cum-sacred-grove patch and the homestead dwelling area of the islanders. The paddy field becomes flood plains during the wet-season period during which the ground is prepared for the one-time cultivation of the paddy crop. The islanders mistakenly considering the Thready Killifish as fish fry revealed that the population of *H. setnani* perpetually thrived in the shallow waters amidst the sacred mangrove patch, and also added that during the seasonal flooding of the areas during monsoon period, the population of this tiny fish used to be ubiquitously present in the adjoining paddy floodplains too. Once the season is over, they again recede to the reclusive aquatic habitat areas, especially the mangrove growing brackish waters. As revealed by them, the survey party could not detect the fish in the stagnant water pools in the crop-harvested paddy field at the time of survey, whereas small populations of this fish species were observed in the shallow waters amidst the mangroves forming the sacred grove.

Sporadic occurrence of small populations of this species was also observed on the surface of calm brackish waters in the creeks and corners of the mangrove-system associated with the Peruvamba River, at the locality Kunhimangalam, in the coastal plains of the Kannur District, northern Kerala, South India.

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**NEW LOCALITY-RECORD OF DISTRIBUTION OF
HORADANDIA ATUKORALI DERANIYAGALA
(PISCES : CYPRINIDAE : RASBORINAE)
ALONG THE WEST COAST IN KERALA, INDIA**

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INTRODUCTION

Pethiyagoda (1991) speculated on the possibility of certain cyprinid fishes, believed to be endemic to Sri Lanka, also occurring in India. Proving this notion true, *Horadandia atukorali* Deraniyagala, 1943, described from the freshwater ponds in the coastal plains of Sri Lanka and earlier thought to be endemic to it, was later recorded from India by Rema Devi and Menon (1992). Based on the specimens obtained from a freshwater pond in the coastal plains of west coast (collection locality : Pathiramanal Island in the 'Vembanad' Lake of Alappuzha District, Kerala), they initially described them as a new subspecies *Horadandia atukorali brittani* Rema Devi and Menon. However, Menon (1999) considered it to be a synonym of *H. atukorali*.

Rema Devi (1996), later, reported its extended range of distribution to the eastern coastal plains of India, recording the species from the weed infested freshwater bodies at Kalpakkam, Tamil Nadu, and Villianur, Pondicherry, and as well updated the information about the distributional occurrence of the species along the west coastal plains in ponds, ditches and in 'Vembanad' Lake of Kottayam and Alappuzha Districts in southern Kerala (Rema Devi, *et al*, 1996). There has been no record of *H. atukorali* from the allied habitat environs in the coastal plains of northern Kerala, and further beyond along the west coastal plains of India.

A good number of very small cyprinid fish specimens (12–21 mm long) were collected by us from a freshwater pond—locally known as 'Mananchira'—in the coastal plains of Kozhikode District in northern Kerala. The fish specimens on detailed study could be identified as *H. atukorali*.

***Horadandia atukorali* Deraniyagala**

(Fig. 1)

1943. *Horadandia atukorali* Deraniyagala, *J. Royal Asiatic Soc.*, Vol. xxxv, 96 : 158, 159, fig. 1 (Type locality : Attidiya, Colombo, *etc.*, Ceylon (*i.e.*, Sri Lanka); Munro, 1955, *Marine and Freshwater fishes of Ceylon* : 41, pl. 7, fig. 107.
1992. *Horadandia atukorali brittani* Rema Devi and Menon, *Tropical Fish Hobbyist*, Vol. XL(10) : 175-176, Figs. 1 & 2 (Type locality : Pond in the Pathiramanal Island, Shertallay, Kerala, India).

Diagnosis : The species is characterized by the small body size (hardly 3 cm in total length), with absence of barbels and lateral line, dorsal fin with 3 simple and 7 branched rays, anal fin with 3 simple and 5 branched rays, scale counts : along longitudinal series 19–22, along transverse series 6.5–7, circumpeduncular 8, predorsal 10–12, *etc.* The features tally with the illustration of species characteristics given by Rema Devi and Menon (*op. cit.*). The fish in life is pale yellowish green in colour, with belly and eyes silvery, and fins hyaline.

Certain salient attributes of biology of the species, according to Brittan (1961), are that this very small carplet is habituated to spawn freely among weeds, and the extremely tiny eggs are found attached to the clumps of weed in water. Eggs hatch in 36–48 hours. The adult ones exhibit no parental care of hatchlings or fry. By the time the fish becomes a little more than a year old, its reproductive life is completed.

The occurrence of this fish species in a pond in the coastal plains of a northern district of Kerala, as presently reported, indicates its extension of range of distribution to northward of Kerala along the west coast of India. There is all the possibility that the species is likely to occur in other freshwater bodies such as ponds, tanks and beels in the coastal plains of the Kozhikode and the other north-bound districts of Kerala, and also further beyond, along the coast.

The pond having an approximate area of 100 sq. m. is an important supply source of drinking water to the city dwellers. It is, therefore, well protected all-around by strong walls, which prevents any kind of seasonal run offs, inflow or outflow, of rainwater. The optimal storage of the pond is attained only through direct precipitation during monsoon period as well as by underground recharges through natural subterranean springs.

The pond, even under protected conditions, has become, over the years, veritably a functional ecological system of a pond habitat. Its lentic waters harbour considerable accumulation of hydrilla weed and also profuse growth of grassy weed in the shallow margin waters. The sample specimens of fish were collected, using a plankton-net, from the grassy weed growth in the shallow waters of the pond in the margins. The apparent ease availability of the fish specimens (a few sweeps of the plankton-net through the shallow, margin waters resulted in the collection of 12 specimens of 9–21 mm TL) during the collection indicates that a good population of *H. atukorali* thrives in the pond habitat. This carplet must have had the opportunity to proliferate in the congenial habitat conditions of the pond system, which remains both isolated and protected in nature.

The sample collection from the pond also included, besides *H. atukorali*, the other common fish species such as *Puntius vittatus* Day, *Pseudosphromenus cupanus* (Valenciennes) and *Aplocheilus blocki* (Arnold). The piscivorous birds such as Little Cormorant (*Phalacrocorax niger*), Little Grebe (*Podiceps ruficollis*), Little Egret (*Egretta garzetta*), Median Egret (*Egretta intermedia*) and the Pond Heron (*Ardeola grayii*), are frequent visitors to this pond system, quite often using the pond environs for foraging.

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Fig. 1. : *Horadandia atukorali* Deraniyagala

FISHES OF PULICAT LAKE

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INTRODUCTION

Pulicat lake located north-east of Chennai between latitudes 13°24' and 13°47' N and longitudes 80°2' and 80°16' E is one of the largest brackishwater lagoons in India. The waterspread is about 350 km². It is a shallow lake with an average depth of 1 m. The opening into the sea is at the narrow southern end with the main body extending north and north-west. The lake mouth is very shallow and has a maximum width of about 200 m. The lake mouth gets silted up and closed for varying periods from June-July and Nov-Dec. A peculiarity of the lake is the presence of man made navigational canal (Buckingham canal) traversing the entire length of the spit formation (Sriharikota spit) separating the lake from the sea. This canal is connected with the lake here and there and in the northern mud flats. These connections have developed into fairly extensive shallow water bodies which support atleast some sustainable fishery. About 70 km north of Pulicat and in the east of Buckingham canal there is a wide shallow opening into the sea near Duggirajapatnam which remains open during the major part of the year. The salinity of this lake ranges between 0.75 to 57.0 ppt.

Earlier reports on studies on fishes of Pulicat lake are those of Chacko *et al* 1953, Kaliyamurthy and Janardhana Rao 1972, Ramamohana Rao and Kaliyamurthy 1974 and Rangasamy 1975, Raman *et al* 1975a, 1975b and Kaliyamurthy *et al* 1986. Various aspects of the Lake have formed the subject matter of several Doctoral Theses.

However this is the first comprehensive list of the Ichthyofauna of this lake during its glorious undisturbed period. This information is expected to form the basis for future comparative studies. Identifications are based on Day 1875-1878, 1889, Talwar and Kacker 1984 and FAO identification sheets.

MATERIAL AND METHODS

The present report on the fishes of Pulicat lake is based on earlier collections by the Zoological Survey of India parties during 1963 and from 1971-75 (Table 1). The bulk of the collections from Pulicat lake deposited in Southern Regional Station, is by late Shri. T. Venkateswarlu, Scientist SE. A total of 2533 specimens have been identified as belonging to 88 species under 33 families and 11 orders. The classification of fishes listed here is based on Nelson 1994. Against each species, the serial number of the collection localities (chronologically arranged and serially numbered as in Table 1) is cited in parenthesis along with the number of specimens collected.

Table 1. Collection dates and species richness in Pulicat Lake.

| No. | DATE | COLLECTOR | No. OF SPECIES |
|------------|-------------|---|-----------------------|
| 1. | 27.07.1963 | Shri T. Venkateswarlu | 1 |
| 2. | 13.10.1971 | Dr. K. V. Ramarao | 1 |
| 3. | 22.04.1972 | " | 2 |
| 4. | 24.04.1972 | " | 1 |
| 5. | 29.04.1972 | " | 2 |
| 6. | 02.12.1972 | " | 7 |
| 7. | 07.10.1973 | Shri T. Venkateswarlu | 1 |
| 8. | 27.04.1974 | Dr. A. G. K. Menon & Dr. M. B Raghunathan | 10 |
| 9. | 27.09.1974 | " | 16 |
| 10. | 11.02.1975 | Shri T. Venkateswarlu | 5 |
| 11. | 12.02.1975 | " | 2 |
| 12. | 13.02.1975 | " | 6 |
| 13. | 14.02.1975 | " | 2 |
| 14. | 15.02.1975 | " | 4 |
| 15. | 19.02.1975 | " | 5 |
| 16. | 21.02.1975 | " | 7 |
| 17. | 22.02.1975 | " | 17 |
| 18. | 22.03.1975 | " | 12 |
| 19. | 26.03.1975 | " | 16 |
| 20. | 26.04.1975 | " | 4 |
| 21. | 09.05.1975 | " | 7 |
| 22. | 22.05.1975 | " | 1 |
| 23. | 04.06.1975 | " | 15 |
| 24. | 26.09.1975 | " | 1 |
| 25. | 13.12.1975 | " | 1 |
| 26. | 16.12.1975 | " | 1 |
| 27. | 04.02.1976 | " | 31 |
| 28. | 21.02.1976 | " | 12 |
| 29. | 30.04.1976 | " | 1 |
| 30. | 04.06.1976 | " | 8 |
| 31. | 26.06.1976 | " | 3 |
| 32. | 17.07.1976 | " | 9 |
| 33. | 17.08.1976 | " | 12 |
| 34. | 14.09.1976 | " | 8 |

LIST OF SPECIES

Class PISCES

Division TELEOSTEI

Subdivision ELOPOMORPHA

Order ANGUILLIFORMES

Suborder CONGROIDEI

Family MURAENESOCIDAE

1. *Muraenesox bagio* (Ham.) 17(2). 2 exs.

Subdivision CLUPEOMORPHA

Order CLUPEIFORMES

Suborder CLUPEOIDEI

Family ENGRAULIDAE

Subfamily COILIINAE

2. *Thryssa hamiltonii* (Gray) 12(1), 14(14), 15(13), 17(1), 28(2). 31 exs.
 3. *Thryssa kammalensis* (Bleeker) 19(2). 2 exs.
 4. *Thryssa malabarica* (Bloch) 19(29). 29 exs.
 5. *Thryssa mystax* (Schneider) 12(28), 28(2). 30 exs.
 6. *Thryssa purava* (Ham.) 9(1), 10(1), 16(1), 17(1), 18(7), 21(2), 27(1). 14 exs.

Subfamily ENGRAULINAE

7. *Stolephorus andhraensis* Babu Rao 9(1), 16(1), 17(3), 18(2), 19(2)
 27(7), 32(7) 23 exs.

Family CLUPEIDAE

Subfamily CLUPEINAE

8. *Herklotsichthys quadrimaculatus* (Ruppell) 27(1). 1 ex.
 9. *Sardinella* sp. 9(1). 1 ex.

Subfamily ALOSINAE

10. *Hilsa kelee* (Cuvier) 30(1). 1 ex.

Subfamily DOROSOMATINAE

11. *Anodontostoma chacunda* (Ham.) 8(1). 1 ex.
 12. *Nematalosa nasus* (Blkr.) 4(5), 9(1), 10(1), 11(123), 12(23), 14(33),
 17(116), 18(3), 19(3), 20(44), 21(66), 26(75), 27(42), 28(6), 30(5). 546 exs.

Subdivision EUTELEOSTEI

Superorder OSTARIOPHYSI

Order SILURIFORMES

Family BAGRIDAE

13. *Mystus gulio* (Ham.) 8(1), 15(4), 18(1). 6 exs.

Family ARIIDAE

14. *Arius arius* (Ham.) 10(1). 1 ex.

15. *Arius caelatus* (Val.) 6(1), 8(1), 9(1). 3 exs.

16. *Arius maculatus* (Thunberg) 28(1). 1 ex.

Family PLOTOSIDAE

17. *Plotosus canius* (Ham.) 10(1). 1 ex.

Superorder CYCLOSQUAMATA

Order AULOPIFORMES

Suborder ALEPISAUROIDEI

Family SYNODONTIDAE

Subfamily HARPADONTINAE

18. *Saurida thumbil* (Bloch) 27(4). 4 exs.

Superorder ACANTHOPTERYGII

Series MUGIOMORPHA

Order MUGILIFORMES

Family MUGILIDAE

19. *Liza parsia* (Ham.) 6(2), 18(3), 23(2), 24(7), 33(7). 21 exs.

20. *Liza subviridis* (Val.) 19(2), 27(4). 6 exs.

21. *Liza tade* (Forsskal) 27(2). 2 exs.

22. *Liza vaigiensis* (Quoy & Gaimard) 30(1). 1 ex.

23. *Mugil cephalus* (Linnaeus) 8(2), 19(7), 20(8), 23(11), 27(25), 31(16), 32(28). 98 exs.

24. *Valamugil cunnesius* (Val.) 6(2), 27(1). 3 exs.

25. *Valamugil seheli* (Forsskal) 17(2), 28(1), 30(1). 4 exs.

Series ATHERINOMORPHA

Order ATHERINIFORMES

Suborder ATHERINOIDEI

Family ATHERINIDAE

26. *Atherinomorus duodecimalis* (Val.) 19(1). 1 ex.
 27. *Hypoatherina temminckii* (Blkr.) 27(1). 1 ex.

Order BELONIFORMES

Suborder BELONOIDEI

Family BELONIDAE

28. *Strongylura strongylura* (V. Hasselt) 12(2), 13(1), 21(3), 32(1). 7 exs.
 29. *Xenentodon cancila* (Ham.) 32(1). 1 ex.

Family HEMIRAMPHIDAE

30. *Hyporhamphus limbatus* (Val.) 8(2), 9(2), 12(168), 13(99), 19(2), 21(22), 25(98), 27(3), 28(4), 33(1). 401 exs.

Order SCORPAENIFORMES

Suborder PLATYCEPHALOIDEI

Family PLATYCEPHALIDAE

31. *Grammoplites scaber* (Linn.) 27(1). 1 ex.
 32. *Platycephalus indicus* (Linn.) 18(1), 28(2). 3 exs.

Order PERCIFORMES

Suborder PERCOIDEI

Superfamily PERCOIDEA

Family CHANDIDAE

33. *Ambassis commersoni* Cuvier 9(1). 1 ex.
 34. *Ambassis gymnocephalus* (Lacepede) 6(2), 19(1), 23(12), 27(2), 33(3). 20 exs.
 35. *Chanda ranga* (Ham.) 20(1). 1 ex.

Family SERRANIDAE

Subfamily EPINEPHELINAE

36. *Epinephelus morrhua* (Val.) 19(1). 1 ex.
 37. *Epinephelus salmoides* (Lacepede) 30(1). 1 ex.

Family SILLAGINIDAE

38. *Sillago sihama* (Forsskal) 17(20), 18(2), 19(4), 27(2), 28(2), 30(2), 32(3). 35 exs.
39. *Sillago vincenti* Mckay 9(1). 1 ex.

Family LACTARIIDAE

40. *Lactarius lactarius* (Schneider) 32(8). 8 exs.

Family LEIOGNATHIDAE

41. *Gazza minuta* (Bloch) 9(1), 23(9), 27(4). 14 exs.
42. *Leiognathus brevirostris* (Val.) 17(1), 18(1), 27(6). 8 exs.
43. *Leiognathus dussumieri* (Val.) 8(8). 8 exs.
44. *Leiognathus equulus* (Forsskal) 19(2), 27(2). 4 exs.
45. *Leiognathus splendens* (Cuv.) 9(2), 17(20), 27(4), 33(142), 34(39). 207 exs.
46. *Secutor insidiator* (Bloch) 9(7), 19(1), 23(87), 27(1), 33(21). 117 exs.
47. *Secutor ruconius* (Ham.) 17(1), 23(12), 34(3). 16 exs.

Family LUTJANIDAE

Subfamily LUTJANINAE

48. *Lutjanus argentimaculatus* (Forsskal) 17(3), 33(1). 4 exs.
49. *Lutjanus kasmira* (Forsskal) 8(1). 1 ex.

Family GERREIDAE

50. *Gerres abbreviatus* (Blkr) 18(2), 23(5), 30(1). 8 exs.
51. *Gerres filamentosus* (C & V.) 7(1), 15(2), 16(1), 17(2), 27(6), 32(8). 20 exs.
52. *Gerres lucidus* (= *G. limbatus*) Cuv. 6(2), 9(1), 14(2), 15(6), 17(41), 23(3), 27(4), 28(7). 66 exs.
53. *Gerres oyena* (Forsskal) 9(1), 19(1), 21(1), 23(43). 46 exs.
54. *Gerres poeti* Cuv. 23(1). 1 ex.
55. *Gerres setifer* (Ham.) 22(10). 10 exs.

Family HAEMULIDAE

56. *Pomadasys hasta* (Bloch) 23(8). 8 exs.
57. *Pomadasys kakkan* (Cuv.) 27(1), 28(1). 2 exs.

Family SPARIDAE

58. *Acanthopagrus berda* (Forsskal) 33(2). 2 exs.

59. *Rhabdosargus sarba* (Forsskal) 27(1). 1 ex.
 60. *Crenidens crenidens indicus* Day 23(1). 1 ex.

Family LETHRINIDAE

61. *Lethrinus nebulosa* (Forsskal) 17(2). 2 exs.

Family SCIAENIDAE

62. *Daysciaena albida* (Cuv.) 10(1). 1 ex.
 63. *Nibea maculata* (Sch.) 33(15). 15 exs.

Family MULLIDAE

64. *Upeneus sulphureus* (Cuv.) 23(1). 1 ex.

Family DREPANIDAE

65. *Drepane punctata* (Linn.) 27(1). 1 ex.

Family NANDIDAE

Subfamily NANDINAE

66. *Nandus nandus* (Ham.) 16(2). 2 exs.

Family TERAPONIDAE

67. *Terapon jarbua* (Forsskal) 16(2), 18(2), 19(1), 23(3), 28(1), 32(1). 10 exs.
 68. *Terapon puta* (Cuv.) 9(1), 15(3). 4 exs.
 69. *Terapon theraps* (Cuv.) 8(1), 18(2). 3 exs.

Suborder LABROIDEI

Family CICHLIDAE

70. *Etroplus suratensis* (Bloch) 33(5). 5 exs.
 71. *Oreochromis mossambica* (Peters) 21(27) 27 exs.

Suborder TRACHINOIDEI

Family URANOSCOPIDAE

72. *Uranoscopus guttatus* (Cuv.) 16(1) 1 ex.

Suborder GOBIOIDEI

Family GOBIIDAE

Subfamily OXUDERCINAE

73. *Boleophthalmus boddarti* (Pallas) 33(1). 1 ex.

Subfamily AMBLYOPINAE

74. *Ctenotrypauchen microcephalus* (Blkr) 5(47) 47 exs.

Subfamily GOBIINAE

75. *Acentrogobius cyanomos* (Blkr.) 27(25), 34(4). 29 exs.
 76. *Acentrogobius viridipunctatus* (C. & V.) 31(19). 19 exs.
 77. *Ctenogobius criniger* (C. & V.) 1(26), 3(80), 5(2), 9(13), 34(4). 125 exs.
 78. *Favonigobius reichei* (Blkr) 27(40), 34(8). 48 exs.
 79. *Glossogobius biocellatus* (C. & V.) 2(1). 1 ex.
 80. *Glossogobius giuris* (Ham.) 3(1), 16(2), 23(3), 27(3), 28(1), 34(3). 13 exs.
 81. *Oxyurichthys microlepis* (Blkr.) 7(71), 29(31), 30(15), 31(19), 32(35), 33(25), 34(39). 235 exs.
 82. *Parachaeturichthys polynema* (Blkr.) 27(2), 34(14). 16 exs.

Order PLEURONECTIFORMES

Family SOLEIDAE

83. *Euryglossa orientalis* (Bloch) 18(2). 2 exs.

Order TETRAODONTIFORMES

Suborder TRIACANTHOIDEI

Family TRIACANTHIDAE

84. *Triacanthus biaculeatus* (Bloch) 6(1), 8(1), 14(5), 17(30), 19(1), 20(19), 21(1). 58 exs.

Suborder TETRAODONTOIDEI

Superfamily TETRAODONTOIDEA

Family TETRAODONTIDAE

Subfamily TETRAODONTINAE

85. *Chelonodon patoca* (Ham.) 17(2) 2 exs.
 86. *Lagocephalus lunaris* (Bloch & Sch.) 6(1), 33(1). 2 exs.
 87. *Takifugu oblongus* (Bloch) 9(1), 17(1). 2 exs.
 88. *Tetraodon cutcutia* (Ham.) 8(2). 2 exs.

DISCUSSION

It is observed that the collections comprise mainly marine fishes and a few secondary freshwater fishes, chiefly constituted by the order Perciformes (56.82%). Other major orders encountered are Clupeiformes (12.5%), Mugiliformes (7.95%), Atheriniformes (5.68%) and Tetraodontiformes (5.68%). Of the Perciformes collected, the single large group was constituted by the gobioids (11.36%) represented by 10 species, followed by groups having about 8 or lesser number of species representatives belonging to the families Leiognathidae and Gerreidae.

Of the 88 species collected, the bulk was constituted by the species *Nematalosa nasus* (21.54%) which incidentally has also been observed to be the most frequently encountered species being represented in 52.94% of the collections made. This was followed by *Hyporhamphus limbatus* forming 15.83% of the collections with a frequency of occurrence of 32%. Other frequently encountered species (20–23%) were viz. *Gerres lucidus*, *Thryssa purava*, *Mugil cephalus*, *Sillago sihama*, *Oxyurichthys microlepis* and *Triacanthus biaculeatus*.

Maximum number of species were encountered mostly during the post monsoon period (Table 1) when moderate salinity prevails in the lake. Extreme salinity values during premonsoon period may be a limiting factor in the species abundance.

This was the species composition of Pulicat Lake 25 to 30 years ago. Now with reports of increasing pollution and changes in the physico-chemical and hydrological parameters, species composition of the lake cannot be the same or as rich as it was a few decades ago.

SUMMARY

Faunistic surveys of the Ichthyofauna of Pulicat Lake by the scientists of ZSI a few decades ago, revealed a rich biodiversity represented by 88 species under 33 families and 11 orders. Though called a lake, its connection to the sea results in seasonal fluctuations of salinity of its waters. This ecosystem harbours many euryhaline species and serves as nursery for several marine species especially gobioids, which group was also well represented in Pulicat Lake. This was the scenario in yester years before pollution took its toll of the fauna of this large ecosystem.

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ON A COLLECTION OF SCARABAEID BEETLES (COLEOPTERA) FROM PACHMARHI BIOSPHERE RESERVE, MADHYA PRADESH

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INTRODUCTION

The eco-sensitive zone of Pachmarhi Biosphere Reserve, falling in three administrative districts *i.e.* Hoshangabad, Betul, and Chhindwara in Madhya Pradesh has been designated as Pachmarhi Biosphere Reserve (vide notification no. J-22016/17/94-BR dated March, 1999.M.O.E.F., Govt. of India). It is situated in Central Narmada valley and extends over the Satpura hill ranges and comprises the highest peak of Madhya Pradesh. The highest point of the Biosphere Reserve is the Dhoopgarh Hill (1352 m. above sea level). The important river of the area is Narmada and its tributaries Tawa, Malani, Sonbhadra, Denwa and Dudhi, which run in south-north direction. The Pachmarhi Biosphere Reserve (PBR) includes three protected areas *i.e.*, Satpura National Park and two wildlife sanctuaries *i.e.*, Pachmarhi Sanctuary and Bori Sanctuary. The Pachmarhi Biosphere Reserve encompasses ecologically rich forest pockets of Betul and Chhindwara divisions having diverse habitats. The total area of Biosphere Reserve is 4926.28 sq. km. Out of this an area of 524.37 sq. km. encompassing the Satpura National Park comprise the core zone. The remaining area of 4401.91 sq. km. has been designated as a buffer zone of the Biosphere Reserve.

STUDY AND OBSERVATIONS

The comprehensive exploration of fauna of PBR, except higher groups of vertebrates, is yet to be carried out seriously. In view of this, Zoological Survey of India, has undertaken the project to study different groups of animals of the Pachmarhi Biosphere Reserve to formulate the management strategy for the conservation of its biodiversity in its natural ecosystem. The one of the authors undertook the survey of Pachmarhi B.R. during the month of June, 1999 and the collection was made from Bori Sanctuary and Satpura National Park and a total of 163 specimens of Scarabaeid beetles were collected (Table-1 & II). These represent 18 species belonging to 11 genera under 6 subfamilies. All these Scarabaeid beetles, except three, are new addition to the fauna of Hoshangabad. Among these, five species are very common, while nine are common and the remaining four species are reported to be not commonly found in the area during the present investigation. Only three species of Scarabaeid beetles *i.e.* *Termitopisthes laticollis* Wassman. of subfamily Aphodiinae, *Onitis philemon* Fabricius, and *Onthophagus ramosellus* Bates of subfamily Scarabaeinae are hitherto known from Hoshangabad (Arrow, 1910, 1917 & 1931) and (Balthasar,

1963 & 1964). The scarabaeid beetles have both useful as well as deleterious effects from human considerations. The coprophagous beetles generally known as dung beetles, play an important role in nature's sanitation by utilizing the animal dung as food in their larval and adult stages. While the phytophagous beetles, commonly known as chafers, are the pests of agricultural crops, plantations and forests.

Table 1. Scarabaeid Beetles collected from Pachmarhi B.R.

| Subfamily/Species | No. of Examples Collected | Status in Area | NRH |
|--|---------------------------|----------------|-----|
| Hybosorinae | | | |
| <i>Hybosorus orientalis</i> (Westwood) | 1 | C | NRH |
| Scarabaeinae | | | |
| <i>Catharsius pithecius</i> (Fabricius) | 12 | C | ” |
| <i>Gymnopleurus cyaneus</i> (Fabricius) | 25 | VC | ” |
| <i>Gymnopleurus miliaris</i> (Fabricius) | 1 | NC | ” |
| <i>Gymnopleurus mundus</i> (Wiedman) | 19 | VC | ” |
| <i>Gymnopleurus opacus</i> (Redt.) | 5 | C | ” |
| <i>Gymnopleurus parvus</i> (Macl.) | 1 | NC | ” |
| <i>Oniticellus cinctus</i> (Fabricius) | 1 | C | ” |
| <i>Onthophagus pactolus</i> (Fabricius) | 6 | C | ” |
| <i>Phalops divisus</i> (Wiedman) | 20 | VC | ” |
| <i>Scarabaeus sanctus</i> (Fabricius) | 2 | C | ” |
| Melolonthinae | | | |
| <i>Schizonycha ruficollis</i> (Fabricius) | 23 | VC | ” |
| Rutelinae | | | |
| <i>Adoretus bicaudatus</i> Arrow | 41 | VC | ” |
| <i>Adoretus bicolor</i> Brenske | 1 | NC | ” |
| <i>Adoretus lasiopygus</i> (Burm.) | 9 | C | ” |
| <i>Anomala dorsalis</i> (Fabricius) | 1 | C | ” |
| <i>Anomala varicolor</i> (Gyll.) | 4 | C | ” |
| Dynastinae | | | |
| <i>Phyllognathus dionysius</i> (Fabricius) | 2 | NC | ” |

C = Common; VC = Very common; NC = Not common; B.R. = Bori Sanctuary; NRH = New record Hoshangabad; S.N.P. = Satpura National Park.

Table 2. Date-wise collection of species and their abundance.

| Date | Locality | Species Collected | Examples | Source |
|------------|---------------|--------------------------------|----------|--------|
| 8.VI.1999 | B.S., Bori | <i>Phyllognathus dionysius</i> | 1 | light |
| 9.VI.1999 | ” | <i>Scyzonycha ruficollis</i> | 1 | ” |
| ” | ” | <i>Phyllognathus dionysius</i> | 2 | ” |
| 10.VI.1999 | B.S., Churna | <i>Catharsius pithecius</i> | 3 | ” |
| ” | ” | <i>Gymnopleurus cyaneus</i> | 20 | dung |
| ” | ” | <i>Gymnopleurus mundus</i> | 1 | ” |
| ” | ” | <i>Schizonycha ruficollis</i> | 7 | light |
| ” | ” | <i>Adoretus bicaudatus</i> | 1 | light |
| 11.VI.1999 | ” | <i>Catharsius pithecius</i> | 1 | ” |
| ” | ” | <i>Gymnopleurus cyaneus</i> | 2 | dung |
| ” | ” | <i>Gymnopleurus mundus</i> | 18 | ” |
| ” | ” | <i>Gymnopleurus opacus</i> | 5 | ” |
| ” | ” | <i>Gymnopleurus parvus</i> | 1 | ” |
| ” | ” | <i>Onthophagus pactolus</i> | 4 | ” |
| ” | ” | <i>Phalops divisus</i> | 3 | ” |
| ” | ” | <i>Scarabaeius sanctus</i> | 1 | ” |
| ” | ” | <i>Schizonycha ruficollis</i> | 1 | light |
| 12.VI.1999 | ” | <i>Hybosorus orientalis</i> | 1 | ” |
| 13.VI.1999 | S.N.P., Madai | <i>Schizonycha ruficollis</i> | 3 | ” |
| ” | ” | <i>Adoretus bicaudatus</i> | 37 | ” |
| ” | ” | <i>Adoretus lasiopygus</i> | 1 | ” |
| ” | ” | <i>Anomala varicolor</i> | 1 | ” |
| 14.VI.1999 | ” | <i>Gymnopleurus cyaneus</i> | 3 | dung |
| ” | ” | <i>Gymnopleurus miliaris</i> | 1 | ” |
| ” | ” | <i>Oniticellus cinctus</i> | 1 | ” |
| ” | ” | <i>Onthophagus pactolus</i> | 2 | ” |
| ” | ” | <i>Phalops divisus</i> | 17 | ” |
| ” | ” | <i>Scarabaeius sanctus</i> | 1 | ” |
| ” | ” | <i>Schizonycha ruficollis</i> | 8 | light |
| ” | ” | <i>Adoretus bicaudatus</i> | 3 | ” |
| ” | ” | <i>Adoretus bicolor</i> | 1 | ” |
| ” | ” | <i>Adoretus lasiopygus</i> | 8 | ” |
| ” | ” | <i>Anomala dorsalis</i> | 1 | ” |
| ” | ” | <i>Anomala varicolor</i> | 2 | ” |

SUMMARY

A total of 18 species of Scarabaeid beetles belonging to 11 genera under 6 subfamilies are collected from Pachmarhi Biosphere Reserve. Madhya Pradesh. All these are new addition to the fauna of Hoshangabad and this Biosphere Reserve.

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**LIFE CYCLE OF *AMBLYSEIUS MULTIDENTATUS* (SWIRSKI & SHECHTER)
AT ROOM TEMPERATURE FEEDING UPON *EOTETRANYCHUS
FREMONTI* TUTTLE & BAKER ON *AVICENNIA ALBA* BLUME**

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INTRODUCTION

Among the predatory mites which have been reported to be of potential importance in India for biocontrol of agricultural mite pests, *Amblyseius multidentatus* (Swirski & Shechter) is certainly one of those having been seen actively feeding upon mostly eriophyid mites and tetranychid mites infesting brinjal and other vegetables and help in keeping the pest mite population under control (Gupta 1985, Gupta & Gupta 1992, Gupta 2002). Unfortunately, no study has been made in India to work out its biology and duration of different developmental stages and hence an attempt has been made in this study to work out duration of different developmental stages, longevity, fecundity, sex ratio, etc. and results thereof are presented here.

MATERIAL AND METHODS

The mass culture of prey mite *Eotetranychus fremonti* Tuttle & Baker, which was found to infest fig tree severely, was used as prey of this predatory mite. This prey mite was mass cultured on fig leaf kept on wet cotton swab in a Petridish (10 cm diameter). The room temperature and humidity which were maintained were 30°–32°C and 80–85%, respectively. The mite developed fast on fig leaf and completed a generation in 7–10 days. The life cycle of this predatory mite was studied in a small Petridish on which excised leaf of *Avicennia alba* was kept on wet cotton swab. From mass culture, the different stages of *E. fremonti* were given as food. Ten adults of *Amblyseius multidentatus* were put (one on each Petridish) and were kept at room temperature and humidity allowing the adults to lay eggs. Within 24–36 hours, eggs were laid and as soon as the eggs were found, the adult was removed keeping only the eggs. Hence life cycle study of this mite was initiated with 10 freshly laid eggs almost of the same age. Precautions were taken to remove all organisms on the leaves by brushing and then examining the excised leaf under stereo-binocular microscope. Thereafter, observations were recorded after every 12 hours to find out the duration of different developmental stages. After the egg hatched, the newly emerged larva was transferred

to a freshly excised leaf of *A. alba* on which the prey mites, both adults and nymphs, were given as food for this predatory mite. Observations were recorded at every 12 hourly interval to determine duration of different developmental stages, pre-oviposition, oviposition, post-oviposition periods, fecundity, longevity and % of mortality. The data so collected were subjected to statistical analysis.

RESULTS AND DISCUSSION

1. *Mating* : As usual, the mating took place almost immediately after the emergence of the adult. Since the males emerged earlier than females it was seen that the males kept on waiting for emergence of female and impregnated it as soon as the female emerged. The male mated with several females but female was unigamous.

2. *Incubation* : The eggs were elliptical, about 84 microns in length and were laid singly on the under surface of the leaf. The mean incubation period was 1.72 ± 0.02 days having minimum of 1.0 day and maximum of 2.0 days. The percentage of hatching was 79.56 ± 0.79 . The incubation periods as were reported by other workers were 1.92 days in *A. tetranychivorus* (Jagadish & Nageshchandra, 1979), 1.86 days in *A. longispinosus* (Mallik and ChannaBasavanna, 1983), 2.09 ± 0.20 days in *A. ovalis* (Borah & Rai, 1989), 1.35 days in *Amblyseius delhiensis* (Nageshchandra *et al.* 1998), 2.30 ± 0.14 days in *A. alstoniae* (Gupta *et al.* 2003). From these, it appears that the incubation period observed in the present study was within the range reported by the previous workers.

3. *Larva stage* : The larva was light creamish colour having three pairs of legs and moved very slowly and most probably it did not feed. The mean larval period was 1.56 ± 0.08 days with the minimum of 1 day and maximum of 2 days. The earlier workers like Daniel (1981) in case of *A. channabasavannai*, Mallik and ChannaBasavanna (1983) in case of *A. longispinosus*, Borah & Rai (1989) in case of *A. ovalis*, Jagadish *et al.* (1990) in case of *A. concordis*, reported larval periods being less than 1 day *i.e.*, 0.71, 0.51, 0.87 ± 0.12 , 0.73 ± 0.07 days, respectively. However, Jagadish & Nageshchandra, 1982 in case of *A. tetranychivorus*, Sharma & Sadana (1985) in case of *A. finlandicus* and Gupta *et al.* (2003) in case of *A. alstoniae* reported this period as one day and above being respectively 1.06 days, 1.00 day and 2.00 days. Therefore, the results of the present investigation is within the range of the second group of workers.

4. *Protonymph stage* : The protonymph is more active and unlike the larvae it fed on the nymphs of the prey mite *E. fremonti*. It is creamish white in colour. The mean protonymphal period was 1.60 ± 0.25 days with the minimum of 1 day and the maximum of 2 days while Daniel (1981) in case of *A. channabasavannai*, reported this period to be only 0.92 days and Mallik and ChannaBassavana (1983) in case of *A. longispinosus* reported this as 0.87 days. But there are reports wherein this duration has been reported to be almost double in case of *A. delhiensis*, where it was 1.95 days Nageshchandra *et al.* (1998) and 2.30 ± 0.15 days in *A. alstoniae* (Gupta *et al.* 2003). However, Sharma & Sadana (1985) and Jagadish *et al.* (1990) reported this period to be 1.2 ± 0.40 days in *A. finlandicus* and 1.02 ± 0.10 days in case of *A. concordis*.

5. *Deutonymph stage* : The deutonymphs were bigger than the protonymphs and were more active, found feeding on nymphs of the prey mite. The mean duration of this period was 2.30 ± 0.36 days. Some of the workers like Daniel (1981) in *A. channabasavannai*, and Mallik and ChannaBasavanna (1983) in *A. longispinosus* reported this period to be less than 1 day, mean 0.99 day and 0.91 day respectively which appeared to be somewhat unusual. However, the other workers like Sharma & Sadana (1985) in case of *A. finlandicus*, Nageshchandra *et al.* (1998) in case of *A. delhiensis* and Gupta *et al.* (2003) in case of *A. alstoniae* reported this period as 2.4 ± 0.48 days, 2.24 days and 3.25 ± 0.15 days, respectively. Therefore, the duration as recorded in the present study tallies with the observations made by the latter workers.

6. *Egg to Adult Period* : The mean egg to adult period was 7.35 ± 0.15 days with the minimum of 6.00 days and maximum of 7.00 days. The percentage of mortality was found to be reasonably high being 28%. This duration appears to be on the much higher side as compared to 5.83 ± 0.31 days in *A. tetranychivorus* (Puttaswamy, 1978), 5.29 days in *A. ovalis* (Borah & Rai, 1989), 5.02 days in *A. concordis* (Jagadish *et al.* 1995, 1999) and 4.83 ± 0.22 days in *A. coccosocius* (Saha *et al.* 1998). On the contrary, Gupta *et al.* (2003) found this period to be as high as 9.50 ± 0.39 days in *A. alstoniae*. May be, the condition of temperature and humidity differed in the experiments conducted by the different workers which caused this differences.

7. *Pre-oviposition Period* : The mean pre-oviposition period was 1.43 ± 0.49 days. The observations reported by other workers were 0.18 ± 0.08 days in *A. channabasavannai* (Daniel, 1981), 0.1 day in *A. delhiensis* (Nageshchandra *et al.* 1998), 0.3 ± 0.08 day in *A. coccosocius* (Saha *et al.* 1998). On the contrary, there are reports where the duration has been shown to be as high as 3.63 days in case of *A. tetranychivorus* (Jagadish & Nageshchandra, 1982) and 3.72 ± 0.15 days in *A. alstoniae* (Gupta *et al.* 2003). Therefore, the present duration is in mid way between the two extreme reports.

8. *Oviposition Period* : The mean oviposition period was 14.52 ± 0.54 days. The earlier reports which were found to be more nearer to the present observations were Daniel (1981), who reported 15.7 ± 1.71 days in *A. channabasavannai*, Sharma & Sadana (1985) who reported 15 ± 1.32 days in *A. finlandicus* and Borah & Rai (1989) who reported 14.01 ± 2.05 days in *A. ovalis*. On the contrary, Nageshchandra *et al.* (1998) and Gupta *et al.* (2003) reported 2.46 days in *A. delhiensis* and 4.75 ± 0.15 days in *A. alstoniae*, respectively.

9. *Postoviposition Period* : The mean postoviposition period in the present study was 6.62 ± 0.63 days. Excepting Sharma & Sadana (1985) in case of *A. finlandicus* and Nageshchandra *et al.* (1998) in case of *A. delhiensis* who reported this duration to be 1.2 ± 0.40 days and 0.63 days, respectively, the present observation tallies with Jagadish & Nageshchandra (1982) who reported 5.12 days in *A. tetranychivorus*, Krishnamoorthy (1989) who reported 10.00 ± 1.76 days in *Phytoseiulus persimilis* and Gupta *et al.* (2003) reported 8.0 ± 0.25 days in *A. alstoniae*.

10. *Adult Longevity* : The average adult longevity in female was found to be 12.01 ± 0.71 days which came closer to observations made by other workers like Sharma & Sadana, 1985 (18.6 ± 1.49 days) in *A. finlandicus*, Borah & Rai (1989) (16.21 ± 2.03 days) in *A. ovalis*, Gupta *et al.* (2003) (17.25 ± 0.39 days) in *A. alstoniae* but was much shorter as compared to Krishnamoorthy (1989) (31.88 ± 3.63 days) in *Phytoseiulus persimilis*.

11. *Fecundity* : The average fecundity appeared to be very poor as evident from the fact that it was 18.01 ± 0.56 eggs but it was close to Gupta *et al.* (2003) who reported 11.87 ± 0.67 eggs in *A. alstoniae* and Sharma & Sadana (1985) who reported 15.6 ± 1.20 eggs in *A. finlandicus*. Whereas in most of the other earlier reports it was reasonably higher as 27.3 in *A. channabasavannai* (Daniel, 1981), 26.8 eggs in *A. tetranychivorus* (Jagdish & Nageshchandra, 1982), 39.2 ± 0.49 eggs in *A. ovalis* (Borah & Rai, 1989) and 17.40 in *Phytoseiulus persimilis* (Krishnamoorthy, 1989).

12. *Sex Ratio* : The Male : Female sex ratio was found to be 1 : 3.5 and was quite close to 1 : 3.30 in *A. finlandicus* (Sharma & Sadana, 1985) and 1 : 1.25 in *A. alstoniae* (Gupta *et al.* 2003). So, the sex ratio appears to be female biased.

Table 1 : Life cycle of *Amblyseius multidentatus* (Swirski & Shechter), Under Laboratory condition at room temperature.

| Stage | Range (in days) | Average (in days) | Duration (in days) |
|--------------------------------------|-----------------|-------------------|-----------------------|
| Egg | 1-2 | 1.72 | 1.72 ± 0.02 |
| Larva | 1-2 | 1.56 | 1.56 ± 0.08 |
| Protonymph | 1-2 | 1.60 | 1.60 ± 0.25 |
| Deutonymph | 2-3 | 2.30 | 2.30 ± 0.36 |
| Egg to Adult | 6-7 | 7.35 | 7.35 ± 0.15 |
| Pre-oviposition | 1-2 | 1.43 | 1.43 ± 0.49 |
| Oviposition | 11-14 | 14.52 | 14.52 ± 0.54 |
| Post-Oviposition | 5-6 | 6.62 | 6.62 ± 0.63 |
| Adult Longevity | 8-17 | 12.01 | 12.01 ± 0.71 |
| Fecundity | 16-20 eggs | 18.01 eggs | 18.01 ± 0.56 eggs |
| % of Hatching :- | 75-80% | 79.56% | $79.56 \pm 0.79\%$ |
| % of Mortality :- 28% | | | |
| Sex Ratio :- Male : Female = 1 : 3.5 | | | |

SUMMARY

The present paper reports the duration of different developmental stages of *Amblyseius multidentatus* (Swirski & Shechter) along with fecundity, longevity and sex ratio. The life cycle (egg to adult) took 7.35 ± 0.15 days. The fecundity, longevity and Male : Female sex ratio were 18.01 ± 0.56 eggs, 12.01 ± 0.71 days and 1 : 3.5, respectively.

ACKNOWLEDGEMENTS

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**A NEW SPECIES OF THE GENUS *TEGEOCRANELLUS* BERLESE, 1913
(ACARINA : ORIBATIDA : TEGEOCRANELLIDAE)
FROM TRIPURA, INDIA**

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INTRODUCTION

Berlese (1913) established the genus *Tegeocranellus* with *T. laevis* Berlese, 1905 as the type under the family Tectocepheidae Grandjean, 1954. Later on, in the year 1987 P. Balogh placed this genus in a separate family Tegeocranellidae. In 1992 Balogh shifted the family Tegeocranellidae from the superfamily Carabodoidea to Polypterozetoidea Grandjean, 1959. They included only one genus *Tegeocranellus* Berlese, 1913 under the family Tegeoceranellidae.

The genus *Tegeocranellus* differs markedly from the genus *Tectocepheus* Berlese, 1913 in having dorsosejugal suture and shoulders on the antero-lateral sides of the notogaster. Grandjean (1962) redescribed *Tegeocranellus laevis* Berlese, 1905 and in the same year Csiszar and Jeleva reported the species *Tegeocranellus laevis* for the first time from Bulgaria. Kok (1968) described two new species, *T. knysnaesis* from Knysna and *T. sacchareus* from Jululand. Balogh and Mahunka (1969) described another new species, *T. bolivianus* from South Africa. In the year 1983, Balogh and Balogh described *T. concavus* and *T. conoexus*. According to key of Balogh and Balogh (1992) in the book 'The Oribatid Mites Genera of the World' 8 species were recorded under the genus *Tegeocranellus*.

Generic Diagnosis : Rostrum almost straight, prodorsum squarish, translamella may or may not be present, if present then thick, and situated apically; rostral and lamellar setae very short, arise from anterior margin of rostrum; interlamellar setae on lamella proper, sensillus longer than prodorsal setae, dorsosejugal suture present; notogaster rounded with humeral appendages; 10 pairs of simple notogastral setae; genital and anal plates large, placed close; legs monodactylous.

Distribution : INDIA : Orissa, Tripura. Elsewhere : Bulgaria, England, France, South Africa, U.S.A.

In the present paper a new species *T. punctatus* sp. nov. is described from the South District of Tripura. The genus *Tegeocranellus* Berlese, 1913 is reported here for the first time from India.

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The measurements of the specimens have been given in micron (μm).

The type specimens are deposited in the National Zoological Collection, Zoological Survey of India, Kolkata.

DESCRIPTION OF SPECIES

Tegeocranellus punctatus sp. nov.

(Figs. 1–4)

Colour : Dark brown.

Measurements : Length of the body : 221; width of the body : 146.

Prodorsum : Prodorsum almost square, flat; rostrum slightly elevated medially; *ro* (12) longest among prodorsal setae, thin, simple; *la* short (7), thin, simple, situated on outer straight border of lamellae, thin, simple; *in* short (5), located postero-laterally on lamellae proper; bothridium cup-shaped; sensillus long (68) with rough proximal stalk and a broadly cup-shaped distal head, beset with fine bristles at tip; lamellae very broad, extended from bothridium to base of rostrum; translamella thick, broad, forming a band little below the base of rostrum; prodorsum punctated with foveolation along translamella.

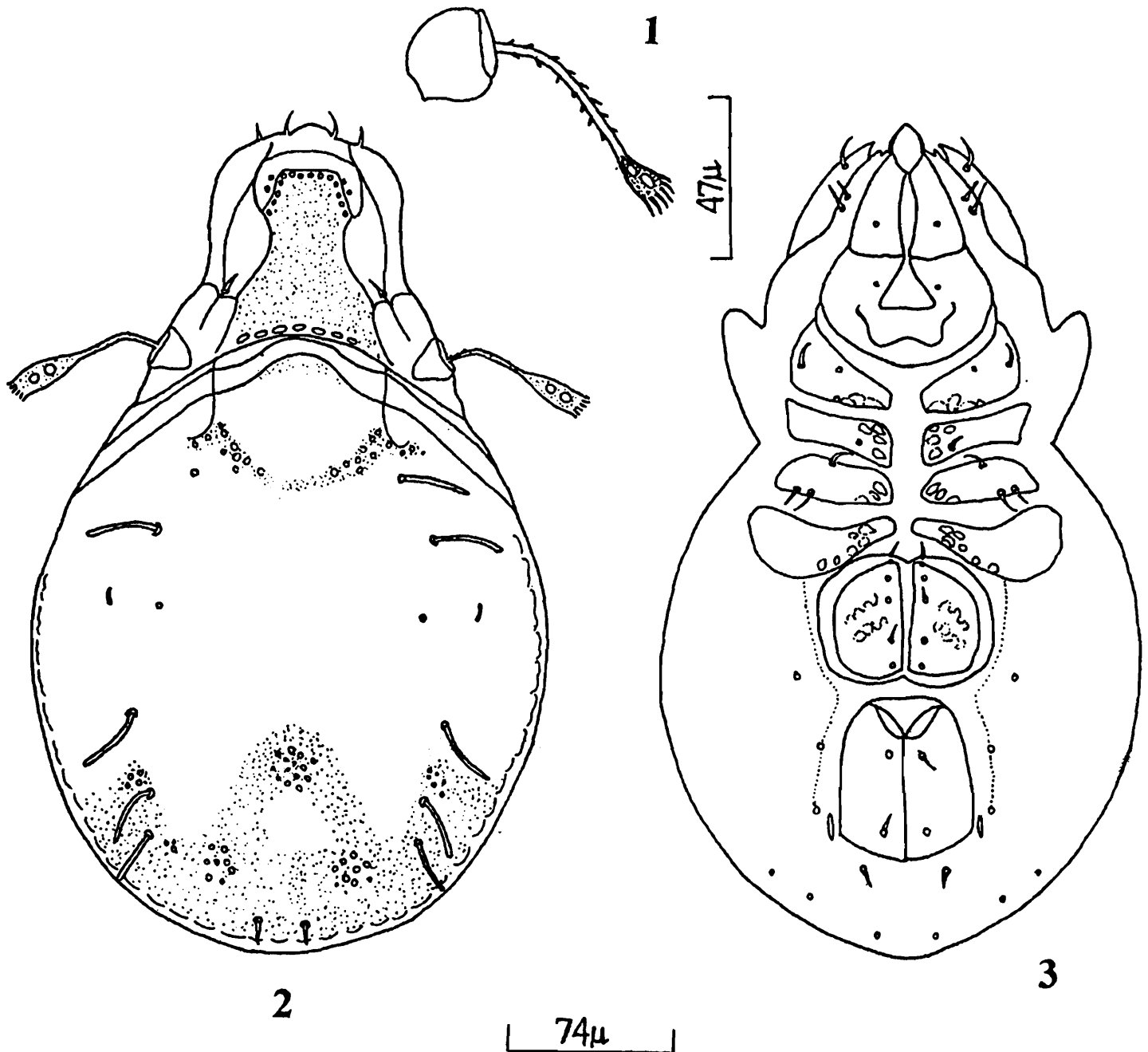
Notogaster : Notogaster rounded, separated from prodorsum by a convex thick dorsosejugal suture, lenticulus like flat hollow area at anterior margin; minute punctations and scattered foveolae along posterior margin of hollow portion; notogastral setae 10 pairs, moderately long (28–33), setae *ta*, *te*, *ti*, *ms*, *r*₃, *r*₂ smooth with blunt tip, arranged laterally in a line, *r*₁ and all setae of the series *p* minute; middle portion of notogaster smooth, posterior part punctated with a few foveolae; *im* placed laterally near middle of notogaster.

Epimeral Region : Epimeres conspicuous, scatteredly foveolated, epimeral setae simple, with setal formula 2 : 1 : 3 : 0.

Ano-genital Region : Genital plate and anal plate large, nearly meeting each other, surrounded on both sides by two lines; genital plates (length : 59; width : 75) almost oval, with prominent markings; 6 pairs of minute genital setae arranged longitudinally along inner margin of genital plates; 1 pair aggenital setae present, anal plates (length : 75; width : 59), with 2 pairs of minute setae; adanal setae 3 pairs, short; *iad* on postero-lateral border of anal plate.

Legs : All legs monodactylous. *Leg chaetotaxy* : Leg I : 0–3–4–5–16+1–1; Leg II : 0–2–2–5–16–1; Leg III : 0–3–1–3–13–1; Leg IV : 0–2–1–4–13–1.

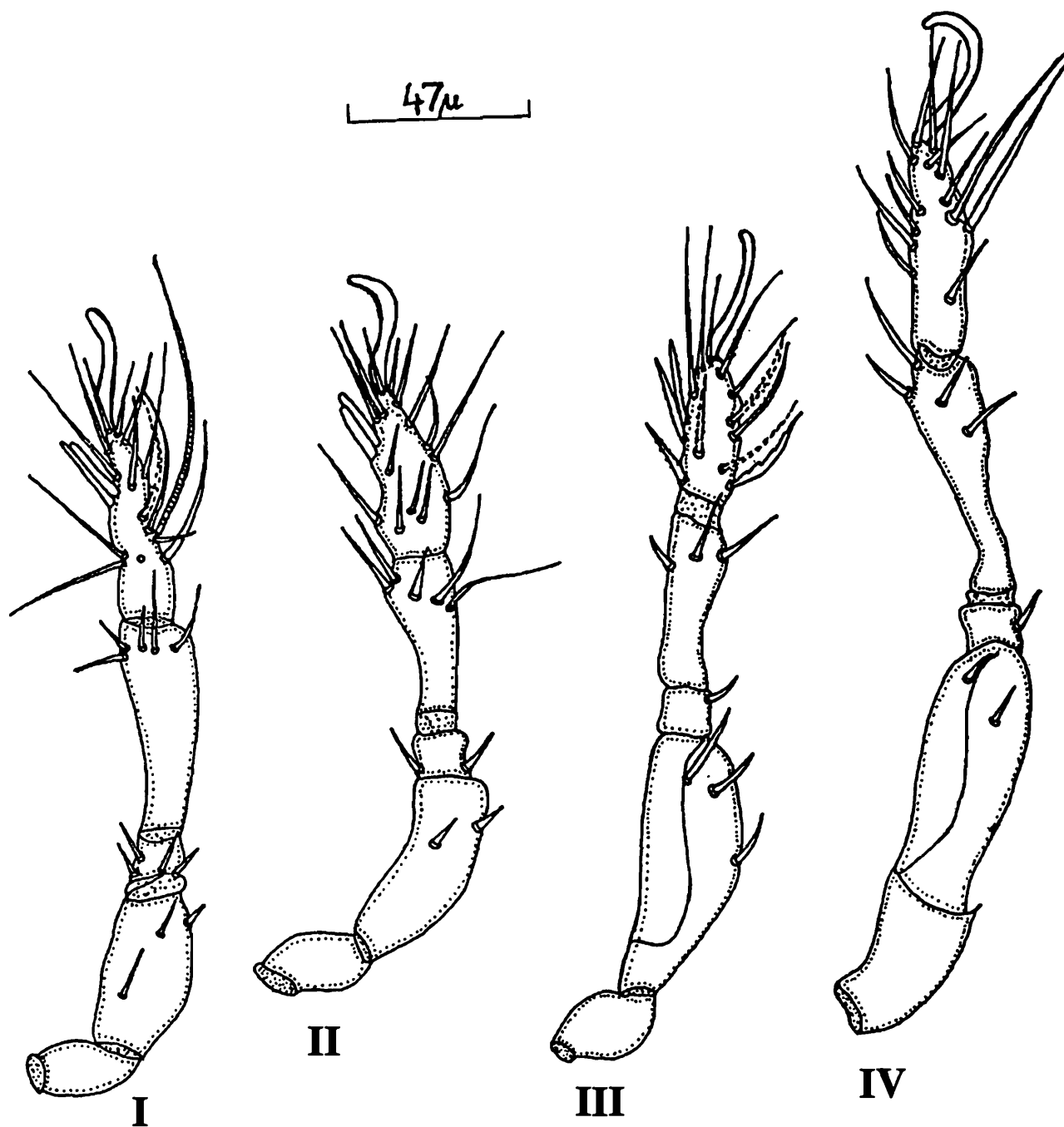
Material examined : HOLOTYPE : Adult female, India : Tripura, Karbuk (Amarpur), 1.iii.1992, from humus beside a narrow stream, coll. S. Saha. PARATYPES : 5 adult females, data same as for holotype.



Figs. 1-3. *Tegeocranellus punctatus* sp. nov. : 1. Sensillus; 2. Dorsal view; 3. Ventral view.

Distribution : INDIA : Tripura (South District).

Remarks : *Tegeocranellus punctatus* sp. nov. comes close to *T. laevis* Berlese, 1905 in general body shape, form of lamellae, shape and position of rostral and interlamellar setae and position of notogastral setae. The new species however, differs from *T. laevis* by rough stalk and broadly club-shaped sensillus, beset with bristles at the tip, shape of notogastral setae (with blunt tips), punctation and foveolation on prodorsum and notogaster. The new species also differs from all other species under this genus in the structure of prodorsum, shape of notogastral setae and body ornamentation.



Figs. 4. Legs (I-IV) of *Tegeocranellus punctatus* sp. nov.

SUMMARY

The new species *Tegeocranellus punctatus* sp. nov. from Karbuk, Amarapur in Tripura, India is described and illustrated alongwith affinities with *T. laevis* Berlese, 1905.

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**A NEW SPECIES OF THE GENUS *ZYGORIBATULA*
(ACARINA : ORIBATIDA : ORIBATULIDAE)
FROM TRIPURA, INDIA**

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INTRODUCTION

Berlese (1916) recognised *Zygoribatula* as a subgenus of the genus *Oribatula* Berlese, 1896 with the type species *Oribatula connexa* Berlese, 1904. But subsequently he (1917) gave it the generic status. Balogh (1972) has considered *Neoribatula* Ewing, 1917 as a synonym of *Zygoribatula* Berlese, 1916.

According to the key of Balogh and Balogh (1992) a total of 106 species are known from the world. Grobler (1994) mentioned that Lee (1991) and Balogh and Balogh (1992) diagnosed the genus *Zygoribatula* based on number of notogastral setae, presence of lamellae, translamella and dorsosejugal suture.

The genus *Zygoribatula* with a known species, *Z. longiporosa* Hammer, 1953 was reported for the first time from India by Bhattacharya *et al.* (1980) from West Bengal. Chakrabarti and Mondal (1983) recorded another known species, *Z. tortilis* Hammer, 1977 from Darjeeling, India. Gupta and Paul (1989) reported *Zygoribatula* from the nest of a bird from Medinipur, West Bengal. Sengupta and Sanyal (1990) recorded *Z. tenuiseta* Hammer, 1977 and *Z. tortilis* Hammer, 1977 from the soil of Himachal Pradesh.

Generic Diagnosis : Lamellae well developed; ribbon-shaped with prominent translamella; continuous dorsosejugal suture; notogaster usually oval, sometimes broadly elliptical, generally with anterior shoulder, notogastral setae 11-14 pairs; 4 pairs of true area porosae present on notogaster; genital setae 4 pairs; aggenital setae 1 pair; anal setae 2 pairs; adanal setae 3 pairs; pteromorphae absent; legs tridactylous.

Distribution : INDIA : Orissa, Tripura, West Bengal. Elsewhere : Antarctica, Australia, Canada, Europe, Hungary, Japan, Kazakhstan, Mauritius, Mongolia, New Zealand, Pakistan, Queensland, Russia, South Africa, Subantarctic Islands, Seychelles, Sweden, Uzbekistan.

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In the present paper a new species *Z. beloniensis* sp. nov. is described from the South District of Tripura.

The measurements of the specimens are given in micron (μm). The type specimens are deposited in the National Zoological Collection, Zoological Survey of India, Kolkata.

DESCRIPTION OF SPECIES

Zygoribatula beloniensis sp. nov.

(Test figs. 1–3)

Colour : Brown.

Measurements : Length of the body : 536; width of the body : 376–404.

Prodorsum : Rostrum with a sharp tooth situated medially on its anterior border, rostral setae long (48), thin, rough, situated on lateral margins of rostrum and extending beyond tip of rostrum for about half of their length; lamellar setae longest (92) among prodorsal setae, thin, smooth with pointed tip, extending beyond tip of rostral setae; lamellae of equal thickness throughout their length, translamella well developed, equal in thickness to lamellae and forming a flat arch; inner margin of lamellae and translamella thickened, cuspes absent, but lamellar-translamellar junctions somewhat anteriorly directed; interlamellar setae long (63), stout, smooth, erect, anteriorly and outwardly directed; sensillus with moderately long (22) stalk, head round, smooth, granulated; prodorsum finely punctated.

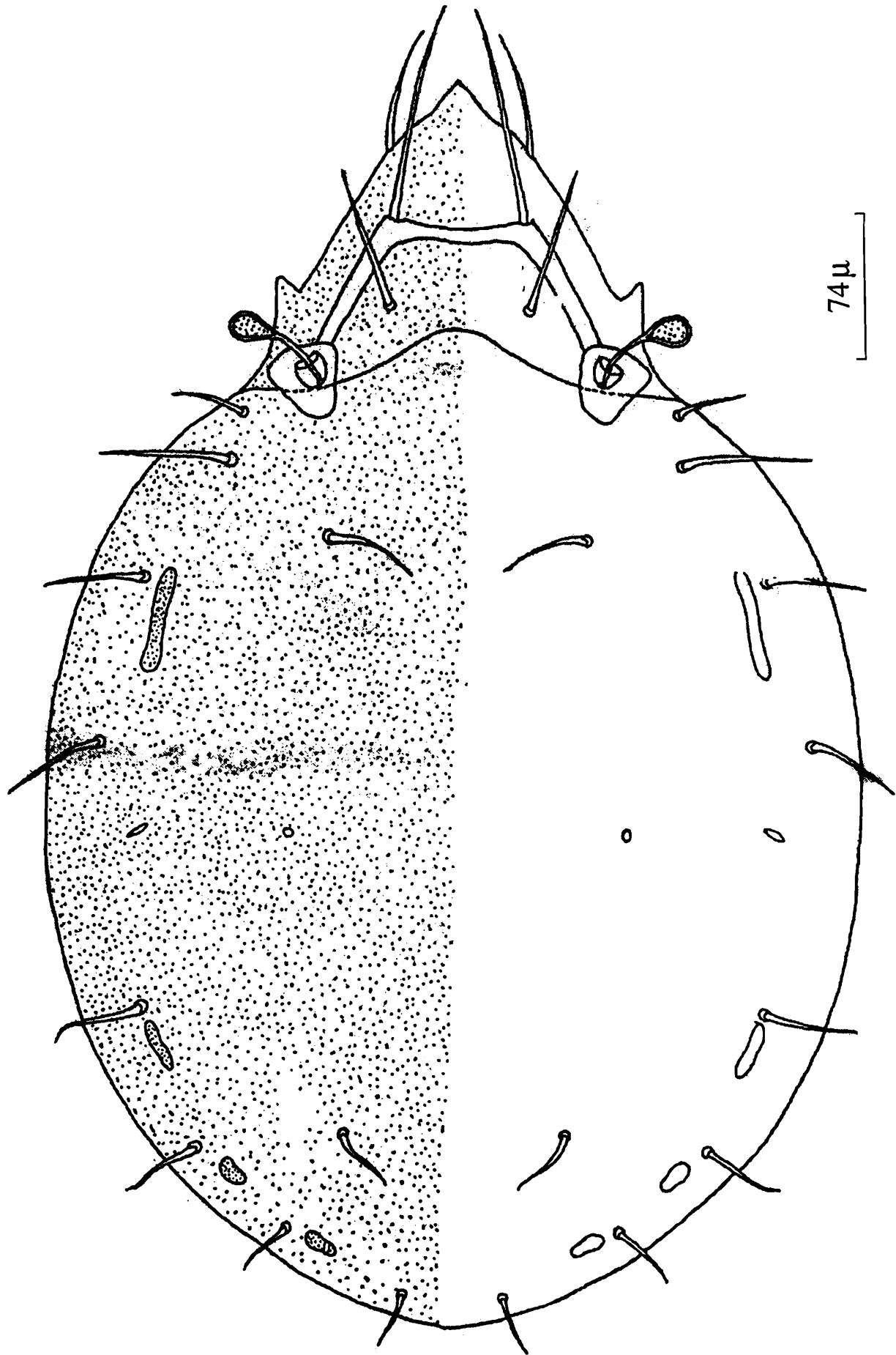
Notogaster : Notogaster oval-shaped, rounded posteriorly, its anterior margin forming a flat, anteriorly directed arch which ends laterally in well-developed shoulders; notogaster finely punctated; notogaster with 11 pairs of smooth, thin, long (22–47) setae; areae porosae distinct and large, area porosa adalaris very long (58) and narrow, area porosa mesonotica elongated, shorter (33) than previous one and area porosa posteriora round-shaped.

Epimeral Region : Epimeral region finely punctated; apodemata I and III incomplete, apodemata II complete, apodemata IV absent; epimeral setae smooth, short, setal formula 3–1–3–3.

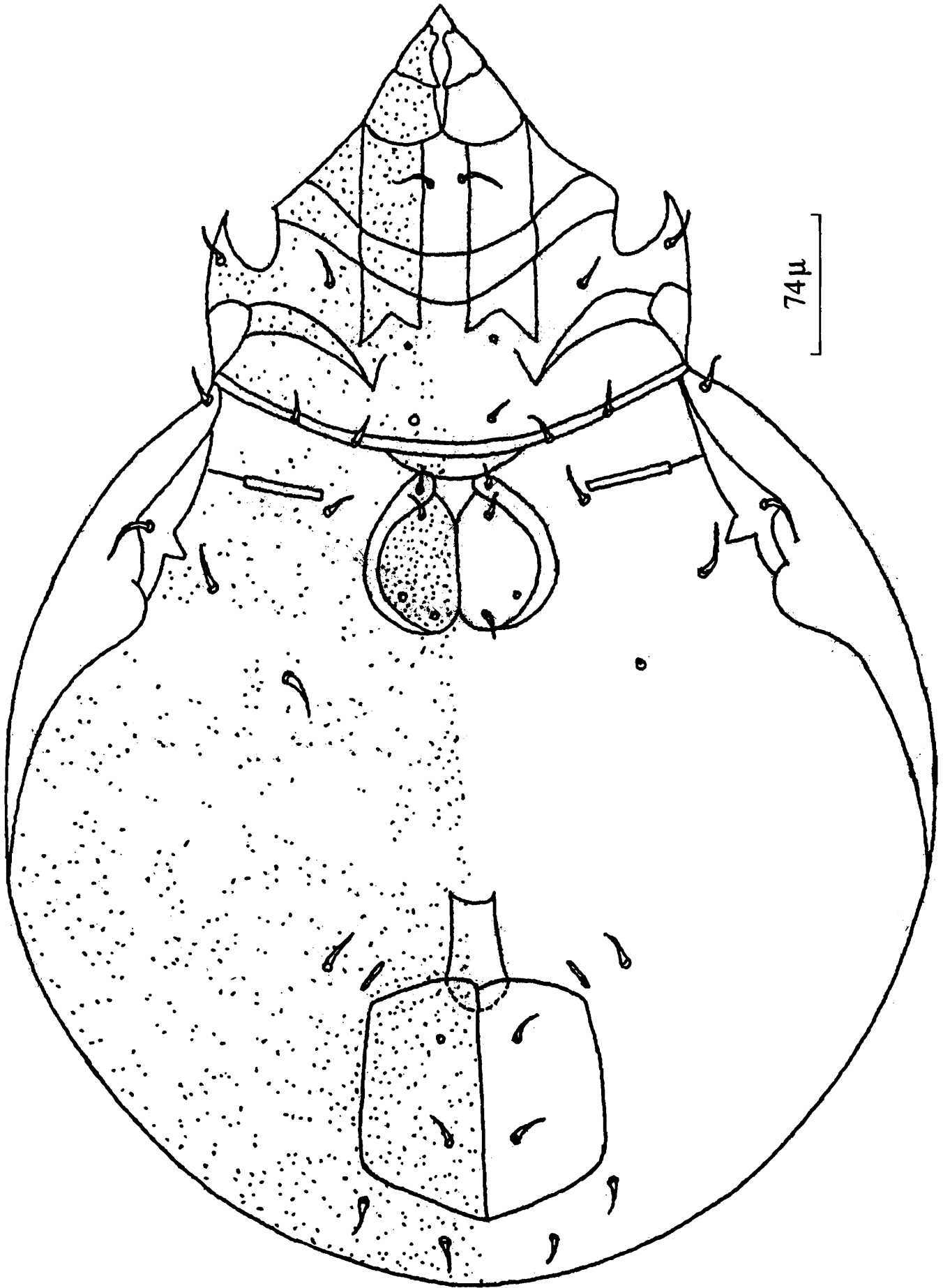
Ano-genital Region : Genital plates punctated and more or less oval (length : 63, width : 70) with 4 pairs of smooth, small genital setae; anal plates punctated and more or less squarish (length : 92, width : 107) with 2 pairs of smooth setae; adanal setae 3 pairs, ad_3 anterolateral to anal plates; iad anterior to anal plates, ventral plates finely punctated.

Legs : Tridactylous. Leg chaetotaxy : I : 0–4–3–3+1–16–3; II : 0–4–3–4+1–17–3; III : 0–2–1–4–11–3; IV : 1–2–2–6–9–3.

Material examined : HOLOTYPE : Adult female, India : Tripura : Radhakisorganj (Belonia), 12.x.1993, from loose soil by the side of root of bamboo tree with cowdung and rotten straw, coll. S. Saha. PARATYPES : 3 adult females, data same as for holotype.



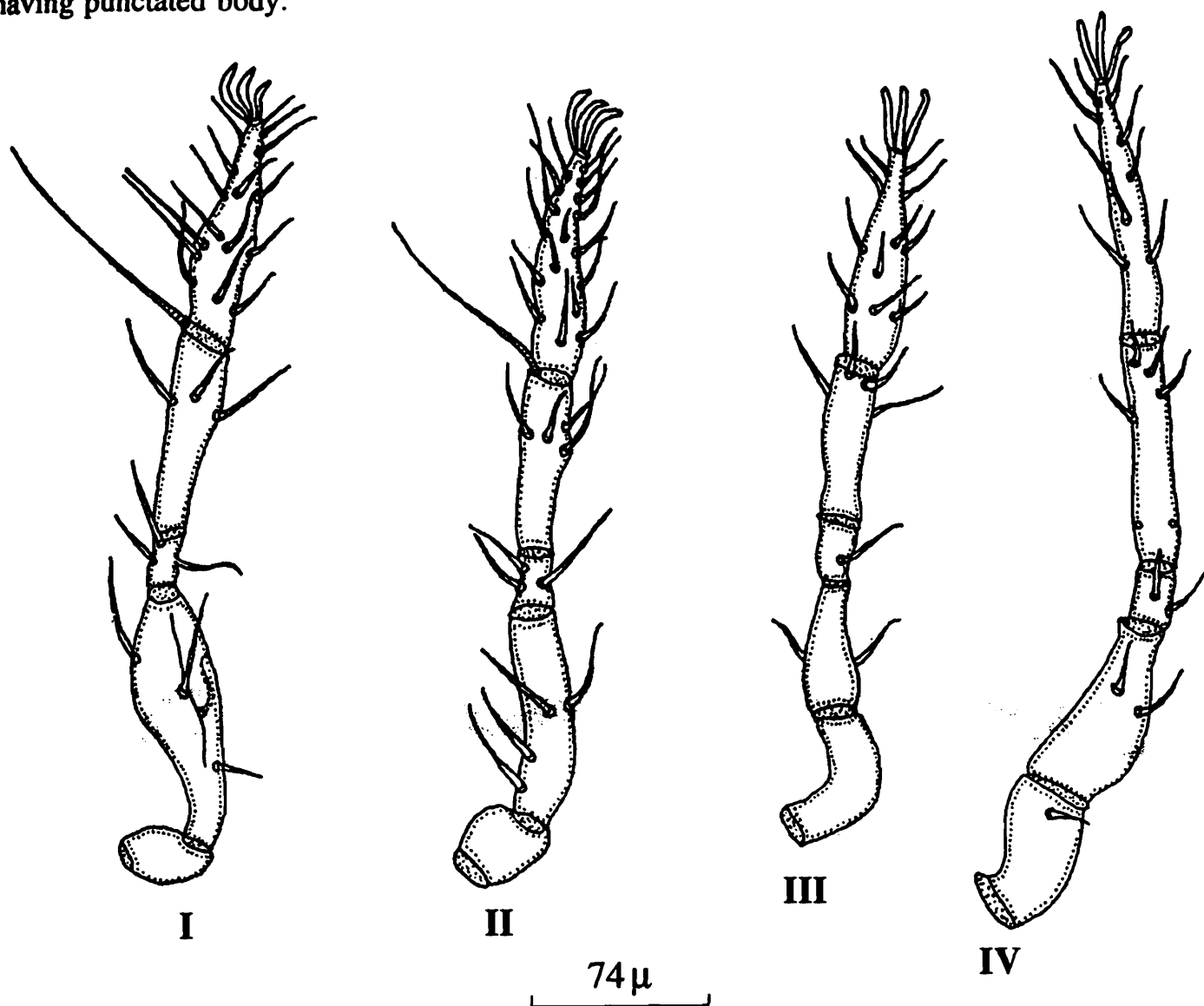
Figs. 1. *Zygoribatula beloniensis* sp. nov. – dorsal view.



Figs. 2. *Zyoribatula beloniensis* sp. nov. – ventral view.

Distribution : INDIA : Tripura (South District).

Remarks : The new species from Tripura is closely related to *Z. longiporosa* Hammer, 1953 regarding body shape, medially pointed toothed rostrum and nature of area porosa. The new species can be distinguished from *longiporosa* by the presence of smooth round headed sensillus and in having punctated body.



Figs. 3. *Zygoribatula beloniensis* sp. nov. – legs (I–IV).

SUMMARY

This paper contains the description along with illustrations of a new species *viz.*, *Zygoribatula beloniensis* from Tripura, India.

ACKNOWLEDGEMENTS

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AN INVENTORY OF FISH SPECIES DESCRIBED ORIGINALLY FROM FRESH AND COASTAL MARINE WATERS OF PONDICHERRY

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INTRODUCTION

Inventorisation of living resources is of paramount importance to evolve conservation measures and sustainable management strategies in addition to knowing the current status of economically viable and non-viable species. As on date, quite unfortunately we do not have a National Inventory of faunistic constituents to rely on for experimental and theoretical studies. With the effort of the Zoological Survey of India in bringing out fauna volumes of various states, the requirement is partially fulfilled and in this task the present paper provides base line taxonomic information on the fishes originally described from Pondicherry.

The state of Pondicherry is unique to ichthyotaxonomists, for, in the last two centuries a large number of species of fishes have been described as new to science by various authors from there. The most important work pertaining to this place is by Cuvier and Valenciennes (1828–1849). Information available on these species is scattered and many of them only from fishery point of view. A concise account on the ichthyotaxonomic data is lacking. Hence, in this paper we report 56 valid species belonging to 33 families and the current status of 76 species of fishes.

TAXONOMIC ACCOUNT

Family CARCHARHINIDAE

1. *Carcharhinus dussumieri* (Valenciennes)

1839. *Carcharias (Prionodon) dussumieri* Valenciennes, in Muller & Henle, *Syst. Besch. Plagiost.*, (2) : 47 pl. 19 (Bombay and Pondicherry; China).

1984. *Carcharhinus dussumieri* : Campagno, *FAO Fish. Synop.*, (125) 4(2) : 469.

Diagnosis : A small *Carcharhinus* sp., with moderately long rounded snout; oblique-cusped serrated teeth in both jaws; upper teeth with strong, serrated cusplets; usually 13/13–14 rows of anterolateral teeth; small semifalcate pectoral fins; a small triangular first dorsal fin with a short

rear tip; a moderately large second dorsal fin with a short rear tip; a black spot on the second dorsal fin; no other distinguishing marks.

Distribution : Indo-west Pacific.

2. *Carcharhinus hemiodon* (Valenciennes)

1838. *Carcharhinus (Hypoprion) hemiodon* Valenciennes, in Muller & Henle, *Syst. Besch. Plagiost.*, (2) : 35, pl. 19 (Pondicherry).

1984. *Carcharhinus hemiodon* : Compagno, *FAO Fish. Synop.*, (125) 4(2) : 475.

Diagnosis : A small *Carcharhinus* sp. with moderately long and narrowly rounded or pointed snout; oblique-cusped, weakly serrated upper anterolateral teeth with strong cusplets; 14–15/13–14 rows of anterolateral teeth; interdorsal ridge present; small pectoral fins, a fairly large first dorsal fin with a short rear tip; tips of the pectorals, second dorsal and ventral lobe of caudal black.

Distribution : Indo-west Pacific but uncertain beyond India, Pakistan and China.

3. *Carcharhinus sorrah* (Valenciennes)

1839. *Carcharias (Prionodon) sorrah* Valenciennes, in Muller & Henle, *Syst. Besch. Plagiost.*, (2) : 45, pl. 16 (Madagascar; Pondicherry; Java).

1984. *Carcharhinus sorrah* : Talwar & Kacker, *Commercial Sea Fishes of India* : 49.

Diagnosis : A small, slender *Carcharhinus* sp. with short, moderately broad snout; upper and lower teeth with oblique and narrow cusps, well delimited from bases; cusps serrated; second dorsal fin very low, its inner margin enlarged, 2 to 3 times fin-height; a huge dermal ridge between dorsal fins. *Colour* : Dark grey-black on back, belly whitish; conspicuous black tips on pectorals, second dorsal and lower caudal lobe.

Distribution : Widespread in the tropical Indo-west Pacific.

4. *Lamiopsis temmincki* (Muller & Henle)

1839. *Charcharias (Prionodon) temmincki* Muller & Henle, *Syst. Besch. Plagiost.*, (2) : 48, pl. 18 ('Indien', Pondicherry).

1984. *Lamiopsis temmincki* : Compagno, *FAO Fish. Synop.*, (125) 4(2) : 512.

Diagnosis : A small, stocky shark with a moderately long snout nearly equal to mouth; a small round eye with a nictitating eyelid; second dorsal fin nearly as large as first; upper teeth serrated and with broad triangular cusps; lower teeth with smooth, hooked, narrow cusps; longitudinal upper precaudal pit; pectoral fins broad and triangular; anal fin with posterior margin nearly straight. *Colour* : Light grey or tan above, light below without prominent markings

Distribution : Pakistan, India, Myanmar, Indonesia, China

Family RHINOBATIDAE

5. *Rhinobatos granulatus* Cuvier

1829. *Rhinobatos granulatus* Cuvier, *Regne Animal*, (ed. 2), 2 : 396 (Pondicherry).

1984. *Rhinobatos granulatus* : Talwar & Kacker, *Commercial Sea Fishes of India* : 81.

Diagnosis : Snout long and narrow; rostral ridges close together through out their length; width of mouth 2.6 to 3.2 in snout length; nostrils about half width of mouth and equal to or greater than internarial distance; anterior nasal flap extending across inner margin of nostril; spiracles slightly smaller than eye; back coarsely tuberculated; body brownish above, sides of rostral cartilage buff brown, whitish below; dorsal and caudal fins greyish.

Distribution : Indo-west Pacific.

6. *Rhinobatos obtusus* Muller & Henle

1841. *Rhinobatus (Rhinobatus) obtusus* Muller & Henle, *Syst. Besch. Plagiost.* : 122, pl. 37, fig. 2 (Pondicherry and Malabar).

1984. *Rhinobatos obtusus* : Talwar & Kacker, *Commercial Sea Fishes of India* : 83.

Diagnosis : Snout short and narrow; rostral ridges separated by a considerable distance through out their length; width of mouth about 1.9 in snout length; nostrils about half width of mouth; anterior nasal flap extending beyond inner margin of nostril; spiracle with only one skinny projection from the hind margin; back with small tubercles, some spinyform; body grey to brownish above, occasionally with black blotches, whitish below.

Distribution : India and Indonesia.

Family DASYATIDAE

7. *Dasyatis zugei* (Muller & Henle)

1841. *Trygon zugei* Muller & Henle, *Syst. Besch. Plagiost.* : 165, pl. 54 (Pondicherry, India; China and Japan).

1991. *Dasyatis zugei* : Talwar & Jhingran, *Inland Fishes of India*, 1 : 40.

Diagnosis : Sting ray with rhomboidal disk; mouth undulated without buccal papillae on its floor; tail whip like with both dorsal and ventral cutaneous folds; dorsal surface of disk dusky brown, pale marginally, ventral surface whitish, tail folds dusky brown.

Distribution : Indo-west Pacific

Family OPHICHTHIDAE

8. *Bascanichthys deraniyalalai* Menon

1961. *Bascanichthys deraniyalalai* Menon, *J. Zool. Soc. India*, 13(1) : 13 (Arasalar River. Karaikal).

Diagnosis : Body slender, cylindrical and compressed posteriorly; trunk slightly longer than tail; head small, rugose; snout short, blunt and grooved underside; eyes small; anterior nostrils

tubular; posterior nostrils open into mouth; mouth small; teeth small, conical, uniserial on jaws; gill openings ventro-lateral, horizontal; median fins low, dorsal fin origin well forward on head in advance of gill-opening, extending nearly to tail tip; pectoral fins minute flap of skin; tail fin-tip hard and pointed. *Colour* : In live condition olive-brown dorsally, yellow ventrally.

Distribution : India, Sri Lanka.

Remarks : Occurrence in India is known by the type specimen alone, Deraniyagala (1931) misidentified it as *Callechelys longipinnis* and reported from the coastal waters of Sri Lanka.

Family CLUPEIDAE

9. *Escualosa thoracata* (Valenciennes)

1847. *Kowala thoracata* Valenciennes, *Hist. nat. poiss.*, **20** : 363 (Pondicherry).

1985. *Escualosa thoracata* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 119.

Diagnosis : D iii-iv, 12–14; A iii-iv, 14–18; V i, 6; LL 35–40; GR 27–40; belly scutes (17–19) + (10–12); body depth 27–38% of SL; 2nd supramaxilla large and rectangular. *Colour* : Dull white with a broad silvery stripe along flanks.

Distribution : Pakistan, India, eastward to the Philippines, Papua New Guinea, Australia.

10. *Sardinella albella* (Valenciennes)

1847. *Kowala albella* Valenciennes, *Hist. nat. poiss.*, **20** : 362 (Pondicherry).

1985. *Sardinella albella* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 91.

Diagnosis : D iii-v, 14–16; A iii-iv, 16–19; V i, 7; belly scutes (17–18) + (12–14), total 29–33; lower GR 41–68 (at 40–150 mm SL); scales perforated and fimbriated at posterior margin; posterior scales with 4 or 5 vertical striate, interrupted at the center; predorsal medial ridge with two rows of overlapping scales. *Colour* : A dark spot at dorsal fin origin, no other distinguishing marks.

Distribution : Indo-west Pacific.

11. *Sardinella longiceps* Valenciennes

1847. *Sardinella longiceps* Valenciennes, *Hist. nat. poiss.*, **20** : 273 (Pondicherry)

Diagnosis : D iii-iv, 13–15; A iii-iv, 12–15; V i, 8; belly scutes (18–19) + (14–15); lower GR 150–250 (at 80–150 mm SL); head 29–35% of SL. *Colour* : Blue-green, flanks silvery, a distinct black spot at hind border of gill cover.

Distribution : Somalia coast to east coast of India to Andanians.

12. *Tenualosa toli* (Valenciennes)

1847. *Alausa toli* Valenciennes, *Hist. nat. poiss.*, **20** : 435 (Bombay, Pondicherry)

1985. *Tenualosa toli* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 226.

Diagnosis : D iv-v, 14–15; A iii, 15–17; P i, 13; V i, 8; belly scutes 28–30; lower GR 60–100; head 3.6–4.5 in SL; caudal fin 2.9–3.2 in SL; fronto-parietal striae hidden under skin; gill rakers on inner arches straight. *Colour* : Silvery with yellow, purple tinge; a diffuse dark blotch behind gill opening; fins hyaline.

Distribution : Rivers and coasts of India to Java Sea and South China Sea.

Family PRISTIGASTERIDAE

13. *Ilisha obfuscata* Wongratana

1983. *Ilisha obfuscata* Wongratana, *Jap. J. Ichth.*, **29**(4) : 397, fig. 14 (Bombay, Pondicherry).

Diagnosis : A species of *Ilisha* with body depth 34–35% of SL; belly with (19–20) + 8, total 27–28 scutes; lower GR 27–28; anal fin rays 39–42; dorsal fin origin about midpoint of body; anal fin origin under or just behind last dorsal fin ray; vertical striae on scales continuous or overlapping across centre; swimbladder with two very short tubes passing back in the muscles.

Distribution : India

Remarks : Description of this species is based on a syntype of *Pellona filigera* Valenciennes and a paralectotype of *Pellona micropus* Valenciennes = *Ilisha melastoma* (Schneider). This species is unique among Indo-Pacific *Ilisha* in its high gill raker count (lower GR 20–25 in others) and very short swimbladder tubes (Whitehead, 1985). More work required to confirm present status.

Family ENGRAULIDIDAE

14. *Coilia dussumieri* Valenciennes

1848. *Coilia dussumieri* Valenciennes, *Hist. nat. poiss.*, **21** : 81, pl. 610 (Bombay, Pondicherry, Mahe).

Diagnosis : D iii, 10–12; A ii, 103; P vi + 8–9; V i, 6; lower GR 23–26; belly scutes (5–6) + (7–9), total 12–15; maxilla short, not reaching the edge of gill cover. *Colour* : Back brown, flanks silvery; flanks and belly with golden or pearly spots in rows below scales.

Distribution : Coasts of India to Thailand, Malaysia, Indonesia.

Remarks : The description of Valenciennes (1848) is based on specimens brought from Bombay, Pondicherry and Mahe, although Whitehead *et al.*, (1988) noted Bombay as type locality.

15. *Setipinna taty* (Valenciennes)

1849. *Engraulis taty* Valenciennes, *Hist. nat. poiss.*, **21** : 60 (Pondicherry).

1988. *Setipinna taty* : Whitehead *et al.*, *FAO Fish Synop.*, (125) **7**(2) : 457.

Diagnosis : D i, 15–16; A iii, 45–55; P i, 12–14; V i, 6; lower GR 18–21, serrae forming clumps; belly scutes (20–29) + (10–14); lower jaw not projecting beyond tip of snout; pectoral

filament long, reaching beyond base of 23rd anal fin ray. *Colour* : Yellowish brown or bluish above, flanks and belly silvery.

Distribution : East coast of India, Andamans, Sri Lanka, Indonesia.

Family CYPRINIDAE

16. *Puntius sarana subnasutus* (Valenciennes)

1842. *Barbus subnasutus* Valenciennes, *Hist. nat. poiss.*, 16 : 154 (Pondicherry).

1991. *Puntius sarana subnasutus* : Talwar & Jhingran, *Inland Fishes of India*, 1 : 285.

Diagnosis : D iii, 8; A ii, 5; P i, 16; V i, 7; LL 28–31, complete; predorsal scale 10; head length 4.4–4.8 in SL, barbels two pairs; dorsal fin inserted equidistant between tip of snout and base of caudal fin, its last unbranched ray osseus, strong and serrated. *Colour* : Silvery on back, belly with golden tinge; a dark band behind operculum, a black blotch on lateral line on 24th scale; fins orange, caudal fin with black superior and inferior edges.

Distribution : Freshwater of Peninsular India.

Family BAGRIDAE

17. *Mystus keletius* (Valenciennes)

1839. *Bagrus keletius* Valenciennes, *Hist. nat. poiss.*, 14 : 411 (Pondicherry).

1977. *Mystus keletius* : Jayaram, *Rec. zool. Surv. India, Occ. Pap.*, (8) : 31, fig. 26A.

Diagnosis : D I, 7; A ii-iii, 7–8; P I, 10; V i, 5; depth 4.5 in SL; occipital bone not extending to basal bone of dorsal fin; mid-longitudinal groove does not reach the base of occipital process; eye large, 4.2–4.5 times in head. *Colour* : Silvery with yellowish tinge on back, dull white below with a light band along lateral line, a silvery band and below it; a dark shoulder spot; dorsal and caudal fins black tipped.

Distribution : India (Tamilnadu, Karnataka, Kerala), Sri Lanka.

Family CLARIIDAE

18. *Clarias dussumieri* Valenciennes

1840. *Clarias dussumieri* Valenciennes, *Hist. nat. poiss.*, 15 : 382 (Pondicherry, Malabar).

Diagnosis : D 66–69; A 45–59; P I, 10–11; V i, 5; snout broad, occipital process broadly rounded, its distance about 3 times in head length; barbels four pairs; maxillary barbels extending beyond pectoral fin base, nasal barbels more than half head length; pectoral spine strongly serrated in its posterior border. *Colour* : Dark above and lighter below.

Distribution : West coast of India; occurrence in Pondicherry doubtful.

Family PLOTOSIDAE

19. *Plotosus limbatus* (Valenciennes)

1840. *Plotosus limbatus* Valenciennes, *Hist. nat. poiss.*, **15** : 422 (Malabar, Pondicherry).

Diagnosis : D₁I, 4–6; D₂ procurrent C 106–133; A 87–126; P I, 12–15; V i, 11–15; C 9–11; lower GR 22–25; eye diameter 5–9 times in head length; barbels four pairs; nasal barbels short and extend to middle or posterior border of eyes. *Colour* : Body with green tint; fins blackishbrown with black border.

Distribution : India (Southern coasts), Sri Lanka.

Family EXOCOETIDAE

20. *Parexocoetus mento* (Valenciennes)

1846. *Exocoetus mento* Valenciennes, *Hist. nat. poiss.*, **19** : 124 (Pondicherry).

1984. *Parexocoetus mento* : Talwal & Kacker, *Commercial Sea Fishes of India* : 306.

Diagnosis : D 9–12; A 10–12; P i, 12–13; GR 25–30; LS 38–42; depth 4.5–5.0, head 3.7–4.0, P 1.8–2.1 in SL; teeth on vomer; pelvic fin not reaching anal fin origin; juveniles with a bony knob at front of lower jaw. *Colour* : Dorsal fin mostly blackish; pectoral and caudal fins greyish, other fins transparent.

Distribution : Tropical Indo-west Pacific, Red Sea, also entered Mediterranean via Suez Canal.

Family HEMIRAMPHIDAE

21. *Hyporhamphus limbatus* (Valenciennes)

1846. *Hemiramphus limbatus* Valenciennes, *Hist. nat. poiss.*, **19** : 44 (Malabar coast, Bombay, Pondicherry).

1991. *Hyporhamphus limbatus* : Talwar & Jhingran, *Inland Fishes of India*, **2** : 734.

Diagnosis : D 12–16; A 13–16; P i, 10–11; V i, 5; GR (6–11) + (19–23), total 23–37; head 3.5–3.7 in trunk length; upper jaw width 9.6–10.8 times in its length. *Colour* : Greenish above, flanks with a silvery stripe widening posteriorly, white ventrally; fleshy tip of beak reddish, fins hyaline.

Distribution : Persian Gulf, Pakistan, India, Sri Lanka, Myanmar to Thailand and China.

Family SCORPAENIDAE

22. *Scorpaenopsis venosa* (Cuvier)

1829. *Scorpaena venosa* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, **4** : 317 (Pondicherry).

1986. *Scorpaenopsis venosa* : Eschmeyer, in Smith & Heemstra, *Smith's Sea Fishes* : 475, pl. 25, fig. 149.36.

Diagnosis : D XII, 9; A III, 5; P 16–18; LS about 50; ridges between eyes nearly straight, ending abruptly at front edge of pit on top of head behind eyes; upper opercular spine single.

Colour : Reddish or brownish; fins with dark bands or clouded marmorations; a dark blotch between 7th and 10th spine of dorsal fin.

Distribution : Indo-Pacific.

Family TETRAROGIDAE

23. *Tetraroge niger* (Cuvier)

1829. *Apistes niger* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 4 : 415 (Pondicherry).

1962. *Tetraroge niger* : de Beaufort & Briggs, *Fish. Indo-Aust. Archip.*, 11 : 70, fig. 16.

Diagnosis : D XII-XIII, 8; A III, 5; P 10-12; V I, 5; depth 2.4-2.9, head 2.3-2.6 in SL; eye 3.6-5.0 in head; palatine toothed; origin of dorsal above eye; head and body naked. *Colour* : Dark brown to greenish with irregular dark blotches and spots; all fins with a white border and a dark, cloudy, broad subterminal band; all fins dusky with dark blotches and spots except caudal which is generally white.

Distribution : India, Sri Lanka through Indonesia to the Philippines and New Guinea.

Family AMBASSIDAE

24. *Ambassis commersoni* Cuvier

1828. *Ambassis commersoni* Cuvier, *Hist. nat. poiss.*, 2 : 176, pl. 25, fig. 29 (Pondicherry).

Diagnosis : D VII+I, 8-9; A III, 8-9; P I, 12-14; V I, 5; LL 27-30, complete; predorsal scales 16-21; cheek scales one rows; GR (8-9) + (20-22). Supraorbital ridge smooth, with a single backwardly-directed spine. *Colour* : Yellowish to amber with a bright silvery midlateral stripe; fins hyaline; a black blotch on spinous part of dorsal fin between 2nd and 3rd spines; a black streak on both lobes of caudal fin.

Distribution : Indo-west Pacific.

Family SERRANIDAE

25. *Cephalopholis sonnerati* (Valenciennes)

1828. *Serranus sonnerati* Valenciennes, in Cuvier and Valenciennes, *Hist. nat. poiss.*, 2 : 299 (Pondicherry and Ceylon).

1992. *Cephalopholis sonnerati* : Heemstra & Randall, *FAO Fish, Synop.*, (125) 16 : 57.

Diagnosis : D IX, 14-16; A II, 9; P 18-20; GR (7-9) + (14-16); LL pored 66-80; LS 115-134; body depth 2.3-2.8, head 2.5-3.7 in SL; nape of adult convex. *Colour* : Red to reddish brown with widely scattered whitish blotches.

Distribution : Indo-west Pacific.

Family TERAPONIDAE

26. *Terapon puta* Cuvier

1829. *Therapon puta* Cuvier, *Hist. nat. poiss.*, 3 : 131 (Pondicherry, Mahe).

1991. *Terapon puta* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 811.

Diagnosis : D XI-XII, 9–11; A III, 8–9; P 13–15; V I, 5; lower GR 18–24; LL 70–85; Ltr 10–13/22–24. *Colour* : Along side of body, three or four horizontal stripes; spinous dorsal fin uniformly dark in smaller juveniles, but clear with a black blotch on upper membrane between third and seventh spines in young and adults; soft anal fin with black blotch; caudal lobes with two bars, upper lobe with black tip.

Distribution : Indo-west Pacific.

Family APOGONIDAE

27. *Apogon nigripinnis* Cuvier

1928. *Apogon nigripinnis* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 2 : 152 (Pondicherry).

Diagnosis : D VII+I, 9; A II, 8; P 15–16; LL 27; predorsal scales 2; GR (3–4) + (13–14), developed GR 12–13; depth 2.2–2.3, head 2.4 in SL; eye 3.3–3.6 in head; preopercle ridge smooth, suborbitals without spine, caudal truncate. *Colour* : Body with a dark vertical bar under each dorsal fin and another on caudal base; a large ocellus above pectoral fin, ventral fin black, pectoral fin light, other fins dusky to dark.

Distribution : Indo-west Pacific.

28. *Apogon quadrifasciatus* Cuvier

1828. *Apogon quadrifasciatus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 2 : 153 (Pondicherry).

Diagnosis : D VII+I, 9; A II, 8; P 15–16; LL 28; predorsal scales 5; GR (5–6) + 14; depth 2.8–3.0, head 2.5–2.6 in SL; eye 2.9–3.2 in head; preopercle ridge smooth in young, becoming serrated around angle with age; suborbital usually undulate, sometimes with spinules in large adults. *Colour* : Two dark horizontal stripes on upper half of body, lower one continuous on caudal fin.

Distribution : Indo-west Pacific.

Family CARANGIDAE

29. *Alepes vari* (Cuvier)

1833. *Caranx vari* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 9 : 48 (Pondicherry).

1984. *Alepes vari* : Talwar & Kacker, *Commercial Sea Fishes of India* : 441.

Diagnosis : D VIII+I, 25–27; A II, I, 21–23; lower GR 22–24; straight part of LL begins below 1st or 2nd dorsal ray, LL scutes 61–69. *Colour* : Spinous dorsal fin distinctly black; opercle with a black spot.

Distribution : South-west and East coasts of India through Indonesia to the Philippines.

30. *Atule mate* (Cuvier)

1833. *Caranx mate* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 9 : 54 (Pondicherry; Seychelles; New Guinea; Anjer Strait).

1984. *Atule mate* : Talwar & Kacker, *Commercial Sea Fishes of India* : 444.

Diagnosis : D VIII+I, 22–25; A II, 18–21; terminal D and A rays finlet like in adults but joined to adjacent rays by inter-radial membrane; GR (10–13) + (26–31); straight LL with 0–10 scales and 36–39 scutes. *Colour* : Olive green dorsally, fading to white ventrally; 9–10 grey bands wider than interspaces usually present dorsolaterally; opercle with black spot; dorsal and caudal fin dusky to greenish yellow.

Distribution : Indo-west Pacific, eastward to Hawaii.

31. *Caranx sem* Cuvier

1833. *Caranx sem* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 9 : 79 (Pondicherry).

Diagnosis : D VIII+I, 19–21; A II, I, 15–17; D+A rays 34–38; GR (6–8) + (17–19); straight LL with 30–40 strong scutes; breast completely scaled to naked ventrally but typically with a patch of prepelvic scales. *Colour* : Dark bronze to yellow green above, silvery bronze to yellow below; C bright yellow to dusky with distal half of upper lobe darker to black; other fins bright yellow to dusky without an yellow hue.

Distribution : Indo-west Pacific.

32. *Caranx tille* Cuvier

1833. *Caranx tille* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 9 : 124 (Pondicherry).

Diagnosis : D VIII+I, 20–22; A II, I, 16–18; D+A rays 36–40; GR (6–8) + (15–17); straight LL with 33–42 strong scutes; breast completely scaled; dorsal profile strongly convex; dorsal fin lobe 5.7–8.8 times in fork length (in samples longer than 150 mm FL). *Colour* : Head and body dark olive-green to bluish grey above, silvery white below; black spot of half diameter of pupil (absent in young) at upper margin of opercle; second dorsal fin olive-grey to blackish, its lobe without white tip.

Distribution : Indian Ocean distribution poorly known; South Africa to Zanzibar, Madagascar; Sri Lanka; Okinawa, the Philippines, Indonesia, northern Australia and Fiji.

Remarks : There is no positive record of occurrence in Indian waters after the original description.

33. *Scomberoides tol* (Cuvier)

1832. *Chorinemus tol* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 8 : 385 (Malabar, Pondicherry).

1986. *Scomberoides tol* : Smith-Vaniz, in Smith & Heemstra, *Smith's Sea Fishes*, 655, fig. 210.40.

Diagnosis : D VI-VII+I, 19–21; A II, I, 18–20; GR (4–7) + (17–20); scales on mid-body needle like; maxilla does not extend to rear margin of eye. **Colour** : Back grey, silvery below; 5 to 8 oval or vertically oblong black blotches along flanks, the first 4 to 5 intersect the SL; distal half of dorsal lobe heavily pigmented.

Distribution : Wide spread in Indo-west Pacific.

34. *Trachinotus mookalee* Cuvier

1832. *Trachinotus mookalee* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 8 : 423 (Pondicherry).

Diagnosis : D VI+I, 18–20; A II, I, 16–18; GR (5–8) + (8–10); tongue with narrow band of teeth; first predorsal bone like inverted 'L' with the arm projecting anteriorly. **Colour** : Silvery, greenish to bluish-grey dorsally; paler below; second dorsal and caudal fins dusky yellow, leading edges and fin tips darkest; anal fin bright to dirty yellow, lobe without a darker anterior margin. Juveniles with pale yellow fins except distal half of dorsal fin lobe which is black.

Distribution : From Gulf of Oman through the coasts of India to Singapore, Gulf of Thailand, Hong Kong.

Family LUTJANIDAE

35. *Lutjanus rivulatus* (Cuvier)

1828. *Diacope rivulata* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 2 : 414, pl. 38 (Coromandel, Pondicherry, Java, Red Sea, Malabar).

1985. *Lutjanus rivulatus* : Allen, *FAO Fish, Synop.*, (125) 6 : 112.

Diagnosis : D X, 15–16; A III, 8–9; P 17; LL 47–49; GR 6 + (12–13); depth 2.1–2.4, head 2.4–2.5 in SL; preorbital space 3.3–3.9 in head; preopercular notch wide and distinct; vomerine tooth patch crescentic without a medial posterior extension; longitudinal scale rows above lateral line run obliquely to dorsal surface. **Colour** : Brown with reddish tinge; scales with bluish-white spots at centre; head with numerous blue undulating lines; juveniles with a series of 3 to 8 brown bars on sides and a chalky white spot with a broad black margin, below anterior soft dorsal rays at the level of LL.

Distribution : Wide-spread in Indo-west Pacific.

36. *Lutjanus sebae* (Cuvier)

1828. *Diacope sebae* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 2 : 411 (Waigiu; Pondicherry; Java).

1985. *Lutjanus sebae* : Allen, *FAO Fish, Synop.*, (125) 6 : 116.

Diagnosis : D XI, 15–16; A III, 10; P 17; LL 49–50; GR 6 + (10–12); depth 2.1–2.4, head 2.3–2.5 in SL; preorbital space broad; preopercular notch distinct; vomerine tooth patch crescentic without a medial posterior extension; longitudinal scale rows above lateral line rising obliquely. *Colour* : Red or pink in adults; juveniles pink with a dark red band from first dorsal spine through eye to tip of snout; a second band from middle of spinous part of dorsal fin to pelvic fin and a third band from base of last dorsal spine running obliquely downward across caudal peduncle and along lower edge of caudal fin.

Distribution : Wide-spread in Indo-west Pacific.

Family GERREIDAE

37. *Gerres limbatus* Cuvier

1830. *Gerres limbatus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 6 : 476 (Malabar & Pondicherry).

Diagnosis : D IX, 10; A III, 7; LL 33–39; 4 scale rows between LL and dorsal fin origin; depth 2.3–2.7 in SL. *Colour* : Body silvery with 3 faint grey vertical bands below dorsal fin; fins yellowish, dorsal fin margin dusky.

Distribution : Seas of India.

38. *Gerres lucidus* Cuvier

1830. *Gerres lucidus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 6 : 177 (Pondicherry).

Diagnosis : D IX, 10; A III, 7 : LL 33–35 plus 3 more on base of caudal fin; 3 scale rows between and 5th dorsal spine; depth 2.3 to 2.7 in SL. *Colour* : Silver with a diffuse dark saddles along back extending down on sides to midline; dorsal fin faintly golden with a dark patch on the tip of the spinous portion above a line running from middle of 2nd dorsal spine to tip of 6th dorsal spine; caudal fin pale yellow with a dusky trailing edge; pectorals yellow, while anal and pelvic fins with orange tinge.

Distribution : Coasts of India, Sri Lanka to South-east Asia and the South China Sea.

Family HAEMULIDAE

39. *Pomadasys kaakan* (Cuvier)

1830. *Pristipoma kaakan* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 5 : 244 (Pondicherry).

1986. *Pomadasys kakkan* : Smith & McKay, in Smith & Heemstra, *Smith's Sea Fishes* : 569, fig. 179.13.

Diagnosis : D XII 13–15; A III, 7–8; P 17–18; GR (5–6) + (13–14); LL 43–47; depth 2.5–2.8 in SL; fin spines very strong; 7 transverse scale rows between LL and first dorsal fin spine. *Colour* : body silvery grey with about 7–11 interrupted double dark brown to greyish spots

forming transverse bars in juveniles but generally becoming less distinct and disappearing completely with age; 2 to 3 rows of round spots on basal half of dorsal fin always present; other fins yellowish.

Distribution : Indo-west Pacific.

Family SCIAENIDAE

40. *Daysciaena albida* (Cuvier)

1830. *Corvina albia* Cuvier, *Hist. nat. poiss.*, 5 : 93 (Pondicherry and Malabar).

1991. *Daysciaena albida* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 853.

Diagnosis : D IX-X+I, 23–26; A II, 7; P I, 17 : LL 48–51; lower GR 7–9 with several toothed plates below; a pair of small tapering barbels on chin; gas bladder carrot shaped, anterior pair of appendages of gas bladder extending into head and branching under the skull. *Colour* : Grey above, silvery below with faint oblique lines along scale rows; spinous part of dorsal fin black; a black blotch at the axil of pectoral fin.

Distribution : India, Sri Lanka, eastwards to Indonesia.

41. *Johnieops sina* (Cuvier)

1830. *Corvina sina* Cuvier, *Hist. nat. poiss.*, 5 : 112 (Pondicherry and Malabar).

1991. *Johnieops sina* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 854.

Diagnosis : D IX-X+I, 27–31; A II, 7–8; P i, 16–17; LL 48–50; lower GR 10–13, slender; snout rounded but not projecting; teeth villiform; teeth on outer row of upper jaw and inner row of lower jaw enlarged and widely spaced; gas bladder hammer shaped with 14 or 15 pairs of arborescent appendages. *Colour* : Greyish on back, silvery below; a steel-blue blotch on opercle; upper two thirds of first dorsal dark grey, anal and paired fins yellowish.

Distribution : Gulf of Oman through India, Indonesia to the Philippines and northern Australia.

42. *Johnius belangerii* (Cuvier)

1830. *Corvina balangerii* Cuvier, *Hist. nat. poiss.*, 5 : 120 (Pondicherry).

1991. *Johnius belangerii* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 856.

Diagnosis : D IX+I, 27–31; A II, 7–8; P i, 15–16; LL 48–52; lower GR 8–10; snout steeply rounded, slightly projecting; teeth villiform, differentiated in size in upper jaw only, largest ones in outer row close-set; second anal spine 38–49% of head length; gas bladder hammer-shaped with

11–15 pairs of arborescent appendages. *Colour* : Darkly pigmented; spinous part of dorsal fin black; dark blotch on gill cover.

Distribution : Coasts of India, Sri Lanka, eastward to New South Wales in Australia.

43. *Paranibea semiluctuosa* (Cuvier)

1830. *Corvina semiluctuosa* Cuvier, *Hist. nat. poiss.*, 5 : 106 (Goa, Malabar, Pondicherry).

1984. *Paranibea semiluctuosa* : Talwar & Kacker, *Commercial Sea Fishes of India*, 667.

Diagnosis : D X-XI+I, 7–31; A II, 7; lower GR 5–8; dorsal profile arched; mouth slightly inferior; upper jaw with outer row of larger teeth; teeth in lower jaw uniform and strong; gas bladder carrot-shaped with 15–20 pairs of arborescent appendages, the first one entering the head and branching below the occipital region. *Colour* : Dark with numerous oblique wavy black stripes reaching down the flanks to belly; pelvic and anal fins very dark.

Distribution : Coasts of India, eastwards to Sumatra and Java.

Family CHAETODONTIDAE

44. *Chaetodon decussatus* Cuvier

1831. *Chaetodon decussatus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 7 : 54 (Pondicherry).

Diagnosis : D XIII, 24–25; A III, 20–21; P 15; LL 36–41; Ltr 5–6/17–18; GR 17–20; snout 3.0–4.0 in head. *Colour* : 5 or 6 diagonal lines extending from upper posterior part of head to base of dorsal spines; 11–12 similar lines extending at right angles from last of previous lines towards anal fins; dorsal and anal fins, caudal peduncle and adjacent areas black with a yellow stripe through anal fin.

Distribution : India, Sri Lanka, Singapore, Thailand.

Remarks : Often misidentified as *C. vagabundus* Linnaeus or *C. pictus* Forsskal.

Family MUGILIDAE

45. *Liza carinata* (Valenciennes)

1836. *Mugil carinatus* Valenciennes, *Hist. nat. poiss.*, 11 : 148 (Malabar, Pondicherry).

1984. *Liza carinata* : Thomson, in Fischer & Bianchi. *FAO species identification sheets for fishery purposes. Western Indian Ocean (Fishing area 51)* : MUGIL LIZA 9.

Diagnosis : D IV+I, 8; A III, 9; LS 35–40; Ltr 11; a distinct keel or ridge present in front of dorsal fin; pectoral axillary scale absent or rudimentary. *Colour* : Greenish grey dorsally, silvery on sides and belly; golden around eye; end of maxilla black.

Distribution : Red Sea to Bombay coast of India.

Remarks : Though Valenciennes (1836) mentioned about the presence of this species at Pondicherry, there is no reliable record of occurrence so far in the east coast of India.

46. *Liza subviridis* (Valenciennes)

1836. *Mugil subviridis* Valenciennes, *Hist. nat. poiss.*, 11 : 115 (Malabar, Pondicherry).

1991. *Liza subviridis* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 894.

Diagnosis : D IV+I, 8–9; A III, 9; P 16; LS 27–32; Ltr 11; preorbital not filling space between lip and eye; corner of mouth on vertical through anterior nostril; back not keeled in front of dorsal fin; second dorsal fin inserted over anterior half of anal fin base; pectoral fin not reaching vertical through first dorsal fin origin; pectoral axillary scale rudimentary or absent. *Colour* : Dark greenish above, white below; caudal fin edged with black.

Distribution : Persian Gulf to India, Sri Lanka, China, Queensland, Polynesia.

Family SPHYRAENIDAE

47. *Sphyraena jello* Cuvier

1829. *Sphyraena jello* Cuvier, *Hist. nat. poiss.*, 3 : 349 (Pondicherry).

Diagnosis : D V+I, I, 8; A II, I, 7; P ii, 12–13; LL 130–140; no GR on first arch; depth 7.9–8.9; head 3.2–3.6 in SL. *Colour* : Body with about 20 short serpentine cross bars, not chevron shaped which extend only a short distance below LL.

Distribution : Indian Ocean.

Remarks : Often misidentified as *S. bleekeri* Williams = *S. putnamiae* Jordan & Sacle and *S. genie* Klunzinger. Range is not certain; commonly found in Arabian Sea and Bay of Bengal.

48. *Sphyraena obtusata* Cuvier

1829. *Sphyraena obtusata* Cuvier, *Hist. nat. poiss.*, 3 : 350, pl. 10, fig. 2 (Pondicherry).

Diagnosis : D V+I, I, 8; A II, I, 8; P ii, 11–13; LL 85–96; GR 2 on first arch; depth 6.0–7.5; head 2.8–3.0 in SL; pectoral fin tip reaches past the level of D₁ origin; height of D₁ equal to or greater than post orbital length of head. *Colour* : Body olive green above, silvery below; inside of mouth yellow; fins with yellow tinge except pelvic fin; caudal with black edge.

Distribution : Indo-Pacific.

Remarks : Range of occurrence is not clear. The exact distribution of small barracudas of *chrysotaenia-flavicauda-pinguis-obtusata* complex is not known because of difficulties in identification of the types and other museum specimens (de Sylva & Williams, 1986).

Family POLYNEMIDAE

49. *Filimanus xanthonema* (Valenciennes)

1831. *Polynemus xanthonemus* Valenciennes, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 7 : 517 (Pondicherry).

1991. *Filimanus xanthonema* : Feltes, *Copeia* (2) : 318.

Diagnosis : D VIII+I, 11; A III, 11–12; P 15+vi; free pectoral filamentous rays extending beyond tip of pelvic fin; upper pectoral fin rays mostly branched; air bladder absent. *Colour* : Greenish back, silvery abdomen and sides; yellow fins with black border.

Distribution : Seas of India to China.

Family LABRIDAE

50. *Xyrichtys cyanifrons* Valenciennes

1840. *Xyrichtys cyanifrons* Valenciennes, *Hist. nat. poiss.*, 14 : 46 (Pondicherry).

Diagnosis : D IX, 12; A III, 12; LL 27; top of head and snout compressed to form a sharp edge; cheek scale-less; a few rudimentary scales below and behind orbit, first two dorsal spines a little longer, flexible and separated from the rest by an incised membrane reaching the lower one-third of the third spine; the outer ray of ventral fin produced, extending to the origin of anal fin. *Colour* : Rose, a blue band along the upper ridge of head to the dorsal fin.

Distribution : Coasts of India.

Family URANOSCOPIDAE

51. *Ichthyscopus inermis* (Cuvier)

1830. *Uranoscopus inermis* Cuvier, *Hist. nat. poiss.*, 3 : 310, pl. 65 (Pondicherry).

1876. *Ichthyscopus inermis* : Day, *Fish. India* : 261, Pl. 55, fig. 5.

Diagnosis : D III-IV, 16–18; A 16–19; P 18; pyloric caecae 8; eye dorsally positioned; lips with numerous branched papillae; no spine on shoulder; an elongated angular flap edged with papillae behind the shoulder. *Colour* : Canary yellow with brown markings on sides enclosing white blotches; caudal yellow brown; a dark bar across pectoral.

Distribution : Seas of India to Japan.

52. *Uranoscopus guttatus* Cuvier

1829. *Uranoscopus guttatus* Cuvier, *Hist. nat. poiss.*, 3 : 305 (Pondicherry).

Diagnosis : D IV-V+12–13; A 13; P 17; mouth large, vertical; lower edge of preopercle with 4 to 7 spines, one on subopercle; humeral spine directed upward and backward; lips with a row of tentacles; no prepelvic spine; no fleshy orbital tentacle. *Colour* : Brown above, pale below; 2 to 3 rows of bluish white spots along the back and halfway down the sides; fins dusky to dark, tips whitish; upper part of first dorsal black, lower one-third white.

Distribution : Coasts of India.

Family CALLIONYMIDAE

53. *Elutherochir opercularis* (Valenciennes)

1837. *Callionymus opercularis* Valenciennes, *Hist. nat. poiss.*, 12 : 305 (Pondicherry).

1991. *Eleutherochir opercularis* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 917.

Diagnosis : D IV+9; A 9; P 20; head 3 times in SL; operculum with a large free lap of skin; lower lip with 7 to 9 very small papillae. *Colour* : Brownish or yellowish; cheeks and belly lighter; back with light blotches and dark spots; first dorsal fin black; pelvic fins blackish; rays of other fins spotted with dark brown.

Distribution : Sri Lanka. East coast of India, Andaman & Nicobar Islands; eastwards to the Philippines to Japan.

Family GOBIIDAE

54. *Glossogobius biocellatus* (Valenciennes)

1838. *Gobius biocellatus* Valenciennes, *Hist. nat. poiss.*, 12 : 73 (Pondicherry).

1941. *Glossogobius biocellatus* : Koumans, *Mem. Indian Mus.*, 13(3) : 255.

Diagnosis : D VI+I, 9; A I, 8; P i, 16–18; branchiostegal membranes form a free fold across isthmus; iris with a lappet dorsally covering part of pupil. *Colour* : Body dark brown to black with small black spots in longitudinal rows; two or three broad saddles on back and flanks.

Distribution : Indo-west Pacific.

55. *Parapocryptes rictuosus* (Valenciennes)

1837. *Apocryptes rictuosus* Valenciennes, *Hist. nat. poiss.*, 12 : 151 (Pondicherry).

1941. *Parapocryptes rictuosus* : Koumans, *Mem. Indian Mus.*, 13(3) : 275.

Diagnosis : D VI+I, 23–26; A I, 24–28; P i, 19; LS 75; depth 10.0–12.0 in SL; eye 6.0–7.0 in head; teeth on lower jaw pointed; dorsal fins continuous at base. *Colour* : Greyish with ill-defined

oblique bands from back half-way to the flanks; innerside of mouth with dark spots; pelvic fins whitish; other fins with spots.

Distribution : East Coast of India.

Family BELONTIIDAE

56. *Macropodus cupanus* (Cuvier)

1831. *Polyacanthus cupanus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 7 : 357 (Pondicherry).

1991. *Macropodus cupanus* : Talwar & Jhingran, *Inland Fishes of India.*, 2 : 1002.

Diagnosis : D XIII-XV, 5-7; A XVI-XX, 9-13; P i, 10; V I, 5; LL 29-32; first ray of pelvic fin elongated and filamentous. *Colour* : Dark olive to green; a brown stripe from eye to corner of opercle; brown spots on head; a dusky blotch on caudal peduncle.

Distribution : Eastern India, Sri Lanka, Western Burma, Malay peninsula, Sumatra. Inhabits freshwater ponds and ditches.

Apart from these 56 valid species of fishes, a number of species described by Cuvier and Valenciennes (1828-1849) have been synonymised. They are reported here as nominal species in Table 1, with their current status.

DISCUSSION

An analysis reveals that out of 56 valid species reported here, 4 are freshwater forms (*Puntius sarana subnasutus*, *Mystus keletius*, *Clarias dussumieri* and *Macropodus cupanus*) and the rest are coastal marine. But for 12 species, (*Apogon nigripinnis*, *A. quadrifasciatus*, *Bascanichthys deraniyagalai*, *Chaetodon decussatus*, *Eleutherochir opercularis*, *Glossogobius biocellatus*, *Ichthyscopus inermis*, *Macropodus cupanus*, *Parapocryptes rictuosus*, *Scorpaenopsis venosa*, *Tetraroge niger* and *Uranoscopus guttatus*) all are commercially valuable. Now a days, *Chaetodon decussatus* and *Macropodus cupanus* have gained a commercial status as aquarium fishes.

Endemic to Indian waters are 10 species, viz. *Bascanichthys deraniyagalai*, *Clarias dussumieri*, *Gerres limbatus*, *Ilisha obfusca*, *Mystus keletius*, *Parapocryptes rictuosus*, *Plotosus limbatus*, *Puntius sarana subnasutus*, *Uranoscopus guttatus* and *Xyrichtys cyanifrons*.

It is rather unfortunate that the present status and availability of *Ilisha obfusca* are not known to us beyond information gained while describing the species by two specimens coming from the type series of *I. filigera* and *I. micropus* (Whitehead, 1985). Though there is no positive record of occurrence after original description for *Caranx tille* in Indian Coast (Talwar & Kacker, 1984), it occurs in other areas of Indo-west Pacific region. However, Smith-Vaniz (1984) indicates the possibility of its fishery in the Gulf of Mannar.

Despite our intensive searches, *Clarias dussumieri* could not be located in Pondicherry so far. Incidentally, Silas (1952) points out that it is primarily a hill fish leading us to believe that the record of occurrence from Pondicherry doubtful. Another doubtful record is that of *Liza carinata* though Valenciennes (1836) has mentioned of having the specimens from Pondicherry. Till date, it has not been reported from anywhere in the east coast of India.

The existing taxonomic hurdles due to overlapping meristic characters have not been resolved, atleast for two genera, *Sardinella* and *Sphyraena*. As suggested by Sivakumaran *et al*, (1989), an easier isolation methodology shall have to be worked out for *albella-fimbriata-gibbosa-sindensis* complex in *Sardinella*. Similarly, *chrysotaenia-flavicauda – obtusata-pinguis* complex in *Sphyraena* will have to be studied to know the ranges of small barracudas precisely.

Among *Chaetodon decussatus* samples colour variance due to suspected hybridization with *C. vagabondus* Linnaeus leads to erroneous identification. In general, many *Chaetodon* species are known to hybridize freely (Burgess, 1978).

From the nominal species list (Table 1), out of the 76 species, atleast 45 have commercial value; only 6 are restricted to freshwaters while the rest are marine. As far as *Barbus roseipinnis* is concerned, it is considered to be an invalid species by ichthyotaxonomists though Talwar and Jhingran (1991) retained its validity. The last sample sent by Dr. Belanger to Sir Francis Day is stated to have been lost (Day, 1878). In the absence of further samples and due to the opinion that it is the breeding stage of some other *Puntius* species, we refrain from assigning it to any known taxon.

SUMMARY

Taxonomic information on 56 species of fish originally described from Pondicherry is given. Other relevant details including geographical distribution and current status are provided. A list of nominal species with their present status is also included.

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Table 1. : List of nominal species described originally by Cuvier and Valenciennes (1828–1849) from Pondicherry.

| Sl. No. | Species as described | Present status |
|---------|---|---|
| 1. | <i>Lates nobilis</i> Cuvier, 1828 | <i>Lates calcarifer</i> (Bloch, 1790) |
| 2. | <i>Serranus lineatus</i> Valenciennes, 1828 | <i>Epinephelus undulosus</i> (Quoy and Gaimard, 1824) |
| 3. | <i>Serranus semi-punctatus</i> Valenciennes, 1828 | <i>Epinephelus malabaricus</i> (Bloch and Schneider, 1801) |
| 4. | <i>Diacope marginata</i> Cuvier, 1828 | <i>Lutjanus fulvus</i> (Schneider, 1801) |
| 5. | <i>Mesoprion flavipinnis</i> Cuvier, 1828 | <i>Lutjanus argentimaculatus</i> (Forsskal, 1775) |
| 6. | <i>Mesoprion rubellus</i> Cuvier, 1828 | <i>Lutjanus erythropterus</i> Bloch, 1790 |
| 7. | <i>Cirrhites fasciatus</i> Cuvier, 1829 | <i>Cirrhitichthys aprinus</i> (Cuvier, 1829) |
| 8. | <i>Holocentrum orientale</i> Cuvier, 1829 | <i>Sargocentron rubrum</i> (Forsskal, 1775) |
| 9. | <i>Polynemus longifilis</i> Cuvier, 1829 | <i>Polynemus paradiseus</i> Linnaeus, 1758 |
| 10. | <i>Polynemus uronemus</i> Cuvier, 1829 | <i>Polydactylus indicus</i> (Shaw, 1804) |
| 11. | <i>Apistus alatus</i> Cuvier, 1829 | <i>Apistus carinatus</i> (Bloch and Schneider, 1801) |
| 12. | <i>Synanceia elongata</i> Cuvier, 1829 | <i>Trachicephalus uranoscopus</i> (Bloch and Schneider, 1801) |
| 13. | <i>Sillago acuta</i> Cuvier, 1829 | <i>Sillago sihama</i> (Forsskal, 1775) |
| 14. | <i>Sillago domina</i> Cuvier, 1829 | <i>Sillaginopsis panijus</i> (Hamilton-Buchanan, 1822) |
| 15. | <i>Diagramma poecilopterum</i> Cuvier, 1830 | <i>Diagramma pictum</i> (Thunberg, 1792) |
| 16. | <i>Lobotes erate</i> Cuvier, 1830 | <i>Lobotes surinamensis</i> (Bloch, 1790) |
| 17. | <i>Scolopsides kate</i> Cuvier, 1830 | <i>Scolopsis vosmeri</i> (Bloch, 1792) |
| 18. | <i>Etroplus meleagris</i> Cuvier, 1830 | <i>Etroplus suratensis</i> (Bloch, 1785) |
| 19. | <i>Dentex tolu</i> Valenciennes, 1830 | <i>Nemipterus peronii</i> (Valenciennes, 1830) |
| 20. | <i>Lethrinus korely</i> Valenciennes, 1830 | <i>Lethrinus nebulosus</i> (Forsskal, 1775) |
| 21. | <i>Lethrinus erythrurus</i> Valenciennes, 1830 | <i>Lethrinus nebulosus</i> (Forsskal, 1775) |
| 22. | <i>Gerres punctatus</i> Cuvier, 1830 | <i>Gerres filamentosus</i> Cuvier, 1829 |
| 23. | <i>Platax raynaldi</i> Cuvier, 1831 | <i>Platax teira</i> (Forsskal, 1775) |
| 24. | <i>Platax blochi</i> Cuvier, 1831 | <i>Platax orbicularis</i> (Forsskal, 1775) |
| 25. | <i>Platax leschenaldi</i> Cuvier, 1831 | <i>Platax teira</i> (Forsskal, 1775) |

Table 1. : Cont'd.

| Sl. No. | Species as described | Present status |
|---------|--|--|
| 26. | <i>Colisa ponticeriana</i> Cuvier, 1831 | <i>Colisa fasciatus</i> (Schneider, 1801) |
| 27. | <i>Ophiocephalus marginatus</i> Cuvier, 1831 | <i>Channa orientalis</i> Bloch and Schneider, 1801 |
| 28. | <i>Cybium interruptum</i> Cuvier, 1832 | <i>Scomberomorus lineatus</i> (Cuvier, 1831) |
| 29. | <i>Elacate pondiceriana</i> Cuvier, 1832 | <i>Rachycentron canadus</i> (Linnaeus, 1766) |
| 30. | <i>Apolectus stromateus</i> Cuvier, 1832 | <i>Parastromateus niger</i> (Bloch, 1795) |
| 31. | <i>Rhynchobdella ocellata</i> Cuvier, 1832 | ? <i>Macrogathus arel</i> (Bloch and Schneider, 1801) |
| 32. | <i>Mastacembelus ponticeriana</i> Cuvier, 1832 | <i>Mastacembelus armatus</i> (Lacepede, 1800) |
| 33. | <i>Caranx kiliche</i> Cuvier, 1833 | <i>Decapterus russelli</i> (Ruppel, 1830) |
| 34. | <i>Caranx kalla</i> Cuvier, 1833 | <i>Caranx para</i> Cuvier, 1833 |
| 35. | <i>Caranx ire</i> Cuvier, 1833 | <i>Carangoides praeustus</i> (Bennett, 1830) |
| 36. | <i>Caranx nigriceps</i> Cuvier, 1833 | <i>Atropus atropos</i> (Schneider, 1801) |
| 37. | <i>Gallichthys major</i> Cuvier, 1833 | <i>Alectis indicus</i> (Ruppel, 1830) |
| 38. | <i>Seriola binotata</i> Valenciennes, 1833 | <i>Seriolina nigrofasciata</i> (Ruppel, 1829) |
| 39. | <i>Lactarius delicatus</i> Valenciennes, 1833 | <i>Lactarius lactarius</i> (Bloch and Schneider, 1801) |
| 40. | <i>Stromateus albus</i> Cuvier, 1833 | <i>Pampus chinensis</i> (Euphrasen, 1788) |
| 41. | <i>Stromateus griseus</i> Cuvier, 1833 | <i>Pampus argenteus</i> (Euphrasen, 1788) |
| 42. | <i>Kurtus cornutus</i> Cuvier, 1833 | <i>Kurtus indicus</i> Bloch, 1786 |
| 43. | <i>Equula ensifera</i> Valenciennes, 1835 | <i>Leiognathus equulus</i> (Forsskal, 1775) |
| 44. | <i>Equula gomorah</i> Valenciennes, 1835 | <i>Leiognathus splendens</i> (Cuvier, 1829) |
| 45. | <i>Equula dentex</i> Valenciennes, 1835 | <i>Gazza minuta</i> (Bloch, 1797) |
| 46. | <i>Equula interrupta</i> Valenciennes, 1835 | <i>Secutor ruconius</i> (Hamilton-Buchanan, 1822) |
| 47. | <i>Equula insidiatrix</i> Valenciennes, 1835 | <i>Secutor insidiator</i> (Bloch, 1787) |
| 48. | <i>Acanthurus rasi</i> Valenciennes, 1835 | <i>Acanthurus xanthopterus</i> Valenciennes, 1835 |
| 49. | <i>Acanthurus melanurus</i> Valenciennes, 1835 | <i>Acanthurus xanthopterus</i> Valenciennes, 1835 |
| 50. | <i>Mugil cepalotus</i> Valenciennes, 1835 | <i>Mugil cephalus</i> Linnaeus, 1758 |

Table 1. : Cont'd.

| Sl. No. | Species as described | Present status |
|---------|--|---|
| 51. | <i>Mugil amarulus</i> Valenciennes, 1836 | <i>Valamugil cunnesius</i> (Valenciennes, 1836) |
| 52. | <i>Gobius kokius</i> Valenciennes, 1837 | <i>Glossogobius giuris</i> (Hamilton-Buchanan, 1822) |
| 53. | <i>Gobius russelli</i> Valenciennes, 1837 | <i>Glossogobius giuris</i> (Hamilton-Buchanan, 1822) |
| 54. | <i>Gobius catebus</i> Valenciennes, 1837 | <i>Glossogobius giuris</i> (Hamilton-Buchanan, 1822) |
| 55. | <i>Gobius setosus</i> Valenciennes, 1837 | <i>Oligolepis acutipennis</i> (Valenciennes, 1837) |
| 56. | <i>Gobius venenatus</i> Valenciennes, 1837 | <i>Acentrogobius viridipunctatus</i> (Valenciennes, 1837) |
| 57. | <i>Apocryptes dentatus</i> Valenciennes, 1837 | ? <i>Pseudoapocryptes lanceolatus</i> (Bloch and Schneider, 1801) |
| 58. | <i>Bagrus albilabris</i> Valenciennes, 1839 | <i>Mystus gulio</i> (Hamilton-Buchanan, 1822) |
| 59. | <i>Bagrus bilineatus</i> Valenciennes, 1839 | <i>Arius thalassinus</i> (Ruppell, 1837) |
| 60. | <i>Bargus netuma</i> Valenciennes, 1839 | <i>Arius thalassinus</i> (Ruppell, 1837) |
| 61. | <i>Bagrus doroides</i> Valenciennes, 1839 | ? <i>Arius sagor</i> (Hamilton, 1822) |
| 62. | <i>Clarias marpus</i> Valenciennes, 1840 | <i>Clarias batracus</i> (Linnaeus, 1758) |
| 63. | <i>Arius granosus</i> Valenciennes, 1840 | <i>Arius caelatus</i> (Valenciennes, 1840) |
| 64. | <i>Dangila leschenaulti</i> Valenciennes, 1842 | <i>Cirrhinus cirrhosus</i> (Bloch, 1795) |
| 65. | <i>Belone annulata</i> Valenciennes, 1846 | <i>Tylosurus crocodilus crocodilus</i> (Peron and Le Sueur, 1821) |
| 66. | <i>Megalops indicus</i> Valenciennes, 1847 | <i>Megalops cyprinoides</i> (Broussohet, 1782) |
| 67. | <i>Pellona leschenaulti</i> Valenciennes, 1847 | <i>Ilisha elongata</i> (Bennett, 1830) |
| 68. | <i>Engraulis brownii</i> Valenciennes, 1848 | <i>Stolephorus commersoni</i> Lacepede, 1803 |
| 69. | <i>Notopterus pallasii</i> Valenciennes, 1848 | <i>Notopterus notopterus</i> (Pallas, 1769) |
| 70. | <i>Equula parviceps</i> Valenciennes, 1835 | Indeterminate |
| 71. | <i>Amblyopus gracilis</i> Valenciennes, 1837 | Indeterminate |
| 72. | <i>Callionymus lineatus</i> Valenciennes, 1837 | Indeterminate |
| 73. | <i>Scarus lacerta</i> Valenciennes, 1839 | Indeterminate |
| 74. | <i>Clarias capensis</i> Valenciennes, 1840 | Indeterminate |
| 75. | <i>Barbus roseipinnis</i> Valenciennes, 1842 | Indeterminate |
| 76. | <i>Hemiramphus russeli</i> Valenciennes, 1846 | Indeterminate |

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A CONTRIBUTION TO THE TAXONOMY OF INDIAN FIVESTRIPED SQUIRREL (*FUNAMBULUS PENNANTI* WROUGHTON), WITH DESCRIPTION OF TWO NEW SUBSPECIES

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INTRODUCTION

The Fivestriped Squirrel, *Funambulus pennanti* Wroughton, is found over almost all of India in forested country, comparatively open area or in human habitations. Its range of distribution is approximately from Dharwar in Karnataka (c15°27' N lat.), Maharashtra and about Godavari River in Andhra Pradesh in the South, and from Bengal as far as west to Iran through plains of northern India and Himalayan foot hills, including Nepal. Chaturvedi (1966) has reported it from Andaman Island (probably introduced). From Karnataka through Maharashtra, Madhya Pradesh, Orissa to southern parts of Bihar and southern West Bengal it occurs with the Threestriped Squirrel, *Funambulus palmarum* Wroughton, but under variable ecological conditions in different places.

Originally, Wroughton (1905, 1916) described three subspecies of *Funambulus pennanti*, namely, *pennanti* (type locality : Mandvi Taluka, Surat, Gujarat), *argentescens* (type locality : Rawalpindi, Pakistan) and *lutescens* (type locality : Dessa, Banas Kantha (= Palanpur), Gujarat). Ellerman and Morrison-Scott (1951) and Ellerman (1961), however did not give validity to any of Wroughton's subspecies. Ellerman (1961, p. 210) says : "Wroughton divided this species into three races based on supposed colour characters. These are completely inconsistent and what he seems to have described three colour variation which it appears may take place anywhere." Moore and Tate (1965) in their valuable contribution have revived all the three of Wroughton's subspecies. They (Moore and Tate, *op. cit.*) gave the distribution of *F. p. argentescens* from the western border of Nepal through northern part of Uttar Pradesh, Himachal Pradesh in India, Punjab, North West Frontier Provinces, Sind, Baluchistan in Pakistan and westwards, that of *F. p. lutescens* at Dessa, Palanpur (presently Banas Kantha), Gujarat, and rest of India up to Dharwar, Karnataka, is occupied by *F. p. pennanti*. However, Agrawal and Chakraborty (1979) could not recognise any difference in the three subspecies and found Ellerman's (*op. cit.*) observation to be correct. From the present study based on the materials of this species in the collection of the Zoological Survey of India and large number of specimens borrowed from the Bombay Natural History Society, we, however, do

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not agree with Ellerman and Morrison-Scott's (1951), Ellerman's (1961) also of Agrawal and Chakraborty's (1979) views. On the contrary, like Moore and Tate (1965) we are in the opinion of recognising all these subspecies of Wroughton, but observations are slightly different from them.

A critical study on the geographic variations in the colour of the dark and light stripes forming the saddle, head, sides of the body, flank, forelimb and hindfoot, tail and position of the saddle, besides general colouration and size was made on 250 examples of this species from different areas of India. From the study it was revealed that in *Funambulus pennanti*, the average character rather than absolute measurements or particular colour, as it generally happens in many other rodents and small mammals, is important in the recognition of its infra specific categories. It is found that, in spite of having individual variation among the members of various populations of the Fivestriped Squirrels, colour pattern is not as inconstant as has been commented by Ellerman (*op. cit.*), and the white stripes alone do not have much importance in its subspecific identification.

In consideration of the average colour pattern, we agree with Ellerman (*op. cit.*, p. 210) that the specimens of *F. pennanti* from Salt Range, Pakistan 'cannot be distinguished from the normal *lutescens*' for they actually belong to this subspecies of Wroughton rather than to *argentescens*, as considered by the above author. On the contrary, we disagree with Ellerman that the specimens from Danta (near the type locality of *F. p. lutescens*) in Gujarat, Sind in Pakistan and Gwalior in Madhya Pradesh belong to the same population, or the material from Khadesh in Maharashtra are similar to those of *lutescens* on average characters. However, after working carefully through this difficult species which is distributed over a wide area with variable physiography, climate, rainfall and forest zones, it is considered in this work that the undermentioned subspecies of this Indian squirrel should be recognised. These subspecies, in addition to their morphological differences on average characters, also possess variable ecological co-relations (vide Table 1).

In dealing with the subspecies, morphometry of the skulls have not been accounted in this study, for they hardly represent any appreciable differences for subspecific recognition.

The materials referred in the work, unless otherwise mentioned, are all study skins and adult specimens. The body measurements refer to those taken by the collector in the field and given here in millimeters. Measurements available in Ellerman (1961) were also utilised, when required for comparison, estimation, *etc.*

The colour names mentioned with initial capital letters are recognised after Ridgway's (1886) nomenclature.

Abbreviations commonly used are : m = meter; c = *circa* (= approximately); ex = example; lat. = latitude; long. = longitude.

The abbreviations like ZSI and BNHS denote the Zoological Survey of India and the Bombay Natural History Society; others as N., S., indicate geographical directions like north, south *etc.*

The main ecological works have been done by one of us (PSG).

OBSERVATIONS

Funambulus pennanti pennanti Wroughton, 1905

1905. *Funambulus pennanti pennanti* Wroughton. *J. Bombay nat. Hist. Soc.*, 16(3) : 411. (Mandvi Taluka, Surat, Gujarat).

Material examined : INDIA : 24♂, 16♀, 2 unsexed : MAHARASHTRA : Jalgaon District (East Kahndesh) : 2♀; Pachora; March 1911 (BNHS). 1♂, 3♀; Ghodasgaon; April 1911 (1ex : ZSI, 3ex BNHS). 5♂; Vawal Taluk; February and April 1919 (BNHS). 6♂, 1♀; Moharala, Vawal Taluk; December 1918 and February 1919 (BNHS). 1♂; Maloa, Vawal Taluk; February 1919 (BNHS). 1♂, 1 unsexed; Bhusawal; May 1919 (BNHS). 2♀; Chalisgaon; February 1919 (BNHS). 1♀; Bhaunti; no date (BNHS). 2♂, 2♀; Edlabad; March 1974 (ZSI). GUJARAT : Surendranagar District : 1♂; Satapur, Dhrangadhra; September 1912 (ZSI). Rajkot District : 1♀; Rajkot; December 1912 (ZSI). Junagadh District : 1♂; Junagadh; September 1912 (ZSI). 1♀; Talala, Junagadh; October 1912 (ZSI). Surat District : 2♂; Sirwan; November 1962 (ZSI). MADHYA PRADESH : East Nimar District : 2♂; Chandgarh (c 398 m alt.); December 1911 (BNHS). 1♂; Ganon; December 1911 (BNHS). Hoshangabed District : 1♀; Dhaim; February 1912 (BNHS). 1 unsexed; Bori Forest; no date (BNHS). 2♂, 1♀; Sakot (c 367 m alt.); January 1912 (2 ex : BNHS; 1 ex : ZSI).

| | | |
|---|-----------------|-------------------------|
| External measurements : | 24♂ | 21♀ |
| Head and body : | 135–156 (142.4) | 134–150 (142.6) |
| Tail : | 130–158 (147.1) | 74–169 (147.3) (19 ex.) |
| Hind Foot : | 33–49 (36.9) | 34–40 (37.3) |
| Ear : | 15–17 (16.2) | 15–18 (16.2) |
| Proportion of ear to head and body size : | 8.3–13.5% | 10–12.5% |

The dark stripes in this subspecies are speckled with black and Buff or Orange-Buff hairs; in fully adult specimens proportions of black and Buff are more or less same. Head Cream Buff and in some specimens Buff-Yellow to Orange-Buff, minutely speckled with black; lighter in the back, but generally not very lighter than the nape and anterior portion of saddle, particularly in the northern material of this subspecies. The light stripes vary from creamish white to Primrose Yellow in colour. The central light stripes, with the exception of few western Indian examples, generally darker than the outer pairs. The dorsal sides of the manus and pes are lighter, ranging from dirty white, Primrose Yellow, Straw Yellow to Cream Buff; sometimes speckled with black, especially those from northeastern area of the range. The colouration in the ventral side Straw Yellow to Cream colour. The sides of the body, the flank, the fore and hind limbs are Straw Yellow speckled with certain amount of black, in few occasions with rusty wash. The saddle generally commences from the anterior angle of ears or slightly posterior between the ears. The outer light stripes are quite prominent. The tail is not bushy, but somewhat slender.

Range : Western India, from about 15°27' N lat. in Dharwar in Karnataka and then through Maharashtra to Gujarat (excluding Bhuj, Kutch and Banas Kantha (= Palanpur) in the west; the eastern limit of its range being approximately up to Hoshangabad District in Madhya Pradesh.

Remarks : *Funambulus pennanti pennanti* Wroughton has its affinity with *F. p. argentescens* Wroughton regarding colour.

This subspecies though occurs in the the same geographical area with *Funambulus palmarum* (Linn), but in different ecological environs, unlike the next subspecies mentioned hereunder. C. A. Crump (*in* Wroughton and Ryley, 1913, pp. 53–54) says that in Hoshangabad *F. palmarum* lives up on the hills amongst bamboo bushes and *F. pennanti* in the valleys. At Panchgani-Mahabaleshwar Plateau it has been observed that *F. palmarum* occurs at a higher elevations in cooler, moister and thicker semi-evergreen type of forests. Where as *F. pennanti* is commonly found at the base of the hills forming the plateau in deciduous type of forests (Tiwari *et al*, 1971). Moore and Tate (1965, p. 70) have cited similar habitat difference of these two species at Palni Hills. Tiwari *et al.* (*op. cit.*) have also observed that *F. pennanti* is less arboreal than *F. palmarum* at Panchgani-Mahabaleshwar Plateau.

Moulting has been observed in one specimen from Jalgaon District (East Khandesh) in Maharashtra, collected in early February.

***Funambulus pennanti chhattisgarhi*, new subspecies**

Material examined : *Holotype* : INDIA : 1♀ : ZSI Reg. No. 19513; skin and skull; Katagarh, Dhenkanal District, Orissa; 25th May 1972; Coll. P. K. Das. Deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

Paratypes : INDIA : 29♂, 33♀; MAHARASHTRA : Chandrapura District : 4♂, 1♀; Chandrapura (= Chanda); June 1912 (4 ex : BNHS; 1 ex : ZSI). 2♂, 3♀; Chichapalli; June 1912 (3 ex : BNHS; 2 ex : ZSI). Nagpur District : 1 subad ♂, 1♀; Khindsi, c 4 km N. of Ramtek; June 1969 (ZSI). 1♀; Mansar; June 1969 (ZSI). 1♀; Wahi Tola, Mansar Mines; June 1969 (ZSI). MADHYA PRADESH : Balaghat District : 1♂, (in spirit); Santia vill. (near Khatia), c 8 km NE of Kisli, Kanha National Park; February 1966 (ZSI). 1♀; Ouda (c 157 m alt.); May 1912 (BNHS). 1♀; Baihar; September 1957 (ZSI). ORISSA : Puri District : 1♂, 1♀; Baligai; October 1908 (ZSI). Cuttack District : 1♀; Nandan Kanan; November 1971 (ZSI). Mayurbhanj District : 1♀; Baripada; no date (ZSI). Dhenkanal District : 1♂, 1♀; Tikarpara; January 1972 (ZSI). Bolangir District : 1♀; Lerk Paley, c 5 km S. of Bolangir; March 1946 (ZSI). Kalahandi District : 1♂; Madanpur, Rampur; May 1972 (ZSI). Sambalpur District : 1♂; Rairakhol; July 1973 (ZSI). Ganjam District : 1♂, 1♀; Tarasingi; December 1971 (ZSI). Boudh Khondmals (= Phulbani) District : 1♀; Katagarh; 1972 (ZSI). WEST BENGAL : Purulia District : 1♂; Purulia; December 1948 (ZSI). 2♂; Raghunathpur; 1 ex. without any date and the other December 1948 (ZSI). 1♂, 1♀;

Inampur, Manbhum (= Purulia); one taken in 1886 (without any other particulars) and the other in November 1948 (ZSI). 1♀; Manbhum (Purulia); November 1948 (ZSI). BIHAR : Singhbhum District : 1♀; Luia (c 305 m alt.), Chaibasa; July 1914 (BNHS). Hazaribagh District : 4♂, 2♀; Nimiaghat (c 305 m alt.); April to June 1914 (5 ex : BNHS; 1 ex : ZSI). 1♂; Barkagaon (c 647 m alt.); April 1914 (BNHS). 2♂, 1♀; Lohra (c 305 m alt.); April 1914 (BNHS). 4♀; Jagodih (c 183 m alt.); April 1914 (BNHS). Palamau District : 5♂, 6♀; Daltongunj; March 1914 (6 ex. : BNHS; 5 ex. : ZSI). 1♀; Palamau (c 183 m alt.); March 1914 (BNHS).

External measurements of the holotype : Head and body 145; tail 140; hindfoot 35; ear 14.

| External measurements of paratypes : | 28♂ | 25♀ |
|---|---------------|-----------------|
| Head and body : | 122–175 (141) | 118–159 (144.3) |
| Tail : | 102–157 (137) | 83–171 (136.2) |
| Hind Foot : | 32–41 (36.2) | 34–40 (36.4) |
| Ear : | 15–18 (16.1) | 15–18 (16.2) |
| Proportion of ear to head and body size : | 8.4–12.5% | 7.3–12.9% |

Diagnosis : General colouration on the dorsal side is brighter than all other subspecies of *Funambulus pennanti*; seasonally (particularly from rainy seasons to winters) becomes very dark. The head is not remarkably lighter than the back and of the same colour as those of the inner and outer pairs of dark stripes. The stripes are quite glossy and speckled with bright Orange-Buff and black. The light stripes are generally Buff-Yellow in many individual and extends over the basal region of the tail. The outermost light stripes is occasionally very faint and scarcely distinguishable. The manus and the pes are dorsally lighter and Straw Yellow to Buff or intermediate between those two colours. The side of the body, the flank, the fore and the hind limbs are speckled with Buff and black with rusty wash; the Buff colour, however, predominated. The tail slender, not bushy; underside in many individuals has a Buff or Buff-yellow lines running down its middle region. The saddle is brightly coloured (due to the brightness of the dark bands) than any other subspecies of the species; sometimes the dark stripes of the saddle, especially the posterior half, becomes almost black. The inner pair of dark stripe and central stripe generally commences between the ear. Colouration of the ventral side Primrose-Yellow.

Range : Central and eastern India, from southern Bihar and southeastern West Bengal through Orissa and easternmost district of Madhya Pradesh and Maharashtra to as far south about the Godavari River.

Remarks : The subspecies, unlike *Funambulus pennanti pennanti*, occurs together with *Funambulus palmarum* (Linn.) in the same place. Crump (*in* Wroughton, 1915, p. 108) said that at Hazaribagh and Rajmahal Hills both the species occur together at the same place and on the same

ground. In January 1966 we have noticed *F. palmarum* and *F. pennanti* on two side by side trees at Motinala, Mandala District, Madhya Pradesh. We have also trapped specimens of both the species from the same ground at Khindsi, near Ramtek, Nagpur District, Maharashtra. Collection of both the species from the same ground has also been made by ZSI party in Kalahandi; Boudh Khondamals and Ganjam Districts in Orissa. In some specimens from Daltongunj in Bihar, the Buff-Yellow of the central light stripes is less pronounced and approximates to the next subspecies mentioned hereunder. Perhaps an intergrading zone! This needs further study on additional material.

Moulting of hairs on the head has been observed in two specimens collected from Daltongunj, Bihar, in March.

***Funambulus pennanti gangutrianus*, new subspecies**

Material examined : Holotype : 1♂; ZSI Reg. No. 16398; skin and skull; Banaras Cant., Uttar Pradesh; 25 October 1956; Coll. H. Khajuria. Deposited in the National Zoological Collection, Zoological Survey of India.

Paratypes : INDIA : 51♂, 25♀; 6 unsexed : WEST BENGAL : Calcutta 5♂, 1♀; Calcutta; December to January 1868–1869 and March 1960 (1♂ without any date) (ZSI). Howrah District : 1 unsexed; Botanical Garden, Shibpur; no date (ZSI). 2♂, 1 unsexed; Belur; November 1908 (ZSI). 1♂, Balley; June 1963 (ZSI). Hoogly District : 1♀; Chandernagar; July 1950 (ZSI). BIHAR : Darbhanga District : 3♂, 6♀; Bhagownie (c 46 m alt.); April to May and August to September 1921 and 1922 (8 ex. BNHS; 1 ex. ZSI). 2♂, 2♀; Bhunar (c 46 m alt.); March and May 1914 (BNHS). Gaya District : 2♂, 1♀; Singar (c 427 m alt.); March and May 1914 (BNHS). Giridhi District : 1 unsexed; Pareshnath; April 1909 (ZSI). MADHYA PRADESH : Rewa District : 5♂ (1 juv.); Rewa; March 1947 (ZSI). Gwalior District : 2♂; Chorepura (c 336 m alt.); August 1914 (ZSI and BNHS). 1♂; Agar Malwa; December 1922 (ZSI). 1♂, 1♀; Morari; June 1922 (ZSI). 5♂; Chatigaon (c 274 m alt.); July 1914 (BNHS). 1♀; Guna; October 1922 (ZSI). 1♂; Rothia; November 1922 (ZSI). UTTER PRADESH : Gorakhpur District : 2♂; Gorakhpur; January and February 1955 (ZSI). Mirzapur District : 1♂; Mirzapur; December 1946 (ZSI). Varanasi District : 5♂, 3♀; Varanasi (= Banaras) Cantonment; March to December 1945, 1946, 1948, 1956 (ZSI). 3♂; 2 unsexed; Varanasi; January, February and September 1945 (ZSI). Lucknow District : 2♂, 1♀; Lucknow; January 1908 (ZSI). Agra District : 1♂; Agra Cantonment; January 1908 (ZSI). Bareilly District : 2♂, 1♀; Bareilly; March 1907 (ZSI). Bahraich District : 3♂ (1 subad.), 3♀; Bahraich; October 1956 (ZSI). Bijnor District : 3♀; Bijnor; January 1907 (ZSI). Pilbhit District : 1♀; Pilbhit; March 1919 (ZSI). Nainital District : 1♂; Ramnagar, Kumaon; December 1913 (ZSI). PUNJAB : Hoshiarpur District : 1♂; Hoshiarpur; 1955 (no other particulars) (ZSI).

NEPAL : 2♂; locality unknown; September 1958 (ZSI). 1 unsexed; no other particulars (ZSI).

External measurements of the holotype : Head and body 150; tail 130, hind foot 38; ear 38.

| | | |
|---|-----------------|-----------------|
| External measurements of paratypes : | 31♂ | 20♀ |
| Head and body : | 126–182 (148.8) | 133–165 (145.9) |
| Tail : | 75–166 (132.3) | 78–164 (135.6) |
| Hindfoot : | 35–40 (38.1) | 34–41 (37.9) |
| Ear : | 15–19 (16.6) | 13–18 (17.0) |
| Proportion of ear to head and body size : | 8.2–14.3% | 9.1–12.5% |

Diagnosis : This subspecies is not brightly coloured as in *Funambulus pennanti chhattisgarhi*. Comparatively brightness in some specimen between July and September are however noticed than those collected in other seasons. Coat coarse. The dark stripes are speckled with black and Buff to Orange-Buff; black predominated in some individuals, while in others the Buff or Orange-Buff. The head is lighter than the back; Buff to Buff-Yellow, minutely speckled with black. The light stripes are Primrose Yellow, the central light stripes very rarely darker than the other observed in two specimens of which one is from Hosiarpur in Punjab and Medinipur in West Bengal. In two specimens from Darbhanga in Bihar and Gwalior in Madhya Pradesh a tendency of darkness have also been observed. The hands and feet are lighter; Primrose Yellow or between Primerose Yellow and Straw Yellow. The sides of the body, the flank, the fore and hind limbs are Primrose Yellow to Straw Yellow washed with very little amount of black. The saddle commences between the ears, but prominent posterior to the forelimbs. The colouration of the ventral side is Primrose Yellow or sometimes between Primrose Yellow and Straw Yellow or lighter. The tail usually appears bushy; midventral line occasionally Buff-Yellow or Straw Yellow. The outer light stripe is quite prominent.

Range : From Bengal through Bihar (excluding southern Bihar and southwestern West Bengal), Uttar Pradesh, northern part of Madhya Pradesh, Nepal to southeastern Himachal Pradesh and as far west around Hosiarpur in Punjab in India.

Remarks : Unlike in *F. p. pennanti* and *F. p. chhattisgarhi*, this subspecies does not occur with *Funambulus palmarum* (Linnaeus).

Out of six examples examined from Gwalior, the head of two specimens from Chatigaon (Ghatigaon) gives Straw Yellow colour as in the next subspecies *lutescens*. It appears that the area is an intergrading zone between *F. p. gangutrianus* and *F. p. lutescens*, and needs confirmation on study based on further material.

Moulting has been observed in a specimen behind the fore limbs collected in May from Darbhanga in Bihar.

Funambulus pennanti lutescens Wroughton

1916. *Funambulus pennanti lutescens* Wroughton. *J. Bombay nat. Hist. Soc.*, **24** : 430. (Deesa, Banas Kantha (= Palanpur), Gujarat).

Material examined : INDIA : 24♂, 14♀, and 2 unsexed : GUJARAT : Banas Kantha District : 1♂; Lunwa; April 1913 (ZSI). 2♂, 1♀; Deesa (type locality); March 1948 (ZSI). 1♀; near Balaram River, Palanpur; March 1948 (ZSI). RAJASTHAN : Ganganagar District : 1♀; Asarjana (c 15 km W of Nohar); October 1960 (ZSI). 1♀; Diplana (c 20 km E of Nohar); October 1960 (ZSI). Bikaner District : 1♀; Kotri (c 6 km N of Kolayat); September 1960 (ZSI). 1 unsexed; Bikaner; October 1962 (ZSI). Jaipur District : 1♂, 1♀; Dudu; January 1959 (ZSI). 8♂ (1 juv., 3 ex. in alcohol), 3♀ (in alcohol); Sambhar; April and May 1957 (ZSI). 1♀; Kishangarh; November 1956 (ZSI). Ajmer District : 1♂ (in alcohol); Rajoshi Reserve Forest (c 11 km SE of Ajmer); November 1956 (ZSI). Udaipur District : 1♂; Forest near Udaipur Lake (near Udaipur); October 1941 (ZSI). 1 unsexed without any locality; October 1941 (ZSI). 2♂; (c 3 km E of Maoli Junction Riy. Stn.); February 1948 (ZSI). 1♂; Kankroli (c 32 km N of Maoli Junction Riy. Stn.); February 1948 (ZSI). 1♂; Jagmandi (c 22 km E of Phuled Riy. Stn.); March 1948 (ZSI). Sirohi District : 1♂; Mt. Abu; March 1948 (ZSI). Jodhpur District : 1♂, 1♀ (in alcohol); Beriganga (c 16 and 19 km N of Jodhpur); December 1956 (ZSI). 1 juv. ♂, 1 unsexed (both in alcohol); Kailana Lake (c 8 km W of Jodhpur); December 1956 and January 1958 (ZSI). 1♀ (in alcohol); Mandore (c 12 km N of Jodhpur); June 1960 (ZSI). Jaisalmer District : 1 juv. ♂, 2♀; Nokh; August 1960 (ZSI). HIMACHAL PRADESH : Kangra District : 1♂, 1♀; Dhamtal; November 1922 (ZSI). PUNJAB : Gurdaspur District : 1♂; Madhupur, southeastern bank of Ravi River; February 1929 (ZSI).

PAKISTAN : 1♂, 2♀ : PUNJAB : Rawalpindi Division : 1♂; Kallar Kahar, Salt Range; April 1923 (ZSI). 1♀; Sodhi, Salt Range; May 1923 (ZSI). 1♀; Chakri, Salt Range; March 1923 (ZSI).

| External measurements : | 22♂ | 16♀ |
|---|-----------------|-------------------------|
| Head and body : | 125–152 (140.6) | 129–152 (141.0) |
| Tail : | 87–126 (139.8) | 91–167 (138.2) (17 exs) |
| Hindfoot : | 33–41 (37.5) | 32–42 (36.1) |
| Ear : | 12–18 (15.2) | 14–19 (15.8) |
| Proportion of ear to head and body size : | 7.8–12.2% | 9.2–13.1% |

This subspecies, on the average, is larger in head and body length than *Funambulus pennanti pennanti*, the dark stripes are speckled black and Ochraceous Buff. The later colour, however, pre-dominates. The head is lighter than the back and is Straw Yellow to sandy in colour, minutely speckled with black. The light stripes are Cream Buff to Buff; occasionally white.

The central light stripe never gets darker than the other light stripes. The manus and pes are lighter dorsally, Cream Buff to Straw Yellow in colour. The sides of the body, the flank, anterior and posterior limbs are Primrose Yellow, sometimes Straw Yellow, speckled with black. The tail is generally prominent but sometimes not traceable very well for it becomes almost concolourous with the colouration of the sides of the body.

Range : It occurs from Deesa, Banas Kantha (= Palanpur), Gujarat, northwards through the Great Desert and others parts of Rajasthan, extending as far north on Salt Range in Punjab, in Pakistan and Kangra Valley in Himachal Pradesh in India.

Remarks : As in *Funambulus pennanti gangutrianus* and *F. p. argentescens*, this subspecies also does not occur together with *Funambulus palmarum*.

***Funambulus pennanti argentescens* Wroughton**

1905. *Funambulus pennanti argentescens* Wroughton. *J. Bombay nat. Hist. Sco.*, 16(3) : 413. (Rawalpindi; northern Punjab, Pakistan).

Material examined : INDIA : 1♂; GUJARAT : Kachchh District : 1♂; Bhuj; August 1911 (ZSI).

PAKISTAN : 6♂, 5♀ : SIND : Hyderabad Division : 1♂; Mirpur Sikra; October 1922 (ZSI). 1♀; Gharo; October 1922 (ZSI). 1♀; Gholam; October 1922 (ZSI). 1♂; Hyderabad; 1855 (no other particulars) (ZSI). Khairpur Division : 1♂; Jacobabad; February 1915 (ZSI). BALUCHISTAN : Kalat Division : 1♂; Tarbat; November 1917 (ZSI). 1♀; Punjgur; January 1918 (ZSI). 1♀; Mand, Makhirali; March 1918 (ZSI). Quetta Division : 1♀; Pishin; February 1872 (ZSI). PUNJAB : Rawalpindi Division : 1♂; Rawalpindi; no date (ZSI). 1♂; Chak-Lala; July 1921 (ZSI).

| External measurements : | 17♂ | 12♀ |
|---|-----------------|-----------------|
| Head and body : | 112–140 (135.8) | 117–146 (135.0) |
| Tail : | 115–164 (136.6) | 125–170 (145.5) |
| Hindfoot : | 33–38 (35.3) | 33–39 (36.4) |
| Ear : | 15–19 (16.2) | 13–19 (16.4) |
| Proportion of ear to head and body size : | 10.8–14.7% | 9.5–14.3% |

This is smallest in head and body size among all the subspecies known. The dark stripes are speckled black and Cream Buff; black predominates. The head is lighter than the back; Cream-colour to smoky, minutely speckled with black. The light stripes are white. The central light stripes never darker than the outer light stripes. The manus and pes are lighter dorsally; whitish to

Cream-colour. The ventral side is white in colour. The sides of the body, the flank, the fore and hind limbs are Primerose Yellow speckled with a certain amount of black. The tail is not bushy, more or less slender. The saddle generally commences from the inner angle of the ear. The outer pair of light stripes are quite prominent.

Range : Kutch in Gujarat in India through arid and semiarid country of Pakistan as far west to Iran.

**Tentative Key to the Identification of the Subspecies of *Funambulus pennanti*
Based on Average Body Measurements**

1. Average head and body length under 136 mm. *F. p. argentescens*
— Average head and body length above 136 mm. 2
2. Head and body length averages above 145 mm. *F. p. gangutrianus*
— Head and body length averages below 145 mm. 3
3. Tail larger than head and body. *F. p. pennanti*
— Tail average shorter than head and body. 4
4. Average ear length below 16 mm. *F. p. lutescens*
— Average ear length above 16 mm. *F. p. chhattisgarhi*

A comparison of external characters and ecological co-relations of the five subspecies are summarized in Table 1, and comparison of average external measurements of the above subspecies are given in Table 2. Also their approximate distribution have been shown in Text-figure 1.

SUMMARY

Taxonomy of one of the most common rodent, *Funambulus pennanti* Wroughton, which occurs over a wide area from southern to northern India, under variable ecological conditions, has been studied afresh in the light of the material present in the Zoological Survey of India and Bombay Natural History Society. The colour variation which is obvious in such a widely distributed species, the three subspecies, namely, *Funambulus pennanti pennanti* Wroughton, 1905, *Funambulus pennanti argentescens* Wroughton, 1905, and *Funambulus pennanti lutescens* Wroughton, 1916, have been recognised to be valid on average colour characters and measurements. Moreover, description of two new subspecies of the Five striped Squirrel has been provided.

Table 1. Comparison of the subspecies of *Funambulus pennanti*.

| | <i>F. p. pennanti</i> | <i>F. p. chhattisgarhi</i> | <i>F. p. gangutrianus</i> | <i>F. p. lutescens</i> | <i>F. p. argentescens</i> |
|---|---|--|--|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| CHARACTERS | | | | | |
| Size of head and body | 134–156 (142.5) | 118–175 (142.6) | 126–182 (147.3) | 125–152 (140.8) | 112–146 (135.4) |
| Proportion of ear to head and body size | 8.3–13.5 (10.9) | 7.3–12.9 (10.1) | 8.2–14.3 (11.2) | 7.8–13.1 (10.4) | 9.5–14.7 (12.1) |
| Dark stripes | Speckled black and Buff to Orange-Buff. Proportion of black and other colour almost same | Glossy; speckled with bright Orange-Buff and black | Speckled black and Orange-Buff. Generally Orange-Buff predominates to some extent, sometimes the black | Speckled black and Ochraceous Buff. Latter colour predominates | Speckled black and Cream Buff. Black predominates |
| Light stripe | Creamish white to Primrose Yellow | Creamish white | Primrose Yellow | Cream Buff to Buff, sometimes white | White |
| Central light stripe | Often deeper than other light stripes | Generally deeper than other light stripes, and Buff Yellow in colour | Very rarely deeper than the outer light stripes | Never deeper than other light stripes | Never deeper than other light stripes |
| Outer light stripe | Quite prominent | Generally prominent; in rare cases hardly distinguishable | Prominent | Generally prominent, but sometimes untraceable | Quite prominent |
| Shaddle | Generally commences from the anterior angle of the ears or between the ears | Commences between the ears; brightly coloured than any other subspecies | Generally commences posterior to forelimbs | Commences between the ear; usually prominent up to base of tail | Commences from the inner angle of the ears usually prominent up to the base of tail |
| Head | Lighter than back, ranges from Cream Buff to Orange Buff, minutely speckled with black. In many individuals not lighter than the nape and anterior portion of shaddle | Not lighter than back; concolourous with the dark stripes of the shaddle | Lighter than back; Buff to Buff-yellow, minutely speckled with black | Lighter than back and Straw Yellow to sandy in colour, minutely speckled with black | Lighter than back, Cream colour to smoky, minutely speckled with black |

| 1 | 2 | 3 | 4 | 5 | 6 |
|--|--|--|---|---|---|
| Upper side of manus and pes | Light whitish to Cream colour and even Primrose Yellow to Straw Yellow | Light, Straw Yellow to Buff or intermediate | Light, Primrose Yellow to Straw Yellow | Light, Cream Buff to Straw Yellow | Light, whitish to Cream colour |
| Sides of body, flank, fore and hind limbs | Straw Yellow speckled with certain amount of black or speckled black and Straw Yellow, with faint rusty wash | Speckled Buff and black, with a rusty wash; Buff colour predominates | Primrose Yellow to Straw Yellow speckled with very little amount of black | Primrose Yellow, sometimes Straw Yellow and speckled with black | Primrose Yellow speckled with certain amount of black |
| Tail | Generally slender; down the middle region of north-eastern examples Straw Yellow in most cases | Slender, under side has a Buff or Buff Yellow line down the middle region | Bushy, down the middle region of underside generally Buff yellow | Generally not very Bushy | More or less slender |
| Ventral side | Whitish to Cream colour, even Primrose Yellow to Straw Yellow | Primrose Yellow | Primrose Yellow to Straw Yellow | Cream Buff, sometimes white | White |
| ENVIRONMENTAL CORRELATION Soil type | Primarily black and deep black soil (Regur soil) | Primarily red and yellow soil or red loam | Primarily alluvial, mixed red and black or salt impregnated grey and brown soil | Primarily sandy or desert type | Primarily alluvial |
| Rainfall | 60-400 cm | 200-300 cm | 100-300 cm | 20-60 cm | 15-70 cm |
| Vegetation type | Tropical : Mainly dry deciduous and thorny; moist deciduous and evergreen or semievergreen in places | Tropical : Mainly moist deciduous and evergreen; partly occurs in dry deciduous vegetation | Tropical : Mostly dry deciduous, and moist evergreen and deciduous | Tropical : Thorny, including desert type | Tropical : Thorny |
| Occurrence with <i>Funambulus palmarum</i> | Occurs in the same geographical region, but not found in the same place with <i>F. palmarum</i> | Occurs in the same geographical region and in the same place with <i>F. palmarum</i> | Does not occur with <i>F. palmarum</i> | Does not occur with <i>F. palmarum</i> | Does not occur with <i>F. palmarum</i> |

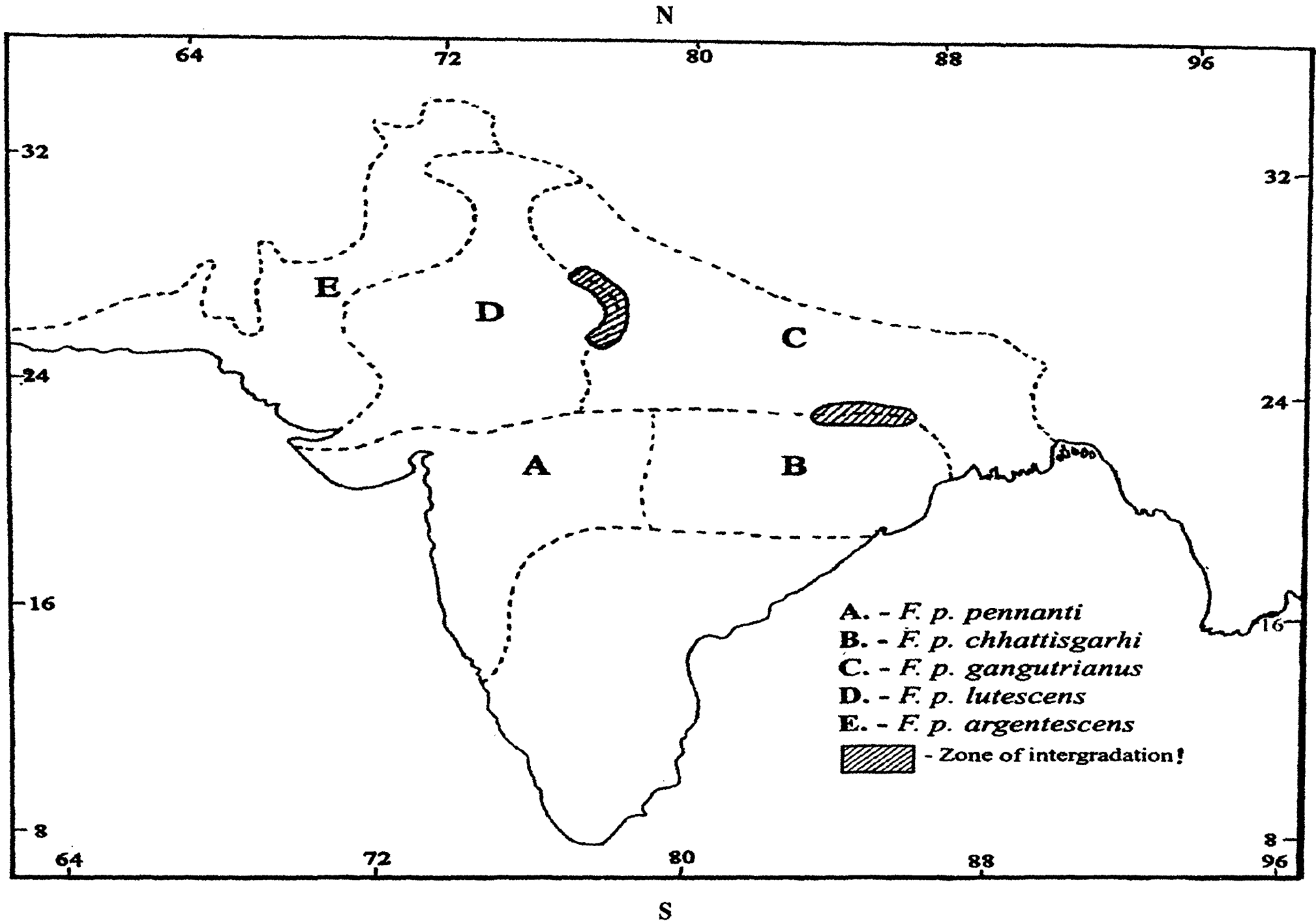


Fig. 1. Showing distribution of five subspecies of *Funambulus pennanti*. A-*F. p. pennanti*; B-*F. p. chhattisgarhi*; C-*F. p. gangutrianus*; D-*F. p. lutescens*; E-*F. p. argentescens*.

Table 2. Comparative average external measurements of five subspecies of *Funambulus pennanti*.

| Subspecies | No. of examples and sex | Head and body | Tail | Hindfoot | Ear |
|----------------------------|-------------------------|---------------|-------|----------|------|
| <i>F. p. pennanti</i> | 24 ♂: | 142.4 | 147.1 | 36.9 | 16.2 |
| | 21 ♀: | 142.6 | 147.3 | 37.3 | 16.2 |
| <i>F. p. chhattisgarhi</i> | 28 ♂: | 141.0 | 137.0 | 36.2 | 16.1 |
| | 25 ♀: | 144.3 | 136.2 | 36.4 | 16.2 |
| <i>F. p. gangutrianus</i> | 31 ♂: | 148.8 | 132.3 | 38.1 | 16.6 |
| | 20 ♀: | 145.9 | 135.6 | 37.9 | 17.0 |
| <i>F. p. lutescens</i> | 22 ♂: | 140.6 | 139.8 | 37.5 | 15.2 |
| | 16 ♀: | 141.0 | 138.2 | 36.1 | 15.8 |
| <i>F. p. argentescens</i> | 17 ♂: | 135.8 | 136.6 | 35.3 | 16.2 |
| | 12 ♀: | 135.0 | 145.5 | 36.4 | 16.4 |

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FURTHER NOTES ON STATEWISE DISTRIBUTION OF THE AMPHIBIAN FAUNA OF NORTH EAST INDIA

NIBEDITA SEN

Eastern Regional Station, Zoological Survey of India, Shillong

The North-East India with its varied physiographic zones harbour a rich and diversified amphibian fauna. It is interesting to note that all the three orders of Class Amphibia namely Anura, Gymnophiona and Caudata are represented in this region.

The region with its seven sister states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) is one of the hotspot for amphibian biodiversity.

Elaborate studies on Anurans of N. E. India was first published by Chanda (1994) and reported 54 species of toads and frogs. Dutta (1997) reported 69 species of Amphibia (67 anurans, 1 gymnophiona, 1 caudata) from this region. As per BCPP (C.A.M.P) report (1998), 72 species of amphibia (69 anurans, 2 gymnophiona, 1 caudata) are occurring in N.E. India. Chanda (2002) in his handbook of India reported 64 species of amphibia (60 anurans, 3 gymnophiona, 1 caudata) from this region. The distributional pattern of Amphibia in N.E. India was studied earlier by Pillai and Chanda (1976) and Chanda (1990, 1991, 1992). Statewise, as per Chanda (2002), 35 species of amphibia are occurring in Meghalaya, 24 species in Assam, 43 species in Arunachal Pradesh, 16 species in Mizoram, 12 species in Nagaland, 14 species in Manipur and 8 species in Tripura.

The present study is based on collections present at Eastern Regional Station, Zoological Survey of India, Shillong from different localities of North Eastern India. All the recorded and reported species (Ahmed *et. al.* 2001; Borah *et. al.* 2001; Bordoloi *et. al.* 1999, 2001; Das & Chanda 2000; Deuti *et. al.* 2001, 2002; Dutta *et. al.* 2000; Pillai & Ravichandran 1999; Sarkar *et. al.* 2002; Sen Gupta *et. al.* 2001) have been incorporated here with present nomenclatural status for getting on overall picture of the amphibian fauna of this region.

The systematic arrangement and nomenclatural status followed after Dutta (1997).

SYSTEMATIC LIST

83 species of amphibians comprising of 78 anurans, 4 gymnophiona and 1 caudata have been dealtwith in this paper. Statewise distribution of each species along with their IUCN status (as per BCPP (C.A.M.P.) 1998) wherever available is shown in Table 1.

Table 1. : Amphibia of N. E. India (Recorded & Reported).

| Sl. No. | Species | ORD | FAM | M | A | AP | MN | N | MI | T | Status* | Endemic |
|---------|--|-------------|---------------|---|---|----|----|---|----|---|---------|---------|
| 1. | <i>Pleurodeles varrucosus</i> (Anderson, 1871) | Caudata | Salamandridae | + | - | + | + | - | - | - | EN | |
| 2. | <i>Ichthyophis garoensis</i> Pillai & Ravichandran, 1999 | Gymnophiona | Ichthyophidae | + | - | - | - | - | - | - | ne | NE |
| 3. | <i>Ichthyophis glutinosus</i> (Linnaeus, 1754) | Gymnophiona | Ichthyophidae | - | + | - | - | - | - | - | ne | |
| 4. | <i>Ichthyophis husaini</i> Pillai & Ravichandran, 1999 | Gymnophiona | Ichthyophidae | + | - | - | - | - | - | - | ne | NE |
| 5. | <i>Gegeniophis fulleri</i> (Alcock, 1904) | Gymnophiona | Caecillidae | - | + | - | - | - | - | - | VU | NE |
| 6. | <i>Leptobrachium hasseltii</i> Tschudii, 1838 | Anura | Pelobatidae | + | + | - | - | - | - | - | EN | |
| 7. | <i>Megophrys kempii</i> (Annandale, 1912) | Anura | Pelobatidae | - | - | + | - | - | - | - | EN | |
| 8. | <i>Megophrys lateralis</i> (Anderson, 1871) | Anura | Pelobatidae | - | + | + | - | - | - | - | DD | |
| 9. | <i>Megophrys monticola</i> Kuhl & Van Hasselt, 1822 | Anura | Pelobatidae | + | - | + | - | + | - | - | EN | |
| 10. | <i>Megophrys parva</i> (Boulenger, 1893) | Anura | Pelobatidae | + | + | + | - | - | - | - | LR-nt | |
| 11. | <i>Scutiger sikkimensis</i> (Blyth, 1854) | Anura | Pelobatidae | + | - | - | - | + | - | - | LR-nt | |
| 12. | <i>Scutiger mokokchungensis</i> Das & Chanda, 2000 | Anura | Pelobatidae | - | - | - | - | + | - | - | ne | NE |
| 13. | <i>Bufo himalayanus</i> Gunther, 1864 | Anura | Bufoidea | + | + | + | + | - | - | - | LR-nt | |
| 14. | <i>Bufo melanostictus</i> Schneider, 1799 | Anura | Bufoidea | + | + | + | + | + | + | + | VU | |
| 15. | <i>Bufo stomaticus</i> Lutken, 1862 | Anura | Bufoidea | - | + | - | - | - | - | - | LR-nt | |
| 16. | <i>Bufo stuarti</i> Smith, 1929 | Anura | Bufoidea | - | + | - | - | - | - | - | LR-nt | |
| 17. | <i>Bufoides meghalayanus</i> (Yazdani & Chanda, 1971) | Anura | Bufoidea | + | + | - | - | - | + | - | CR | NE |
| 18. | <i>Pedostibes kempii</i> (Boulenger, 1919) | Anura | Bufoidea | + | - | - | - | - | - | - | CR | NE |
| 19. | <i>Hyla annectans</i> (Jerdon, 1870) | Anura | Hylidae | + | + | - | - | + | - | + | LR-nt | |
| 20. | <i>Kaloula taprobanica</i> (Parker, 1934) | Anura | Microhylidae | + | + | - | - | - | - | + | ne | |
| 21. | <i>Kalophrynus orangensis</i> Dutta, Ahmed & Das, 2000 | Anura | Microhylidae | - | + | - | - | - | - | - | ne | NE |
| 22. | <i>Microhyla berdmorei</i> (Blyth, 1856) | Anura | Microhylidae | + | + | + | - | - | + | + | LR-nt | |

Table 1. : Cont'd.

| Sl. No. | Species | ORD | FAM | M | A | AP | MN | N | MI | T | Status* | Endemic |
|---------|--|-------|---------------|---|---|----|----|---|----|---|---------|---------|
| 23. | <i>Microhyla ornata</i> (Dumeril & Bibron, 1841) | Anura | Microhylidae | + | + | + | + | + | + | + | LR-lc | |
| 24. | <i>Microhyla rubra</i> (Jerdon, 1853) | Anura | Microhylidae | - | + | - | - | + | + | - | LR-nt | |
| 25. | <i>Uperodon globulosum</i> (Gunther, 1864) | Anura | Microhylidae | - | + | + | - | - | - | - | LR-nt | |
| 26. | <i>Chirixalus doriae</i> Boulenger, 1893 | Anura | Rhacophoridae | - | - | + | - | - | - | - | EN | |
| 27. | <i>Chirixalus simus</i> Annandale, 1915 | Anura | Rhacophoridae | - | + | - | - | - | - | - | EN | NE |
| 28. | <i>Chirixalus vittatus</i> (Boulenger, 1887) | Anura | Rhacophoridae | - | - | + | - | + | + | - | EN | |
| 29. | <i>Nyctixalus moloch</i> (Annandale, 1912) | Anura | Rhacophoridae | - | + | + | - | - | - | - | EN | |
| 30. | <i>Philautus andersonii</i> (Ahl, 1927) | Anura | Rhacophoridae | + | + | + | - | + | + | - | EN | |
| 31. | <i>Philautus annandalii</i> (Boulenger, 1906) | Anura | Rhacophoridae | + | + | + | - | - | - | - | LR-nt | |
| 32. | <i>Philautus argus</i> (Annandale, 1912) | Anura | Rhacophoridae | - | - | + | - | - | - | - | ne | NE |
| 33. | <i>Philautus cherrapunjiae</i> Roonwal & Kripalani, 1961 | Anura | Rhacophoridae | + | + | + | - | - | - | - | EN | NE |
| 34. | <i>Philautus garo</i> (Boulenger, 1919) | Anura | Rhacophoridae | + | + | - | - | - | - | - | CR | NE |
| 35. | <i>Philautus kempiae</i> (Boulenger, 1919) | Anura | Rhacophoridae | + | + | - | - | - | - | - | CR | NE |
| 36. | <i>Philautus namdaphaensis</i> Sarkar & Sanyal, 1985 | Anura | Rhacophoridae | - | - | + | - | - | - | - | VU | NE |
| 37. | <i>Philautus shillongensis</i> Pillai & Chanda, 1973 | Anura | Rhacophoridae | + | - | - | - | - | - | - | CR | NE |
| 38. | <i>Philautus shyamrupus</i> Chanda & Ghosh, 1989 | Anura | Rhacophoridae | - | - | + | - | - | - | - | VU | NE |
| 39. | <i>Polypedates leucomystax</i> (Gravenhorst, 1829) | Anura | Rhacophoridae | + | + | + | + | + | + | + | LR-lc | |
| 40. | <i>Polypedates maculatus</i> (Gray, 1834) | Anura | Rhacophoridae | + | - | + | - | - | - | - | EN | |
| 41. | <i>Rhacophorus appendiculatus</i> Gunther, 1859) | Anura | Rhacophoridae | - | - | + | - | - | - | - | DD | |
| 42. | <i>Rhacophorus bipunctatus</i> Ahl, 1927 | Anura | Rhacophoridae | + | + | + | + | + | - | + | LR-nt | |
| 43. | <i>Rhacophorus bisacculus</i> Taylor, 1962 | Anura | Rhacophoridae | - | - | - | - | + | - | - | EN | |
| 44. | <i>Rhacophorus jerdonii</i> (Gunther, 1875) | Anura | Rhacophoridae | - | + | + | - | - | - | - | VU | |

Table 1. : Cont'd.

| Sl. No. | Species | ORD | FAM | M | A | AP | MN | N | MI | T | Status* | Endemic |
|---------|---|-------|---------------|---|---|----|----|---|----|---|---------|---------|
| 45. | <i>Rhacophorus maximus</i> Gunther, 1858 | Anura | Rhacophoridae | + | + | + | + | + | + | - | LR-nt | |
| 46. | <i>Rhacophorus namdaphaensis</i> Sarkar & Sanyal, 1985 | Anura | Rhacophoridae | - | - | + | - | - | - | - | VU | NE |
| 47. | <i>Rhacophorus naso</i> Annandale, 1912 | Anura | Rhacophoridae | - | - | + | - | - | - | - | DD | NE |
| 48. | <i>Rhacophorus nigropalmatus</i> Boulenger, 1895 | Anura | Rhacophoridae | + | - | + | - | - | - | - | ne | |
| 49. | <i>Rhacophorus reinwardtii</i> (Kuhi & van Hasselt, 1822) | Anura | Rhacophoridae | + | - | + | - | - | - | - | LR-nt | |
| 50. | <i>Rhacophorus tuberculatus</i> (Anderson, 1871) | Anura | Rhacophoridae | + | + | + | - | - | - | - | LR-nt | |
| 51. | <i>Theلودerma asper</i> (Boulenger) | Anura | Rhacophoridae | - | + | + | - | - | - | - | DD | |
| 52. | <i>Amolops afghanus</i> (Gunther, 1858) | Anura | Ranidae | + | + | + | + | + | + | + | LR-nt | |
| 53. | <i>Amolops formosus</i> (Annandale, 1875) | Anura | Ranidae | + | - | + | - | + | - | - | LR-nt | |
| 54. | <i>Amolops gerbillus</i> (Annandale, 1912) | Anura | Ranidae | + | + | + | - | - | + | - | LR-nt | |
| 55. | <i>Chaparana sikimensis</i> (Jerdon, 1870) | Anura | Ranidae | + | - | - | - | - | - | - | LR-nt | |
| 56. | <i>Euphlyctis cyanophlyctis</i> (Schneider, 1799) | Anura | Ranidae | + | + | + | + | + | + | + | LR-nt | |
| 57. | <i>Euphlyctis ghosi</i> (Chanda, 1990) | Anura | Ranidae | - | - | - | + | - | - | - | EN | NE |
| 58. | <i>Euphlyctis hexadactylus</i> (Lesson, 1834) | Anura | Ranidae | - | - | - | - | - | - | + | LR-nt | |
| 59. | <i>Hoplobatrachus crassus</i> (Jerdon, 1853) | Anura | Ranidae | - | + | + | - | + | - | + | ne | |
| 60. | <i>Hoplobatrachus tigerinus</i> (Daudin, 1802) | Anura | Ranidae | + | + | + | + | + | + | + | VU | |
| 61. | <i>Limnonectes khasiensis</i> (Anderson, 1871) | Anura | Ranidae | + | - | - | - | - | - | - | DD | NE |
| 62. | <i>Limnonectes kuhlii</i> (Tschudi, 1838) | Anura | Ranidae | + | + | - | - | - | - | - | ne | |
| 63. | <i>Limnonectes laticeps</i> (Boulenger, 1882) | Anura | Ranidae | + | + | + | - | - | - | - | ne | |
| 64. | <i>Limnonectes limnocharis</i> (Gravenhorst, 1829) | Anura | Ranidae | + | + | + | + | + | + | + | VU | |
| 65. | <i>Limnonectes mawlyndipi</i> (Chanda, 1990) | Anura | Ranidae | + | - | - | - | - | - | - | CR | |
| 66. | <i>Limnonectes mawphlangensis</i> (Pillai & Chanda, 1977) | Anura | Ranidae | + | - | - | + | - | - | - | CR | |

Table 1. : Cont'd.

| Sl. No. | Species | ORD | FAM | M | A | AP | MN | N | MI | T | Status* | Endemic |
|---------|---|-------|---------|---|---|----|----|---|----|---|---------|---------|
| 67. | <i>Paa annandalii</i> (Boulenger, 1920) | Anura | Ranidae | - | - | + | - | - | - | - | ne | |
| 68. | <i>Paa blanfordii</i> (Boulenger, 1882) | Anura | Ranidae | + | - | - | - | - | - | - | LR-nt | |
| 69. | <i>Paa liebigeri</i> (Gunther, 1860) | Anura | Ranidae | - | - | + | - | - | - | - | LR-nt | |
| 70. | <i>Phrynoglossus borealis</i> (Annandale, 1912) | Anura | Ranidae | - | - | + | - | - | - | - | EN | NE |
| 71. | <i>Rana alticola</i> Boulenger, 1882 | Anura | Ranidae | + | + | - | - | + | + | + | LR-nt | |
| 72. | <i>Rana assamensis</i> Sclater, 1892 | Anura | Ranidae | + | - | - | - | - | - | - | LR-nt | |
| 73. | <i>Rana danieli</i> Pillai & Chanda, 1977 | Anura | Ranidae | + | + | + | + | - | + | - | LR-nt | |
| 74. | <i>Rana erythraea</i> (Schlegel, 1837) | Anura | Ranidae | + | + | + | - | + | + | - | LR-nt | |
| 75. | <i>Rana garoensis</i> Boulenger, 1920 | Anura | Ranidae | + | + | + | + | - | - | - | EN | NE |
| 76. | <i>Rana keralensis</i> Dubois, 1980 | Anura | Ranidae | - | - | - | - | - | - | + | ne | |
| 77. | <i>Rana khare</i> (Kiyasetuo & Khare, 1986) | Anura | Ranidae | - | - | - | + | + | + | - | EN | NE |
| 78. | <i>Rana leptoglossa</i> (Cope, 1868) | Anura | Ranidae | + | + | - | - | - | - | - | EN | |
| 79. | <i>Rana livida</i> (Blyth, 1855) | Anura | Ranidae | + | + | - | + | - | - | - | LR-nt | |
| 80. | <i>Rana malabarica</i> Tschudi, 1838 | Anura | Ranidae | - | + | - | - | - | + | - | ne | |
| 81. | <i>Rana nicobarensis</i> (Stoliczkae, 1870) | Anura | Ranidae | - | + | - | - | - | - | + | LR-nt | |
| 82. | <i>Rana nigrovittata</i> (Blyth, 1855) | Anura | Ranidae | - | + | - | - | - | - | - | EN | |
| 83. | <i>Rana taipehensis</i> Van Denburgh, 1909 | Anura | Ranidae | + | + | + | - | - | - | - | ne | |

M–Meghalaya, A–Assam, AP–Arunachal Pradesh, MN–Manipur, N–Nagaland, MI–Mizoram, T–Tripura.

* As per BCPP (C.A.M.P.) 1998, CR–Critical, EN–Endangered, VU–Vulnerable, LR–nt–Low risk near threatened,

LR–lc–Low risk least concerned, DD–Data deficient, ne–not evaluated, NE–North Eastern Region

78 species of anurans belonging to 25 genera, 6 families, 1 order; 4 species of gymnophiona belonging to 2 genera, 2 families, 1 order and 1 species of caudata belonging to 1 genus, 1 family and 1 order have so far been recorded and reported from N. E. India.

Statewise, Meghalaya is represented by 49 species belonging to 8 families and 3 orders., followed by Assam (48 spp. under 8 families and 2 orders), Arunachal Pradesh (46 spp. under 6 families and 2 orders), Nagaland (22 spp. under 6 families and 1 order), Mizoram (19 spp. under 4 families and 1 order), Manipur (17 spp. under 5 families and 2 orders) and Tripura (16 spp. under 5 families and 1 order).

DISCUSSION

The present paper dealt with 83 species of amphibia recorded and reported from N. E. India. Major percentage belongs to family Ranidae (38.55%) followed by Rhacophoridae (31.33%), Pelobatidae (8.43%), Bufonidae, Microhylidae (7.24% each), Ichthyophiidae (3.61%), Hylidae, Caecillidae and Salamandridae (1.20% each).

As per record, 22 species are endemic to North East India. Out of which 6 spp. (*Philautus argus*, *P. namdaphaensis*, *P. shyamrupus*, *Rhacophorus namdaphaensis*; *R. naso*, *Phrynoglossus borealis*) are endemic to Arunachal Pradesh; 3 spp. (*Gegeniophis fulleri*, *Kalophrynus ornagensis*, *Chirixalus simus*) to Assam; 5 spp. (*Ichthyophis garoensis*, *I. husaini*, *Pedostibes kempi*, *Philautus shillongensis*, *Limnonectes khasiensis*) to Meghalaya; 1 sp. (*Euphlyctis ghosi*) to Manipur, 1 sp. (*Scutigera mokochungensis*) to Nagaland and the rest 6 spp. (*Bufoides meghalayanus*, *Philautus cherrapunjie*, *P. garo*, *P. kempiae*, *Rana garoensis*, *R. khare*) are endemic to Northern Eastern Region as a whole.

Of 83 species, status of 68 species have so far been evaluated (BCPP, C.A.M.P. 1998) which include 33 threatened species (7 CR, 18 EN and 8 VU) from this region.

As per evaluation, 18 threatened (7 CR, 8 EN, 3 VU) species are occurring in Meghalaya followed by 18 (11 EN, 7 VU) in Arunachal Pradesh; 16 (3 CR, 8 EN, 5 VU) in Assam; 8 (1 CR, 4 EN, 3 VU) in Manipur; 8 (5 EN, 3 VU) in Nagaland; 7 (1 CR, 3 EN, 3 VU) in Mizoram and 3 VU species in Tripura.

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A NEW SPECIES OF *LARINIA* SPIDER (ARANEAE : ARANEIDAE) FROM JABALPUR, MADHYA PRADESH, INDIA

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INTRODUCTION

Simon established the genus *Larinia* in 1874 with the type species *Larinia lineata* (Lucas, 1846). Patel (1975) described two species *L. chhagani* and *L. tyloridia* from India. Tikader (1982) reillustrated and redescribed two species *L. chloris* (Audouin, 1826) and *L. phtisica* (L. Koch, 1871). Biswas (1984) described the species *L. jaysankari*; Patel & Nigam (1994) described the species *L. kanpurae*, and Bhandari & Gajbe (2001) described the species *L. bhadatae* from India.

A new species *Larinia emertoni* sp. nov. is being described herein from Jabalpur district (c. 23°10' N, 79°57' E). The type specimen has been deposited with the National Zoological Collection, Zoological Survey of India, Kolkata.

Larinia emertoni sp. nov.

General : Cephalothorax brownish yellow, legs and abdomen yellowish. Total length 8.5 mm. Carapace 3.9 mm. long, 2.0 mm. wide; abdomen 5.6 mm. long, 2.3 mm. wide.

Cephalothorax : Much longer than wide, narrow in front, clothed with hairs and pubescence, light brown bands running to the sides from the deep longitudinal thoracic furrow as in fig. 1. Ocular quad forming a trapezium, more than three times wider in front than behind; anterior medians much larger than posterior medians, posterior medians closely situated, laterals subequal, extremely close to each other and situated on distinct tubercles; both rows of eyes recurved but posterior row more narrowly recurved than anterior row. Sternum elongated, oval, clothed with fine pubescence, without any patch. Labium as long as wide, yellowish brown; maxillae slightly longer than broad, yellowish, provided with distinct scopulae. Chelicerae strong and stout, provided with distinct boss; anterior margin of each chelicera armed with four teeth. Legs long and slender, clothed with hairs and spines.

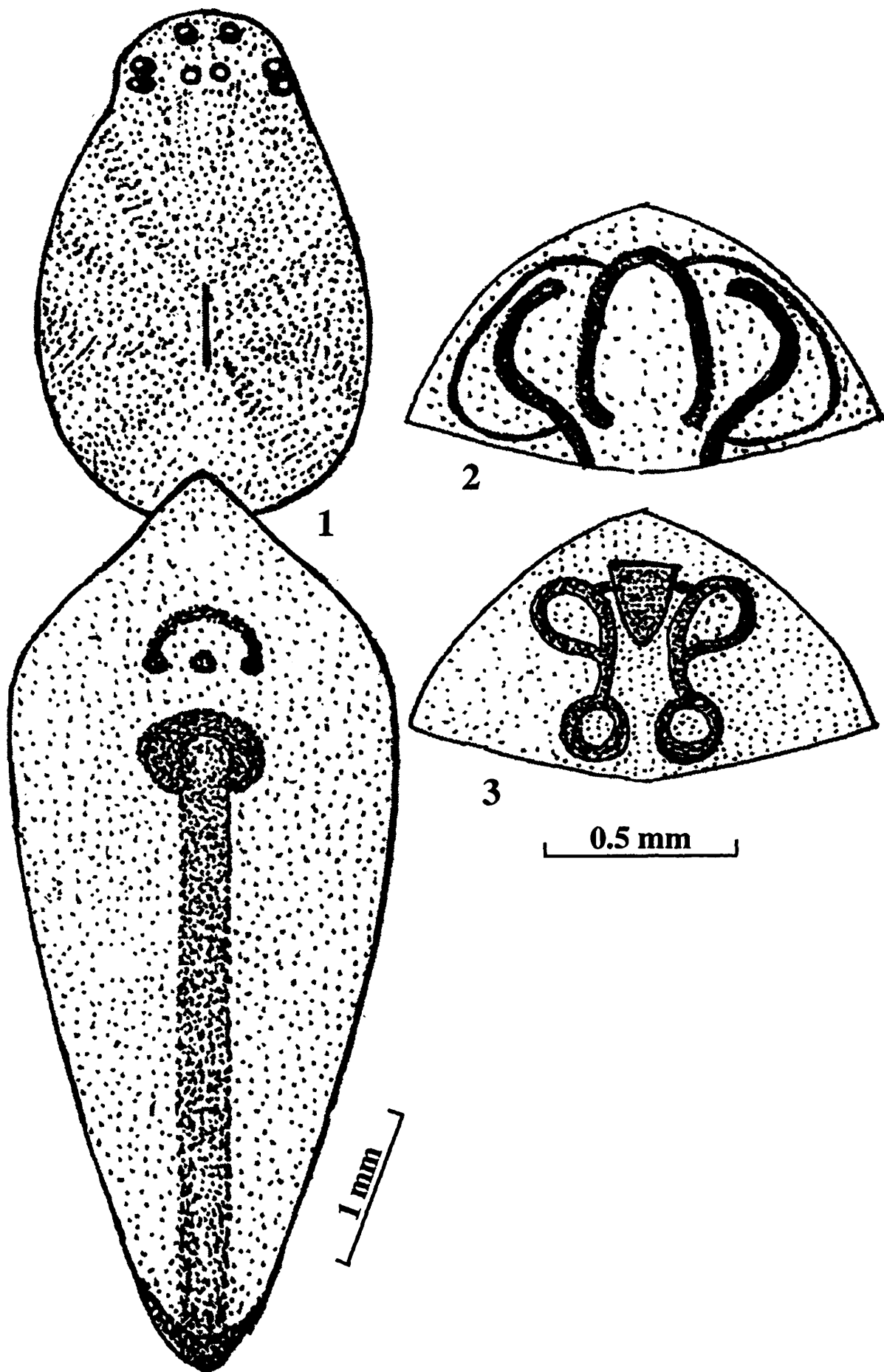


Fig. 1-3. *Larinia emertoni* sp. nov. 1. Dorsal view of female, legs omitted. 2. Epigyne. 3. Internal genitalia.

Abdomen : Much longer than wide, pointed anteriorly over the carapace, clothed with pubescence and few spines. An inverted U-shaped black spot present on the mid-dorsal line above which three tiny black spots are present as in fig. 1. The posterior end is blackish, the region between the inverted U-shaped black spot and the posterior end is slightly darker than the rest. Ventral side lighter than dorsal, without any patch. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

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

Type-locality : Gandhi Smarak, Jabalpur, Coll. Pawan Gajbe, 12.7.1997.

Etymology : The specific name is a Patronym in honour of Dr. J. H. Emerton.

This species resembles *Larinia phtisica* (L. Koch) but differs from it as follows : (i) Light brown bands running to the sides from the deep longitudinal thoracic furrow but such bands are absent in *L. phtisica*. (ii) An inverted U-shaped black spot present on the mid-dorsal line of abdomen but such spot is absent in *L. phtisica*. (iii) Epigyne and internal genitalia also structurally different.

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A NEW SPECIES OF *CHORIZOPES* SPIDER (ARANEAE : ARANEIDAE) FROM JABALPUR, MADHYA PRADESH, INDIA

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INTRODUCTION

O. P.-Cambridge established the genus *Chorizopes* in 1870 with the type species *Chorizopes frontalis* O. P.-Cambridge, 1870. O. P.-Cambridge (1885) described two species *C. congener* and *C. stoliczkae* from India. Sadana & Kaur (1974) described the species *C. tikaderi*. Tikader (1982) redescribed four species *C. calciopae* (Simon, 1895); *C. khanjanas* Tikader, 1965; *C. anjanas* Tikader, 1965; and *C. bengalensis* Tikader, 1975. Reddy & Patel (1993) described two species *C. khedaensis* and *C. pateli*. Bhandari & Gajbe (2001) described the species *C. tikaderi* from India.

A new species *Chorizopes kastoni* sp. nov. is being described herein from Jabalpur district (c. 23°10' N, 79°57' E). The type specimen has been deposited with the National Zoological Collection, Zoological Survey of India, Kolkata.

Chorizopes kastoni sp. nov.

General : Cephalothorax, legs and abdomen black. Total length 6.7 mm. Carapace 1.9 mm. long, 2.4 mm wide; abdomen 4.8 mm. long, 4.5 mm. wide.

Cephalothorax : Wider than long, narrowing anteriorly, clothed with hairs, cephalic region elevated and convex. Ocular quad forming a trapezium, wider behind than in front; eyes pearly white; anterior median eyes slightly larger than posterior median eyes; lateral eyes subequal in size, separated a little; both rows of eyes recurved. Sternum heart-shaped, pointed behind, dark brown in colour and clothed with fine hairs. Labium wider than long, pale in colour. Chelicerae strong and stout, dark brown, clothed with hairs. Legs moderately strong, coxae and femora with brownish transverse bands, clothed with hairs and spines.

Abdomen : Longer than wide, clothed with hairs, posterior end concave, dorsum elevated and provided with four pairs of white spots as in fig. 1. Ventral side same in colour as dorsal. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

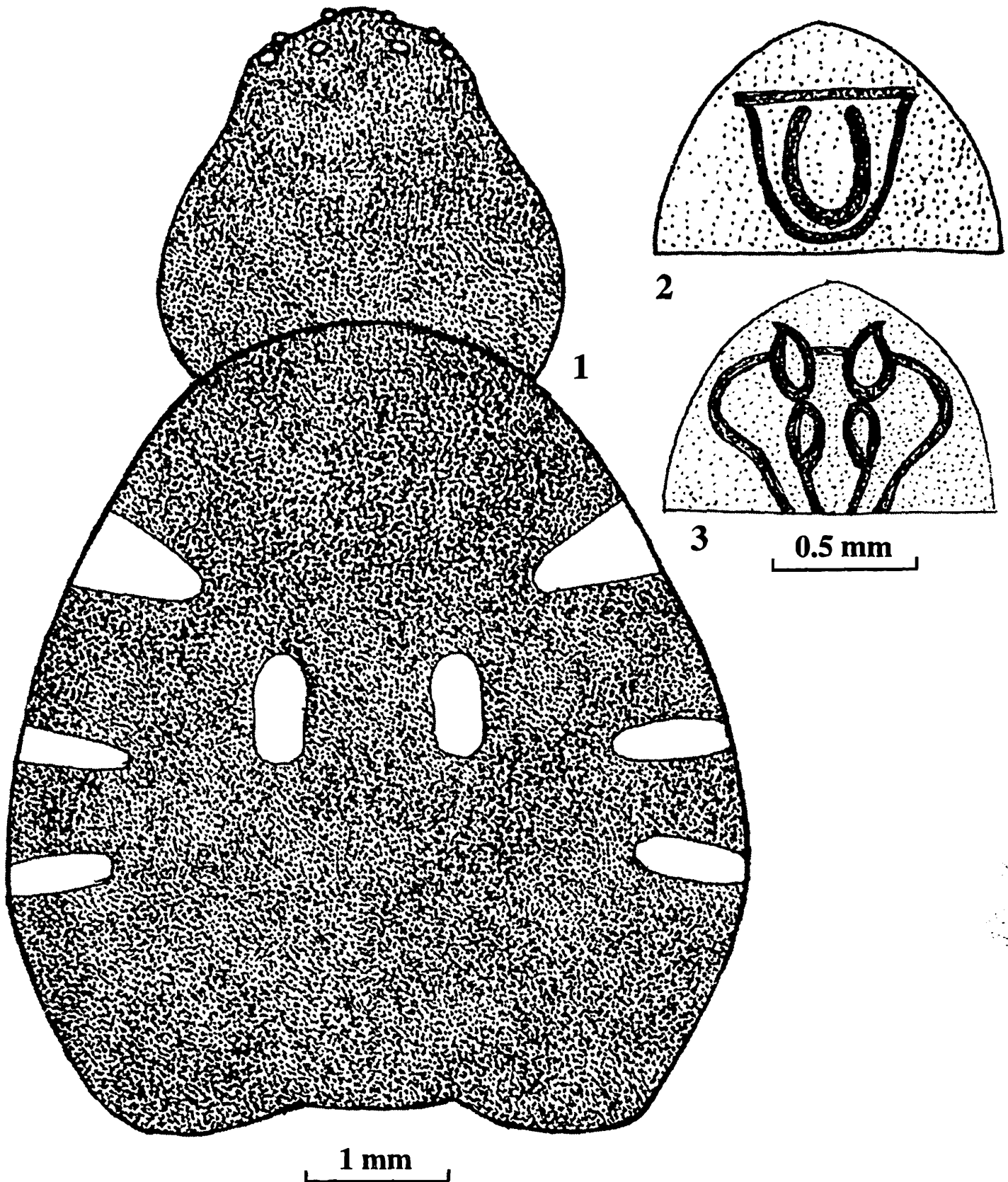


Fig. 1-3. *Chorizopes kastoni* sp. nov. 1. Dorsal view of female, legs omitted. 2. Epigyne. 3. Internal genitalia.

Type-specimen : *Holotype* female in spirit, other details as above. Type collected from *Lantana* bushes.

Type-locality : Gandhi Smarak, Jabalpur. Coll. Pawan Gajbe, 12.7.1997.

Etymology : The specific name is a patronym in honour of Dr. B. J. Kaston.

This species resembles *Chorizopes khanjanus* Tikader but differs from It as follows : (i) Cephalothorax, legs and abdomen black but in *C. khanjanus* cephalothorax blackish brown and abdomen greyish. (ii) Sternum without any coloured patch but in *C. khanjanus* sternum with a median large orange yellowish patch. (iii) Dorsum of abdomen provided with four pairs of white spots but in *C. khanjanus* such spots are absent. (iv) Epigyne and internal genitalia also structurally different.

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We are grateful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Kolkata, for facilities. Thanks are also due to Shri. K. Vinod, Stenographer, Central Regional Station, Zoological Survey of India, Jabalpur, for typing the manuscript.

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ECHINODERMS OF THE MALDIVES

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INTRODUCTION

Dr. Stanley Gardiner for his classic work on the Fauna and Geography of the Maldives and Laccadive Archipelagoes collected Echinoderms from the Maldives and also from the Minicoy Island in the Laccadives. Crinoids, Asteroids, Ophiuroids and Echinoids collected by him were reported by Bell (1902). Unfortunately some of his identifications proved to be wrong and these were corrected by Clark and Davies (1966), who also reported on a small collection of Echinoderms from the Maldives, mainly from the Addu Atoll. Holothurians collected by Gardiner were cursorily reported by Pearson (1913, 1914) along with other holothurian collections. Clark and Rowe (1971) listed Echinoderms from the Maldivian area which includes the Laccadives also. James and Manikfan (1994) described the commercially important sea cucumbers used for processing from the Maldives. Apart from these papers, some Maldivian Echinoderms are also mentioned in various monographs and papers.

James (1989) reported 77 species of Echinoderms from all the ten Islands of Laccadives. All these species are likely to be distributed in the Maldives also since the faunal composition of Maldives and Laccadives is similar (James, 1986).

In 1979 late Dr. S. Jones, former Director of Central Marine Fisheries Research Institute made arrangements for the collection of Echinoderms from Male through the courtesy of Danish scientists who were stationed there at that time. At the end of 1998 the author had an opportunity to work as a FAO Consultant on sea cucumber culture in the Maldives. He collected 38 species from Kadhdhoo Island in the Laamu Atoll, on the reef flat during the low tide. Some Crinoids were also collected from the Laamu Atoll. They were broken into small bits in transit rendering identification impossible. The Fisheries Department of the Maldives also collected some species from Male in 1998 for the identification of the author. Recently the author's student Dr. M. K. Ram Mohan collected some species from the Thaa Atoll. All the species thus collected formed the basis of the present paper. The species from Male were collected from a depth of 2–5 m. and those from the Laamu and Thaa Atolls were collected from the reef flat during low tide.

In the present paper 47 species belonging to four classes are listed below. All the species are widely distributed in the Indo-West Pacific region. Four species are recorded here for the first time

from the Maldives and these are marked with an asterisk. At the end of the paper some remarks are given on the distribution of Echinoderm fauna of Kadhdhoo Island.

Class ASTEROIDEA

Family OPHIDIASTERIDAE

1. *Dactylosaster cylindricus* (Lamarck) Laamu Atoll
2. *Fromia indica* (Perrier) Male
3. *Linckia laevigata* (Linnaeus) Laamu Atoll, Thaa Atoll, Male
4. *Linckia multifora* (Lamarck) Laamu Atoll, Thaa Atoll, Male

Family ACANTHASTERIDAE

5. *Acanthaster planci* (Linnaeus) Male

Family OREASTERIDAE

6. *Culcita schmideliana* (Retzius) Laamu Atoll, Male

Class OPHIUROIDEA

Family OPHIOCOMIDAE

7. *Ophiocoma scolopendrina* (Lamarck) Laamu Atoll, Male
- *8. *Ophiocoma anaglyptica* Ely Laamu Atoll
9. *Ophiocoma dentata* Muller & Troschel Laamu Atoll
10. *Ophiocoma erinaceus* Muller & Troschel Laamu Atoll, Male
11. *Ophiomastix annulosa* (Lamarck) Laamu Atoll

Class ECHINOIDEA

Family DIADEMATIDAE

12. *Diadema setosum* (Leske) Laamu Atoll
13. *Echinothrix diadema* (Linnaeus) Laamu Atoll, Male
14. *Echinothrix calamaris* (Pallas) Laamu Atoll

Family STOMPONEUSTIDAE

15. *Stomopneustes variolaris* (Lamarck) Laamu Atoll

Family TOXOPNEUSTIDAE

16. *Tripneustes gratilla* (Linnaeus) Laamu Atoll
17. *Toxopneustes pileolus* (Lamarck) Laamu Atoll

Family ECHINOMETRIDAE

18. *Echinometra mathaei* (de Blainville) Laamu Atoll
19. *Heterocentrotus mammillatus* (Linnaeus) Thaa Atoll, Male

Family CLYPEASTERIDAE

20. *Clypeaster reticulatus* (Linnaeus) Laamu Atoll

Family FIBULARIDAE

21. *Fibularia volva* L. Agassiz Laamu Atoll

Family LAGANIDAE

22. *Laganum depressum* Lesson Laamu Atoll

Class HOLOTHUROIDEA

Family HOLOTHURIIDAE

23. *Pearsonothuria graeffei* (Semper) Laamu Atoll, Male
24. *Actinopyga mauritiana* (Quoy & Gaimard) Laamu Atoll
25. *Actinopyga lacanora* (Jaeger) Laamu Atoll
26. *Actinopyga miliaria* (Quoy & Gaimard) Laamu Atoll
27. *Actinopyga echinites* (Jaeger) Laamu Atoll
28. *Bohadschia marmorata* (Jaeger) Laamu Atoll
29. *Bohadschia argus* (Jaeger) Laamu Atoll
30. *Holothuria (Halodeima) atra* (Jaeger) Laamu Atoll
31. *Holothuria (Thymiosycia) hilla* Lesson Laamu Atoll
- *32. *Holothuria (Thymiosycia) arenicola* Semper Laamu Atoll
33. *Holothuria (Thymiosycia) impatiens* (Forsk.) Laamu Atoll
34. *Holothuria (Mertensiothuria) leucospilota* Brandt Laamu Atoll
35. *Holothuria (Microthele) nobilis* Selenka Laamu Atoll
- *36. *Holothuria (Microthele) fuscogilva* Cherbonnier Laamu Atoll
37. *Holothuria (Lessonothuria) pardalis* Selenka Laamu Atoll
38. *Holothuria (Platyperona) difficilis* Semper Male
39. *Holothuria (Semperothuria) cinerascens* (Brandt) Laamu Atoll

Family STICHOPODIDAE

40. *Stichopus chloronotus* Brandt Laamu Atoll
 41. *Stichopus herrmanni* Semper Laamu Atoll, Male
 *42. *Stichopus vastus* Sluiter, Male
 *43. *Stichopus horrens* Selenka Laamu Atoll, Thaa Atoll
 44. *Thelenota ananas* (Jaeger), Male
 45. *Thelenota anax* H. L. Clark, Male

Family PHYLLOPHORIDAE

46. *Afrocucumis africana* (Semper) Laamu Atoll

Family SYNAPTIDAE

47. *Synapta maculata* (Chamisso & Eysenhardt) Thaa Atoll

REMARKS

Intensive collections were made on the reef flat at Kadhdhoo Island in the Laamu Atoll in front of the guest house for one week during low tide. The area seemed to be poor in echinoderms since only 38 species could be collected during an intensive search of one week. The starfish *Linckia multifora* which is common in the Laccadives seems to be rare here. *L. laevigata* occurred in two colour forms, blue and pinkish-brown. The blue form had shorter and thicker arms and occurred openly. The other colour form had longer and slender arms and found associated with coral. Only young ones (R 15–18 mm) of *Culcita schmideliana* which were light green in colour were seen on the reef flat. Near the low water mark under coral stones large specimens of *Ophicoma erinaceus* were found. The echinoid *Echinometra mathaei* also occurred in two colour forms, light green and black. Among the sea cucumbers *Holothuria (Thymiosycia) hilla* was common. Often under one coral stone two or three specimens were found. Surprisingly *Holothuria (Halodeima) atra* and *Holothuria (Mertensiothuria) leucospilota* were also rare. *Stichopus horrens* (150 mm in length) had bluish tubercles. One specimen of *Holothuria (Thymiosycia) arenicola* had two gastropod parasites attached to the skin. One small specimen (40 mm in length) *Actinopyga mauritiana* was collected. On the whole the echinoderm fauna of this area is poor.

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CHROMOSOMAL DIVERSITY OF INDIAN MAMMALS, AMPHIBIANS AND REPTILES

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INTRODUCTION

Number and morphology of chromosomes are species specific. Information on chromosomes have been frequently found immensely useful and occasionally even conclusive in distinguishing between closely related taxa. Comparative chromosomal analyses have quite often proved helpful in tracing phylogenetic relationships. Harvey (1916, 1920) was the first to review chromosome numbers in the Metazoa. Makino (1956) reviewed the chromosome numbers in animals. Matthey (1973) published chromosome formulae of Eutherian mammals. Morescalchi (1973), Singh (1972) and Gorman (1973) also provided information on Amphibian and Reptilian chromosomes for the purpose. Manna (1983) and Rao & Ghosh (1983) updated the information on Indian Amphibian and Reptilian chromosomes. In this brief account we have presented only the diploid chromosome numbers (2n) of Indian Ungulates, Rodents, Amphibians and Reptiles. The chromosomal features of these species are being worked out to be published in the form of a catalogue, what have been published on 129 Mammalian species belonging to 9 orders (refer Singh *et. al.* 1999).

MAMMALIA

Order ARTIODACTYLA

Family BOVIDAE

| | 2n (Diploid number) |
|--|---------------------|
| 1. <i>Antilope cervicapra</i> (Linnaeus) | 31-33 ♂; 30-32 ♀ |
| 2. <i>Bos frontalis</i> Lambert | 58 |
| 3. <i>Bos grunniens</i> Linnaeus | 60 |
| 4. <i>Bos taurus</i> Linnaeus | 60 |
| 5. <i>Boselaphus tragocamelus</i> (Pallas) | 46 |
| 6. <i>Bubalus bubalis</i> (Linnaeus) | 50 |
| 7. <i>Budorcas taxicolor</i> Hodgson | 52 |
| 8. <i>Capra falconeri</i> (Wagner) | 60 |
| 9. <i>Capra hircus</i> Linnaeus | 60 |

| | |
|---|------------|
| 10. <i>Capra ibex</i> Linnaeus | 60 |
| 11. <i>Gazella dorcas</i> (Linnaeus) | 31 ♂; 30 ♀ |
| 12. <i>Hemitragus jemlahicus</i> (H. Smith) | 48 |
| 13. <i>Nemorhaedus goral</i> (Hardwicke) | 55 |
| 14. <i>Oryx gazella</i> (Linnaeus) | 56 |
| 15. <i>Ovis ammon</i> (Linnaeus) | 58 |
| 16. <i>Ovis aries</i> Linnaeus | 54 |
| 17. <i>Pseudois nayaur</i> (Hodgson) | 54 |
| 18. <i>Tetracerus quadricornis</i> (Blainville) | 38 |

Family CAMELIDAE

| | |
|---|----|
| 19. <i>Camelus bactrianus</i> Linnaeus | 74 |
| 20. <i>Camelus dromedarius</i> Linnaeus | 74 |

Family CERVIDAE

| | |
|---|----------|
| 21. <i>Cervus axis</i> Erxleben | 66 |
| 22. <i>Cervus duvauceli</i> G. Cuvier | 56 |
| 23. <i>Cervus elaphus</i> Linnaeus | 68 |
| 24. <i>Cervus eldi</i> M'Clelland | 58 |
| 25. <i>Cervus porcinus</i> (Zimmermann) | 68 |
| 26. <i>Cervus unicolor</i> (Kerr) | 64-65 |
| 27. <i>Muntiacus muntjak</i> (Zimmermann) | 6 ♀; 7 ♂ |

Family SUIDAE

| | |
|------------------------------------|----|
| 28. <i>Sus salvanius</i> (Hodgson) | 38 |
| 29. <i>Sus scrofa</i> Linnaeus | 38 |

Order PERISSODACTYLA

Family EQUIDAE

| | |
|-----------------------------------|----|
| 1. <i>Equus asinus</i> Linnaeus | 62 |
| 2. <i>Equus caballus</i> Linnaeus | 64 |
| 3. <i>Equus onager</i> Boddaert | 56 |

Family RHINOCEROTIDAE

| | |
|---|----|
| 4. <i>Rhinoceros unicornis</i> Linnaeus | 82 |
|---|----|

Order RODENTIA

Family ARVICOLIDAE

1. *Alticola roylei* Gray 56

Family CAVIIDAE

2. *Cavia porcellus* (Linnaeus) 64

Family CRICETIDAE

3. *Meriones hurrianae* Jerdon 40
4. *Tatera indica* (Hardwicke) 66, 68

Family HYSTRICIDAE

5. *Hystrix indica* Kerr 66

Family MURIDAE

6. *Apodemus sylvaticus* (Linnaeus) 48
7. *Bandicota bengalensis* (Gray & Hardwicke) 42, 44
8. *Bandicota indica* (Bechstein) 42, 44-47
9. *Berylmus bowersi* (Anderson) 40
10. *Berylmus mackenziei* (Thomas) 40
11. *Chiropodomys gliroides* (Blyth) 28
12. *Cremnomys blanfordi* (Thomas) 36
13. *Cremnomys cutchicus* Wroughton 36
14. *Golunda ellioti* Gray 50, 52, 54
15. *Leopoldamys edwardsi* (Thomas) 42
16. *Leopoldamys sabanus* (Thomas) 42
17. *Micromys mimutus* (Pallas) 68
18. *Millardia gleadowi* (Murray) 40
19. *Millardia meltada* (Gray) 50, 52
20. *Mus booduga* (Gray) 40
21. *Mus castaneus* Waterhouse 40
22. *Mus cervicolor* Hodgson 40
23. *Mus cookii* Ryley 40
24. *Mus domesticus* Ruddy 24, 26, 28, 29, 30, 40
25. *Mus dunni* Wroughton (= *Mus terricolor* Blyth) 40

| | |
|--|---|
| 26. <i>Mus musculus</i> Linnaeus | 40 |
| 27. <i>Mus pahari</i> Thomas | 40, 48 |
| 28. <i>Mus platythrix</i> Bennett | 22, 24, 26, 30 |
| 29. <i>Mus saxicola</i> Elliot | 22, 24-26 |
| 30. <i>Nesokia indica</i> (Gray & Hardwicke) | 42 |
| 31. <i>Niviventer fulvescens</i> (Gray) | 42, 46 |
| 32. <i>Niviventer niviventer</i> (Hodgson) | 46 |
| 33. <i>Rattus exulans</i> (Peale) | 42 |
| 34. <i>Rattus muelleri</i> (Jentink) | 42 |
| 35. <i>Rattus nitidus</i> (Hodgson) | 42 |
| 36. <i>Rattus norvegicus</i> (Berkenhout) | 42 |
| 37. <i>Rattus rattus</i> (Linnaeus) | 38, 42 |
| 38. <i>Rattus turkestanicus</i> (Satunin) | 42 |
| 39. <i>Vandeleuria oleracea</i> (Bennett) | 29 ♂, X ₁ X ₂ Y; 29 ♀ X ₁ X ₁ X ₂ |

Family SCIURIDAE

| | |
|--|--------|
| 40. <i>Funambulus palmarum</i> (Linnaeus) | 46, 54 |
| 41. <i>Funambulus pennanti</i> wroughton | 54 |
| 42. <i>Funambulus tristriatus</i> (Waterhouse) | 46 |
| 43. <i>Hylopetes alboniger</i> (Hodgson) | 38 |
| 44. <i>Hylopetes fimbriatus</i> (Gray) | 46 |
| 45. <i>Marmota caudata</i> (Geoffroy) | 38 |
| 46. <i>Petaurista magnificus</i> (Hodgson) | 38 |
| 47. <i>Petaurista petaurista</i> (Pallas) | 38 |

AMPHIBIA

Order ANURA

Family BUFONIDAE

| | |
|--|----|
| 1. <i>Bufo andersonii</i> (Boulenger) | 22 |
| 2. <i>Bufo himalayanus</i> Günther | 22 |
| 3. <i>Bufo melanostictus</i> Schneider | 22 |
| 4. <i>Bufo stomaticus</i> Lütken | 22 |

Family MICROHYLIDAE

- | | |
|---|--------|
| 5. <i>Kaloula pulchra</i> Gray | 28 |
| 6. <i>Microhyla heymonsi</i> Vogt | 24 |
| 7. <i>Microhyla ornata</i> (Duméril & Bibron) | 24, 26 |
| 8. <i>Ramanella variegata</i> (Stoliczka) | 26 |
| 9. <i>Uperodon globulosus</i> (Günther) | 26 |
| 10. <i>Uperodon systoma</i> (Schneider) | 26 |

Family PELOBATIDAE

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|---|----|
| 11. <i>Megophrys lateralis</i> (Anderson) | 26 |
|---|----|

Family RANIDAE

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|--|----|
| 12. <i>Euphlyctis cyanophlyctis</i> (Schneider) | 26 |
| 13. <i>Euphlyctis hexadactylus</i> (Lesson) | 26 |
| 14. <i>Hoplobatrachus crassus</i> (Jerdon) | 26 |
| 15. <i>Hoplobatrachus tigerinus</i> (Daudin) | 26 |
| 16. <i>Limnonectes limnocharis</i> (Gravenhorst) | 26 |
| 17. <i>Limnonectes macrodon</i> (Duméril & Bibron) | 24 |
| 18. <i>Occidozyga lima</i> (Gravenhorst) | 26 |
| 19. <i>Rana chalconota</i> (Schlegel) | 26 |
| 20. <i>Rana livida</i> (Blyth) | 26 |

Family RHACOPHORIDAE

- | | |
|--|----|
| 21. <i>Polypedates leucomystax</i> (Gravenhorst) | 26 |
| 22. <i>Polypedates maculatus</i> (Gray) | 26 |
| 23. <i>Rhacophorus reinwardtii</i> (Schlegel) | 26 |

Order CAUDATA

Family SALAMANDRIDAE

- | | |
|--|----|
| 24. <i>Pleurodeles verrucosus</i> (Anderson) | 24 |
|--|----|

Order GYMNOPTIONA

Family CAECILIDAE

- | | |
|--|----|
| 25. <i>Gegenophis carnosus</i> (Beddome) | 30 |
|--|----|

Family ICHTHYOPHIIDAE

26. *Ichthyophis beddomei* Peters 42

Family URAEOTYPHLIDAE

27. *Uraeotyphlus menoni* Annandale 36
28. *Uraeotyphlus narayani* Seshachar 36

REPTILIA

Order CROCODYLIA

Family CROCODYLIDAE

1. *Crocodylus palustris* Lesson 30
2. *Crocodylus porosus* Schneider 34

Family GAVIALIIDAE

3. *Gavialis gangeticus* (Gmelin) 32

Order SAURIA

Family AGAMIDAE

4. *Bronchocela cristatella* (Kuhl) 34
5. *Calotes emma* Gray 34
6. *Calotes jerdoni* Günther 34
7. *Calotes mystaceus* Duméril & Bibron 34
8. *Calotes versicolor* (Daudin) 32, 34
9. *Ceratophora stoddartii* Gray 34
10. *Cophotis ceylanica* Peters 28
11. *Japalura variegata* Gray 34
12. *Laudakia caucasica* (Eichwald) 34, 36
13. *Laudakia himalayana* (Steindachner) 36
14. *Laudakia nupta* (De Filippi) 36
15. *Laudakia tuberculata* (Hardwicke & Gray) 34
16. *Lyriocephalus scutatus* (Linnaeus) 30
17. *Psammophilus dorsalis* (Gray in : Griffith & Pidgeon) 32
18. *Ptyctolaemus gularis* (Peters) 34
19. *Sitana ponticeriana* Cuvier 36, 44, 46

20. *Trapelus ruderatus* (Olivier) 46
 21. *Uromastyx hardwickii* Hardwicke & Gray 34, 36

Family EUBLEPHARIDAE

22. *Eublepharis macularius* (Blyth) 38

Family GEKKONIDAE

23. *Bunopus tuberculatus* Blanford 42
 24. *Cosymbotus platyurus* (Schneider) 46
 25. *Crossobamon eversmanni* (Wiegmann) 42
 26. *Gekko gekko* (Linnaeus) 38
 27. *Gekko smithii* (Gray) 38
 28. *Hemidactylus brookii* Gray 40
 29. *Hemidactylus bowringii* (Gray) 46
 30. *Hemidactylus flaviviridis* Rüppell 40, 46
 31. *Hemidactylus frenatus* Duméril & Bibron 40
 32. *Hemidactylus garnotii* Duméril & Bibron
 $2n = 3x = 63$; $2n = 3x = 42$; $2n = 3x = 70$
 33. *Hemidactylus turcicus* (Linnaeus) 44
 34. *Lepidodactylus lugubris* (Duméril & Bibron)
 $2n = 3x = 63$; $2n = 3x = 66$; $2n = 44$
 35. *Ptychozoon kuhli* Stejneger 42
 36. *Teratoscincus scincus* (Schlegel) 34, 36

Family LACERTIDAE

37. *Eremias guttulata* (Lichtenstein) 38
 38. *Eremias persica* Blanford 38
 39. *Eremias velox* (Pallas) 38
 40. *Ophisops elegans* Ménétriés 38
 41. *Takydromus sexlineatus* Daudin 38, 40, 42

Family SCINCIDAE

42. *Asymblepharus himalayanus* (Günther) 30
 43. *Chalcides ocellatus* (Forsskál) 26, 28
 44. *Dasia olivacea* Gray 32

| | |
|---|------------|
| 45. <i>Eumeces schneideri schneideri</i> (Daudin) | 32 |
| 46. <i>Lygosoma punctata</i> (Gmelin) | 24 |
| 47. <i>Mabuya aurata</i> (Linnaeus) | 32 |
| 48. <i>Mabuya carinata</i> (Schneider) | 30, 32 |
| 49. <i>Mabuya macularia</i> (Blyth) | 26, 32, 38 |
| 50. <i>Mabuya multifasciata</i> (Kuhl) | 32 |
| 51. <i>Mabuya rudis</i> Boulenger | 32 |
| 52. <i>Mabuya rugifera</i> (Stoliczka) | 32 |
| 53. <i>Sphenomorphus indicus</i> (Gray) | 28, 30 |

Family VARANIDAE

| | |
|--|----|
| 54. <i>Varanus bengalensis</i> (Daudin) | 40 |
| 55. <i>Varanus flavescens</i> (Hardwicke & Gray) | 40 |
| 56. <i>Varanus griseus</i> (Daudin) | 40 |
| 57. <i>Varanus salvator</i> (Laurenti) | 40 |

Order SERPENTES

Family ACROCHORDIDAE

| | |
|---|----|
| 58. <i>Acrochordus granulatus</i> (Schneider) | 36 |
|---|----|

Family BOIDAE

| | |
|--------------------------------------|----|
| 59. <i>Eryx conicus</i> (Schneider) | 34 |
| 60. <i>Eryx johnii</i> (Russell) | 34 |
| 61. <i>Python molurus</i> (Linnaeus) | 36 |

Family COLUBRIDAE

| | |
|---|--------|
| 62. <i>Ahaetulla nasuta</i> (Lacepède) | 36 |
| 63. <i>Amphiesma stolatum</i> (Linnaeus) | 36 |
| 64. <i>Argyrogena fasciolata</i> (Shaw) | 36 |
| 65. <i>Boiga forsteni</i> (Duméril, Bibron & Duméril) | 36 |
| 66. <i>Boiga trigonata</i> (Schneider in : Bechstein) | 36 |
| 67. <i>Cerberus rynchops</i> (Schneider) | 36, 38 |
| 68. <i>Chrysopelea ornata</i> (Shaw) | 36, 40 |
| 69. <i>Dendrelaphis pictus</i> (Gmelin) | 36 |
| 70. <i>Elaphe mandarina</i> (Cantor) | 38 |

| | |
|---|--------|
| 71. <i>Elaphe radiata</i> (Schlegel) | 30 |
| 72. <i>Elaphe taeniura</i> (Cope) | 36 |
| 73. <i>Enhydris enhydris</i> (Schneider) | 36 |
| 74. <i>Gerarda prevostiana</i> (Eydoux & Gervais) | 36 |
| 75. <i>Lycodon aulicus</i> (Linnaeus) | 36 |
| 76. <i>Natrix tessellata</i> (Laurenti) | 34 |
| 77. <i>Oligodon arnensis</i> (Shaw) | 46 |
| 78. <i>Pseudoxenodon macrops</i> (Blyth) | 38 |
| 79. <i>Ptyas korros</i> (Schlegel) | 36 |
| 80. <i>Ptyas mucosus</i> (Linnaeus) | 34, 36 |
| 81. <i>Xenochrophis piscator</i> (Schneider) | 40, 42 |
| 82. <i>Zaocys nigromarginatus</i> (Blyth) | 34, 36 |

Family ELAPIDAE

| | |
|---|------------|
| 83. <i>Bungarus caeruleus</i> (Schneider) | 44 ♂, 43 ♀ |
| 84. <i>Bungarus fasciatus</i> (Schneider) | 38 |
| 85. <i>Naja kaouthia</i> Lesson | 38 |
| 86. <i>Naja naja</i> (Linnaeus) | 38 |

Family HYDROPHIIDAE

| | |
|---|----------------------|
| 87. <i>Enhydrina schistosa</i> (Daudin) | 32 ♂, 33 ♀ |
| 88. <i>Hydrophis cantoris</i> Günther | 35 ♀ |
| 89. <i>Hydrophis cyanocinctus</i> Daudin | 32 ♂, 33 ♀, 36 (♂ ♀) |
| 90. <i>Hydrophis fasciatus</i> (Schneider) | 35 ♀ |
| 91. <i>Hydrophis gracilis</i> (Shaw) | 35 ♀ |
| 92. <i>Hydrophis ornatus</i> (Gray) | 32 |
| 93. <i>Hydrophis spiralis</i> (Shaw) | 32 ♀ |
| 94. <i>Kerilia jerdonii</i> Gray | 32 |
| 95. <i>Laticauda colubrina</i> (Schneider) | 34 |
| 96. <i>Laticauda laticaudata</i> (Linnaeus) | 40 |
| 97. <i>Pelamis platurus</i> (Linnaeus) | 38 |
| 98. <i>Praescutata viperina</i> Schmidt | 32 |

Family TYPHLOPIDAE

| | |
|---|--|
| 99. <i>Ramphotyphlops braminus</i> (Daudin) | |
| 2n = 3x = 42 | |

Family VIPERIDAE

| | | |
|------|---|----|
| 100. | <i>Daboia russelii</i> (Shaw & Nodder) | 36 |
| 101. | <i>Echis carinatus</i> (Schneider) | 36 |
| 102. | <i>Macrovipera lebetina</i> (Linnaeus) | 36 |
| 103. | <i>Trimeresurus erythrurus</i> (Cantor) | 36 |
| 104. | <i>Trimeresurus mucrosquamatus</i> (Cantor) | 36 |
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SUMMARY

Chromosome numbers of 228 species reported from the Indian subcontinent have been presented. Mammalia consist of Artiodactyla 29, Perissodactyla 4 and Rodentia 47 species. Amphibia include Anura 24, Caudata 1, and Gymnophiona 4 species. Reptilia the largest group with 119 species are represented by 4 orders *viz.*, Crocodylia 3, Sauria 54, Serpentes 49 and Testudines 13. All these species with diploid numbers have been placed under their different families alphabetically.

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MORPHOLOGICAL CHANGES AMONG JUVENILES AND ADULTS OF SOME MARINE FISHES OF WEST BENGAL

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During the course of the systematic studies on the marine fishes of our country it has been observed that juveniles of some marine fishes differ morphologically with their adults. Some morphological characters that are taken into consideration for identification develop with the maturity of the fishes; some characters present in the young stages diminish and shape of some morphological characters change with the growth of the fishes. Further, the colour pattern and the teeth pattern of many fishes change remarkably with the maturity of the fishes. As a result identification of the juveniles of fishes is problematical. An attempt has, therefore, been undertaken to record the characteristics of the juveniles of some marine fishes of West Bengal.

SYSTEMATIC LIST OF JUVENILES OF SOME MARINE FISHES OF WEST BENGAL

Order 1 ANGUILLIFORMES

Family 1 ANGUILLIDAE

1. *Anguilla bengalensis bengalensis* (Gray)

Family 2 OPHICHTHIDAE

2. *Pisodonophis boro* (Hamilton)

Family 3 ARIIDAE

3. *Arius maculatus* (Thunberg)
4. *A. thalassinus* (Ruppell)

Order 2 BELONIFORMES

Family 4 BELONIDAE

5. *Tylosurus crocodilus crocodilus* (Peron & Le Sueur)

Order 3 PERCIFORMES

Family 5 TERAPONIDAE

6. *Terapon theraps* (Cuvier)

Family 6 ECHENEIDAE

7. *Echeneis naucrates* Linnaeus

Family 7 CARANGIDAE

8. *Alectis ciliaris* (Bloch)
9. *A. indicus* (Ruppell)
10. *Atropus atropus* (Schneider)
11. *Gnathanodon speciosus* (Forsskal)
12. *Parastromateus niger* (Bloch)
13. *Scomberoides lysan* (Forsskal)
14. *S. tala* (Cuvier)
15. *Trachinotus blochii* (Lacepede)
16. *Uraspis uraspis* (Bloch)

Family 8 CORYPHAENIDAE

17. *Coryphaena hippurus* Linnaeus

Family 9 LEIOGNATHIDAE

18. *Leiognathus brevirostris* (Valenciennes)
19. *L. equulus* (Forsskal)
20. *Secutor ruconius* (Hamilton)

Family 10 GERREIDAE

21. *Gerres abbreviatus* Bleeker

Family 11 LUTJANIDAE

22. *Lutjanus johnii* (Bloch)

Family 12 SCIAENIDAE

23. *Otolithes ruber* (Schneider)

Family 13 EPHIPPIDAE

24. *Ephippus orbis* (Bloch)

Family 14 DREPANIDAE

25. *Drepane punctata* (Linnaeus)

Family 15 SCATOPHAGIDAE

26. *Scatophagus argus* (Bloch)

Family 16 MUGILIDAE

27. *Liza parsia* (Hamilton)

28. *L. tade* (Forsskal)

Family 17 SPHYRAENIDAE

29. *Sphyaena jello* Cuvier

Family 18 SCOMBRIDAE

30. *Scomberomorus commerson* (Lacepede)

Family 19 MONODACTYLIDAE

31. *Monodactylus argenteus* (Linnaeus)

SYSTEMATIC ACCOUNT

Keys to the orders of OSTEICHTHYS

- 1a. Body greatly elongate, cylindrical and eel-like; gill openings narrow, or gill cavity not enlarged on sides of head; fin spines absent *Anguilliformes*
- 1b. Body not very elongate nor eel-like, but if eel-like, then either gill openings not separate from each other (as in true eels) but united on ventral side of body near throat; or pelvic fins present, spiny rays in dorsal and anal fins 2
- 2a. Snout beak-like, with upper and/or lower jaws greatly prolonged or with enlarged wing-like pectoral and sometimes also pelvic fins; lateral line near ventral profile of body; single dorsal fin consisting of soft rays; pelvic fins abdominal *Beloniformes*
- 2b. Snout not beak-like without prolongation of upper or lower jaw; pectoral fins and pelvic fins not greatly elongated, if so, not wing-like 3
- 3a. Body without scales but a bony head shield often present; barbels well-developed, present around mouth; a strong spine usually present at front of dorsal and pectoral fins; an adipose fin often present *Siluriformes*
- 3b. Body with scales but a bony head shield generally absent; barbels generally absent, but if present, poorly developed; adipose fin generally absent *Perciformes*

Order 1 ANGUILLIFORMES

Key to families of order ANGUILLIFORMES

Body with minute embedded scales; dorsal, anal, pectoral and caudal fins well developed; branchial region and throat not swollen ANGUILLIDAE

Body naked; dorsal, anal, pectoral and caudal fins moderately developed; swollen branchial region and throat, supported by a basket of free branchial rays that overlap below
 OPHICHTHIDAE

Family ANGUILLIDAE

1. *Anguilla bengalensis bengalensis* (Gray)

1834. *Muraena bengalensis* Gray, *Illust. Indian Zool.*, : pl. 95, fig. 5 (type-locality : Ganges).
 1991. *Anguilla bengalensis bengalensis*, Talwar & Jhingran, *Inland Fish.*, 1 : 74 (Species description & distribution).

Common English name : Long-finned eel.

Diagnostic features : Body snake-like and cylindrical in shape. Mouth slightly oblique, extending beyond orbit. Teeth small, conical, present in both jaws and vomer, teeth on lower jaw divided by a longitudinal groove. Dorsal fin origin midway between gill opening and anal-fin base. Pectoral fins well developed. Body yellowish to olive or brown, mottled with dark brown, lighter below.

Distribution : India, Pakistan, Sri Lanka and Myanmar.

Characteristics of juveniles : The colour pattern of the species changes with growth. Body of the juvenile specimens not mottled (changes in colour and in sizes of the eye, mouth and snout with the growth of the fish). Juveniles are found in the seas and estuaries but its adult forms are inhabitants of the freshwaters.

Family OPHICHTHIDAE

2. *Pisodonophis boro* (Hamilton)

1822. *Ophisurus boro* Hamilton, *Fishes of Ganges* : 20, pl. 5, fig. 5 (type-locality : Hooghly estuary near Calcutta).
 1984. *Pisodonophis boro*, Talwar and Kacker, *Commercial Sea Fish. India* : 249, fig. 130 (Species description and distribution).

Common English Name : Bengal's snake eel.

Diagnostic features : Body snake like, cylindrical, compressed only along extreme tail tip. Eyes relatively small. Anterior nostril tubular, posterior nostrils along lower edge of lip. Teeth on

jaws and vomer granular to molariform. Dorsal fin originating about a pectoral fin length behind tips of pectoral fins; pelvic fins absent. Lateral line inconspicuous.

Distribution : Indo-West Pacific.

Characteristics of juveniles : The teeth pattern of this species changes with the growth. Teeth on jaws in the juveniles sharper and more pointed.

Order 2 SILURIFORMES

Family ARIIDAE

Keys to species

Teeth on palate as a single patch on each side *Arius maculatus*

Teeth on palate in 2 or 3 patches on each side *Arius thalassinus*

3. *Arius maculatus* (Thunberg)

1792. *Silurus maculatus* Thunberg, *Kongl. Vet. Akad. Nya Handl. Stockholm*, **13** : 31, pl. 1, fig. 2 (type-locality : Japan).

1984. *Arius maculatus*, Talwar & Kacker, *Commercial Sea Fish. India* : 264, fig. 107 (Species description & distribution).

Common English Name : Spotted catfish.

Diagnostic features : Dorsal profile of head as a steep slope to first dorsal fin base. Three pairs of barbels around mouth, maxillary pair slightly shorter, not extending up to pectoral fin base. Teeth on palate granular or molariform, in a single large, fully elliptical or semioval patch on each side. First dorsal fin ray often produced into a long filament.

Distribution : India, Pakistan, Sri Lanka to Indo-Australian Archipelago, but not the Philippines and Australia.

Characteristics of the juveniles : The size of the maxillary barbels differs between its juveniles and adult forms. Maxillary barbels comparatively larger, extending up to pectoral fin base in the juveniles. The teeth pattern also differs between its juveniles and adults. Size of teeth patch small and far behind the jaws, the granular teeth few and sparse.

4. *Arius thalassinus* (Ruppell)

1837. *Bagrus thalassinus* Ruppell, *Neue. Wirbelth. Fische Rothen Meeres* : 75, pl. 20, fig. 2 (Type-locality : Mossaua, Red Sea).

1984. *Arius thalassinus*, Talwar & Kacker, *Commercial Sea Fish India* : 271, fig. 11 (Species description & distribution).

Common English Name : Giant marine catfish.

Diagnostic features : Dorsal profile of head sharply rising from occiput to first dorsal fin base. Head shields weakly granulated and rugose, a prominent preorbital conical protuberance tapering as a wide 'V' posteriorly. Teeth in jaws villiform, teeth on palate fine, in 3 patches on either side, forming a triangle, posterior patch longest, patches usually fused. Dorsal and pectoral fins each with a strong spine.

Distribution : Widespread in the Indo-West Pacific region.

Characteristics of juveniles : The teeth pattern of this species differs between its juveniles and adult forms. Teeth patches in the juveniles separate.

Order 3 BELONIFORMES

Family BELONIDAE

5. *Tylosurus crocodilus crocodilus* (Peron & Le Sueur)

1821. *Belone crocodila* Peron and Le Sueur, *J. Acad. Nat. Sci. Philad.*, 2(2) : 129 (type-locality : Isle of France).

1981. *Tylosurus crocodilus crocodilus*, Talwar and Kacker, *Commercial Sea Fish. India* : 326, fig. 134 (Species description and distribution).

Common English Name : Hound needlefish.

Diagnostic features : Body elongate, rounded in cross section. Upper and lower jaws greatly elongated and studded with sharp teeth. Dorsal fin with 22 or 23 soft rays. Anal fin with 18 to 21 soft rays. Caudal fin forked. A small black lateral keel on caudal peduncle. Body dark bluish green above, silvery below. A dark blue stripe along sides.

Distribution : A worldwide species in tropical and warm temperate seas.

Characteristics of juveniles : The teeth pattern of this species differs between its juveniles and adult forms. Teeth directed anteriorly in juveniles. An elevated black lobe in the posterior part of the dorsal fin present in the juveniles.

Order 4 PERCIFORMES

Keys to families of order PERCIFORMES

- 1a. Two short dorsal fins, widely separated 2
- 1b. Dorsal fin either one or two (when two, with continuous bases, but if (rarely) the fins are separate, the interspaces is negligible) 3
- 2a. Lateral line well developed; first dorsal fin with 5 spines; jaws with strong canine teeth *Sphyraenidae*
- 2b. Lateral line absent; first dorsal fin with 4 spines; teeth in jaws small, feeble, hidden or absent *Mugilidae*

- 3a. Dorsal and anal fins each with only soft rays, without spines 4
- 3b. Dorsal and anal fins each with spines and soft rays 5
- 4a. Head flattened with a characteristic transversely laminated, oval-shaped sucking disc *Echeneidae*
- 4b. Head without sucking disc *Coryphaenidae*
- 5a. Premaxillae fixed (non protrusible upper jaw) *Scombridae*
- 5b. Maxillary bones not very firmly attached to premaxillae, hence free to move forward 6
- 6a. First 2 anal fin spines detached from rest of fin (these are partially or completely embedded in large specimens); scutes on straight part of lateral line usually present *Carangidae*
- 6b. First 2 anal fin spines not detached from rest of fin; no scutes on caudal peduncle 7
- 7a. Anterior rays of soft dorsal and anal fins markedly elongated, giving both fins a sickle shape; pelvic fins usually small or vestigial *Monodactylidae*
- 7b. Anterior rays of soft dorsal and anal fins not elongated, when elongate they do not give either fin a sickle-shape; pelvic fins not small or vestigial 8
- 8a. Body very deep, its maximum depth more than half total length; single dorsal fin, spines clearly distinguishable 9
- 8b. Body oblong or fairly deep, its maximum depth less than half total length; when deep-bodied and with a single dorsal fin, there are no spines or spiny rays hard to distinguish from soft rays 11
- 9a. Anal fin with 4 spines; gill membranes narrowly united to isthmus *Scatophagidae*
- 9b. Anal fin with 3 spines; gill membranes broadly united to isthmus 10
- 10a. Mouth protractile; pectoral fins falcate, longer than head length. Maxillae distally exposed *Drepanidae*
- 10b. Mouth not protractile or scarcely so; pectoral fins short, rounded, short than head length; Maxillae distally hidden *Ephippidae*
- 11a. Pelvic fins without an axillary scale *Teraponidae*
- 11b. Pelvic fins usually with an axillary scale 12
- 12a. Anal fin with 2 spines *Sciaenidae*
- 12b. Anal fin with 3 spines 13
- 13a. Mouth moderately protractile *Lutjanidae*
- 13b. Mouth strongly protractile 14
- 14a. Head usually naked (but small scales on cheek in few species), upper surface with bony ridges with a nuchal spine on nape; gill membrane united with isthmus *Leiognathidae*
- 14b. Head entirely covered with clearly visible scales, upper surface smooth; gill membranes free from isthmus *Gerreidae*

Family TERAPONIDAE

6. *Terapon theraps* (Cuvier)

1828. *Terapon theraps* Cuvier, *Hist. Nat. Poiss.*, 3 : 129, pl. 53 (type-locality : Java, Mahe).
 1984. *Terapon theraps*, Talwar and Kacker, *Commercial Sea Fish, India* : 409, fig. 157 (Species description and distribution).

Common English Name : Largescaled terapon.

Diagnostic features : Body moderately deep, compressed. Jaws equal, gape slightly oblique. Preopercle serrate; lower opercular spine very long and strong, extending beyond opercular bone. Caudal fin emarginate. Body with 4 dark brown horizontal stripes; each caudal lobe with one transverse stripe.

Distribution : Indo-West Pacific.

Characteristics of juveniles : The extension of the upper jaw differs between its juveniles and adult forms. Rear end of upper jaw reaching to vertical through anterior margin of eye in the juvenile specimens.

Family ECHENEIDAE

7. *Echeneis naucrates* Linnaeus

1758. *Echeneis naucrates* Linnaeus, *Syst. Nat., ed.*, 10 : 261.
 1986. *Echeneis naucrates*, Heemstra, in Smith & Heemstra, *Smith's Sea Fishes*, : 562, pl. 82.

Common English name : Slender sucker fish.

Diagnostic features : Body elongate, its depth 8 to 14 times in standard length. Jaws broad, the lower projecting beyond upper. First dorsal fin replaced by a transverse laminated, oval cephalic disc (sucking disc) with 16 to 28 laminae; second dorsal long without spines. Anal fin with 29 to 41 rays. Pectoral fins short. Caudal fin almost truncate, middle rays elongated and filamentous in adult. Body with dark longitudinal band on sides bordered with white.

Distribution : Worldwide in tropical and temperate seas.

Characteristics of juveniles : The colour pattern differs between its juveniles and adult forms. Upper and lower margins of fins white. The shape of the caudal fin also changes between its juveniles and adult forms. In juveniles the shape of the caudal fin is lanceolate.

Family CARANGIDAE

Keys to genera and species of family CARANGIDAE

- 1a. Posterior part of lateral line with hardened scutes; pectoral fins long and falcate, generally longer than head 2
 1b. No scutes in lateral line (only pored scales, not enlarged); pectoral fins short and not falcate, shorter than head 7

- 2a. Pelvic fins inserted distinctly anterior to a vertical line through pectoral fin base
.....*Parastromateus niger*
- 2b. Pelvic fins not inserted distinctly anterior to a vertical line through pectoral fin base 3
- 3a. Body superficially naked, scales minute and embedded when present; anterior soft rays of dorsal and anal fins filamentous in juveniles 4
- 3b. Small scales present over most of body; anterior soft rays of dorsal and anal fins not filamentous in juveniles 5
- 4a. Profile of nape and head broadly rounded; suborbital depth relatively narrow, 1.7 to 3.0 times in upper jaw length; gillrakers (excluding rudiments) on lower limb of first arch 12 to 17 *Alectis ciliaris*
- 4b. Profile of nape and head somewhat angular; suborbital depth relatively broad, 0.8 to 1.0 times in upper jaw length; gillrakers (excluding rudiments) on lower limb of first arch 21 to 26 *Alectis indicus*
- 5a. Tongue, roof and floor of mouth white, the rest dark; anal fin spines reduced or reabsorbed *Uraspis uraspis*
- 5b. Lining of mouth not distinctly white or dark; anal fin spines normal and movable 6
- 6a. Belly with a deep median groove, accommodating pelvic fins, anus and anal fin spines; pelvic fins conspicuously long and black, tip of appressed fins extending almost to base of anal fin*Atropus atropos*
- 6b. Belly without median groove; pelvic fins not conspicuously long and black
..... *Gnathanodon speciosus*
- 7a. Posterior soft dorsal and anal fin rays not consisting of semidetached finlets; upper lip separated from snout at middle by a continuous deep groove *Trachinotus blochii*
- 7b. Posterior soft dorsal and anal fin rays consisting of semidetached finlets, distal ¼ to ½ of rays not connected by interradiation membrane; upper lip joined to snout at middle by a bridge of skin and crossed by a shallow groove 8
- 8a. Total gillrakers on first arch 11 to 15; lobe of dorsal fin uniformly pigmented
..... *Scomberoides tala*
- 8b. Total gillrakers on first arch 21 to 27; distal half of dorsal fin lobe abruptly and heavily pigmented.....*Scomberoides lysan*

8. *Alectis ciliaris* (Bloch)

1788. *Zeus ciliaris* Bloch, *Naturges. Ausland. Fische*, 6 : 29, and pl. 119 (type locality : East Indies).
 1984. *Alectis ciliaris*, Talwar and Kacker, *Commercial Sea Fish, India* : 434 (Species description and distribution).

Common English Name : African pompano.

Diagnostic features : Body strongly compressed and deep. Profile of nape and head broadly rounded. Suborbital depth narrow. Upper jaw reaching to below vertical from front edge of middle of eye. Dorsal fin with 18 to 20 soft rays and anal fin with 15 to 17 soft rays. Body superficially naked, scales minute and embedded when present. Body and head silvery-blue above, silvery below.

Distribution : Worldwide in tropical marine waters.

Characteristics of juveniles : The shape of the dorsal and anal fins differs between its juveniles and adult forms. Anterior soft rays of dorsal and anal fin extremely long and filamentous in juveniles. Body with 5 to 7 dark transverse bands.

Remarks : Adults are usually solitary and frequently found in shallow coastal waters up to 100 m. depth. Juveniles are usually pelagic and drifting.

9. *Alectis indicus* (Ruppell)

1828. *Scyris indicus* Ruppell, *Atlas, Nordl. Afrika Fische Rothen Meeres* : 128, pl. 33, fig. 1 (type-locality : Djedda, Red Sea).

1984. *Alectis indicus*, Talwar & Kacker, *Commercial Sea Fish India* : 435, fig. 167 (Species description and distribution).

Common English Name : Indian threadfish.

Diagnostic features : Body deep and strongly compressed. Profile of nape and head somewhat angular. Suborbital depth broad. Dorsal fin with 18 to 20 soft rays and anal fin with 15 to 17 soft rays. Body mostly silvery with a dusky green tinge dorsally.

Distribution : Indo-West Pacific.

Characteristics of juveniles : The shape of the dorsal and anal fins differs between its juveniles and adult forms. Anterior soft rays of dorsal and anal fin extremely long and filamentous and the shape of pelvic fins are elongate and falcate in juveniles. Body of juveniles with dark bars and also on elongate parts of dorsal, anal and pelvic fins with dusky pits.

Remarks : Adults are in large shoals but juveniles are solitary and often enter estuaries.

10. *Atropus atropus* (Schneider)

1801. *Brama atropus* Schneider, *Syst. Ichth.* : 98 (type-locality : Tranquebar).

1984. *Atropus atropus*, Talwar and Kacker, *Commercial Sea Fish India* : 442, fig. 170 (Species description and distribution).

Common English Name : Cleftbelly trevally.

Diagnostic features : Body strongly compressed, more or less ovate. Abdomen with a deep median groove, accommodating pelvic fins, anus and anal fin spines. Pelvic fins considerably

long, tips of appressed fin extending almost to anal fin origin. Caudal fin forked. Head and body bluish-green above, silvery below. Membranes of pelvic fins black with the rays white basally.

Distribution : Widespread in the Indo-Pacific.

Characteristics of juveniles : The colour pattern of this species differs between its juveniles and adult forms. Body of juveniles with prominent dark bands and opercular spot.

11. *Gnathanodon speciosus* (Forsskal)

1775. *Scomber rim speciosus* Forsskal, *Descript. Animal.* : 54 (type-locality : Red Sea, Arabia).

1984. *Gnathanodon speciosus*, Talwar and Kacker, *Commercial Sea Fish. India* : 470, fig. 181 (Species description and distribution).

Common English Name : Golden trevally.

Diagnostic features : Body compressed, oblong. Lips noticeably papillose; upper jaw strongly protractile; no teeth in jaws. Caudal fin deeply forked. Breast completely scaled. Black bands fade with growth and replaced by a few black patches or spots on sides. Body colour becomes yellow-green dorsally, pale yellow below.

Distribution : Indo-West Pacific.

Characteristics of juveniles ; The teeth pattern of this species differs between its juveniles and adult forms. Lower jaw of juveniles with feeble teeth. The colour pattern also differs with its adult forms. Body colour of the juveniles silvery to yellow with 7 to 11 black bands, usually alternately broad and narrow.

12. *Parastromateus niger* (Bloch)

1795. *Stromateus niger* Bloch, *Naturges, ausland. Fische*, 9 : 93, pl. 422 (type-locality : "Malaisch" = Malaya).

1984. *Parastromateus niger*, Smith-Vaniz, in Fischer and Bianchi, *FAO species Identification Sheets*, FAO, Rome.

Common English Name : Black pomfret.

Diagnostic features : Body diamond-shaped, fairly deep and compressed. Dorsal and anal fins long and with spines. Pectoral fins long and falcate. Pelvic fins absent in adult specimens. Caudal fin forked. Scales on lateral line scute-like on caudal peduncle. Body uniformly silvery grey to bluish brown.

Distribution : Indo-West Pacific.

Characteristics of juveniles : The position of pelvic of this species differs with its juveniles and adult forms. Pelvic fins distinctly anterior to a vertical line through pectoral fin base in juveniles. Juveniles with dark vertical bars and long black jugular pelvic fins as well as dorsal and anal fins black.

13. *Scomberoides lysan* (Forsskal)

1775. *Scomber lysan* Forsskal, *Descript. Animal.*, : 54 (type-locality : Djedda and Lohaja, Red Sea).

1984. *Scomberoides lysan*, Talwar and Kacker, *Commercial Sea Fish. India* : 477 (Species description and distribution).

Common English Name : Doublespotted queenfish.

Diagnostic features : Body oblong to elliptical, strongly compressed, with a pointed snout and a slight depression over eyes. Upper lip joined to snout at midline by a bridge of skin except crossed by a shallow groove in juveniles. Adult specimens with teeth in inner row equal in size to those in outer row. No scutes; scales on midbody below lateral line partially embedded and lanceolate. No caudal peduncle grooves. Adult specimens with a double series of 6 to 8 dusky roundish blotches above and below lateral line.

Distribution : Widespread in the tropical Indo West Pacific.

Characteristics of juveniles : The teeth pattern of this species differs between its juveniles and adult forms. In juveniles lower jaw with 2 rows of teeth separated by a shallow groove. Dusky rounded blotches on body absent in juveniles.

14. *Scomberoides tala* (Cuvier)

1831. *Chorinemus tala* Cuvier, *Hist. Nat. Poiss.*, 8 : 377 (type-locality : Malabar).

1984. *Scomberoides tala*, Talwar and Kacker, *Commercial Sea Fish. India* : 478 (Species description and distribution).

Common English Name : Barred queenfish.

Diagnostic features : Body strongly compressed and elongate, with a concave profile and a pointed snout. Upper jaw extends slightly beyond posterior margin of orbit. Teeth in upper jaw in a single row and in two rows in lower jaw. Body without scutes. Scales on midbody below lateral line partly embedded and lanceolate. Head and body greenish-grey dorsally, grey to silvery below. Sides of adult 4 to 8 vertically elongate plumbeous blotches, most of which intersect lateral line.

Distribution : Widely distributed throughout the Indo-Australian Archipelago and the Bay of Bengal in the Indian Ocean.

Characteristics of juveniles : The teeth pattern of this species differs between its juveniles and adult forms. The anterior teeth in upper jaw enlarged and canine-like in the juveniles. Vertical blotches on sides of the juveniles either absent or indistinct.

15. *Trachinotus blochii* (Lacepede)

1801. *Caesiomorus blochii* Lacepede, *Hist. Nat. poiss.*, 3 : 92, 95, pl. 3, fig. 2 (type-locality : Madagascar).

1984. *Trachinotus blochii*, Talwar and Kacker, *Commercial Sea Fish. India* : 487, fig. 188 (Species description and distribution).

Common English Name : Snubnose pompano.

Diagnostic features : Body subovate and compressed, profile of snout broadly rounded. Both jaws with bands of small villiform teeth, absent in adults above 200 mm standard length. Tongue toothless. Dorsal fin dark, lobe of fin dusky orange. Anal fin dusky to dirty orange, lobe with a brownish anterior margin.

Distribution : Widespread in the tropical Indo-West Pacific.

Characteristics of juveniles : The teeth pattern of this species differs between its juvenile and adult forms. Juveniles with 2 or 3 slender teeth present on tongue. Body of juveniles silvery with pale fins, except lobes of median fins brownish to dirty orange.

16. *Uraspis helvolus* (Forster)

1775. *Scomber helvolus* Forster, *Descript. Animal.* : 414 (type-locality : Ascension Island Ocean).

1984. *Uraspis helvolus*, Talwar and Kacker, *Commercial Sea Fish. India* : 492 (Species description and distribution).

Common English Name ; White tongue jack.

Diagnostic features : Body oblong and compressed. Dorsal profile strongly convex. Snout broadly rounded. Teeth in both jaws numerous, conspicuous, acute and curved, uniserial in adult specimens. Detached 2 anal spines, almost embedded in adults. Pectoral fins in adults long and falcate reaching beyond join of curved and straight lateral line. Head dusky to black, with a large, diffuse black opercular blotch. Body dusky to black dorsally, lighter below and 6 to 7 wide, dark bars and narrow pale interspaces.

Distribution : The Red Sea, Gulf of Oman. India through the East Indies to New Zealand.

Characteristics of juveniles : The teeth pattern of this species differs between its juvenile and adult forms. Teeth in 2 or 3 rows only in the juveniles. The colour pattern also changes with the growth of this species, Dark bars on juveniles extend onto second dorsal and anal fins.

Family CORYPHAENIDAE

17. *Coryphaena hippurus* Linnaeus

1758. *Coryphaena hippurus* Linnaeus, *Systema Naturae*, ed. 10 : 261 (type-locality : Open seas).

1984. *Coryphaena hippurus*, Talwar and Kacker, *Commercial Sea Fish. India* : 493, fig. 190 (Species description and distribution).

Common English Name : Common dolphin fish.

Diagnostic features : Body elongate, compressed and very deep. Head profile becomes vertical with development of a bony crest, especially in male adult specimens Dorsal fin extending from above eyes almost to caudal fin. Anal fin concave, extending from vent almost to caudal fin.

Caudal fin deeply forked. Back brilliant metallic blue-green, flanks silvery with golden sheen, and a row of dark spots or golden blotches running beside dorsal fin. Pectoral and pelvic fins pale. Caudal fin silvery, with a golden sheen.

Distribution : Tropical and subtropical seas of the world.

Characteristics of juveniles : The shape of this species differs between its juveniles and adult forms. Body of the juveniles slender, elongate with head profile slightly convex. Tips of the caudal fin lobes white and pelvic fins black.

Family LEIOGNATHIDAE

Keys to genera and species

- 1a. Mouth oblique, pointed forward when protracted *Secutor ruconius*
- 1b. Mouth horizontal, pointing forward or downward when protracted 2
- 2a. Second dorsal fin spines or both second and anal fin spines distinctly elongated; no spot on caudal peduncle *Leiognathus brevirostris*
- 2b. Second dorsal and anal fin spines not elongated; a dark brown saddle on caudal peduncle present *Leiognathus equulus*

18. *Leiognathus brevirostris* (Valenciennes)

1835. *Equula brevirostris* Valenciennes, *Hist. Nat. Poiss.*, : 10 : 83 (type-locality : Malabar).

1984. *Leiognathus brevirostris*, Talwar and Kacker, *Commercial Sea Fish. India* : 506, fig. 196 (Species description and distribution).

Common English Name : Short nose pony fish.

Diagnostic features : Body oval and compressed. Dorsal and ventral profiles equally convex, dorsal profile showing a distinct notch at the commencement of the nuchal crest. Head and breast scaleless. Abdomen silvery. Back with dark, wavy vertical lines extending down to about lateral line. A brown blotch on nape. A prominent eye-sized, rather diffuse, golden yellow patch on abdomen. Spinous part of dorsal fin golden at mid-height, the distal half grey.

Distribution : Seas of India, Sri Lanka, through the East Indies, to China and the Philippines.

Characteristics of juveniles : The colour pattern of this species between its juveniles and adult forms. The distal half of spinous dorsal fin black in the juveniles.

19. *Leiognathus equulus* (Forsskal)

1775. *Scomber equula* Forsskal, *Descript. Animal* : 75 (type-locality : Red Sea).

1984. *Leiognathus equulus*, Talwar and Kacker, *Commercial Sea Fish. India* : 510, fig. 198 (Species description and distribution).

Common English Name : Common pony fish.

Diagnostic features : Body deep and compressed with a strongly humped back. Mouth pointing downward when protracted. Head and breast scaleless. Dorsal surface greyish, abdomen silvery and close-set faint bars on back and sides; a dark brown saddle on caudal peduncle.

Distribution : Widespread in the tropical Indo-West Pacific.

Characteristics of juveniles : In juveniles thin, closely arranged grey vertical lines descending from back to about mid-height. Membranes anal fin spines conspicuously yellow. Posterior margins of caudal fin lobe pale yellow.

20. *Secutor ruconius* (Hamilton)

1822. *Chanda ruconius* Hamilton, *Fish of Ganges* : 106, 371, pl. 12, fig. 35 (type-locality : estuary of the Ganges River).

1984. *Secutor ruconius*, Talwar and Kacker, *Commercial Sea Fish. India* : 519, fig. 205 (Species description and distribution).

Common English Name : Deep pugnose pony fish.

Diagnostic features : Body oval, very deep and compressed. Mouth small, pointing upward when protracted. Lateral line ending below about middle of soft portion of dorsal fin. Scales present on cheek. Body silvery with blue spots on upper half. A prominent curved black band running from lower margin of eye to beyond posterior angle of lower jaw. Underside of pectoral fin base black.

Distribution : Tropical Indo-West Pacific.

Characteristics of juveniles : In juveniles body with blue spots forming 10 to 12 vertical bars.

Family GERREIDAE

21. *Gerres abbreviatus* Bleeker

1850. *Gerres abbreviatus* Bleeker, *Nat. Tijdschr. Ned.-Indie*, 1 : 103 (type-locality : Batavia).

1984. *Gerres abbreviatus*, Talwar & Kacker, *Commercial Sea Fish. India* : 579, fig. 227 (Species description and distribution).

Common English Name : Deepbody mojarra.

Diagnostic features : Body deep, forming a sharp angle at dorsal fin origin. Mouth small, strongly protractile. Spines strong, particularly the second anal. Pectoral fin long, tip of depressed fin reaching to or past level of base of first anal spine. Caudal fin strongly forked. Body silvery, with indistinct, fine dark stripes following scale rows.

Distribution : Indo-West Pacific.

Characteristics of the juveniles : In juveniles 7 to 11 slender prominent dark bars along sides. Dorsal fin edged with black.

Family LUTJANIDAE

22. *Lutjanus johni* (Bloch)

1792. *Anthias johni* Bloch, *Naturges. Ausland. Fishche*, 6 : 113, 318 (type-locality : Surat).
1984. *Lutjanus johni*, Talwar & Kacker, *Commercial Sea Fish. India* : 541, fig. 212 (Species description and distribution).

Common English Name : John's snapper.

Diagnostic features : Body moderately deep, with head profiles straight or slightly convex. Interopercular knob absent. Second and third anal spines strong and about same length. Caudal fin very slightly concave. Scales fairly large; scales on head beginning above middle of eyes; soft dorsal and anal fins with a scaly sheath; longitudinal scales rows above lateral line parallel to it and those below lateral line horizontal. Body silvery green or bronze-red, with a distinct dark spot on each scale. A large dark blotch usually presents above lateral line at junction of spinous and soft dorsal fins.

Distribution : Indo-West Pacific.

Characteristics of the juveniles : The colour pattern of this species differs between its juvenile and adult forms. In juveniles the dark spot above lateral line at the junction of spinous and soft dorsal fins usually surrounded by a silvery ring, which disappears, with the growth of the fish.

Family SCIAENIDAE

23. *Otolithes ruber* (Schneider)

1801. *Johnius ruber* Schneider, *Syst. Ichth. Bloch* : 75, pl. 17 (type-locality : Tranquebar).
1984. *Otolithes ruber*, Talwar & Kacher, *Commercial Sea Fish. India* : 664, fig. 267 (Species description and distribution).

Common English Name : Tigertooth Croaker.

Diagnostic features : Body slender, depth 4 to 5 times in standard length. Mouth large, terminal, the lower jaw slightly projecting. Teeth in two rows in upper jaw with 1 or 2 pairs of strong canine teeth at front, a pair of canine teeth at tip of lower jaw. Anal fin with 2 spines and 7 soft rays, the second spine short and weak. Caudal fin rhomboid. Swimbladder with 32 to 36 pairs of arborescent appendages, none extending into the head. Body silvery, with no distinctive markings.

Distribution : East coast of Africa, throughout the Indian Ocean and the Indo-Australian Archipelago.

Characteristics of the juveniles : The shape of the caudal fin changes with the growth of this fish. In juveniles the caudal fin is pointed but in adults it is rhomboid in shape.

Family EPHIPPIDAE

24. *Ephippus orbis* (Bloch)

1787. *Chaetodon orbis* Bloch, *Naturges. ausland. Fische*, 3 : 81, pl. 202, fig. 2 (type-locality : East Indies).

1984. *Ephippus orbis*, Talwar & Kacker, *Commercial Sea Fish. India* : 700, fig. 284 (Species description and distribution).

Common English Name : Spadefish.

Diagnostic features : Body deep, almost circular, strongly compressed, and not angular at dorsal and anal fin origin. Mouth small, terminal, and not protractile. Teeth in bands, setiform, none on palate. Dorsal fin with one inconspicuous forwardly pointing spine. Gill cover with scale almost to its ventral edge. Body silvery, with 4 or 5 vertical black bars on body from dorsal fins almost to abdomen.

Distribution : Indo-West Pacific.

Characteristics of the juveniles : The colour pattern changes with growth. In juveniles two dark bars, one through eye and another one on nape present, disappear in adults.

Family SCATOPHAGIDAE

25. *Scatophagus argus* (Linnaeus)

1766. *Chaetodon argus* Linnaeus, *Systema Naturae*, ed. 12, 1 : 464 (type-locality : India).

1984. *Scatophagus argus*, Talwar and Kacker, *Commercial Sea Fish. India* : 704, fig. 286 (Species description and distribution).

Common English Name : Spotted scat.

Diagnostic features : Body quadrangular, strongly compressed. Forehead steep. Mouth small, with brush-like teeth. Dorsal fin with 11 spines, the membranes deeply incised between spines; middle of dorsal fin with a deep notch. Body greenish to silvery with numerous dark spots mainly restricted to upper part of sides; no bars on body.

Distribution : India, Sri Lanka, through the East Indies to China, Taiwan, the Philippines and Queensland.

Characteristics of the juveniles : The colour pattern changes with the growth of this fish. In juveniles bars present on the body which disappear in adults.

Family DREPANIDAE

26. *Drepane punctata* (Linnaeus)

1758. *Chaetodon punctata* Linnaeus, *Systema Naturae*, 1 (ed 10) : 273 (type-locality : Asia).

1984. *Drepane punctata*, Talwar & Kacker, *Commercial Sea Fish. India* : 697, fig. 283 (Species description and distribution).

Common English Name : Spotted sickle fish.

Diagnostic features : Head and body deep, strongly compressed. Mouth protrusible. Teeth pointed, slender, crowded together. Dorsal fin with 8 to 9 spines, fourth one longest. Pectoral fin long and pointed, reaching to base of caudal fin. 4 to 11 vertical bars of small black spots on upper half of body.

Distribution : Indo-West Pacific.

Characteristics of the juveniles : Juvenile specimens with a fringe of 4 to 6 short cirri ventrally on lower jaw. But cirri absent in adults.

Family MUGILIDAE

27. *Liza parsia* (Hamilton)

1822. *Mugil parsia* Hamilton, *Fish. Ganges* : 215, pl. 17, fig. 71 (type-locality : River Hooghly).

1984. *Liza parsia*, Talwar & Kacker, *Commercial Sea Fish. India* : 721 (Species description and distribution).

Common English Name : Goldspot mullet.

Diagnostic features : Body robust, head wide, dorsally flattened. Fatty tissue covers most of the posterior iris. Lips thin, lower lip with a high symphysial knob. Hind end of upper jaw reaching vertical between posterior nostril and anterior rim of eye. Mid-gape above horizontal line through entire of pupil. First dorsal fin origin nearer to snout tip than to caudal fin base. Second dorsal fin origin at vertical between 1/3 and 1/2 along the anal fin base. Pectoral axillary scales absent. Caudal fin slightly forked. Scale on body ctenoid. Body greenish-brown above, white to silvery below; a golden spot on upper gill cover.

Distribution : Seas and estuaries of India, Sri Lanka and Pakistan.

Characteristics of the juveniles : The scale pattern changes with growth. In juveniles cycloid scales cover body but in adults these are transformed into ctenoid scales.

28. *Liza tade* (Forsskal)

1775. *Mugil crenilabris tade* Forsskal, *Descript. Animal.* : 74 (type-locality : Arabia).

1984. *Liza tade*, Talwar & Kacker, *Commercial Sea Fish. India* : 723, fig. 292 (Species description and distribution).

Common English Name : Tade mullet.

Diagnostic features : Body slender and elongate. Head wide, much depressed and pointed. Fatty tissue covers most of the iris. Lips thin, lower lip with a high symphysial knob. First dorsal fin origin nearer to snout tip than the caudal fin base. Second dorsal fin origin at vertical through posterior half of anal fin base. Pectoral axillary scale absent. Caudal fin forked. Body greenish-brown above, silvery below, often with 5 to 7 indistinct longitudinal bands on upper half of body.

Distribution : Red Sea, Pakistan, India, Sri Lanka, Bangladesh, through the East Indies to China and Marianas.

Characteristics of the juveniles : The position of the first dorsal fin changes from juveniles to adults. In juveniles it is in midway between snout tip and caudal fin base but in adult form dorsal fin inserted nearer to snout tip than base of caudal fin. The colour pattern also changes with growth. In juveniles the longitudinal bands are absent but these bands are often present in adults.

Family SPHYRAENIDAE

29. *Sphyraena jello* Cuvier

1829. *Sphyraena jello* Cuvier, *Hist. Nat. Poiss.*, 3 : 258 (based on Russell's "Jellow"), pl. 174 (type-locality : Vizagapatnam).
1984. *Sphyraena jello*, Talwar & Kacker, *Commercial Sea Fish. India* : 741, fig. 302 (Species description and distribution).

Common English Name : Pickhandle barracuda.

Diagnostic features : Body elongate and more or less rounded. Head large, with a long, pointed snout. Mouth large, maxilla almost extends to front border of eye. Lower jaw projecting. No gillrakers on first arch. Upper and lower gill arch platelets rough, but without distinct spines. First dorsal fin inserted slightly behind pelvic fin origin. Body with small scales. Body blue black or brown above, sides silvery. A dark pattern of serpentine bars reaching a little below lateral line.

Distribution : Indo-West Pacific.

Characteristics of juveniles : The colour pattern change with the growth of this species. In juveniles bars on sides of this species is very distinct but in adults these bars are rather indistinct.

Family SCOMBRIDAE

30. *Scomberomorus commerson* (Lacepede)

1800. *Scomber commerson* Lacepede, *Hist. Nat. Poiss.*, 2 : 598, and pl. 20(1) (based on MS drawing by Commerson) (type-locality : Mauritius).
1984. *Scomberomorus commerson*, Talwar and Kacker, *Commercial Sea Fish. India* : 812, fig. 331 (Species description and distribution).

Common English Name : Narrow-barred Spanish mackerel.

Diagnostic features : Body elongate, rather strongly compressed. Upper jaw extending to hind border of eye or slightly beyond. Gillrakers 0 to 2 on upper limb and 1 to 8 on lower limb of first gill arch. Lateral line abruptly bent downward below end of second dorsal fin.

Body iridescent blue or grey, sides silver with bluish reflections, marked with 20 to 65 thin, wavy vertical bands.

Distribution : Widespread throughout the Indo-West Pacific and Mediterranean.

Characteristics of juveniles : The colour pattern differs between the juvenile and adult stage of this species. In juveniles large black blotches present on the body.

Family MONODACTYLIDAE

31. *Monodactylus argenteus* (Linnaeus)

1758. *Chaetodon argenteus* Linnaeus, *Systema Naturae*, ed. 10, 1 : 272 (type-locality : "Indies").

1984. *Monodactylus argenteus*, Talwar and Kacker, *Commercial Sea Fish. India* : 688, fig. 280 (Species description and distribution).

Common English Name : Silver moony.

Diagnostic features : Body oval, strongly compressed, covered with small deciduous scales extending onto median fins and head. Mouth small and terminal. Jaws with small villiform teeth in bands. Pelvic fins reduced to a short spine. Caudal fin with concave margin. Scales small, ctenoid. Body brilliant silvery, tips of dorsal fin lobe dusky.

Distribution : Widespread in the tropical Indo-Pacific.

Characteristics of juveniles : The pelvic fins of this species are prominent in juveniles but in adults pelvic fins reduced into short spines. The colour pattern also differs between its young and adult stage. In juveniles body with two dusky, curved stripes across head and tip of dorsal fin lobe orange.

SUMMARY

The present study has recorded juveniles of 31 species belonging to 4 orders and 19 families of the marine and estuarine fishes of West Bengal. The morphological features of these juveniles have been recorded under each species along with the diagnostic characteristics of these species, to facilitate their identification.

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ON SOME AMMONOIDEA, PELECYPODA (MOLLUSCA), BRACHIOPODA AND REPTILIAN FOSSILS FROM JURASSIC OF KUTCH, GUJARAT

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INTRODUCTION

The Ammonoidea have been extinct long back but their shells in fossilized forms are seen in all the continental areas and many oceanic islands. Numbers of specimens are well preserved and their significance as a basis for lithostratigraphic interrelation has long been recognized by the palaeontologists. Hence, existing information on this group is sizeable one. The understanding about this group has eventually developed through the study of their shells and enclosing rock matrices, and occasionally of a few preserved opercula. The shells of ammonoids are comparable with those of extinct *Nautilus*, which are considered to be a close relative of the former. The nautiloids and ammonoids constitute the Subclass Terebranchiata. They were widespread in the past but are now represented by several species of the Genus *Nautilus* only. Most ammonoids had a relatively long centre of gravity. However, some forms with body chambers about a volution in length may have been able to invert themselves.

The ancient Terebranchiates lived in the oceans and the seas over the globe and most of the known fossil forms have been recovered from the rocks, which represent shallow water marine deposits. In the Ordovician, they were an eminent group of animals. They continued to thrive in the Silurian, and in early Devonian the ammonoids evolved from the nautiloids. Throughout the Mesozoic period ammonoids were more abundant than the nautiloids. However, at the end of the Mesozoic period the former became extinct and the latter one survived with less occurrence. The ammonoids are excellent stratigraphic indices and the marine strata of late Palaeozoic and the Mesozoic are marked with their representatives. The ammonoids are characteristically tightly coiled in a plane and symmetrical, with a bulbous calcareous protoconch, septa forming angular sutural flexures, and a small marginal siphuncule.

Studies on marine Mesozoic succession of Kutch have brought on record diverse molluscan forms of which ammonoids are prevalent. The first comprehensive work on ammonoid was carried out by Waagen (1873–75) and it was elaborated subsequently by Spath (1927–33). Later on, considerable works have come out on the rock stratigraphy and biostratigraphy of

Kutch (Nath, 1932; Agrwal, 1958; Biswas, 1977; Kanjilal, 1978; Mitra *et al.*, 1979; Krishna, 1984; Bardhan *et al.*, 1988; Singh, 1989; Bardhan *et al.*, 1994a, 1994b; Halder & Bardhan, 1996a, 1996b, 1997 etc.). However, it is presumed that a lot more interesting forms are yet to be recovered from this area. The identification of ammonoids requires a careful approach as many individuals of the same population may exhibit considerable variability in their morphological features. Otherwise, a multiplicity of names or misallocation of names would result out of a non-conservative approach. Exact naming of the species have therefore, not been done in this study but the characters of different forms with illustrations are provided for record and understanding of the others.

The present account incorporates the result of a study of a collection of ammonoids, pelecypods and reptilian fossils from Kutch region of Gujarat State (see Map). Their significance in intercontinental correlation is also indicated herein.

STRATIGRAPHY

Lithologically the Jurassic rocks of Kutch have been divided into four subdivisions *i.e.*, Patcham, Chari, Katrol and Bhuj Formations in ascending order and these range from Bathonian to Aptian ages (Waagen, 1873; Nath, 1932; Mitra *et al.*, 1979; Krishna, 1984; Table 1). The Chari Formation, one of the important units of Mesozoic Kutch, is thick, persistent and exposed throughout the Kutch mainland (Nath, 1932; Biswas, 1977; Mitra *et al.*, 1979). It crops out into several structural domes and attains a maximum thickness of 204 m. (Datta, 1992). It ranges in ages from the Callovian to the Late Oxfordian and with its lower boundary extended into the Late Bathonian (Datta *et al.*, 1996; Halder & Bardhan, 1996). The Chari Formation supports a rich biota in places where the full sequence is exposed (Halder & Bardhan, 1997). Its lithologies include mainly shale, sandstone and limestone which were deposited in a warm shallow marine environment (Datta, 1992; Fürsich & Oschmann, 1993). Upper part of the beds contain diverse fossils, in which ammonites are represented by *Macrocephalites madagascariensis* Lemoine, *Indocephalites chrysoothicus* (Waagen), *Sivajiceras congener* (Waagen), etc. Besides, numerous bivalves, brachiopods, corals and sponges characterize this zone (Halder & Bardhan, 1997). Judging from the ammonite association, especially *Macrocephalites* spp., the beds can be assigned an age range from Upper Bathonian to Lower Callovian (Krishna & Westermann, 1987; Datta *et al.*, 1991; Table 2).

Table 1. Lithostratigraphic divisions of Jurassic of Kutch (modified from Krishna *et al.*, 1983).

| Lithostratigraphic Unit | Age |
|-------------------------|--|
| Bhuj Formation | Upper Tithonian – Aptian |
| Katrol Formation | Kimmeridgian – Lower to Middle Tithonian |
| Chari Formation | Upper Bathonian – Upper Oxfordian |
| Patcham Formation | Bajocian – Bathonian |

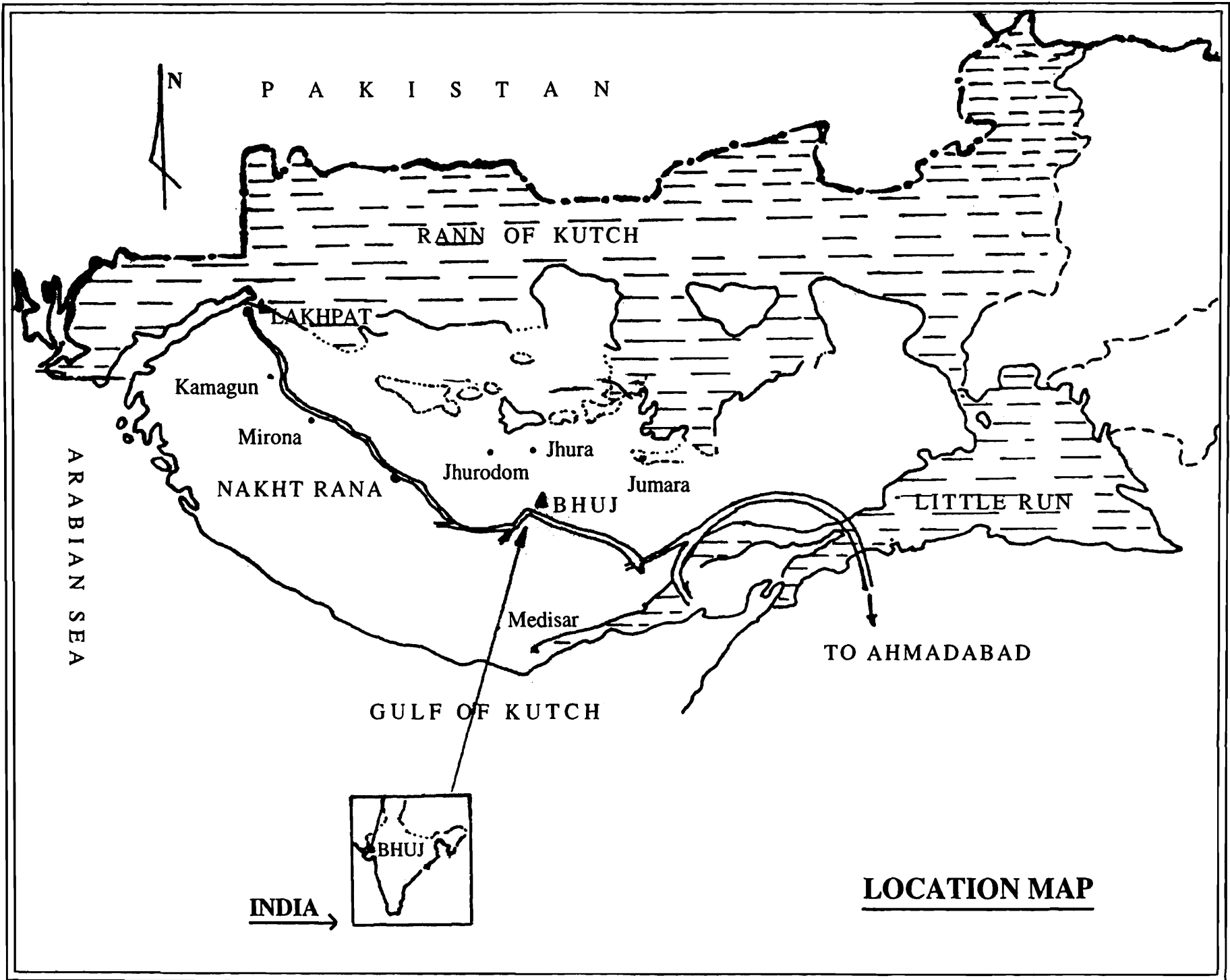


Table 2. Stratigraphic distribution of different ammonites in Kutch (modified from Halder & Bardhan, 1997).

| Age | Zone |
|------------------|--|
| Oxfordian | <i>Mayaites maya</i> |
| Upper Callovian | <i>Peltoceras ponderosum</i> |
| Middle Callovian | <i>Subgrossouvria aberrans</i> |
| | <i>Reineckeia reissi</i> |
| Lower Callovian | <i>Macrocephalites formosus</i> |
| | <i>Macrocephalites chrysoolithicus</i> |
| Upper Bathonian | <i>Macrocephalites triangularis</i> |

STRATIGRAPHIC DISTRIBUTION AND SIGNIFICANCE OF FOSSIL FAUNA

The marine Jurassic sequence of Jhura revealed the existence of rich microfaunal assemblage confined to Patcham and Chari Formations. There is no record of Foraminifera from Katrol Formation. The microfauna is dominated by Foraminifera with representation of ostracods, bryozoans, holothurians, echinoids and minute gastropods (Mandwal & Singh, 1989).

Ammonoids are commonly used as index fossil, because of their widespread occurrence, easy recognition and stable evolution. Many of the 'Faunal zones' recognized in the intercontinental correlation are based on these fossils. Generally, ammonoids evolved from the nautiloids, but intermediate forms are insufficiently known. In recent years however the knowledge of ammonoids has increased considerably (Arkell *et al.*, 1978).

SYSTEMATICS

Class CEPHALOPODA

Order AMMONOIDEA

Suborder AMMONITINA

Family MAYAITIDAE

Genus *Mayaites* Spath

1. *Mayaites* sp. I

Plate A; Fig. 1.

Measurements : Shell diameter-85 cm.; Umbilical diameter-31 cm.; Apertural Height-5.50 cm.; Apertural Width-2.84 cm.

Characters : Giant inflated; coarse-ribbed homeomorphs of *Macrocephalites*, with smooth outer whorl.

Material examined : India : Gujarat : Dist. Kutchch : Jhura, 1 ex., 05.05.2000, Coll. M. K. Naik (ZSI, Calcutta).

Geological age : Oxfordian.

2. *Mayaites* sp. II

Plate A; Fig. 2.

Measurement : Shell diameter—40 cm.; Umbilical diameter—5.9 cm.; Apertural height—6.5 cm.

Characters : Inflated, outer whorl smooth, inner whorl with moderately strong ribbing.

Material examined : India : Gujrat, Dist. Kutch, Habo Dom. 1 ex., 20.iv.2000 Coll. M. K. Naik (ZSI, Kolkata)

Geological age : Upper Oxfordian.

3. *Mayaites* sp. III

Plate A; Fig. 3.

Measurement : Shell diameter—50 cm.; Umbilical diameter—4.8 cm.; Apertural height—5 cm.; Apertural width—5.6 cm.

Characters : Inflated; with coarse, sharp, radiating ribbing on inner whorl, outer whorl smooth.

Material examined : India : Gujarat, Dist. Kutch, Sonaichelly River beds. 1 ex., 22.4.2000 Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Upper Oxfordian.

4. *Mayaites* sp. IV

Characters : Giant, inflated, with smooth outer whorl.

Material examined : India : Gujarat, Dist. Kutch, Keera. 1 ex., 21.iv.2000 Coll. M. K. Naik (ZSI, Kolkata)

Geological age : Upper Oxfordian.

5. *Mayaites* sp. V

Plate A; Fig. 4.

Characters : Inflated, outer whorl smooth, with coarse ribbing on inner whorl, ribs less sharp on upper edge.

Material examined : India : Gujarat, Dist. Kutch, Sonaichelly river beds, Keera sites. 14.4.2000

Geological age : Upper Oxfordian.

6. *Mayaites* sp. VI

Plate B; Fig. 1.

Measurements : Shell diameter–17.9 cm.; Umbilical diameter–6.7 cm.; Apertural height–5.4 cm.*Characters* : Inflated, outer whorl smooth, inner whorl with compressed ribs.*Material examined* : India : Gujarat, Jhura Gram, 7 km. from Jhura, 1 ex., 17.4.2000 Coll. M. K. Naik (ZSI, Kolkata)*Geological age* : Upper Oxfordian.7. *Mayaites* sp. VII

Plate B; Fig. 2.

Measurement : Shell diameter–7.4 cm.; Apertural width–4cm.; Apertural height–2.9 cm.*Characters* : Inflated, outer whorl smooth, smaller specimen.*Material examined* : India : Gujarat, Dist. Kutch, Nakhatrana. 10.iv.2000 Coll. M. K. Naik (ZSI, Kolkata)*Geological age* : Upper Oxfordian.8. *Mayaites* sp. VIII

Plate B; Fig. 3.

Measurement : Umbilical diameter–7.3 cm.; Apertural height–3.7 cm.*Characters* : Inflated, outer whorl smooth, smaller specimen.*Material examined* : India : Gujarat (Jhura in Kuchch Dist.) 1 ex., 22.iv.2000., Coll. M. K. Naik (ZSI, Kolkata).*Geological age* : Upper Oxfordian (Dhosoolite rock).

Family MACROCEPHALITIDAE

Genus *Macrocephalites* Zittel9. *Macrocephalites* sp.

Plate B; Fig. 4

Measurements : Shell diameter–4.8 cm.; Umbilical diameter–1.5 cm.; Apertural height–2 cm.*Characters* : Large to gigantic whorls quadrate in cross section; Juvenile and middle whorls sharply ribbed, with sudden change at adult whorl to strong coarse, distant, ridge or wedge shaped primaries; peristome simple, no constrictions.

Material examined : India : Gujarat, Dist. Kutchch, Jhura, 1 ex., 03.02.1999 Coll. M. K. Naik (ZSI, Calcutta).

Geological age : Upper Oxfordian.

Family PERISPHINETIDAE

Genus *Perisphinctes* Waagen

10. *Perisphinctes* sp. I

Plate C; Fig. 1.

Measurement : Shell diameter–3.6 cm.; Umbilical diameter–1.6 cm.; Apertural height–1.8 cm.

Material examined : India : Gujarat, Dist. Kutch, Jhura Camp, 1 ex., 07.ii.1999, Coll. M. K. Naik (ZSI, Kolkata).

Characters : Small, whorls quadrate, finely ridged. Small, whorls quadrate, finely ribbed.

Geological age : Oxfordian.

11. *Perisphinctes* sp. II

Plate C; Fig. 2.

Measurements : Shell diameter–5.4 cm.; Umbilical diameter–2 cm.; Apertural height–2.6 cm.

Characters : Whorls quadrate, inner and middle whorls moderately sharply ribbed.

Material examined : India : Gujarat, Dist. Kutch, Keera, 5.2.1999, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Oxfordian.

12. *Perisphinctes* sp. III

Plate C; Fig. 3.

Measurements : Umbilical diameter–3.5 cm.; Apertural width–1.5 cm.; Apertural height–1.8 cm.

Characters : Whorls round to depressed, ribbing normal to modified, venter smooth before septation.

Material examined : India : Gujarat, Dist Kutch, Jhura Camp., 7.2.1999, Coll. M. K. Naik (ZSI, Kolkata)

Geological age : Oxfordian.

13. *Perisphinctes* sp. IV

Plate C; Fig. 4.

Measurement : Shell diameter—1.9 cm.

Characters : Ribs remaining close and fine but less distinct on outer whorls, peristome simple.

Material examined : India : Gujarat, Dist Kutch, Jhura, 5.5.2000, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Oxfordian.

Family ASPIDOCERATIDAE

Genus *Peltoceras* Waagen14. *Peltoceras* sp.

Plate D; Fig. 1.

Measurements : Umbilical diameter—4.6 cm.; Apertural height—1.6 cm.; Apertural width—1.5 cm.

Characters : Evolute, whorls hardly overlapping; ribs strong, bifurcating or trifurcating on ventral margin, venter nearly flat, outer whorl with two rows of massive lateral tubercles.

Material examined : India : Gujarat, Dist. Kutch, Jhuragram, 1 ex., 8.5.200. Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Upper Oxfordian.

Family MACROCEPHALITIDAE

Genus *Eucyloceras* Spath15. *Eucyloceras* sp.

Plate D; Fig. 3.

Measurements : Umbilical diameter—6.4 cm.; Apertural height—2.5 cm.

Characters : Involute, compressed; ribbing fine and dense on inner whorls, becoming distant and feeble on outer whorls, especially on venter; sutures simple.

Material examined : India : Gujarat, Dist. Kutch, Jhuragram, 1 ex., 5.v.2002, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Upper Oxfordian

16. *Coquina*

Composite fossil fragment

Gastropod and Bivalvia

Characters : Composite fossil fragment rock constructed with Gastropoda and Bivalvia shells. Composing various colour; mainly with red and rock colour. Lying on superficial layer.

Material examined : India : Gujarat, Dist. Kutch, Jhura Camp. 1 ex., 8.ii.1999.

Geological age : Presumably Upper Oxfordian.

Family MAYAITIDAE

Genus *Epimayaites* Spath

17. *Epimayaites* sp. I

Plate D; Fig. 4.

Measurements : Shell diameter–34 cm.; Umbilical diameter–10.4 cm.; Apertural height–5.3 cm.

Characters : Ribbing projected on venter, sutures simpler than in *Mayaites*

Material examined : India : Gujarat, Dist. Kutch, Jhuragram, 1 ex., 10.ii.99, Coll. M. K. Naik (ZSI, Kolkata)

18. *Epimayaites* sp. II

Plate E; Fig. 1.

Characters : Ribbing projected on venter, sutures simpler than in *Mayaites*; species appear to be transitional from *Pachyceras*.

Material examined : India : Gujarat, Dist. Kutch, Keera. 1 ex., 7.2.99. Coll. M. K. Naik (ZSI, Kolkata).

19. *Epimayaites* sp. III

Plate E; Fig. 2.

Measurements : Shell diameter–9 cm.; Apertural width–6.5 cm.; Apertural height–3 cm.

Characters : Inflated, coarse-ribbed on outer whorls.

Material examined : India : Gujarat, Dist. Kutch, Jhura Camp, 1 ex., 14.4.2000, Coll. M. K. Naik (ZSI, Kolkata)

Geological age : Upper Oxfordian.

20. *Epimayaites* sp. IV

Plate E; Fig. 3.

Character : Small, with lappets, inner whorls with strong ribbing.*Material examined* : India : Gujarat, Dist. Kutch, Jhura Camp. 1 ex., 22.iv.2000, Coll. M. K. Naik (ZSI, Kolkata)*Geological Age* : Oxfordian.Genus *Pleurocephalite* Buckman21. *Pleurocephalites* sp.

Plate E; Fig. 4.

Measurements : Shell diameter–19 cm.; Umbilical diameter–5.2 cm.; Apertural height–2.4 cm.*Characters* : Involute, globular, sharply ribbed with moderately complex structures which typically differ from those of Tutilidae in having slender, pointed 2nd lateral lobe with single central main stem (transition from bifid type of 2nd lateral lobe being seen in *Moricisiceras*). Body chamber smooth in many genera but seldom markedly contracted or eccentric; peristome never collared, flared or constricted. Depressed to cadicone, strongly ribbed to end of adult umbilical wall.*Material examined* : India : Gujarat, Dist. Kutch, Habodom, 5.5.2000, Coll. M. K. Naik (ZSI, Kolkata)*Distribution* : Kutch Region, Gujarat. Other occurrences : North Africa, Kenya, Baluchistan.*Geological age* : Upper Oxfordian.

Class PELECYPODA (Bivalvia)

22. *Oyester shell*

Plate F; Fig. 1.

Measurement : Shell diameter–6.2 cm.; Apertural Width–5 cm.; Apertural Height–2.5 cm.*Characters* : Impression clear and prominent, ray-like structure, back portion suture-like, overall shape semiround. Inner whorls as in *Kossmaticeras* but more inflated, outer whorls with more or less flat parallel sides and broad fastigate venter and with regular tuberculate ribs, ribs coarsen suddenly on body chamber.*Material examined* : India : Gujarat, Dist. Kutch, Jhura dom. 1 ex., 13.iv.2000., Coll. M. K. Naik (ZSI, Kolkata)*Geological age* : Presumably Upper Oxfordian.

23. Oyster shell

Measurements : Shell diameter—4.2 cm.

Characters : Crystal formation on the fragment portion ribbed with wave like structure, back portion suture like and outline of shell orbicular.

Material examined : India : Gujarat, Dist. Kutch, Jhura Camp, 1 ex., 15.4.2000, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Presumably Upper Oxfordian.

24. Oyster shell

Plate F; Fig. 3.

Measurement : Specific measurement not recorded.

Characters : Strong chomata and several strong, continuous and moderately narrow radial ribs on valve, moderately prominent umbo.

Material examined : India : Gujarat, Dist. Kutch, Habodom. 1 ex, 15.4.2000, Coll. M. K. Naik (ZSI, Kolkata)

Geological age : Presumably Upper Oxfordian.

Phylum **BRACHIOPODA**

Class **ARTICULATA**

Order **PALAEOTREMATA**

Family **TERIBRATULIDAE**

Genus *Terebratula* Bruguiere

25. *Terebratula* sp.

Plate D; Fig. 2.

Measurements : Umbilical diameter—3.4 cm.; Apertural height—1.5 cm.

Characters : Tortoise shaped back portion oval, wavy mouth portion curved towards lower side; upper side deep spotted with bird's beak-like structure.

Material examined : India : Gujarat : Dist. Kutch, Jhura, 1 ex., 07.v.2002, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Upper Oxfordian.

Phylum CHORDATA

Class REPTILIA

Subclass ANAPSIDA

Order CHELONIA

26. Ulna of Chelonian

Plate F; Fig. 2.

Measurements : Length—19 cm.; width—1.4 cm.

Characters : Mineralized limb bone with both heads well preserved, broad and considerably curved along the length.

Material examined : India : Gujarat, Jhura in Kuchch Dist., 1 ex., 9.2.1999, Coll. M. K. Naik (ZSI, Kolkata).

Geological age : Not ascertained.

DISCUSSION

Terrestrial rocks of Jurassic age occur in the upper zone of Gondwana series. In the northwestern India, in the Jurassic area of Kutch, nearshore shallow water sediments of Callovian to Tithonian age contain a quite rich fauna of ammonoids (Spath, 1927–33) and bivalves (Cox, 1940). This fauna originated perhaps at the southern margin of the Tethys and as expected, the Tithonian fauna show a strong relationship with the fauna of Spiti shale of Himachal Pradesh (Berggren *et al.*, 1979). Further, close relationships exist between the early Late Jurassic ammonoid fauna of Kutch and those of the southern Europe. The Kutch Section shares many other genera with Europe and much areas of the Tethys. Spath (*loc. cit.*) mentioned that more than two-thirds of the described ammonoids of Kutch were known from that zone only and cautioned about exaggerated taxonomic splitting of the material. This may also be a reason for such a high figure of species from Kutch only. The Jurassic of Kutch belong to the East African-Madagascan-Peninsular Indian epicontinental sea, which had evolved since Callovian time from the Arabian-Madagascan seaway. In the Upper Oxfordian, the Mayaitidae, which were homeomorphic with the older Macrocephalitidae are confined to the East African-Indonesian Region. The Tithonian of Madagascar has close faunal affinity with Kutch (Berggren, *loc. cit.*). Enay (1973) reviewed the zoogeography of Tithonian ammonoid fauna and indicated the difficulties in taxonomic separation of the Perisphinctaceae. A close relationship between the Jurassic cephalopod (Ammonoidea and Nautiloidea) fauna of Kutch and Europe has also been indicated by Halder & Bardhan (1997).

Extensive occurrence of the ammonoids in Kutch region was earlier reported by Spath (*loc. cit.*). The samples collected during our study are generally comparable in shape, size and other features mainly with the European types. They are also not identical with the Middle Oxfordian specimens described from Saudi Arabia. Tetrabranchiate cephalopods are characteristically tightly coiled in a plane and symmetrical, with a bulbous calcareous protoconch, septa that form angular sutural flexures, and a small marginal siphuncle. The material dealt with here perhaps come from a younger horizon. The recent collections from Kutch region representing the period of Bathonian and Callovian time show some differences in relative adult size and ventral modifications.

Some Oxfordian species and their structures are marked both by size variation and ventral differentiation. The Prolecantina, a relatively small suborder of discoidal Palaeozoic ammonoids, are especially important because they represent the stock from which all Mesozoic forms arose. Presumably, the group evolved from the prolobitids during the Devonian time. Members of this suborder have much more stratigraphic value in the Mississippian than in the later Palaeozoic. Characteristically, the sutures form a large number of lobes, which were added progressively in the umbilical region. The siphuncle in ammonoids is of lesser taxonomic significance. However, at maturity it becomes marginal in position and serves to differentiate the ammonoids from the nautiloids. Moreover, it helps in differentiating the ammonoids into two suborders.

SUMMARY

The ammonoidea, a close relative of nautiloidea, have been extinct but their exoskeletons are preserved in many areas of the world. Owing to their well preservation they have been utilized by the palaeontologists for lithostratigraphic interrelations. Ammonoids were more numerous during the Mesozoic. The Mesozoic rocks of Kutch region of Gujarat were explored recently and the Ammonoidea, Bivalvia, Brachiopoda and a vertebrate fossil material in these rocks have been worked out. The result of this study, in the background of stratigraphy of rock formation, is presented in this paper. The material of ammonoids are representing Bathonian and Callovian time with some ventral modification and size differences.

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PLATE A



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. *Mayaites* sp. I. Fig. 2. *Mayaites* sp. II. Fig. 3. *Mayaites* sp. III. Fig. 4. *Mayaites* sp. V.

PLATE B



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. *Mayaites* sp. VI. Fig. 2. *Mayaites* sp. VII. Fig. 3. *Mayaites* sp. VIII Fig. 4. 2. *Macrocephalites* sp. .

PLATE C



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. *Perisphinctes* sp. I. **Fig. 2.** *Perisphinctes* sp. II. **Fig. 3.** *Perisphinctes* sp. III **Fig. 4.** *Perisphinctes* sp. IV.

PLATE D



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. *Peltoceras* sp. Fig. 2. *Terebratula* sp. Fig. 3. *Eucycloceras* sp. Fig. 4. *Epimayaites* sp. 1

PLATE E



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

Fig. 1. *Epimayaites* sp. II. **Fig. 2.** *Epimayaites* sp. III. **Fig. 3.** *Epimayaites* sp. IV. **Fig. 4.** *Pleurocephalites* sp.

PLATE F



Fig. 1.



Fig. 2.



Fig. 3.

Fig. 1. *Oyester* shell Fig. 2. Ulna of *Chelonia*.....Fig. 3. *Oyester* shell.

RECORD OF SOME ETHNOMEDICINAL SPIDERS IN RELATION TO THEIR USAGE AS DRUGS AMONG THE TRIBALS OF EASTERN SUNDARBAN INHABITED ZONE, WEST BENGAL, INDIA

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INTRODUCTION

Sunderban is composed of a group of Islands encompassing the area from the mouth of the river Hoogly on the West and extends up to river Meghna in the East covering four districts North and South 24 Parganas within Indian territory and Khulna, Bagherhat and part of Barisal in Bangladesh. It lies between 21.0 and 21.21 N latitude and 88.0 and 89.0 longitudes occupying an area of 9827 sq.km., of which 4264 sq.km. falls within the jurisdiction of India. The name Sundarban derives from the 'Sundari' tree, which is predominant in the area. Vegetation includes wet evergreen mangrove forest. The area is divided into three zones – (1) Inhabited zone. (2) Buffer zone and (3) Core area. The study area includes only in the eastern inhabited zone of 2 districts, south and north 24 Parganas, West Bengal, India.

No report has yet been made on Ethnomedicinal spiders from the tribal people of Sundarban inhabited zone. Rather few contributions were available in literature dealing with the medicinal spiders. With some ethnomedicinal notes. Savoray (1935) stated that in rural areas of Europe Jaundice and Constipation were also treated by ingesting up *Tarantula* spider (Family : Lycosidae). In some areas of Europe and America, Gout and Rheumatism were also treated by rubbing up theridiid spiders Gertch (1979). Tikader (1968) made taxonomic studies on megalomorph spiders of the families Ctenizidae and Theraphosidae from India. Tikader (1987) further reported some phidippus spiders possessing lethal venom, which is not harmful to human beings. Majumder (1987) worked on the venom of spiders of the families Theraphosidae, Clubionadae and Loxoscelidae from India. Farrington (1834) established 10 species of spider in Homoeopathic therapeutic system of medicine. Kent (1970) added another 6 species of spiders in the Homoeotherapeutic System of medicine.

The present paper deals with two **Ethnomedicinally** important spiders viz., 1. *Pardosa birmanica* Simon, 2. *Cheiracanthium himalayensis* Gravely (Families : Lycosidae & Clubionidae).

The medicinal effects of these species have been confirmed on the basis of exhaustive data collected from their medical usage for health care among the tribal people of the eastern part of Sundarban inhabited zone.

This study also initiated by the extraction of venom from these two species of spiders by Indian Homoeopharmaceutical process and these extracts were also applied orally on fowl (*Gallus gallus*). After application of the extracts/drugs, the pathological data of blood report of the fowl were also made simultaneously. The medicinal effect of these spiders' species was also confirmed on the basis of pathological data of the blood of *Gallus gallus* after administration of the extracts.

MATERIAL AND METHODS

Survey work was conducted near the areas of tribal population in the inhabited zone of Sundarban. Exhaustive data sheet was prepared to ascertain the role of spiders used as drugs among the tribal people of Sundarban inhabited zone. Hand picking was employed for the collection of the specimens and night observations were also made whenever possible. The studies were conducted in two seasons viz., the summer (April – June) and the winter (Nov. – January). Collected samples were then brought to the laboratory and were preserved in 70% alcohol, single specimen in single vial for further studies (Tikader, 1987).

OBSERVATIONS, RESULT AND DISCUSSION

Detailed usage of spiders as ethnomedicine in tribal people of inhabited zone of Sunderban are appended in tabular form.

| Sl. No. & Name of the spider used by the tribes | Mode of application | Diseases | Name of the tribes, places & Districts |
|---|---|--|---|
| 1. <i>Cheiracanthium himalayensis</i> Gravely (Family : Clubionidae) | The spider was rotten and mixed with mastered oil and rubbing on the affected parts | Applied only for Rheumatism | Santal of Chottomollakhali, Dist : South 24 Parganas |
| 2. <i>Cheiracanthium melanostoma</i> Thorell (Family : Clubionidae) | The spider dried up, powdered and mixed with honey, taken every morning | Applied for cardiac and Asthmatic problems | Munda of Hemnagar, Dist : North 24 Parganas |

| Sl. No. & Name of the spider used by the tribes | Mode of application | Diseases | Name of the tribes, places & Districts |
|---|--|--|---|
| 3. <i>Cheiracanthium himalayaensis</i> Gravely (Family : Clubionidae). | Fresh spider mixed with Datura leaf | Applied only for Rheumatism | Santal of Rhadhanagar, Dist : North 24 Parganas |
| 4. <i>Cheiracanthium himalayensis</i> Gravely (Family : Clubionidae) | The fresh spider boiled with honey and taken twice daily after cooling | Applied for heart disease | Munda of Amtali, Dist : South 24 Parganas |
| 5. <i>Cheiranthium himalayensis</i> Gravely (Family : Clubionidae) | Spider dried up, made powder and mixed with honey, taken twice daily | Applied for recurrent cold and cough of children | Munda of Kumirmari, Dist : South 24 Parganas |
| 6. <i>C. himalayensis</i> Gravely (Family : Clubionidae) | The powder mixed with mustard oil and applied on the affected parts | Applied for Gout and Rheumatism | Santal of Chottomollakhali, Dist : South 24 Parganas |
| 7. <i>Pardosa birmanica</i> Simon (Family : Lycosidae) | The spider dried up, made powder all the portion and mixed with ripe banana (<i>Musa sepientim</i>) taken every morning | Applied only for Asthma. | Munda of Sandeshkhali, Dist : North 24 Parganas |
| 8. <i>Pardosa sumatrana</i> Throell (Family : Lycosidae) | The spider dried up, made powder and mixed with honey, taken twice daily | Applied only for Asthmatic complaints | Santal of Baramollakhali, Dist : South 24 Parganas |
| 9. <i>Pardosa birmanica</i> Simon (Family : Lycosidae) | The spider dried up, made powder only of the cheliceral parts mixed with honey taken twice daily. | Applied for Asthma of children. | Santal of Minakhan, Dist : North 24 Parganas |
| 10. <i>Pardosa birmanica</i> Simon (Family : Lycosidae) | The spider dried up, made powder all the portion and mixed with ripe banana (<i>Musa sepientim</i>) taken every morning | Applied for Asthmatic problem | Munda of Uchal, Dist : North 24 Parganas |
| 11. <i>Naphila maculata</i> (Aud.) (Family : Araneidae) | Web of the spiders collected and mixed with Kalmegh leaves, (Family : Acantheceae (<i>Andrographis peniculata</i>)) taken every morning | Applied for Intermittent fever | Munda of Kumirmari Dist : South 24 Parganas |

From the above observations *Cheiracanthium himalayensis* Gravelly and *Pardosa birmanica* Simon were used as Ethnomedicine for treating the diseases like Asthma, recurrent cold and cough of children, rheumatism and heart diseases.

In the case of pathological observation the usage of spiders as drugs was also made on the system of Indian Homoeopathic Pharmacopoeia. The spider species viz., 1. *Cheiracanthium himalayensis* and *Pardosa birmanica* which were collected from the fields and kept in the laboratory were dried up in the sun, collected only the cheliceral parts and prepared into powder and then

Table 1 : Blood report before and after application of drug (*Cheiracanthium himalayensis* Gravelly) on fowl blood (*Gallus gallus*)

| Name of the Spider (Drug) | Blood content of the fowl | Fowl No. 1 Blood report before application of the drug | Fowl No. 2 Blood report after application of the drug |
|---|---------------------------|--|---|
| <i>Cheiracanthium himalayensis</i> Gravelly | T.C. | 16,000 | 16,000 |
| | E.S.R. | 8 | 9.8 |
| | Eosinophil | 00 | 01 |
| | Lymphocyte | 54 | 52 |
| | Monocyte | 01 | 01 |
| | Basophil | 00 | 00 |
| | Neutrophil | 45 | 46 |

Table 2 : Blood report before and after application of drug (*Pardosa birmanica* Simon) on fowl blood (*Gallus gallus*)

| Name of the Spider (Drug) | Blood content of the fowl | Fowl No. 1 Blood report before application of the drug | Fowl No. 2 Blood report after application of the drug |
|--------------------------------|---------------------------|--|---|
| <i>Pardosa birmanica</i> Simon | T.C. | 16,000 | 16,000 |
| | E.S.R. | 7.9 | 8 |
| | Eosinophil | 00 | 01 |
| | Lymphocyte | 54 | 52 |
| | Monocyte | 01 | 01 |
| | Basophil | 00 | 00 |
| | Neutrophil | 45 | 46 |

kept in separate vials. These powders were mixed with 70% alcohol in a proportion of 1 : 9 i.e. 1 part of powder and 9 parts of 70% alcohol in the separate vials. Two vials, one with *Cheiracanthium himalayensis* and other with *Pardosa birmanica* were kept in a cold room for one month and thus the extraction of these species was completed. They were then ready for using as a drugs for oral application to the domestic fowl (*Gallus gallus*). Two fowls were selected for the purpose, Fowl-1 and Fowl-2. Before application of the drugs blood reports were taken. Next 15 days after the application of the two drugs i.e. *Cheiracanthium himalayensis* and *Pardosa birmanica*, blood reports were again taken, after application and before application of this drugs, use blood reports for T.C., Eosinophil, Lymphocyte and monocyte were also taken as in the tables 1 & 2.

CONCLUSION

From the above account and the data collected from the tribal people of the eastern part of the Sundarban inhabited zone on the Ethnomedicinal drugs as extracted from the above mentioned spiders and the pathological observation on the fowl blood after the application of the drugs prepared on the basis of Indian Pharmaceutical system, we come to the conclusion that in future further steps of this direction more efficient effect may be procured for the preparation of drugs from these spider species. In view of their pathological observation, changes of Eosinophil in fowl blood indicate the probable source of drugs of Asthma and skin diseases. Secondly changes of Lymphocyte and Neutrophil in fowl blood indicate the probable source of drugs for heart disease and Rheumatism, because high Lymphocyte and less Neutrophil are the causative factor of Heart disease and Rheumatic factor. High E.S.R. is also an indicator of infection of blood. Hence, these spider species viz., 1. *Pardosa birmanica* Simon (Family : Lycosidae) and *Cheiracanthium himalayensis* Gravelly (Family : Clubionidae) may be considered as medicinal spiders of Sundarban.

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Short Communication

**NEW RECORD OF *ANOPLOMUS FLEXUOSUS* BEZZI (TEPHRITIDAE :
DIPTERA : INSECTA) FROM SOUTHERN INDIA WITH NOTES ON
THE SYSTEMATICS OF THE GENUS *ANOPLOMUS* BEZZI**

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INTRODUCTION

Anoplomus flexuosus Bezzi (Tephritidae : Diptera : Insecta) is known to occur in India, Indonesia and the Philippines (Bezzi, 1913; Macquart, 1843; Hardy, 1974). In India, the species is so far reported from Sikkim, West Bengal (Bezzi, *op. cit.*), Kumaon (Mishra, 1920; Mathur & Singh, 1959) and Arunachal Pradesh (Radhakrishnan, 1984) only.

While exploring the fruit fly fauna of Calicut district, Kerala, the authors could collect 5 specimens of *Anoplomus flexuosus* Bezzi, the details of which are presented below. This is the first report of the species from Southern India. Besides, the current systematic position of the genus *Anoplomus* Bezzi is discussed.

***Anoplomus flexuosus* Bezzi**

(Fig. 1)

1913. *Anoplomus flexuosus* Bezzi, Replacement name for *Tephritis fasciventris* Macquart 1848 : 225, misidentification. Not *fasciventris* Macquart, 1843. Type-locality : Java.

1882. *Trypeta cassandra* Osten Sacken, 228. Type-locality : Philippines.

Material examined : 2 Males, 2 Females, Thusharagiri, Kerala, India 3.vi.2003, C. Radhakrishnan & Party; 1 Male, Thusharagiri, Kerala, India, 13.vi.2003, C. Radhakrishnan & Party.

Diagnosis : Arista plumose; 1st flagellomere slightly pointed at apex above; scutellum inflated, convex dorsally; humeral bristles absent; thorax polished black except for yellow-white humeri and continuous yellow-white mark on each side over most of mesopleuron; also scutellum, metapleuron and pleurotergon yellow-white except for the narrow black base and the three shining black apical spots on scutellum; dorsocentral bristles situated above opposite supraalars; mid and hind femora broadly brown to black at apices; second costal cell dark-brown except for a small subhyaline spot near base; wings rounded apically.

Systematic Notes on the Genus *Anoplomus* Bezzi

Hardy (1973) while describing two new species namely, *Anoplomus nigrifemoratus* (from Laos) and *Anoplomus rufipes* (from Thailand and Laos), mentioned the genus *Anoplomus* Bezzi as being a borderline "Ceratitini", though he retained it under the tribe Trypetini of the subfamily Trypetinae. However, he felt that the genus would probably fit best in the tribe Gastrozonini of the subfamily Trypetinae. Hardy (1974) further emphasized that he found no logical reason for not treating the genus under Gastrozonini and transferred the genus to the tribe Gastrozonini, though the genus had previously been placed under Ceratininae of Hering and other authors. However, Hardy (1988) reducing the status of the tribe Gastrozonini placed *Anoplomus* Bezzi in the subtribe Gastrozonina under the tribe Acanthonevrini of Trypetinae.

Hancock (1986) while discussing the classification of the Trypetinae of the Afro-tropical Region stated that, true Gastrozonini appeared to belong to Ceratitinae and that since the Ceratitinae appeared to be allied to the Dacinae, its inclusion within the Trypetinae as surmised by Hardy (*op. cit.*) would result in a polyphyletic classification. Hancock (1991) while revising the tribal classification of various genera of Trypetinae and Ceratitinae, included the genus *Anoplomus* Bezzi in the tribe Gastrozonini under the subfamily Ceratitinae.

Based on characters which are typically present in each group and relying upon evident relationship, White and Elson-Haris (1992) reduced the tribe Gastrozonini to subtribe Gastrozonina and placed it under the tribe Ceratinini of the subfamily Dacinae. Drew and Hancock (1999) do not however, consider the current evidence significant enough for the inclusion of the taxa Ceratitidini (= Ceratitini) and Gastrozonini in the broader subfamily Dacinae.

According to Norrbom (2000), currently the subfamily Dacinae is divisible into three tribes, Ceratitidini, Dacini and Gastrozonini and accordingly, he placed the genus *Anoplomus* Bezzi under the tribe Gastrozonini of the subfamily Dacinae.

Based on the characters of the specimens studied and on an evaluation of their affinities, the authors agree in retaining *Anoplomus* Bezzi under the tribe Gastrozonini in the subfamily Dacinae as done by Norrbom (2000).

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PLATE I



Fig. 1. : *Anoplomus flexuosus* Bezzi.