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C O N T E N T S

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TWO NEW SPECIES OF THE GENERA *META* C.L. KOCH AND *NEOSCONA* SIMON OF THE FAMILY ARANEIDAE (ARACHNIDA : ARANEAE) FROM COASTAL ANDHRA PRADESH, INDIA

B. H. PATEL AND T S. REDDY

Department of Zoology, Sir P.P. Institute of Science, Bhavnagar University, BHAVNAGAR-364 002, Gujarat, INDIA.

INTRODUCTION

Some informations are available on Indian araneid forms along with other groups of spiders from previous workers *viz.*, Walckenaer (1841), Doleschall (1857), Cambridge (1859, 99), Stoliczka (1869), Simon (1877, 89, 1906), Thorell (1877, 95), Pocock (1900), Narayan (1915), Gravely (1921, 22), Sherriffs (1928, 29), Caporiacco (1934, 35), Dyal (1935) and Sinha (1951). Recently Tikader and his co-workers (1960-1982), Sadana (1973) and Patel (1975) added several new species of this family.

The genus *Meta* was first recorded and only one species was described by Cambridge (1885) from N.W. India. Then, Tikader (1982) added one more species of the same genus. Till now 18 species of the genus *Neoscona* are described from India, out of which recent additions are of two species by Tikader (1975, 80), six species by Tikader & Bal (1981) and one species by Patel & Reddy (in press), *Meta abdomenalis* is the third species and *Neoscona dhumani* is the ninteenth species described from Indian sub-continent.

While examining the spide collections made by one of us (TSR) from Coastal Andhra Pradesh, we came across a new species of the genus *Meta* and a new species of the genus *Neoscona* which are described and illustrated here.

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

1. **Meta abdomenalis** sp. nov. (Fig. 1, a-d)

General : Cephalothorax and legs light yellowish brown with chalk white and brownish patches. Abdomen chalk white greyish with brown patches. Total length 3.75 mm. Carapace 1.20 mm long, 1.15 mm wide ; abdomen 3.00 mm long, 2.50 mm wide.

Cephalothorax : Slightly longer than wide, narrowing in front, clothed with

pubescence and hairs ; cephalic region is slightly elevated than the thoracic region and pale in colour ; thorax with deep fovea. Anterior row of eyes recurved but posterior row nearly straight or slightly recurved. Anterior medians are slightly smaller than the posterior medians, posterior medians encircled by black rings and closer to each other than to adjacent laterals. Laterals close together and situated on prominent tubercles as in Fig. 1 a. Ocular guad as long as wide. Sternum heart shaped, pointed behind, clothed with pubescence and hairs. Labium slightly wider than long, brownish with pale distal end. Maxillae slightly longer than wide, brownish with pale distal end and provided with scopulae. Sternum, labium and maxillae as in Fig. 1 b. Chelicerae moderate, yellowish, having indistinct small boss. Legs thin, long and strong, light yellowish brown, clothed with pubescence, hairs and spines. Femora of all legs provided with some fine but strong hairs on ventral side. Leg formula 1 2 4 3.

Male : Unknown.

Abdomen : Suboval, clothed with pubescence, pointed anteriorly. Dorsum of abdomen provided with a folium composed of chalk white greyish and brownish

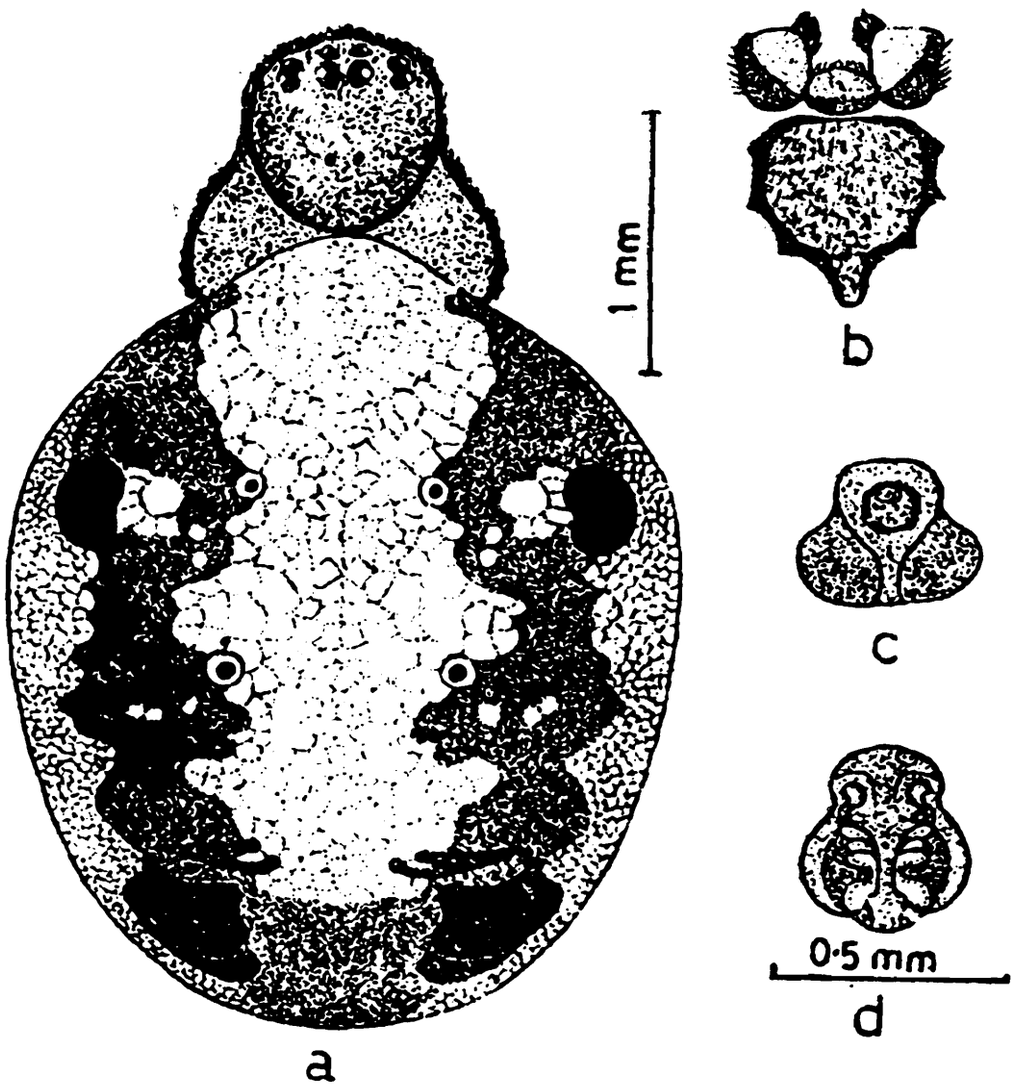

Fig. 1. *Meta abdomenalis* sp.nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia.

patches and two pairs of distinct sigillae arranged midlongitudinally as in Fig. 1 a. Abdomen both anterio-laterally and posterio-laterally provided with one pair of balck patches. Ventral side greyish brown with a median broad greyish patch guarded by a pair of chalk-white bracket shaped patches inbetween epigastric furrow and spinnerets. Epigyne provided with a broad median septum and a pair of lateral swellings as in Fig. 1 c. Internal genitalia as in Fig. 1 d.

Holotype : One ♀ in spirit.

Type Locality : Araku valley, Dist. Visakhapatnam 18.x.1986. Coll. T.S. Reddy.

Diagnosis : This species resembles to *Meta simlaensis* Tikader but it is separated as follows : (i) Abdomen both anterio-laterally and posterio-laterally provided with one pair of black patches but in *M. simlaensis* no such black patches. (ii) Abdomen suboval, pointed anteriorly but in *M. simlaensis* oval, not pointed anteriorly. (iii) Epigyne and internal genitalia are also structurally different.

2. **Neoscona dhumani** sp. nov. (Fig. 2, a-h)

General : Cephalothorax and legs yellowish, abdomen yellowish grey. Total length 6.05 mm. Carapace 2.65 mm long, 2.30 mm wide ; abdomen 3.75 mm long, 3.65 mm wide.

Cephalothorax : Longer than wide. narrowing in front, yellowish-brown, clothed with pubescence and hairs. Thoracic region provided with thin longitudinal deep fovea. Both rows of eyes recurved. Anterior median eyes slightly larger than the posterior medians, laterals close together and each situated on a tubercle. Ocular quad slightly wider than long, wider in front than behind as in Fig. 2 a. Sternum heart shaped, pointed behind, yellowish. Labium wider than long, crescent shaped, yellowish and distal end with hairs. Maxillae nearly triangular, yellowish and provided with distinct scopulae. Sternum, labium and maxillae as in Fig. 2 b. Chelicerae moderately strong, yellowish and provided with median boss ; inner and outer margins of fang furrow provided with three teeth each. Legs long and strong, yellowish, clothed with hairs and spines. Tibiae and metatarsi of legs I and II provided with five and four pairs of ventral spines respectively. Leg formula 1 2 4 3.

Male : It is similar to female but slightly smaller. Total length 4.50 mm. Male palp as in Fig. 2 f, g and h.

Abdomen : Nearly oval, yellowish grey with chalk-white patches, clothed with black based grey hairs, anterior portion wider than behind as in Fig. 2 a. Dorsum of abdomen provided with five pairs of sigillae arranged mid-longitudinally in descending order for their size. Ventral side pale in colour. Epigyne with a upwardly directed scape provided with a constriction nearly at the middle as in Fig. 2 c and d. Internal genitalia as in Fig. 2 e.

Holotype : 1 ♀ , *paratype* : 11 ♀ , *allotype* : 2 ♂ in spirit.

Type Locality : Bhimunipatnam, Dist. Visakhapatnam, 8.x.1986. Coll. T.S. Reddy.

Diagnosis : This species resembles to *Neoscona pavida* (Simon) but it is separate as follows : (i) Base of cephalic region is not provided with a 'V' shaped brow

marking but in *N. pavida* base of cephalic region provided with a 'V' shaped brown marking. (ii) Thoracic region is not provided with a longitudinal deep groove but in *N. pavida* it is present. (iii) Dorsum of abdomen provided with five pairs of sigillae but in *N. pavida* four pairs of sigillae. (iv) Epigyne and internal genitalia are also structurally different.

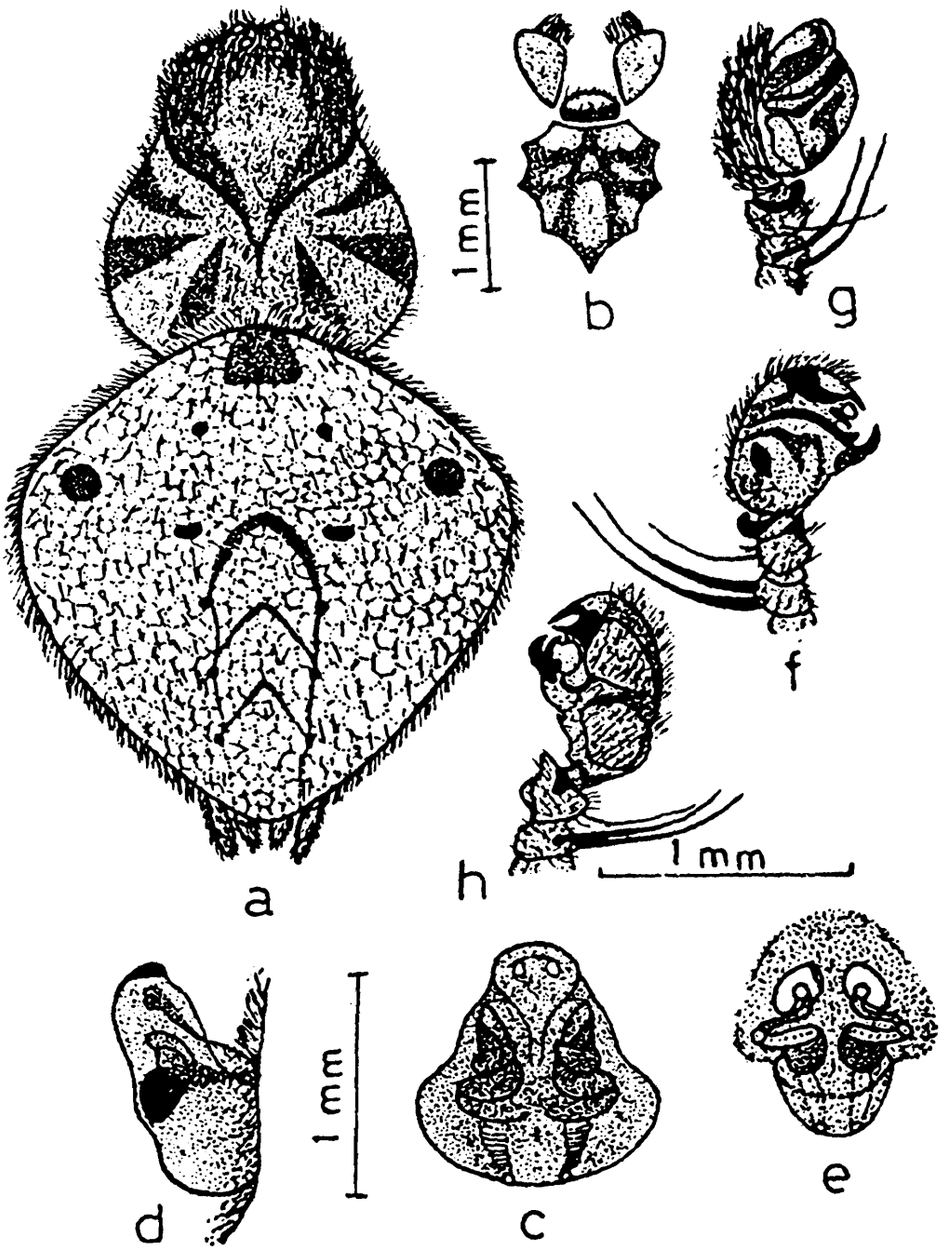

Fig. 2. *Neoscona dhumani* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Lateral view of epigyne ; e. Internal genitalia ; f. Right male palp - ventral view ; g. Right male palp - outer view ; h. right male palp - inner view.

SUMMARY

Two new species of the genera *Meta* and *Neoscona viz.*, *Meta abdomenalis* and *Neoscona dhumani* are described and illustrated here from Visakhapatnam District of Coastal Andhra Pradesh, India.

ACKNOWLEDGEMENTS

The authors are thankful to Prof. K.B. Tipnis, Principal, Sir P.P. Institute of Science, Bhavnagar for providing the laboratory facilities. The financial assistance to one of us (TSR) by the Government of Gujarat is acknowledged.

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Rec. zool. surv. India, 90(1-4) : 7-22, 1992

RECORDS OF CULICINE MOSQUITOES FROM BASTAR DISTRICT (MADHYA PRADESH), INDIA (DIPTERA : CULICIDAE), PART IV, GENUS - CULEX

K.B. RAJPUT* and S.M. KULKARNI**
National Institute of Communicable Diseases/I.C.M.R. Scheme for Malaria, Jagdalpur-494001, M.P.

INTRODUCTION

The genus *Culex* includes many important proved/potential vectors of human diseases like *Culex quinquefasciatus* (vector of periodic bancroftian filariasis) and *C. tritaeniorhynchus* (vector of Japanese encephalitis). Some probable or potential vectors for Japanese encephalitis under the genus *Culex* are *C. gelidus, C. fuscocephala, C. vishnui* and *C. pseudovishnui.* The genus *Culex* inspite of being very important from the public health standpoint remained poorly known from Bastar district of Madhya Pradesh. The district is earlier known with a record of only 7 species under two subgenera (Barraud, 1934 : Husainy, 1981).

The present communication deals with the distribution records of 22 species under five subgenera from this district. The surveys were made during the year 1980-1982. The description of study area, climate, topography and materials & methods used, were described earlier (Rajput and Kulkarni, 1984).

The classification and nomenclature used here are mainly based on Synoptic Catalogue (Knight and Stone, 1977). Besides some recent papers, works of Barraud (1934), Bram (1967), Reuben (1969) and Sirivanakarn (1972, 1976, 1977 a & b) were consulted for identification. Identification was done mainly on adult characters. Genital characters of males and the characters of immatures were also taken into consideration whenever those forms were available.

COLLECTION RECORDS

Subgenus **Culex** Linnaeus

1. **Culex barraudi** Edwards

1922, *Culex barraudi* Edwards, *Ind. Journ. Med. Res.* **10** : 284.
1977. *Culex barraudi* : Knight and Stone : 202.

Present records : *Chindawada* - 1 ♀ (23 mar. '81) from herb vegetation. *Darbha* - 7 ♀♀, 3♂♂ between 18 Mar. '81 and 23 Mar. '81 from herb vegetation. *Karanji* - 2 ♀♀ (11 Aug. '81) from bovine bait. *Potanar* - 1 ♀ (28 Aug. '81) from herb

* Present Address : Central Tasar Research & Training Institute, Basic Seed Multiplication & Training Centre, Kumarganj, Faizabad, Uttar Pradesh-224229 INDIA.

** Present address : National Institute of Virology, Pune-411001 (Maharashtra), INDIA.

vegetation. *Tahakapal* - 1 ♀ (21 Aug. '81) from herb vegetation.

2. **Culex bitaeniorhynchus** Giles

1901. *Culex bitaeniorhynchus* Giles, *Journ. Bomb. Nat. Hist. Soc.* **13** : 607.
1977. *Culex bitaeniorhynchus* : Knight and Stone : 203.

Present records : *Adawal* - 9 ♀♀, 5 ♂ between 11 Jul. '80 and 22 Jan. '82 from herb vegetation, 6♀♀, 10♂♂ between 6 Mar. '81 and 18 Dec. '81 larvae reared from nala margin. *Aghanpur* - 21 ♀♀, 1♂♂ between 19 Sept. '81 and 3 Dec. '81 larvae reared from pond margin. *Balenga*- 3♀♀, 5 ♂♂ (11 Nov. '80) larvae reared from trench, 19♀♀, 20♂♂ larvae reared between 17 Nov. '81 and 28 Dec. '81 from river margin & pits *Bastar* - 1♀, 3♂♂ between 20 Nov. '80 and 27 Jun. '82 from herb vegetation, 1♂ (27 Jan. '82) from human dwellings. *Bhond* - 5♀♀ between 30 Jul '80 and 28 Dec. '81 from herb vegetation, 1♂ (20 Jan. '82) from cattle shed, 4♀♀, 1♂ (15 Sept. '81) larvae reared from paddy field. *Bringpal* - 4♀♀, 1♂ between 14 Sept. '81 and 18 Jan. '82) from shrubby vegetation. *Chapar-Bhanpuri*-1 ♂ (25 Sept. '80), 3♂♂ (28 Aug. '81) from herb vegetation. 1 ♂ (23 Jan. '82) from human dwellings. *Chindawada* - 6♂♂, 2 ♀♀ between 1 Jul '80 and 28 Jan '82 from herb vegetation, 5 ♀♀, 2♂♂ (9 Jun. '81) larvae reared from pond margin, 1 ♀ (29 Jul. '81), 12 ♀♀, 9♂♂ (24 Dec. '81) larvae reared from paddy field. *Darbha* - 4 ♀♀ (18 Aug. '81) from bovine bait, 2♀♀ (22 Sept. '80) from human bait, 1 ♀, 4♂♂ between 23 Mar. '81 and 19 Sept. '81 from herb vegetation, 37♀♀, 43♂♂ between 17 Dec. '80 and 3 Mar. '81 larvae reared from borrow pit, 8 ♀♀, 3 ♂♂ (6 Jan. '81) larvae reared from pond margin, 4♀♀, 1♂ (21 Jul. '81) larvae reared from paddy field. *Daurgaon* - 1 ♂ (5 Sept. '81), 2♀♀, 1 ♂ (13 Nov. '81) from herb vegetation, 3♀♀, 4♂♂ (16 Dec. '81) larvae reared from nala pits. *Dhaniyalur* 3♀♀, 3♂♂ between 7 Feb. '81 and 16 Jan '82 from herb vegetation, 22♀♀, 22♂♂ (2 Jul. '81) larvae reared from nala margin. *Dongariguda* - 4♂♂ between 23 Jul 81 and 9 Nov. '81 from herb vegetation. *Gumiyapal* - 7 ♀♀, 3♂♂ between 3 Sept. '81 and 21 Jan. '82 from herb vegetation, 1 ♂ (31 Dec. '81) from human dwellings. *Jagdalpur* - 18♀♀, 26♂♂ between 29 Sept. '80 and 2 Apr. '81 larvae reared from pond margin, 1 ♂ (17 Jan. '81) larva reared from paddy field. *Kakalgur* - 1 ♀, 4♂♂ between 15 Jul. '81 and 10 Dec. '81 from herb vegetation, 4♀♀, 5♂♂ between 29 Jul. '81 and 15 Jan. '82 larvae reared from paddy field. *Karanji* - 11 ♀♀ between 27 Jul. '81 and 21 Sept. '81 from bovine bait, 8 ♀♀ between 11 Aug, '81 and 8 Sept. '81 from human bait, 8♀♀, 3 ♂♂ between 2 Oct. '80 and 7 Jan. '82 from herb vegetation, 63 ♀♀, 44♂♂ larvae reared between 11 Mar. '81 and 23 Dec. '81 from rocky nala margin. *Keslur* - 1 ♂ (17 Aug. '81), 1 ♂ (18 Jan. '82) from herb vegetation, 5♀♀, 7 ♂♂ (18 Jan, '82) larvae reared from trench. *Kumarawand* - 1 ♀ (19 Sept. '81), 1 ♂ (17 Dec. '81) from herb vegetation, 18 ♀♀, 22♂♂ (19 Mar. '81) larvae reared from marshy land, 25 ♀♀, 24♂♂, larvae reared between 4 Jul. '81 and 17 Dec. '81 from weedy pool. *Kurandi* - 12 ♀♀, 7♂♂ (26 Aug. '80) from bovine bait, 1 ♀ (26 Aug. '80) from human bait, 2♂♂ (18 Jan. '81) from herb vegetation, 1 ♀ , 1 ♂ (27 Aug. '81) larvae reared from paddy field, 1 ♀ (23 Nov. '81) larvae—reared from pond margin *Lendra* - 3 ♂♂ (11 Jan. '82) from herb vegetation. *Pakhanjore* - 22 ♀♀, 1 ♂ (27 Aug. '81) 1 ♀ , 2 ♂♂ (28 Nov. '81) from herb vegetation, 4 ♀♀, 4 ♂♂ (28 Nov. '81) larvae reared from nala margin. *Pandripani*- 2 ♀♀, 1 ♂ between 17 Aug. '81 and 18 Jan. '82 from herb vegetation. *Potanar* - 8 ♀♀,

8 ♂♂ between 3 Jul. '81 and 21 Jan. '82 from herb vegetation, 1 ♀ (21 Jan. '82) from human dwellings. *Rajur*-3 ♀♀, 5 ♂♂ between 15 Nov. '80 and 11 Jan. '82 from herb vegetation. *Retawand*-1 ♂ (9 Jul. '80) from herb vegetation, 1 ♀ (27 Jan. '82) from human dwellings, 3 ♀♀, 5 ♂♂ (17 May '81) larvae reared from nala margin. *Sargipal*-1 ♂ (23 Nov. '80) from herb vegetation. *Tahakapal*-4 ♀♀, 4 ♂♂ between 27 Jun. '81 and 31 Dec. '81 from herb vegetation. *Takaraguda*-3 ♀♀, 1 ♂ between 6 Aug. '80 and 15 Sept. '81 from herb vegetation, 1 ♀ (20 Jan. 82) from cattle shed. *Tandpal*-1 ♂ (21 Jan. '82), 1 ♀, 1 ♂ (31 Dec. '81) from herb vegetation. *Tekameta*-2 ♀♀, 3 ♂♂ between 11 Aug. '81 and 21 Nov. '81 from herb vegetation. *Telengarapur*-1 ♂ (20 Jul. '81), 1 ♀, 1 ♂ (31 Aug. '81) from herb vegetation, 8 ♀♀, 6 ♂♂ (20 Jul. '81), 4 ♀♀, 4 ♂♂ (13 Jan. '82) larvae reared from nala margin. *Tokapal*-1 ♀ (23 Sept. '81) from herb vegetation, 9 ♀♀, 8 ♂♂ (15 Nov. '80) larvae reared from pond margin.

3. **Culex edwardsi** Barraud

1923. *Culex edwardsi* Barraud, *Ind. Journ. Med. Res.* **11** : 507.
1977. *Culex edwardsi* : Knight and Stone : 207.

Present records : *Adawal* - 1 ♂ (22 Jan. '82) from herb vegetation. *Bastar*-5 ♀♀, 2 ♂♂ between 20 Nov., 80 and 27 Jan. '82 from herb vegetation, 1 ♂ (27 Jan. '82) from human dwellings. *Bhond*-1 ♀ (24 Nov. '81) from herb vegetation *Bringpal*-3 ♀♀ (18 Jan. '82) from herb vegetation. *Chindawada*-1 ♂ (18 Nov. '81) from herb vegetation. *Durbha*-1 ♀ (13 Oct. '80) from bovine bait, 1 ♀, 2 ♂♂ (18 Nov. '80), 1 ♂ (4 Jul. '81) from herb vegetation. *Dhaniyalur*-1 ♀ (16 Jan. '82) from herb vegetation. *Gumiyapal*—1 ♀ (21 Jan. '82) from shrubby vegetation. *Kakalgur* - 1 ♂ (28 Jan. '82) from herb vegetation. *Karanji* - 1 ♀ (7 Jan. '82) from herb vegetation. *Kurandi*-1 ♀ (29 Dec. '80), 1 ♀ (15 Jan. '81) from bovine bait, 1 ♀ (26 Sept. '80) from herb vegetation. *Lendra* - 2 ♂♂ (11 Jan. '82) from herb vegetation. *Pakhanjore*-1 ♀ (28 Nov. '81) from herb vegetation. *Pandripani* - 1 ♂ (29 Dec. '81) from shrubby vegetation. *Potanar*-1 ♂ (21 Jan. '82) from herb vegetation. *Rajur* - 1 ♀ (11 Jan. '82) from herb vegetation. *Sargipal*-1 ♀ (22 Nov. '80) from herb vegetation. *Tandpal*-3 ♀♀, 2 ♂♂ (21 Jan. '82) from herb vegetation. *Tekameta* - 3 ♀♀, 1 ♂ (21 Nov. '81) from herb vegetation.

4. **Culex epidesmus** (Theobald)

1910. *Taeniorhynchus epidesmus* Theobald, *Rec. Ind. Mus.* **4** : 22.
1977. *Culex epidesmus* : Knight and Stone : 207.

Present records : *Bringpal*-1 ♀, 1 ♂ (24 Sept. '81) from herb vegetation. *Darbha*-1 ♀ (16 Feb. '81), 1 ♀ (18 Aug. '81) from bovine bait, 1 ♀ (18 Sept. '80) 1 ♀ (1 Sept. '81) from human bait, *Karanji*-5 ♀ ♀ (11 Aug. '81), 2 ♀ ♀ (8 Sept. '81) from bovine bait, 1 ♀ (25 Aug. '81), 2 ♀ ♀ (8 Sept. '81) from human bait. *Kurandi*-61 ♀ ♀ (26 Aug. '80) from bovine bait, 3 ♀ ♀ between 4 Jul. '80 and 3 Oct. '80 from human bait, *Pakhanjore* - 1 ♀ (28 Nov. '81) from herb vegetation. *Telengarapur* - 1 ♀ (12 Jul. '80) from human bait.

5. **Culex fuscocephala** Theobald

1907. *Culex fuscocephala* Theobald, *M. C.* **4** : 420.
1977. *Culex fuscocephala* : Knight and Stone : 208.

Present records : *Adawal*—6 ♀♀, 2 ♂♂ between 11 Jul. '80 and 9 Nov. '81 from

herb vegetation, 60♀♀, 54 larvae reared between 28 Mar. '81 and 10 Apr. '81 from nala margin, 18♀♀ 9♂♂ (28 Mar. '81) larvae reared from rock pools. *Aghanpur*—2♀♀ (14 Jul. '81) from herb vegetation, 2♀♀, 1♂ (14 Jul. '81) larvae reared from hoof prints, 2♀♀, 1♂ (11 Aug. '81) larvae reared from pond margin. *Asana*—5♀♀, 7♂♂ (21 Dec. '80) larvae reared from hoof and foot prints. *Balenga*—1♀, 1♂ (1 Sept. '81) larvae reared from paddy fields, *Bastar*—1♂ (24 Sept. '80), 2♂ (20 Nov. '80) from herb vegetation. *Bhond*—1♂ (15 Sept. '81) from herb vegetation. *Bringpal*—1♀ (24 Sept. '81), 1♂ (29 Nov. '81) from herb vegetation. *Chapar-Bhanpuri*—1♀ (3 Jul. '81) from herb vegetation. *Chindawada*—18♀♀, 6♂♂ between 23 Mar. '81 and 28 Jan. '82 from herb vegetation. *Darbha*—34♀♀ between 8 Sept. '80 and 1 Sept. '81 from bovine bait, 44♀♀ between 17 Mar. '80 and 20 Jul. '81 from human bait, *Daurgapn*—3♀♀ (5 Sept. '81) from herb vegetation. *Dhaniyalur*—1♀ (7 Feb. '81), 4♀♀, 1♂ (4 Apr. '81) from herb vegetation, 62♀♀, 41♂♂ (17 Nov. '80) larvae reared from nala margin, 2♀♀, 3♂♂ (16 Jul. '81) larvae reared from rainy pit. *Dongariguda*—1♂ (26 May '81), 1♀ (30 Sept. '81) from herb vegetation, 46♀♀, 41♂♂ (31 Mar. '81) larvae reared from shallow kaccha well, 1♀ (23 Jul. '81) larvae reared from rainy pool. *Gumiyapal*—2♀♀ (17 Sept. '81) 1♀ (16 Dec. '81) from herb vegetation. *Jagdalpur*—18♀♀, 23♂♂ larvae reared between 18 Jan. '81 and 17 Apr. '81 from pond margin, 5♀♀, 6♂♂ (8 Feb. '81), 6♀♀, 13♂♂ (26 Feb. '81) larvae reared from gutter water, 1♀, 1♂ (12 Mar. '81) larvae reared from rainy pit. *Kachora*—6♀♀ between 6 Aug. '81 and 25 Sept. '81 from herb vegetation. *Kakalgur*—1♂ (15 Oct. '81), 1♀ (28 Jan. '82) from herb vegetation, 1♀, 1♂ (14 Apr. '81) larvae reared from shallow kaccha well, 1♂ (16 Aug. '81) larvae reared from paddy field. *Karanji*—1♀, 1♂ (25 Aug. '81), 1♀ (8 Sept. '81) from bovine bait, 7♀♀ between 25 Aug. '81 and 6 Jan. '82 from human bait, 3♀♀ (30 Mar. '81), 1♂ (22 Sept. '81) from herb vegetation, 1♀ (22 Aug. '81) larvae reared from paddy field, 1♂, (8 Sept. '81) larvad reared from road side rainy pool. *Keslur*—1♀ (4 Aug. '80), 1♀ (31 Aug. '81) from herb vegetation, 3♀♀, 4♂♂ (13 Apr. '81) larvae reared from pond margin. *Kotamsar*—1♀ (27 Apr. '80) from bovine bait, 1♀ (3 Mar. '80) from human bait. *Kumarawand*—2♀♀, 1♂ (5 Sept. '81), 4♀♀ (26 Sept. '81) from herb vegetation, 3♀♀, 2♂♂ (5 Nov. '80) larvae reared from fresh water pool, 1♀, 4♂♂ (19 Mar. '81), 12♀♀, 5♂♂ (19 Mar. '81) larvae reared from marshy land. *Kurandi*—163♀♀ between 27 Mar. '80 and 26 Mar. '81 from bovine bait, 72♀♀ between 25 Feb. '80 and 15 Apr. '81 from human bait, 5♀♀, 2♂♂ (12 Feb. '81) from herb vegetation, 1♀ (2 May '81) from human dwellings, 17♀♀, 21♂♂ (14 Nov. '80), 9♀♀, 8♂♂ (13 Feb. '81) larvae reared from paddy field, 1♀ (27 Feb. '81), 6♂♂ (11 Dec. '81) larvae reared from pond margin. *Lendra*—1♀ (7 Sept. '81) from her vegetation. *Neganar*—9♀♀, 6♂♂ (6 Nov. '80) larvae reared from paddy field, 8♀♀, 11♂♂ (10 Dec. '81) larvae reared from pond margin. *Orcha*—2♀♀ (30 Nov. '81) from bovine bait. *Pakhanjore*—2♀♀ (27 Aug. '81) from herb vegetation, 4♀♀ (22 nov. '81) from cattle shed. *Pandripani*—1♀ (14 Oct. '81) larvae reared from cart track. *Potanar*—8♀♀ between 9 Apr. '81 and 21 Jan. '82 from herb vegetation. *Rajur*—1♀ (7 Sept. '81), 1♀ (23 Sept. '81) from herb vegetation, 1♀ (27 Jul. '81), 4♀♀, 3♂♂ (10 Aug. '81) larvae reared from paddy field, 1♂ (7 Sept. '81) larvae reared from rainy pool. *Retawand*—2♂♂ (21 Jan. '82) larvae reared from nala margin. *Sargipal*—1♀, 4♂♂ (22 Nov. '80), 3♂♂ (23 Nov. '80) from herb vegetation. *Tahakapal*—6♀♀ (21 Jan. '82) from

cattle shed, 1 ♀ (21 Aug. '81) from herb vegetation. *Takaraguda*—3 ♀♀, 2 ♂♂ between 22 Jul. '81 and 15 Sept. '81 from herb vegetation. *Tandpal*—1 ♂ (27 Jun. '81), 1 ♀ (10 Jul. '81) from herb vegetation. *Tekameta*—1 ♂ (3 Jul. '81), 1 ♀, 1 ♂ (9 Sept. '81) from herb vegetation. *Telengarapur*—1 ♀ (12 Jan. '82) from bovine bait, 1 ♀ (12 Jan. '82) from human bait, 1 ♂ (31 Aug. '81), 1 ♀ (14 Dec. '81) from herb vegetation, 2 ♀♀ (13 Apr. '81) larvae reared from nala margin. *Tokapal*—2 ♀♀ (23 Sept. '81) from herb vegetation.

6. **Culex gelidus** Theobald

1901. *Culex gelidus* Theobald, *M. C.* 2 : 20.
1977. *Culex gelidus* : Knight and Stone : 209.

Present records : *Adawal*—2 ♀♀ (25 Sept. '81) from herb vegetation. *Bhond*—2 ♀♀ (30 Jul. '80) from herb vegetation. *Bringpal*—1 ♀ (24 Sept. '81) from herb vegetation. *Chindawada*—1 ♂ (1 Jul. '80) from shrubby vegetation. *Darbha*—16 ♀♀ between 1 Aug '80 and 16 Feb. '81 from bovine bait, 7 ♀♀ between 4 Apr. '80 and 15 Sept. '80 from human bait, 1 ♀ (17 May '80), 1 ♀, 1 ♂ (19 Sept. '81) from herb vegetation. *Daurgaon*— 1 ♂ (13 Nov. '81) from shrubby vegetation. *Dhaniyalur*—2 ♀♀, 2 ♂♂ (11 Jul. '80) from herb vegetation. *Dongariguda*—2 ♀♀, 1 ♂ (30 Sept. '81), 1 ♂ (9 Nov. '81) from herb vegetation. *Jagdalpur*— 1 ♀, 2 ♂♂ (12 Nov. '81) from herb vegetation, 19 ♀♀, 22 ♂♂ (15 Mar. '81) larvae reared from pond margin. *Kachora*—13 ♀♀ 2 ♂♂ (25 Sept. '81), 1 ♀ (18 Dec. '81) from herb vegetation. *Karanji*—14 ♀♀ (27 Jul. '81) from bovine bait, 1 ♀ (9 Sept. '81) 2 ♀♀ (22 Sept. '81) from herb vegetation. *Kotamsar*—1 ♀ (5 May '80), 7 ♀♀ (27 Jun. '80) from bovine bait, 9 ♀♀ between 14 Apr. '80 and 27 Jun. '80 from human bait. *Kumarawand*—7 ♀♀ (19 Sept. '81), 3 ♀♀ (26 Sept. '81) from herb vegetation, 1 ♀ (10 Nov. '81) from human dwellings. *Kurandi*—127 ♀♀ between 27 Mar. '80 and 29 Dec. '80 from bovine bait, 23 ♀♀ between 25 Feb. '80 and 12 Feb. '81 from human bait. *Lendra*—2 ♀♀ (23 Sept. '81) from herb vegetation. *Pakhanjore*—1 ♀ (28 Nov. '81) from herb vegetation. *Potanar*—1 ♀ (31 Jul. '80), 1 ♀ (21 Jan. '82) from herb vegetation. *Rajur*— 37 ♀♀, 17 ♂♂ between 21 Jul. '80 and 23 Sept. '81 from herb vegetation, 1 ♀ (25 Jan. '82) from cattle shed. *Retawand*—4 ♀♀, 4 ♂♂ (9 Jul. '80) from shrubby vegetation. *Tahakapal*—1 ♀ (16 Dec. '81) from herb vegetation. *Takaraguda*—5 ♀♀ between 25 Jul. '80 and 15 Sept. '81 from herb vegetation. *Tekameta*— 1 ♂ (11 Aug. '81) from herb vegetation. *Telengarapur*—2 ♀♀ (12 Jul. '80) from bovine bait.

7. **Culex mimulus** Edwards

1915. *Culex mimulus* Edwards, *Bull Ent. Res.* 5 : 284.
1977. *Culex mimulus* : Knight and Stone : 212.

Present records : *Aghanpur*—4 ♀♀, 1 ♂ (14 Jul. '80) larvae reared from hoof mark. *Balenga*—4 ♀♀, 3 ♂♂ (22 Jul. '81) larvae reared from rainy pits. *Bringpal*—1 ♂ (24 Sept. '81) from herb vegetation. *Chapar-Bhanpuri*— 1 ♀ (31 Jul. '80) from herb vegetation. *Darbha*—2 ♂♂ (23 Mar. '81) from herb vegetation, 6 ♀♀, 2 ♂♂ (23 Sept. '80) larvae reared from forest pool. 1 ♂ (21 Jul. '81) larva reared from paddy field. *Dongariguda*—1 ♀ (20 Aug. '81) from herb vegetation, 1 ♀ (31 May '81), 1 ♂ (23 Jul. '81) larvae reared from kaccha well. *Kakalgur*—1 ♀ (29 Jul. '81),

1 ♀ (15 Jan. '82) from herb vegetation, 4 ♀ ♀, 10 ♂ ♂ (14 Apr. '81) larvae reared from kaccha well, 1 ♀ , 1 ♂ (29 Jul. '81) larvae reared from paddy field. *Keshur*—1 ♀ (20 Jul. '81) from herb vegetation, 1 ♀ (13 Apr. '81) larvae reared from pond margin. *Kotamsar*—5 ♀ ♀, 5 ♂ ♂ (7 Apr. '81) larvae reared from rockpit at nala margin. *Kumarawand*—1 ♀ (26 Sept. '81) from herb vegetation. *Pakhanjore*—1 ♂ (28 Nov. '81) from shrubby vegetation. *Potanar*—1 ♂ (28 Aug. '81), 1 ♀ (21 Jan. '82) from herb vegetation. *Takaraguda*—1 ♀ (20 Jan. '82) from herb vegetation. *Tekameta*—1 ♀ (9 Sept. '81) from herb vegetation.

8. **Cubx pseudovishnui** Colless

1957. *Culex pseudovishnui* Colless, *Ann. Trop. Med. Parasit.* **51** : 88.
1977. *Culex pseudovishnui* : Knight and Stone : 221.

Present records : *Adawal*—34 ♀ ♀, 10 ♂ ♂ between 30 Aug. '80 and 22 Jan. '82 from herb vegetation, 1 ♀ (6 Mar. '81), 3 ♀ ♀, 4 ♂ ♂ (10 Apr. '81) larvae reared from nala margin, 3 ♀ ♀, 5 ♂ ♂ (28 Mar. '81) larvae reared from rock pools. *Aghanpur*— 14 ♀ ♀ , 4 ♂ ♂ between 11 Aug. '81 and 17 Dec. '81 from herb vegetation, 8 ♀ ♀ , 9 ♂ ♂ larvae reared between 16 Feb. '81 and 3 Dec. '81 from pond margin. *Asana*—5 ♀ ♀, 5 ♂ ♂ (21 Dec. '80) larvae reared from hoof marks. *Balenga*—11 ♀ ♀, 3 ♂ ♂ between 22 Jul. '81 and 15 Dec. '81 from herb vegetation, 7 ♀ ♀, 9 ♂ ♂ larvae reared between 11 Nov. '80 and 15 Dec. '81 from pond margin, 2 ♂ ♂ (1 Sept. '81) larvae reared from paddy field. *Bastar*—69 ♀ ♀, 30 ♂ ♂ between 24 Sept. '80 and 27 Jan. '82 from herb vegetation, 2 ♀ ♀ (12 Jan. '82) from cattle shed, 1 ♀ (27 Jan. '82) from human dwelling, 1 ♀ (8 Sept. '81) larvae reared from paddy field. *Bhond*—14 ♀ ♀, 9 ♂ ♂ between 11 Nov. '80 and 28 Dec. '81 from herb vegetation, 1 ♂ (20 Jan. '82) from human dwellings. *Bringpal*—27 ♀ ♀ , 15 ♂ ♂ between 3 Aug. '81 and 18 Jan. '82 from herb vegetation, 1 ♀ (31 Aug. '81) larvae reared from paddy field. *Chapar-Bhanpuri*—3 ♀ ♀, 1 ♂ between 28 Aug. '81 and 17 Dec. '81 from herb vegetation, 1 ♂ (23 Jan. '82 from human dwellings. *Chhepaguda*—8 ♀ ♀ , 5 ♂ ♂ (21 Dec. '80) larvae reared from paddy field. *Chindawada*—15 ♀ ♀ , 4 ♂ ♂ between 18 Nov. '81 and 28 Jan. '82 from herb vegetation, 1 ♀ (28 Jan. '82) from cattle shed, 2 ♀ ♀, 9 ♂ ♂ (29 Aug. '81) larvae reared from paddy field. *Darbha*—88 ♀ ♀ between 28 Aug. '80 and 16 Dec. '80 from bovine bait, 351 ♀ ♀ between 5 Jan. '81 and 28 Dec. '81 from human bait, 3 ♀ ♀ , 1 ♂ (23 Mar. '81), 3 ♀ ♀, 1 ♂ (19 Sept. '81) from herb vegetation, 1 ♀ (23 Mar. '81) larvae reared from rock pool, 3 ♀ ♀ , 3 ♂ ♂ (16 May '81) larvae reared from pond margin. *Daurgaon*—7 ♀ ♀ , 10 ♂ ♂ from herb vegetation, 1 ♂ (19 Jan. '82) from cattle shed. *Dhaniyalur*—6 ♀ ♀ 6 ♂ ♂ between 7 Feb. '81 and 16 jan. '82 from herb vegetation, 1 ♀ (16 Jan. '82) from cattle shed, 3 ♀ ♀, 2 ♂ ♂ (4 Apr. '81) larvae reared from nala margin. *Dhobhiguda*—6 ♀ ♀, 6 ♂ ♂ (12 Dec. '80) larvae reared from pond margin. *Dongariguda*—22 ♀ ♀, 5 ♂ ♂ between 30 Aug. '80 and 20 nov. '81 from herb vegetation, 4 ♀ ♀, 4 ♂ ♂ (31 Mar. '81) larvae reared from kaccha well, 1 ♀ , 1 ♂ (20 Aug. '81) larvae reared from rainy pool, 2 ♀ ♀, 2 ♂ ♂ (20 Nov. '81) larvae reared from road side pool. *Gumiyapal*—20 ♀ ♀, 5 ♂ ♂ between 3 Sept. '81 and 21 Jan. '82 from herb vegetation. *Jagdalpur*—7 ♀ ♀, 6 ♂ ♂ (12 nov. '81) from herb vegetation, 1 ♀ (12 Nov. '81) from cattle shed, 1 ♀ (18 Jan. '82) from human

dwellings, 257 ♀♀, 230 ♂♂ larvae reared between 7 Dec. '80 and 23 Mar. '82 from pond margin, 14 ♀♀, 5 ♂♂ (17 Jan. '81) larvae reared from paddy fields. *Kachora*—7 ♀♀ between 28 Mar. '81 and 8 Jan. '82 from herb vegetation, 1 ♀ (22 Jan, '82) from cattle shed, 1 ♀ (22 Jan. '82) from human dwelling, 3 ♀♀, 1 ♂ larvae reared between 4 Sept. '81 and 30 Sept. '81 from paddy field. *Kakalgur*—5 ♀♀, 3♂♂ between 29 Aug. '81 and 24 Dec. '81 from herb vegetation, 2 ♀♀ (16 Aug. '81), 1 ♀, 1 ♂ (15 Jan. '82) larvae reared from vegetation. *Karanji*—246 00 between 18 Jan. '81 and 12 Nov. '81 from bovine bait, 42 ♀♀ between 27 Jul. '81 and 22 Dec. '81 from human bait, 15 ♀♀, 20 ♂♂ between 2 Oct. '80 and 7 Jan. '82 from herb vegetation, 2 ♀♀ (12 Aug. '81), 1 ♀, 2 ♂♂ (26 Aug. '81) larvae reared from paddy field. *Keslur*—1 ♀, 1 ♂ (20 Jul. '81), 1 ♀, 2 ♂♂ (18 Jan. '82) from herb vegetation. *Kotamsar*—158 ♀♀ between 24 Oct. '80 and 18 Dec. '81 from bovine bait, 36 ♀♀ between 24 Oct. '80 and 3 Nov. '81 from human bait, 1 ♀, 2 ♂♂ (6 Feb. '81) from herb vegetation, 10 ♀♀, 20 ♂♂ larvae reared between 2 Dec. '80 and 19 Dec. '81 from rock pits. *Kumarawand*—21 ♀♀; 7 ♂♂ between 22 Aug. '81 and 17 Dec. '81 from herb vegetation, 19 ♀♀, 23 ♂♂ larvae reared between 5 nov. '80 and 17 Dec. '81 from weedy pools, 2 ♀♀; 2 ♂♂ (11 Mar. '81) larvae reared from pond margin, 4 ♀♀, 1 ♂ (31 Jul. '81) larvae reared from paddy field. *Kurandi*—325 ♂♂ between 26 Aug. '80 and 1 May '81 from bovine bait, 52 ♀♀ between 27 Oct. 80 and 15 Apr. '81 from human bait, 7 ♀♀, 4 ♂♂ between 30 Aug. '80 and 11 Feb. '81 from herb vegetation, 1 ♀ (23 Nov. '81), 2 ♀♀ (11 Dec. '81) from cattle shed, 110 ♀♀, 86 ♂♂ larvae were reared between 29 Nov. '80 and 11 Dec. '81 from pond margin, 34 ♀♀, 36 ♂♂ larvae reared between 14 Nov. '80 and 26 Dec. '81 from paddy fields. *Lendra*—13 ♀♀, 6 ♂♂ between 7 Sept. '81 and 11 Jan. '82 from herb vegetation. *Neganar*—4 ♀♀, 3 ♂♂ (10 Dec. '81) larvae reared from pond margin. *Pakhanjore*—38 ♀♀, 20 ♂♂ between 27 Aug. '81 and 29 Nov. '81 from herb vegetation, 2 ♀♀ (20 Nov. '81), 14 ♀♀ (22 Nov. '81) from cattle shed, 2 ♂♂ (29 Nov. '81) larvae reared from pond margin. *Pandripani*—45 ♀♀, 25 ♂♂ between 17 Aug. '81 and 18 Jan. '82 from herb vegetation, 1 ♀ (14 Dec. '81), 2 ♀♀, 1 ♂ (29 Dec. '81) from cattle shed. *Potanar*—17 ♀♀, 9 ♂♂ between 9 Apr. '81 and 21 Jan. '82 from herb vegetation, 2 ♀♀, 3 ♂♂ (17 Sept. '81) larvae reared from rainy pool. *Rajur*—21 ♀♀, 6 ♂♂ between 7 Oct. '80 and 11 Jan. '82 from herb vegetation, 1 ♀ (11 Jan. '82) from human dwellings, 1 ♀, 2 ♂♂ (27 Jul. '81) larvae reared from paddy fields, 2 ♀♀, 1 ♂ (7 Sept. '81) larvae reared from rainy pool. *Retawand*—1 ♀ (20 Nov. '80) from herb vegetation, 1 ♀, 2 ♂♂ (12 Jan. '82) larvae reared from nala margin. *Sargipal*—5 ♀♀, 1 ♂ between 22 Nov. '80 and 9 Feb. '81 from herb vegetation. *Tahakapal*—17 ♀♀, 5 ♂♂ between 10 Jul. '81 and 16 Dec. '81 from herb vegetation, 4 ♀♀ (21 Jan. '82) from cattle shed, 1 ♀ (21 Jan. '82) from human dwellings. *Takaraguda*—11 ♀♀, 5 ♂♂ between 18 Aug. '81 and 15 Dec. '81 from herb vegetation, 1 ♂ (20 Jan. '82) from cattle shed. *Tandpal*—16 ♀♀, 8 ♂♂ between 21 Jan. '82 and 31 Dec. '81 from herb vegetation. *Tekameta*—20 ♀♀, 17 ♂♂ between 3 Jul. '81 and 3 Dec. '81 from herb vegetation, 2 ♀♀, 1 ♂ (3 Sept. '81) larvae reared from paddy field. *Telengarapur*—15 ♂♂ (12 Jan. '82) from bovine bait, 1 ♀ (12 Jan. '82) from human bait, 7 ♀♀, 3 ♂♂ between 12 Jan. '82 and 13 Jan. '82 from herb vegetation, 2 ♀♀, 1 ♂ (13 Jan. '82) from cattle shed, 7 ♀♀, 4 ♂♂ (13 Apr. '81) larvae reared from nala margin. *Tokapal*—1 ♀, 1 ♂ (23 Sept. '81), 1 ♀ (11 Jan. '82) from herb vegetation, 11 ♀♀, 11 ♂♂ (29 Dec. '81) larvae reared from pond margin.

9. Culex quinquefasciatus Say

1923. *Culex quinquefasciatus* Say, *J. Acad. Nat. Sci. Phila.* 2 : 10.
1978. *Culex quinquefasciatus* : Knight : 46.

Present records : Adawal — 66 ♀♀, 61 ♂♂ between 11 Jul. '80 and 22 Jan. '82 from herb vegetation, 5 ♀♀, 1 ♂ (18 Dec. '81) from cattle shed, 17 ♀♀, 7 ♂ (29 Jan. '82), 2 ♂♂ (18 Dec. '81) from human dwellings, 9 ♀♀, 11 ♂♂ (25 Sept. '81) larvae reared from discarded pitcher. *Aghanpur*—13 ♀♀, 25 ♂♂ between 19 Mar. '81 and 17 Dec. '81 from cattle shed, 1 ♂ (11 Agu. '81) larvad reared from discarded tin, 2 ♀♀ (19 Sept. '81) larvae reared from discarded pitcher. *Balanga*—1 ♀ (4 Aug. '81), 1 ♀ (28 Dec. '81) from herb vegetation. *Bastar*—1 ♀, 2 ♂♂ between 22 Dec. '81 and 27 Jan. '82 from herb vegetation, 5 ♀♀ (27 Jan. '82) from human dwellings. *Bhond*—3 ♀♀, 5 ♂♂ between 11 Nov. '80 and 28 Dec. '81 from herb vegetation, 2 ♀♀, 2 ♂♂ (15 Dec. '81) from human dwellings, 1 ♂ (20 Jan. '82) from cattle shed. *Bringpal*—66 ♀♀, 67 ♂♂ between 15 Jan. '81 and 18 Jan. '82 from herb vegetation, 7 ♀♀ between 16 Nov. '81 and 29 Dec. '81 from cattle shed, 126 ♀♀, 143 ♂♂ (6 Jul. '81), 35 ♀♀, 14 ♂♂ (20 Jul. '81) larvae reared from discarded tub, 2 ♀♀, 5 ♂♂ (20 Jul. '81) larvae reared from discarded pitchers. *Chapar—Bhanpuri*—1 ♀ (31 Jul. '80) from herb vegetation, 12 ♀♀, 5 ♂♂ (23 Jan. '82), 2 ♀♀, 3 ♂♂ (23 Jan. '82) from indoor human dwellings, 1 ♂ (28 Aug. '81) larvae reared from discarded pitcher. *Chindawada*—3 ♀♀, 3 ♂♂ between 23 Mar. '81 and 28 Jan. '82 from herb vegetation. *Darbha*—13 ♂♂ between 21 Jul. '80 and 15 Sept. '81 from bovine bait, 21 ♀♀, 2 ♂♂ between 17 Mar. '80 and 1 Sept. '81 from human bait, 1 ♀ (18 Mar. '81), 2 ♀♀, 3 ♂♂ (4 Jul. '81) from herb vegetation, 2 ♀♀ (23 Sept. '80) larvae reared from forest pool, 1 ♂ (16 Sept. '81) larva reared from rock pool. *Daurgaon*—4 ♀♀, 2 ♂♂ (5 Sept. '81), 1 ♀ (13 Nov. '81) from herb vegetation, 1 ♀ (19 Jan. '82) from cattle shed. *Dhaniyalur*—6 ♀♀, 4 ♂♂ between 12 Jun. '81 and 16 Jan. '82 from cattle shed, 1 ♀ (26 Dec. '81), 3 ♀♀ (16 Jan. '82) from human dwellings. *Dharampura*—40 ♀♀, 28 ♂♂ (14 Jul. '81) larvae reared from Ant well. *Dongariguda*—8 ♀♀, 6 ♂♂ between 23 Jul. '81 and 8 Jan. '82 from herb vegetation, 6 ♀♀, 1 ♂ (22 Jan. '82) from cattle shed, 11 ♀♀, 4 ♂♂ (22 Jan. '82) from human dwellings, 1 ♂ (31 Mar. '81), 8 ♀♀, 3 ♂♂ (23 Jul. '81) larvae reared from kaccha well, 4 ♀♀, 6 ♂♂ (20 Aug. '81) larvae reared from discarded pitcher. *Gumiyapal*—6 ♀♀, 7 ♂♂ (16 Dec. '81) from herb vegetation. *Jagdalpur*—12 ♀♀, 15 ♂♂ between 23 Nov. '80 and 12 Nov. '81 from herb vegetation, 2 ♀♀, 1 ♂ (12 Nov. '81) from cattle shed, 217 ♀♀, 508 ♂♂ between 10 Jan. '81 and 18 Jan. '82 from human dwellings, 6 ♀♀, 9 ♂♂ between 7 Dec. '80 and 15 Mar. '81 larvae reared from pond margin, 313 ♀♀, 425 ♂♂ larvae reared from gutter water, 70 ♀♀, 77 ♂♂ between 8 Feb. '81 and 5 Apr. '81 larvae reared from gutter water, 70 ♀♀, 77 ♂♂ larvae reared from kaccha well, 108 ♀♀, 57 ♂♂ (21 Sept. '80) larvae reared from Iron tank and drums, 56 ♀♀, 63 ♂♂ (21 Sept. '80) larvae reared from rainy pit, 2 ♀♀, 2 ♂♂ (10 Oct. '81), 2 ♂♂ (11 Oct. '81) larvae reared from motor tyre. *Kachora*—40 ♀♀, 29 ♂♂ between 28 Mar. '81 and 8 Jan. '82 from herb vegetation, 9 ♀♀, 13 ♂♂ (8 Jan. '82), 84 ♀♀, 54 ♂♂ (22 Jan. '82) from cattle shed, 41 ♀♀, 20 ♂♂ between 9 Jul. '81 and 4 Sept. '81 larvae reared from discarded pitcher. *Kakalgur*—1 ♀ (29 Aug. '81), 1 ♀ (28 Jan. '82) from herb vegetation. *Kangoli*—2 ♀♀, 3 ♂♂ (21 Nov. '81) from herb vegetation. *Karanji*—6 ♀♀ between

from human bait, 1 ♀ (7 Jan. '82) from herb vegetation, 2 ♀ ♀ (25 Nov. '81) from cattle shed. *Keslur*—5♀♀, 5 ♂♂ between 29 Jun. '81 and 31 Aug. '81 from herb vegetation, 1 ♀ (18 Jan. '82) from cattle shed, 4♀♀ (14 Dec. '81), 3♀♀ (18 Jan. '82) from human dwellings. *Kotamsar*—19 ♀♀ between 3 Mar. '80 and 1 ♀ (18 Dec. '81) from human bait, 1 ♂ (6 Feb. '81) larvae reared from rock pool. *Kumarawand*—9♀♀, 7♂♂ between 19 Mar. '81 and 3 Dec. '81 from herb vegetation, 12♀♀, 5♂♂ (3 Dec. '81) 9♀♀, 4 ♂♂ (23 Jan. '82) from cattle shed, 17♀♀, 3♂♂ between 10 Nov. '81 and 23 Jan. '82 from human dwellings. *Kurandi*—317 ♀♀, 72 ♂♂ between 27 Mar. '80 and 15 Apr. '81 from bovine bait, 967♀♀, 58♂♂ between 25 Feb. '80 and 15 Apr. '81 from human bait, 1 ♂ (30 Aug. '80), 1 ♀, 2 ♂♂ (18 Jan. '81) from herb vegetation, 1 ♀ (23 Nov. '81), 3♀♀, 2♂♂ (16 Jan. '82) from cattle shed, 1 ♀ (2 May '81) from human dwellings. *Lendra*—1 ♀ (7 Sept. '81), 1 ♀ (11 Jan. '82) from herb vegetation, 1 ♂ (11 Jan. '82) from human dwellings. *Pakhanjore*—1 ♀, 2 ♂♂ (27 Aug. '81), 1 ♀ (29 Nov. '81) from herb vegetation, 1 ♀ (28 Nov. '81) from human dwellings. *Pandripani*—5 ♀♀, 2♂♂ between 4 Dec. '81 and 18 Jan. '82 from herb vegetation, 17♀♀ between 16 Nov. '81 and 18 Jan. '82 from cattle shed, 1 ♀ (16 Nov. '81) from human dwellings, 1 ♀ (28 Aug. '81), 2♀♀, 1 ♂ (17 Sept. '81) larvae reared from discarded pitchers. *Potanar*—9♀♀, 11♂♂ between 9 Apr. '81 and 21 Jan. '82 from herb vegetation, 4 ♀♀ (21 Jan. '82) from human dwellings. *Rajur*—6♀♀, 6♂♂ between 10 Aug. '81 and 11 Jan. '82 from herb vegetation, 1 ♀ (11 Jan. '82), 11♀♀, 8♂♂ (25 Jan. '82) from cattle shed, 3 ♀♀ (25 Jan. '82) from human dwellings. *Retawand*—11♀♀, 6♂♂ (7 Jul. '81) larvae reared from discarded earthen pot. *Sargipal*—1 ♀, 11♂♂ between 22 Nov. '80 and 9 Feb. '81 from herb vegetation. *Tahakapal*—3♀♀, 4 ♂♂ between 27 Jan. '81 and 31 Dec. '81 from herb vegetation, 4♀♀, 11 ♂♂ (21 Jan. '82), 1 ♀ (16 Dec. '81) from cattle shed, 2♂♂ (21 Jan. '82), 1 ♀, 1 ♂ (16 Dec. '81) collected from human dwellings. *Takaraguda*—23♀♀, 26♂♂ between 25 Jul. '80 and 20 Jan. '82 from herb vegetation, 2♀♀ (15 Dec. '81) from cattle shed. *Tandpal*—6♀♀, 2♂♂ between 21 Jan. '82 and 17 Sept. '81 from herb vegetation, 1 ♀ (16 Dec. '81) from cattle shed, 155♀♀, 195 ♂♂ (27 Jun. '81), 2♀♀, 1 ♂ (21 Aug. '81) larvae reared from discarded pitchers. *Tekameta*—4♀♀ between 28 Aug. '81 and 21 Nov. '81 from herb vegetation, 2♂♂ (3 Jul. '81) larvae reared from discarded earthen pot, 4♀♀, 2♂♂ (5 Sept. '81) larvae reared from road side rainy pool. *Telengarapur*—1 ♂ (14 Dec. '81) from cattle shed. *Tokapal*—39♀♀, 80♂♂ between 24 Nov. '80 and 25 Jan. '82 from herb vegetation, 3♀♀, 4♂♂ (11 Jan. '82) from cattle shed, 66♀♀, 43 ♂♂ larvae reared between 16 Jul. '81 and 30 Jul. '81 from discarded domestic containers.

10. **Culex sinensis** Theobald

1903. *Culex sinensis* Theobald, *M. C.* 3 : 180.
1977. *Culex sinensis* : Knight and Stone : 222.

Present records : *Adawal*—2♀♀, 1 ♂ between 11 Jul '80 and 20 Nov. '80 from herb vegetation. *Aghanpur*—1 ♂ (26 Sept. '81) from shrubby vegetation. *Balenga*—1 ♀ (15 Dec. '81) from herb vegetation. *Bastar*—1 ♀ (22 Dec. '81) from herb vegetation. *Bringpal*—1 ♀, 1 ♂ (14 Sept. '81) from herb vegetation. *Darbha*—5 ♀♀ between 8 Sept. '80 and 15 Sept. '81 from bovine bait, 7 ♀♀ (15 Sept. '81) from human bait, 1 ♀ (18 Nov. '80), 1 ♂ (19 Sept. '81) from herb vegetation. *Daurgaon*—1 ♂ (13 Nov. '81) from herb vegetation. *Dongariguda*—1 ♂ (30 Sept.

'81) from herb vegetation. *Gumiyapal*—1 ♀ (3 Sept. '81) from herb vegetation. *Kachora*—1 ♀ (6 Aug. '81) from herb vegetation. *Kakalgur*—1 ♂ (15 Jul. '81) from herb vegetation. *Karanji*—9 ♀ ♀ between 27 Jul. '81 and 8 Sept. '81 from bovine bait, 12 ♀ ♀ between 27 Jul. '81 and 30 Sept. '81 from human bait, 1 ♂ (22 Sept.'81) from herb vegetation. *Kumarawand*—1 ♂ (22 Aug. '81), 2 ♀ ♀ (26 Sept. '81) from herb vegetation. *Kurandi*—1 ♀ (17 Jul. 80), 5 ♀ ♀ (26 Aug. '80) from bovine bait, 3 ♀ ♀ (17 Jul. '80) from human bait. *Lendra*—1 ♀ (7 Sept. '81), 1 ♂ (23 Sept. '81) from herb vegetation. *Pakhanjore*—3 ♂ ♂ (27 Aug. '81), 1 ♀ (27 Nov. '81) from herb vegetation. *Pandripani*—1 ♂ (14 Sept. '81), 1 ♀ (24 Sept. '81) from herb vegetation. *Potanar*—1 ♀ , 1 ♂ (3 Sept. '81) from herb vegetation. *Rajur*—1 ♂ (7 Sept. '81) from shrubby vegetation. *Tahakapal*—1 ♀ (17 Sept. '81) from herb vegetation. *Tekameta*—1 ♀ , 1 (9 Sept. '81), 1 ♀ , 1 ♂ (23 Sept. '81) from herb vegetation, 1 ♀ (3 Sept. '81) larvae reared from paddy field. *Telengarapur*—1 ♀ (24 Dec. '81) from cattle shed.

11. **Culex tritaeniorhynchus Giles**

1901. *Culex tritaeniorhynchus* Giles, *Journ. Bomb. Nat. Hist. Soc.* **13** : 606.
1977. *Culex tritaeniorhynchus* : Knight and Stone : 226.

Present records : *Balenga*—1 ♀ , 1 ♂ (22 Jul. '81) larvae reared from rainy pit. *Bastar*—1 ♂ 22 Dec. '81) from herb vegetation, 1 ♀ (8 Sept. '81) larvae reared from paddy fields. *Chapar-Bhanpuri*—1 ♀ (28 Aug. '81) from herb vegetation. *Chindawada*—1 ♀ (29 Aug. '81) from herb vegetation, 1 ♀ (29 Aug. '81) larvae reared from paddy field. *Darbha*—16 ♀ ♀ between 28 Aug. '80 and 15 Sept. '81 from bovine bait, 1 ♀ (17 Nov. '80), 5 ♀ ♀ (18 Aug. '81) from human bait. *Dhaniyalur*—1 ♀ (11 Dec. '81) from herb vegetation. *Gumiyapal*—1 ♀ (3 Sept. '81), 3 ♀ ♀ (17 Sept. '81) from herb vegetation. *Jagdalpur*—1 ♀ (17 Apr. '81) larvae reared from paddy field. *Kakalgur*—1 ♀ (15 Jan. '82) from herb vegetation, 3 ♀ ♀, 1 ♂ (16 Aug. '81) larvae reared from paddy field. *Karanji*—9 ♀ ♀ between 11 Aug. '81 and 8 Sept. '81 from bovine bait. *Kotamsar*—1 ♀ (5 Nov. '80) from bovine bait, 1 ♀ (5 Feb. '81) from human bait. *Kumarawand*—1 ♀ (26 Sept. '81) from herb vegetation. *Kurandi*—69 ♀ ♀ between 26 Aug. '80 and 15 Apr. '81 from bovine bait, 1 ♀ (26 Aug. '80) from human bait, 1 ♀ (30 Aug. '80), 1 ♀ (12 Feb. '81) from herb vegetation, 1 ♀ (27 Aug. '81) larvae reared from paddy field. *Pakhanjore*—1 ♀ (27 Aug. '81) from herb vegetation, 3 ♀ ♀ (22 Nov. '81) from cattle shed. *Pandripani*—1 ♀ (16 Nov. '81), 1 ♂ (18 Jan. '82) from herb vegetation, 1 ♀ (16 Nov. '81) from cattle shed. *Potanar*—2 ♂♂ (28 Aug. '81), 1 ♀ (21 Jan. '82) from herb vegetation. *Rajur*—1 ♀ (25 Jan. '82) from cattle shed. *Takaraguda*—1 ♀ (15 Sept. '81) from herb vegetation. *Tandpal*—1 ♀ , 1 ♂ (21 Jan. '82), 1 ♀ (3 Sept. '81) from herb vegetation. *Tekameta*—1 ♀ (3 Sept. '81) larvae reared from paddy field. *Telengarapur*—2 ♀ ♀ (12 Jan. '82) from bovine bait. *Tokapal*—1 ♀ (10 Aug. '81) from herb vegetation.

12. **Culex vishnui** Theobald

Present records : *Adawal*—1 ♀ (20 Aug. '81) from herb vegetation, 2 ♀ ♀ (28 Mar. '81) larvae reared from rock pool. *Bhond*—1 ♀ , 1 ♂ (4 Aug. '81) from herb

vegetation. *Bringpal*—1 ♀ (14 Sept. '81), 1 ♀ (24 Sept. '81) from herb vegetation. *Chapar-Bhanpuri*—1 ♂ (28 Aug. '81) from herb vegetation. *Darbha*—10 ♀ ♀ between 22 Spet. '80 and 18 Aug. '81 from bovine bait, 1 ♀ (17 Nov. '80) from human bait. *Dhaniyalur*—2 ♀ ♀ (4 Apr. '81) larvae reared from nala margin. *Dongariguda*—6 ♀ ♀, 4 ♂ ♂ (31 Mar. '81) larvae reared from kaccha well. *Gumiyapal*—1 ♀ (3 Sept. '81) from herb vegetation. *Jagdalpur*—2 ♀ ♀ (17 Apr. '81) larvae reared from pond margin. *Kachora*—1 ♀ (9 Jul. '81) from herb vegetation. *Karanji*—3 ♀ ♀ (11 Aug. '81), 3 ♀ ♀ (25 Aug. '81) from bovine bait, 3 ♀ ♀ (11 Aug. '81) from human bait. *Keslur*—1 ♀ (13 Apr. '81) larvae reared from pond margin. *Kotamsar*—1 ♀ (5 Nov. '80) from bovine bait, 2 ♀ ♀ (24 Oct. '80), 1 ♀ (8 Apr. '81) from human bait. *Kumarawand*—2 ♀ ♀, 1 ♂ between 22 Aug. '81 and 10 Nov. '81 from herb vegetation. *Kurandi*—18 ♀ ♀ between 26 Aug. '80 and 29 Jan. '81 from bovine bait, 4 ♀ ♀ between 13 Nov. '80 and 15 Apr. '81 from human bait. *Pakhanjore*—3 ♀ ♀ (22 Nov. '81) from cattle shed. *Potanar*—1 ♀, 1 ♂ (28 Aug. '81) from herb vegetation, 2 ♀ ♀, 2 ♂ ♂ (21 Jan. '82) from cattle shed. *Sargipal*—1 ♀ (22 Nov. '80) from herb vegetation. *Tahakapal*—2 ♀ ♀ (27 Jun. '81), 1 ♀ (16 Dec. '81) from shrubby vegetation. *Takaraguda*—1 ♀ (15 Sept. '81) from herb vegetation. *Tekameta*—1 ♀ (11 Aug. '81) from herb vegetation.

13. **Culex whitmorei** (Giles)

1904. *Taeniorhynchus whitmorei* Giles, *Journ. Trop. Med.* **3** : 367.
1977. *Culex whitmorei* : Knight and Stone : 228.

Present records : *Adawal* - 8 ♀ ♀, 1 ♂ between 11 Jul '80 and 20 Nov.'81 from herb vegetation. *Aghanpur* - 3 ♀ ♀ between 11 Aug. '81 and 26 Sept. '81 from herb vegetation. *Balenga* - 22 ♀ ♀ between 22 Jul. '81 and 15 Sept. '81 from herb vegetation. *Bastar* - 4 ♀ ♀, 1 ♂ between 24 Sept. '80 and 20 Nov. '80 from herb vegetation. *Bhond* - 12 ♀ ♀, 2 ♂ ♂ between 4 Aug. '81 and 15 Sept. '81 from herb vegetation. *Bringpal* - 17 ♀ ♀ between 3 Aug. '81 and 18 Jan. '82 from herb vegetation, 1 ♀ (31 Aug. '81) larva reared from paddy field. *Chapar-Bhanpuri* - 11 ♀ ♀ between 3 Apr. '81 and 5 Sept. '81 from herb vegetation. *Chindawada* - 1 ♀ (29 Aug. '81) from herb vegetation. *Darba* - 89 ♀ ♀ between 27 Jul. '80 and 28 Oct. '81 from bovine bait, 32 ♀ ♀ between 17 Mar. '80 and 15 Sept. '81 from human bait, 6 ♀ ♀, 2 ♂ ♂ between 12 nov. '80 and 19 Sept. '81 from herb vegetation. *Daurgaon* - 11 ♀ ♀, 3 ♂ ♂ between 13 Nov. '80 and 13 Nov. '81 from herb vegetation. *Dongariguda* - 5 ♀ ♀, 5 ♂ ♂ between 30 Aug. '80 and 20 Nov. '81 from herb vegetation 1 ♀ (20 Aug. '81) larvae reared from rainy pool. *Gumiyapal* - 11 ♀ ♀ between 24 Jul. '80 and 17 Sept '81 from herb vegetation. *Kachora* - 1 ♂ (26 Sept. '80) from herb vegetation, 3 ♀ ♀, 2 ♂ ♂ (30 Sept. '81) larvae reared from paddy field. *Kakalgur* - 1 ♀ (29 Aug. '81) from herb vegetation. *Karanji* 194 ♀ ♀ between 7 Jul. '81 and 8 Sept. '81 from human bait, 1 ♂ (2 Oct. '80) from herb vegetation, 4 ♀ ♀, 2 ♂ ♂ (12 Aug. '81), 9 ♀ ♀, 1 ♂ (26 Aug. '81) larvae reared from paddy field. *Keshur* - 3 ♀ ♀ (31 Aug. '81) from herb vegetation. *Kotamsar* - 2 ♀ ♀ (27 Jun. '80), 1 ♀ (5 Nov. '80) from bovine bait, 7 ♀ ♀ between 3 Mar. '80 and 8 Apr. '81 from human bait, 4 ♂ ♂ (6 Feb. '81) from herb vegetation. *Kumarwand* - 3 ♀ ♀ (5 Sept. '81) 1 ♀ (26 Sept. '81) from herb vegetation. *Kurandi* - 53 ♀ ♀ between 15 May '80 and 29 Jan. '81 from bovine bait, 40 ♀ ♀ between 25 Feb. '80 and 1 May '81 from human bait, 1 ♀ (11 Feb. '81) from herb vegetation, 5 ♀ ♀, 8 ♂ ♂

(30 Jul. '81) larvae reared from paddy field. *Lendra* - 1 ♀ (24 Aug. '81), 1 ♀ (7 Sept. '81) from herb vegetation. *Pakhanjore* - 1 ♀ (27 Aug. '81), 2 ♀♀ (28 Nov. '81) from herb vegetation, 1 ♀ (22 Nov. '81) from cattle shed. *Pandripani* - 7 ♀♀, 4 ♂♂ between 14 Sept. '81 and 18 Jan. '82 from herb vegetation. *Potanar* - 1 ♀ (28 Aug. '81), 1 ♀ (3 Sept. '81) from herb vegetation. *Rajur* - 5 ♀♀ between 21 Jul. '80 and 7 Sept. '81 from herb vegetation, 2 ♀♀, 3 ♂♂ (10 Aug. '81) larvae reared from paddy field. *Retawand* - 3 ♀♀, 1 ♂ (9 Jul. '80) from herb vegetation, 5 ♀♀, 1 ♂ (13 Oct. '81) larvae reared from road side pit. *Sargipal* - 2 ♂♂ (22 Nov. '80), 3 ♂♂ (23 Nov. '80) from herb vegetation. Tahakapal - 1 ♀ (21 Aug. '81) from herb vegetation. *Takaraguda* - 11 ♀♀ 1 ♂ between 18 Aug. '81 and 15 Sept. '81 from herb vegetation. *Tandpal* - 1 ♀ (21 Aug. '81), 1 ♀ (3 Sept. '81) from herb vegetation. *Tekameta* - 5 ♀♀, 2 ♂♂ between 11 Aug. '81 and 21 Nov. '81 from herb vegetation. *Telengarapur* - 3 ♀♀, 4 ♂♂ between 19 Nov. '80 and 14 Dec. '81 from herb vegetation. *Tokapal* - 2 ♂♂ (23 Sept. '81) from herb vegetation.

Subgenus **Culiciomyia** Theobald

14. **Culex nigropunctatus** Edwards

1926. *Culex nigropunctatus* Edwards, *Bull. Ent. Res.* **7** : 121.
1977. *Culex nigropunctatus* : Knight and Stone : 131.

Present records : *Bastar* - 1 ♂ (20 Nov. '80). *Bringpal* - 1 ♀ (16 Nov. '81), *Jagdalpur* - 5 ♂♂ (15 Mar. '81). *Karanji* - 1 ♂ (22 Sept. '81). *Kumarawand* - 1 ♀ (26 Sept. '81). *Tandpal* - 1 ♂ (27 Jun. '81). All the mosquitoes were collected from herb vegetation.

15. **Culex pallidothorax** Theobald

1905. *Culex pallidothorax* Theobald, *Journ. Econ. Biol.* **1** : 32.
1977. *Culex pallidothorax* : Knight and Stone : 232.

Present records : *Adawal* - 1 ♂ (18 Dec. '81) from herb vegetation. *Bringpal* - 1 ♂ (14 Dec. '81) from herb vegetation. *Chindawada* - 1 ♀, 1 ♂ (28 Jan. '82) from shrubby vegetation. *Darbha* - 1 ♂ (17 Feb. '81), 2 ♂♂ (18 Mar. '81) from herb vegetation, 17 ♀♀, 19 ♂♂ (23 Mar. '81) larvae reared from rock pool. *Dhaniyalur* - 7 ♀♀, 7 ♂♂ (11 Dec. '81), 2 ♀♀, 4 ♂♂ (16 Jan. '82) from herb vegetation, 1 ♀, 1 ♂ (16 Jan. '82) from human dwellings. *Dongarguda* - 1 ♂ (9 Nov. '81), 2 ♂♂ (20 Nov. '81) from herb vegetation. *Karanji* - 1 ♂ (9 Sept. '81) from herb vegetation. *Kurandi* - 1 ♂ (11 Feb. '81) from herb vegetation. *Pandripani* - 8 ♀♀, 22 ♂♂ between 16 Nov. '81 and 18 Jan. '82 from herb vegetation. *Potanar* - 1 ♀, 1 ♂ (21 Jan. '82) from shrubby vegetation. *Tekameta* - 1 ♀ (21 Nov. '81) from herb vegetation.

Subgenus **Eumelanomyia** Theobald

16. **Culex brevipalpis** (Giles)

1902. *Stegomyia brevipalpis* Giles, *Handbook* 2nd ed : 384.
1977. *Culex brevipalpis* : Knight and Stone : 234.

Present records : 4 ♀♀, 5 ♂♂ between 2 Oct. '80 and 8 Jan. '82 from herb vegetation. *Bringpal* - 1 ♂ (15 Jun. '81), from herb vegetation. *Chindawada* - 1 ♂

(15 Jan. '82), 1♂ (28 Jan. '82) from herb vegetation. *Darbha* - 1♀, 1♂ (17 Feb. '81), 1♀ (18 Mar. '81) from herb vegetation, 4♀♀, 1♂ (5 Aug. '81) larvae reared from the tree hole, 2♂♂ (18 Aug. '81) larvae reared from discarded pitcher, 1♂ (19 Aug. '81) larvae reared from rock pool. *Dhaniyalur* - 6♀♀, 6♂♂ between 11 Jul. '80 and 13 Aug. '81 from herb vegetation. 2♀♀, 4♂♂ (30 Jul. '81), 2♀♀ (13 Aug. '81) larvae reared from tree hole. *Dongariguda* - 1♀, 3♂♂ between 9 Jul. '81 and 9 Nov. '81 from herb vegetation. *Kakalgur* - 1♂ (1 Jul. '80), 1♀ (24 Dec. '81) from herb vegetation, 6♀♀, 2♂♂ (29 Aug. '81) larvae reared from discarded pitcher. *Keslur* - 2♀♀, 1♂ (17 Aug. '81) from herb vegetation. *Pandripani* - 2♀♀, 2♂♂ (21 Jul. '80) from herb vegetation. *Rajur* - 1♂ (23 Sept. '81) from shrubby vegetation. *Retawand* - 1♀, 1♂ (9 Jul. '80), 1♂ (24 Sept. '80) from herb vegetation. *Takaraguda* - 2♀♀, 1♂ (10 Jul. '81) larvae reared from tar barrels.

17. **Culex malayi** (Leicester)

1908. *Aedes malayi* Leicester, *Cul. Malaya* : 182.
1977. *Culex malayi* : Knight and Stone : 237.

Present records : *Adawal* - 5♀♀, 1♂ between 29 Jan. '81 and 22 Jan. '82 from herb vegetation. *Bastar* - 3♂♂ between 8 Sept. ,81 and 27 Jan. '82 from herb vegetation. *Bhond* - 1♀ (11 Nov. '80), 1♂ (15 Sept. '81) from herb vegetation. *Bringpal* - 11♀♀, 3♂♂ (14 Dec. '81), 10♀♀, 3♂♂ (18 Jan. '82) from herb vegetation. *Chindawada* - 5♀♀, 2♂♂ between 23 Mar. '81 and 28 Jan. '82 from herb vegetation, 2♀♀ (18 Nov. '81) larvae reared from rock pool. *Darbha* - 19♀♀, 1♂ between 18 Nov. '80 and 23 mar. '81 from herb vegetation, 2♀♀, 1♂ (23 Sept. '80) larvae reared from forest pool, 3♀♀, 3♂♂ (23 mar. '81) larvae reared from margin pit at rocky nala, 1 o (23 Mar. '81) larvae reared from rock pool. *Dhaniyalur* - 3♀♀, 2♂♂ between 17 Nov. '80 and 16 Jul. '81 from herb vegetation, 1♂ (16 Jan. '81) from cattle shed, 2♀♀, 1♂ (4 Apr. '81) larvae reared from margin pit at nala. *Gumiyapal* 1♂ (17 Sept. '81) from herb vegetation. *Jagdalpur* - 1♀ (17 Sept. '80) larva reared from Iron tank, 1 o (2 Apr. '81) larvae reared from pond margin. *Kakalgur* - 1♀ (28 Jan. '82) from herb vegetation, 4♀♀, 3♂♂ (15 Jul. '81) larvae reared from discarded pitcher. *Karanji* - 1♂ (22 Sept. '81) from herb vegetation. *Keslur* - 7♀♀, 2♂♂ between 31 Aug. '81 and 29 Dec. '81 from herb vegetation. *Kumarawand* - 2♀♀ (21 Nov. '81) from shrubby vegetation. *Orcha* - 1♂ (30 Nov. '81) from herb vegetation. *Pakhanjore* - 29♀♀, 38♂♂ between 27 Nov. '81 and 29 Nov. '81 from tree hole. *Pandripani* - 2♀♀, 1♂ (18 Jan. '82) from herb vegetation. *Potanar* - 4♀♀, 2♂♂ (21 Jan. '82) from herb vegetation, 1♂ (3 Jul. '81) larvae reared from nala margin. *Rajur* - 2♀♀ (15 Nov. '80), 1♀ (24 Aug. '81) from herb vegetation. *Tahakapal* - 1♀ (21 Jan. '82) from cattle shed, 2♀♀ (3 Sept, '81) from herb vegetation. *Takarguda* - 6♀♀, 3♂♂ between 15 Dec. '81 and 20 Jan. '82 from herb vegetation. *Tekameta* - 1♀, 2♂♂ between 9 Sept. '81 and 10 Nov. '81 from shrubby vegetation. *Telengarapur* - 1♂ (19 nov. '80) from herb vegetation. *Tokapal* - 1♀ (24 Aug. '81), 1♀ (23 Sept. '81) from herb vegetation.

18. **Culex pluvialis** Barraud

1924. *Culex pluvialis* barraud, *Ind. Journ. Med. Res.* 11 : 1281.
1977. *Culex pluvialis* : Knight and Stone : 238.

Present records : *Darbha* - 2♀♀, 2♂♂ (23 Mar. '81), *Kurandi* - 1♀ (12 Dec. '80),

Tahakapal - 1 ♀ (27 May '81). All the mosquitoes were collected from herb vegetation.

Subgenus **Lophoceraomyia** Theobald

19. **Culex minor** (Leicester)

1908. *Culex minor* Leicester, *Cul. Malaya* : 126.
1977. *Culex minor* : Knight and Stone : 245.

Present records : *Bhond* - 1 ♀, 1 ♂ (4 Aug. '81) larvae reared from tree hole. *Darbha* - 1 ♂ (23 Mar. '81) larvae reared from rock pool, 4 ♀♀, 6 ♂♂ (16 Sept. '81) larvae reared from tree hole. *Dhaniyalur* - 1 ♂ (30 Jul. '81) larvae reared from tree hole, 7 ♀♀, 10 ♂♂ (13 Aug. '81) larvae reared from discarded pitcher.

20. **Culex minutissimas** (Theobald)

1907. *Culicidmyia minutissimus* Theobald, *M. C.* **4** : 235.
1977. *Culex minutissimus* : Knight and Stone : 245.

Present records : *Adawal* - 13 ♀♀, 19 ♂♂, between 2 Oct. '80 and 20 Nov. '81 from herb vegetation. *Aghanpur* - 1 ♀ (3 Dec. '81) from vegetation. *Balenga* - 1 ♀, 3 ♂♂ (1 Sept. '81), 1 ♀ (15 Dec. '81) from herb vegetation. *Bastar* - 9 ♀♀, 5 ♂♂ between 17 Jun. '81 and 12 Jan. '82 from herb vegetation. *Bhond* - 5 ♀♀, 4 ♂♂ between 24 Jun. '81 and 15 Dec. '81 from herb vegetation. *Bringpal* - 5 ♀♀, 10 ♂♂ between 15 Jun. '81 and 14 Dec. '81 from herb vegetation, 1 ♀ (20 Jul. '81) larvae reared from discarded pitcher. *Chindawada* - 18 ♀♀, 10 ♂♂ between 23 Mar. '81 and 28 Jan. '82 from herb vegetation. *Darbha* - 24 ♀♀, 17 ♂♂ between 18 Mar. '81 and 23 Mar. '81 from herb vegetation, 9 ♀♀, 11 ♂♂ (23 Mar. '81) larvae reared from rock pool. *Daurgaon* 1 ♀ (13 Nov. '81) from herb vegetation. *Dhaniyalur* - 8 ♀♀, 14 ♂♂ between 11 Jul. '80 and 16 Jan. '82 from herb vegetation. *Dongariguda* - 1 ♀, 1 ♂ (31 Mar. '81) 1 ♂ (30 Sept. '81) from herb vegetation, 1 ♀ (22 Jan. '82) from human dwellings. *Gumiyapal* - 4 ♀♀, 4 ♂♂ (3 Sept. '81), 2 ♀♀, 3 ♂♂ (17 Sept. '81) from shrubby vegetation. *Jagdalpur* - 4 ♀♀, 8 ♂♂ (17 Jul. '81) from herb vegetation. *Kachora* - 4 ♀♀, 5 ♂♂ between 25 Sept. '81 and 18 Dec. '81 from herb vegetation, 1 ♂ (6 Aug. '81) larvae reared from discarded pitcher, *Kakalgur* - 1 o (15 Jul. '81) from herb vegetation. *Karanji* - 3 ♀♀, 3 ♂♂ (9 Sept. '81) from herb vegetation. *Keslur* - 1 ♂ (29 May '81), 3 ♀♀, 2 ♂♂ (29 Dec. '81) from herb vegetation. *Kumarawand* - 2 ♀♀, 6 ♂♂ between 22 Aug. '81 and 10 Nov. '81 from herb vegetation. *Lendra* - 1 ♀ (23 Sept. '81) from shrubby vegetation. *Pakhanjore* - 4 ♀♀, 22 ♂♂ (27 Nov. '81), 1 ♀, 1 ♂ (29 Nov. '81) from herb vegetation. *Pandripani* - 4 ♀♀, 2 ♂♂ between 15 Jun. '81 and 18 Jan. '82 from herb vegetation. *Potanar* - 6 ♀♀, 3 ♂♂ between 3 Jul. '81 and 21 Jan. '82 from herb vegetation. *Rajur* - 2 ♂♂ (22 Sept. '81) from shrubby vegetation. *Retawand* - 3 ♀♀, 1 ♂ between 17 Jun. '81 and 12 Jan. '82 from herb vegetation. *Tahakapal* - 7 ♀♀, 10 ♂♂ between 10 Jul. '81 and 17 Sept. '81 from herb vegetation. *Takaraguda* - 4 ♀♀, 3 ♂♂ between 7 Jul. '81 and 28 Dec. '81 from shrubby vegetation. *Tandpal* - 1 ♀ 4 ♂♂ between 21 Jan. '82 and 17 Sept. '81 from herb vegetation. *Tekameta* - 5 ♀♀, 12 ♂♂ between 11 Aug. '81 and 21 Nov. '81 from herb vegetation. *Tokapal* - 2 ♀♀ (22 Jun. '81) from herb vegetation.

Subgenus **Lutzia** Theobald

21. **Culex fuscanus** Wiedemann

1820. *Culex fuscanus* Widemann, *Dipt. Exot.* 1 : 9.
1977. *Culex fuscanus* : Knight and Stone : 248.

Present records : *Adawal* - 1 ♂ (25 Sept. '81) from herb vegetation, 1/♂ (25 Sept. '81) larva reared from discarded pitcher. *Aghanpur* - 1 ♀ (3 Dec. '81), 1/♂ (23 Jan. '82) from herb vegetation, 2 ♂♂ (19 Sept. '81) larvae reared from discarded pitcher. *Bhond* - 1 ♂ (25 Aug. '81), 2 ♀♀ (1 Sept. '81) from herb vegetation. *Chindawada* - 2♀♀, 1/♂ (29 Aug. '81) larvae reared from discarded pitcher. *Darbha* - 1♀ (23 Mar. '81), 1♀ (19 Sept. '81) from herb vegetation. *Dongariguda* - 6♀♀, 4/♂♂ (31 Mar. '81), 2 ♀♀, 1 ♂ (10 Apr. '81) larvae reared from shallow kaccha well. *Gumiyapal* - 1♀ (3 Sept. '81) from herb vegetation. *Jagdalpur* - 1 ♀ (17 Jul. '81) from herb vegetation, 3 ♀♀ (26 Feb. '81), 1 ♀, 1 ♂ (22 Mar. '81) larvae reared from gutter water, 4 ♀♀, 7 ♂♂ (22 Mar. '81) larvae reared from kaccha well, 1/♂ (2 Apr. '81) larvae reared from pond margin. *Kachora* - 2 ♀♀ (20 Aug. '80), 2 ♀♀ (4 Sept. '81) from herb vegetation. *Karanji* - 1 ♀ (9 Sept. '81), 1 ♂ (22 Sept. '81) from herb vegetation, 1 ♀ (22 Sept. '81) from human dwelling. *Kumarawand* - 1♀, 3/♂♂ (10 Nov. '81) larvae reared from discarded pitcher. *Kurandi* - 1 ♀ (13 Feb. '81) from herb vegetation. *Potanar* - 1 ♀ (28 Aug. '81) from herb vegetation. 4 ♀♀, 6/♂♂ (7 Sept. '81) larvae reared from discarded pitcher. *Rajur* - 1 ♀ (27 Jul. '81) larvae reared from paddy field. *Tekameta* - 1 ♀ (21 Nov. '81) from herb vegetation. *Tokapal* - 1 ♂ (12 Oct. '81) larvae reared from trench.

22. **Culex halifaxi** Theobald

1903. *Culex halifaxi* Theobald, *Monogr. Cul.* 3 : 231.
1977. *Culex halifaxi* : Knight and Stone : 249.

Present record : *Adawal* - 3 ♂♂ between 11 Jul. '80 and 2 Oct. '80 from herb vegetation. *Aghanpur* - 3 ♀♀ (11 Aug. '81) larvae reared from discarded tin. *Balenga* - 1 ♀ (22 Jul. '81) 1 ♂ (15 Dec. '81) from herb vegetation. *Bastar* - 3/♂♂ (20 Nov. '80) from herb vegetation. *Chindawada* - 1 ♀ (18 Nov. '81) from herb vegetation. *Darbha* - 1 ♀ (16 Sept. '81) larvae reared from sandy pit at rocky nala. *Jagdalpur* - 2♀♀, 3♂♂ (7 Dec. '80), 1 ♂ (18 Jan. '81) larvae reared from pond margin. *Kakalgur* - 1 ♀ (15 Jan. '82) larvae reared from paddy field. *Kotamsar* - 1 ♂ (6 Feb. '81) larvae reared from rock pit. *Kurandi* - 1 ♂ (27 Aug. '81) larvae reared from pond margin, 1♀, 1 ♂ (27 Aug. '81) larvae reared from paddy field. *Sargipal* - 1 ♂ (22 Nov. '80) from herb vegetation.

pallidothorax, C. brevipalpis, C. malayi, C. pluvialis, C. minor, C. minutissimus, C. fuscanus and *C. halifaxii.* The distribution records for these species were also included in the paper.

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NOTES ON THE SPECIES OF *ABOROLABIS* SRIASTAVA (INSECTA : DERMAPTERA) FROM THE INDIAN SUBCONTINENT

G. K. SRIVASTAVA
Zoological Survey of India, Calcutta

The genus *Aborolabis* was erected by Srivastava (1969) with *A. pervicina* (Burr) as its type-species. It is mainly characterised by the presence of a tooth at the base of parameres in males.

Steinmann (1979) presented a revision of the genus and recorded six species from India, South Europe and North Africa.

From the Indian subcontinent four species are known which are distributed in the mountains of North India, Nepal and Bhutan. Besides, two more species are described as new from India and *Aborolabis nigrecens* Brindle, is treated here as the synonym of *A. pervicina* (Burr).

Family ANISOLABIDIDAE
Subfamily CARCINOPHORINAE
Genus **Aborolabis** Srivastava

Aborolabis Srivastava, 1969; *Entomologist's Rec. J. Var.*, **18** : 246, Fig. 1 ; Srivastava 1976, *J. zool. Soc. India*, **2** : 40 ; Steinmann, 1978, *Fol. Ent. Hung.*, **31** (1) : 181 ; Steinmenn, 1979, *EOS, Madr.*, **53** :223.

Type species. - *Anisolabis pervicina* Burr, 1913.

Diagnostic characters—Male genitalia with parameres three times longer than broad, gently dilated at about middle, slightly narrowed apically, armed at base with a tooth of variable size, often as large as the parameres itself, distal lobes often provided with longitudinal rows of chitinous teeth.

Distribution—Oriental (Himalayas and other mountains of North East India) and Palearctic (Iberian Penninsula and Palearctic North Africa) Regions.

Key to the species (based on males only)

1(2). Penultimate sternite emarginate posteriorly, parameres broader
A. emarginata Srivastava

2(1). Penultimate sternite entire or with a small emargination in middle

3(6). Parameres longer than its basal tooth

4(5). Sides of abdominal segments ecarinate; parameres armed internally at base a minute tooth *A. meghalayaensis* sp.n.

5(4). Sides of abdominal segment ecarinate (or occasionally with a linear convexity on 8th segment only); parameres armed internally at base with a larger tooth *A. nepalensis* (Brindle)

6(3). Parameres about as long as its basal tooth

7(8). Sides of abdominal segments ecarinate *A. kalaktangensis* Srivastava

8(7). Sides of certain abdominal segments carinate

9(10). Elytra and wings well developed or former abbreviated and latter absent; sides of abdominal segments 6th to 9th obtuse angled posteriorly *A. sikkimensis* sp.n.

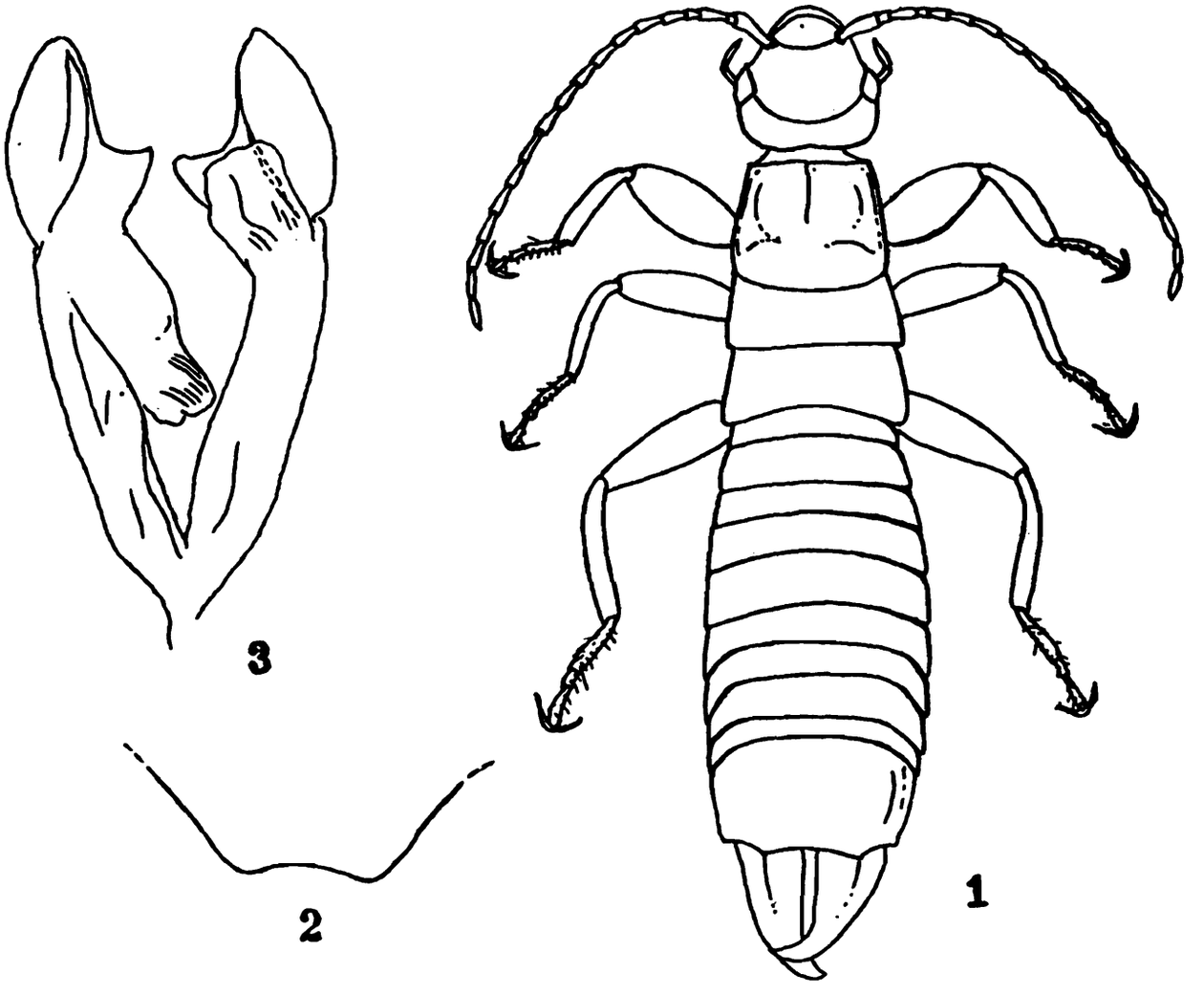
10(9). Apterous; sides of abdominal segments 6th to 9th acute angled posteriorly *A. pervicina* (Burr)

Aborolabis emarginata Srivastava

(Figs. 1-3)

Aborolabis emarginata Srivastava, 1976. *J. zool. Soc. India*, **26**(1&2) : (India, Arunachal Pradesh, Kameng Dist., Norgum River bank below Bitselling Village and Shergaon - Type in the Zoological Survey of India, Calcutta).

Material examined—INDIA : Arunachal Pradesh, Kameng Dist., Norgum River bank below Bitselling Village, 914 m, Holotype ♂ , 14.II.1961, Shergeon;



Figs. 1-3 : *Aborolabis emarginata* Srivastava, Holotype ♂, 1. Dorsal view ; 2. Posterior margin of penultimate sternite ; 3. Genitalia.

1828 m, Allotype ♀ , 29.III.1961 (*K.C. Jayaramakrishnan*); Subansiri Dist., Kimin, 1 ♂ 1 ♀, 5 nymphs, 4.XI.1989 (*S.K. Gupta*); Meghalaya, Mawphlong, 2 ♂ ♂ , 5 ♀ ♀ , 18.V.1979, ex under stones (*G.K. Srivastava*).

Brief description : ♂ General colour blackish brown; antennae with three basal and one or two ante-apical segments yellow. Pronotum yellow on sides; legs yellow but femora banded with brown in middle.

Head about as long as broad, frons tumid. Eyes smaller than the post-ocular length. Antennae 16-segmented or more. Pronotum slightly expanded posteriorly, hind margin subtruncate. Elytra and wings wanting. Legs typical for the genus. Abdomen convex, narrowed basally, finely punctulate, sides of segments 6th to 9th acute angled posteriorly, carina present on 7th and 8th only. Penultimate sternite with posterior margin emarginate. Ultimate tergite transverse, sparsely punctulate. Forceps sub-contiguous, tapering apically, trigonal in basal one third, afterwards somewhat depressed, weakly asymmetrical, left branch almost straight, right branch more curved and crossing over the left, internally crenulate. Genitalia with parameres broad, basal tooth shorter than the paramere.

♀ : Agrees with male but sides of abdominal segments rounded and ecarinate : penultimate sternite obtuse posteriorly and forceps simple and straight with apices gently incurved.

Measurements : (in mm)

	♂♂	♀♀
Length of body	11.25-11.7	9.25-12.9
Length of forceps	1.8-2.0	1.8-2.0

Distribution—India (Arunachal Pradesh and Meghalaya).

Remarks—This species differs from the following species in having the penultimate sternite emarginate posteriorly and the paremeres are greatly dilated in middle with inner basal tooth slightly shorter than parameres in length.

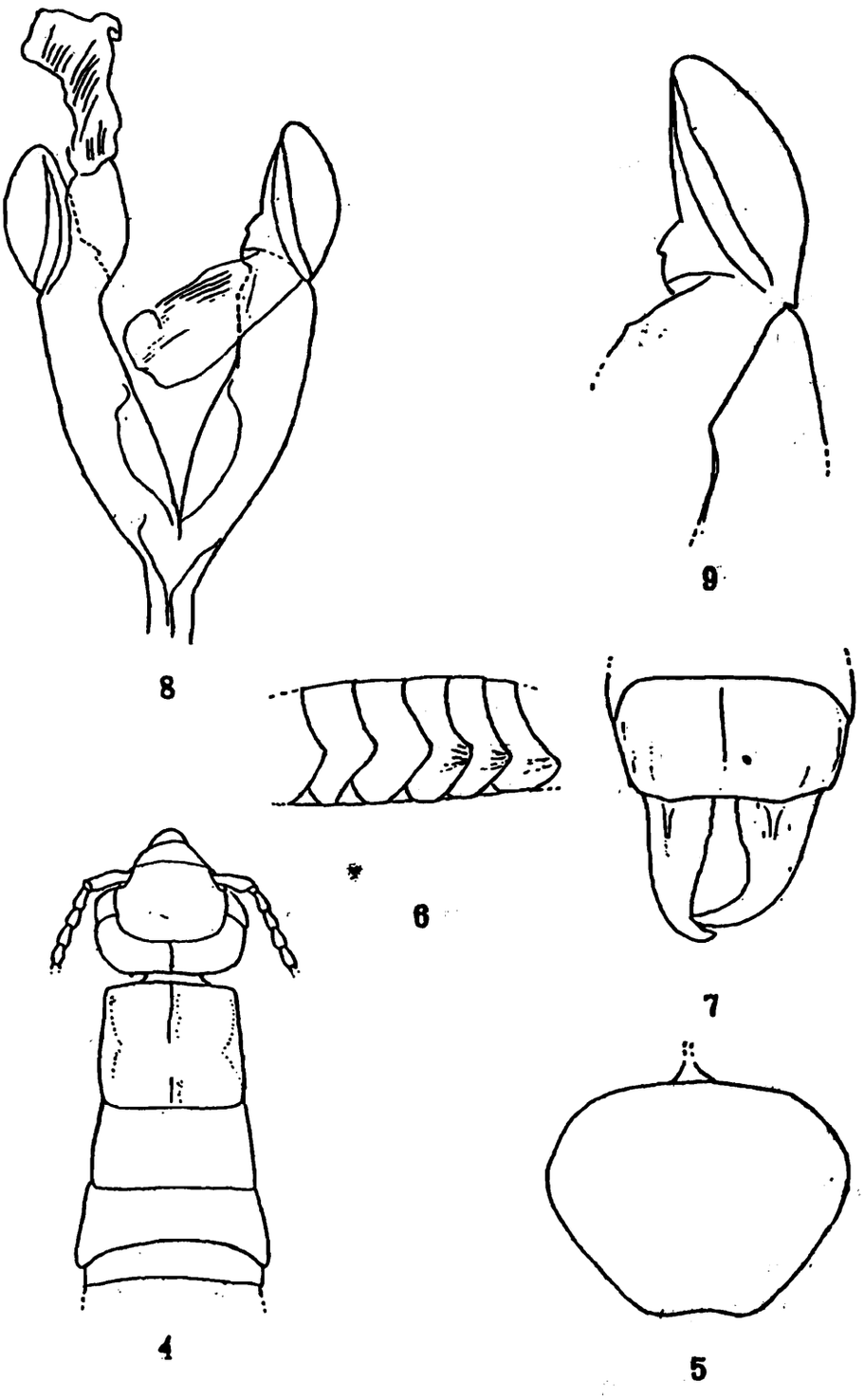
Aborolabis meghalayaensis sp.n.

(Figs. 4-9)

Description—General colour shining dark brownish black with traces of red on some tergites in middle; mouth parts, a few basal antennal segments, sides of pronotum and legs yellowish abut femora banded with black in middle.

♂ : Head about as long as broad, smooth, sutures finely marked, hind margin feebly emarginate in middle. Eyes shorter than genae in length. Antennae-12 segmented or more (partly damaged), basal segment about as long as the distance between antennal bases ; 2nd small; 3rd long, cylindrical, about as long as the combined length of 4th and 5th which are subconical, remaining gradually increasing in length distally and each narrowed basally. Pronotum smooth, as long as broad, all margins straight, sides gently reflexed in middle, gently widened posteriorly with angles rounded, median sulcus faintly marked; pro- and metazona little differentiated. Legs normal. Meso- and metanotum smooth, transverse, latter

broadly emarginate posteriorly. Abdomen moderately convex, punctate, punctation slightly faint in middle of tergites, gradually widening posteriorly, sides of segments 5th to 9th acute angled posteriorly but segments 7th to 9th only rugosely striate. Penultimate sternite punctate, triangular, scarcely emarginate in middle posteriorly; manubrium three times as long as the sternite with apex dilated. Ultimate tergite transverse, sparsly punctate, sloping backwards, median sulcus distinct, laterally an oblique carina present and more strongly punctate. Forceps remote at base, triangular in basal one third, thence depressed, tapering, in apical third gently curved with apices hooked, internal margin finely serrated. Genitalia as seen in Figs. 8 and 9.



Figs. 4-9 : *Aborolabis meghalayaensis* sp.n., Holotype ♂, 4. Anterior portion of body, without legs ; 5. Penultimate sternite ; 6. Sides of Abdominal segments ; 7. Ultimate tergite and forceps ; 8. Genitalia ; 9. Left Paramere, enlarged.

♀ : Agrees with males in most characters except that sides of abdominal segments obtusely convex; penultimate sternite triangular with hind margin entire; ultimate tergite comparatively narrowed posteriorly and forceps with branches subcontiguous and straight.

Measurements.—(in mm)

	Holotype ♂	Paratype ♀
Length of body	13.1	14.5
Length of forceps	2.1	2.7

Material examined.—INDIA : Meghalaya : Forest around Mawsamai Cave, Cherrapunji, 1300 m, Holotype ♂ (genitalia mounted between two coverslips and penultimate sternite mounted on a card and both pinned with the specimen), Paratype ♀ , 25.V.1979, under stones (*G.K. Srivastava*); deposited in the Zoological Survey of India, Calcutta.

Distribution—Known from the type locality only.

Remarks—This species comes close to *Aborolabis nepalensis* (Brindle) in having the sides of segments ecarinate but differs in having the pronotum about as long as broad (*vs* transverse in *A. nepalensis*), sides of segments 5th to 9th acute angled (*vs* 7th to 9th acute angled) and parameres armed at base with a minute tooth (*vs* armed with a large tooth).

Aborolabis nepalensis (Brindle)

(Figs. 10-13)

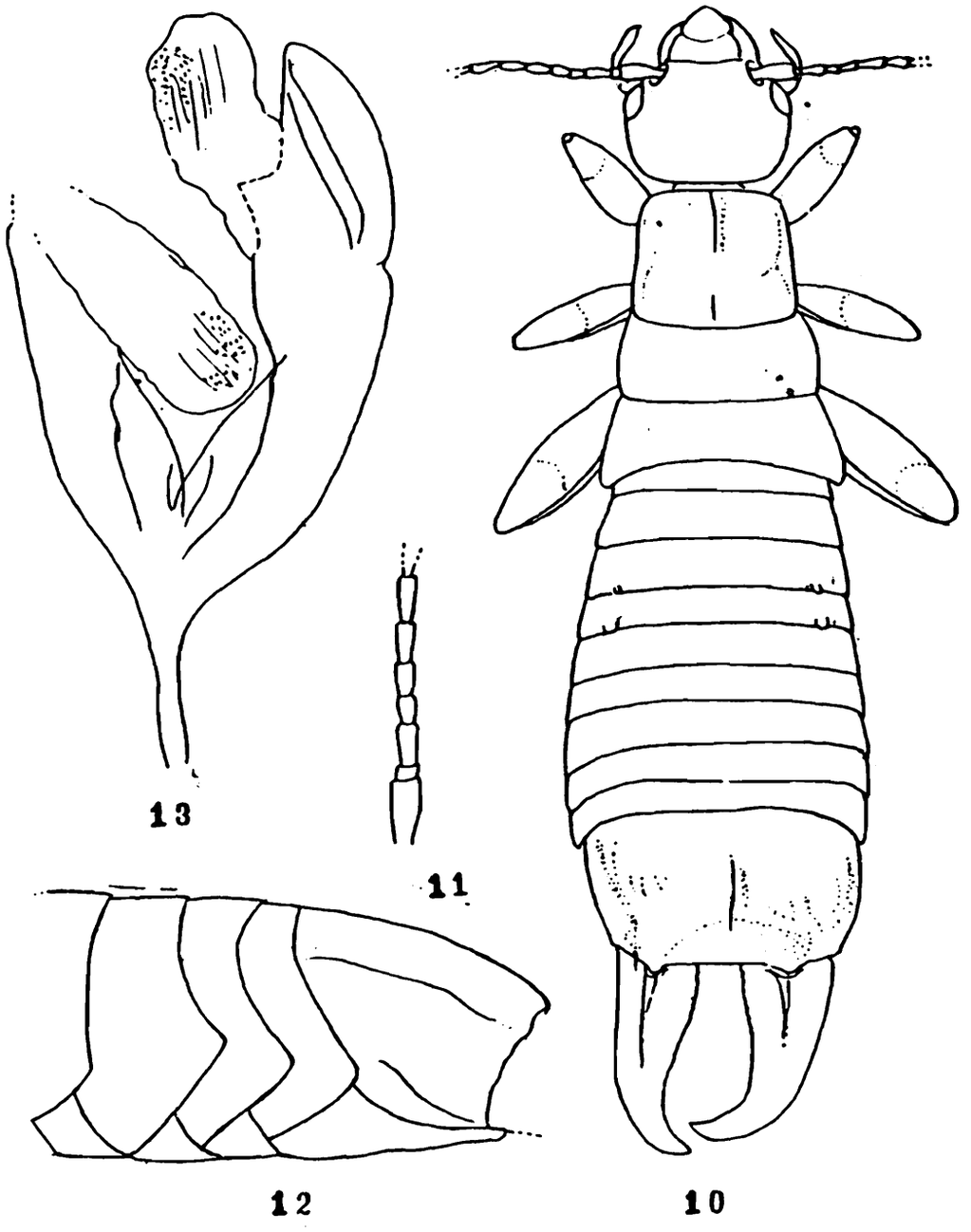
Anisolabis nepalensis Brindle, 1974, *senckenberginana biol.*, 55(1/3) : 148 (♂, ♀; Nepal-Holotype ♂, Allotype ♀ and Paratypes 2♂♂, in Senckenberg Museum, Frankfurt A. M. and Paratypes 1/♂, 1 ♀ in Manchester Museum, Manchester).

Material examined.—NEPAL : South Dhaulagiri Himal, 2300 m, Paratype 1/♂ (det. by A. Brindle as *Anisolabis nepalensis* sp.n.), 31.III.1970 (*J. Martens*); Aghore, 1050 m, 3 ♂ ♂ , 18.XI.61 (det. by *G.K. Srivastava*) (*E.S. Ross* and D.Q. Cavagnaro).

Brief description— ♂ : General colour dark brownish black ; antennae with one or two pre-apical segments yellow with apices ringed with brownish black ; legs yellow, femora dark brownish black in basal two thirds.

Head smooth, hardly emarginate in middle posteriorly. Pronotum transverse, gently widened posteriorly. Apterous. Lengs normal. Abdomen widening gradually up to 9th tergite, finely punctulate, sides of segments 7th to 9th acute angled, rugosely striate, ecarinate, occasionally with a convexity on 8th only. Penultimate sternite triangular, faintly emarginate in middle posteriorly. Ultimate tergite transverse, smooth and punctate stripes alternating, convex above in basal half, posteriorly sloping, on sides oblique carina present. Forceps remote at base, trigonal above in basal one third afterwards depressed, tapering, gently hooked

near apices, internally crenulate. Genitalia as seen in Fig. 13.



Figs. 10-13 : *Aborolabis nepalensis* (Brindle), Paratype o, 10. Dorsal view ; 11. A few basal antennal segments ; 12. Sides of abdominal segments ; 13. Genitalia, left paramere not shown.

♀ : Agrees with males in most characters except that ultimate tergite narrowed posteriorly, penultimate sternite triangular posteriorly, forceps simple and straight.

Measurements—(in mm)

	♂♂	♀♀
Length of body	12.0-13.0	12.0
Length of forceps	3.0- 3.1	2.0

Distribution.—Nepal.

Remarks—The sides of abdominal segments 7th to 9th are acute angled, often provided with a median convexity (not carina) on 8th only. In 1 ♂ from Aghore, the sides abdominal segments are smooth and ecarinate.

yellow ring; 2nd and one or two pre-apical segments yellow.

Head smooth, convex, slightly longer than broad, hind margin scarcely emarginate in middle, sutures faint. Eyes prominent, shorter than post-ocular length. Antennae 17-segmented (in Holotype ♂ , antennae of right side missing and on the left 14 segments remaining), basal segment stout, expanded apically, slightly shorter than the distance between antennal bases; 2nd short, about as long as broad; 3rd long and cylindrical; 4th a trifle shorter than 5th; 6th onwards segments slightly increasing in length and becoming less stouter. Pronotum about as long as broad, gently expanded posteriorly, sides straight, hind margin convex, median sulcus faint, prozona raised and metazona depressed; in Paratype ♂ pronotum more expanded posteriorly. Elytra well developed, meeting along the middle line, hind margin convex, shoulder week; in Paratype ♂ elytra abbreviated, shorter than pronotum in length. Wings well developed. Legs typical for the genus. Abdomen spindle shaped, weakly convex, finely punctulated, sides of abdominal segments 6th to 9th obtuse angled, rugosely punctate posteriorly, with a linear convexity but weaker on 5th and 9th segments. Penultimate sternite truncate posteriorly. Ultimate tergite transverse, gently contracted posteriorly, finely punctulated, weakly depressed, gently sloping backwards with a slight depression in middle, median sulcus distinct and short, sides straight, hind margin almost straight in middle, gently concave and oblique laterally. Forceps with branches subcontiguous, broader at base, tapering apically, trigonal in basal 1/3, afterwards depressed, left branch almost straight except in apical 1/4 gently curved, right branch strongly curved in middle with apices hooked, internal margin crenulated. Genitalia with parameres armed internally at base with a large triangular tooth, distal lobes without denticulated pads.

♀ : Agrees with males in most characters except that sides of abdominal segments convex and ecarinate; penultimate sternite obtuse posteriorly; ultimate tergite strongly narrowed posteriorly and forceps simple and straight.

Measurements—(in mm)

	Holotype	Paratypes	
	♂	1 ♂	1 ♀
Length of body	10.2	10.6	11.6
Length of forceps	2.0	2.0	2.1

Material examined.—INDIA : Sikkim, Rangpo, Holotype ♂ (macropterous; genitalia mounted between two coverslips and pinned with the specimen), Paratype 1 ♂ (brachypterous; genitalia mounted between two coverslips and pinned with the specimen), Paratype 1 ♀ (macropterous), 19.IX.1983, (*G.K. Srivastava* coll) ; deposited in the Zoological Survey of India, Calcutta.

Remarks.—This species can be easily separated from all the other known species of the genus by its slender build; presence of elytra and wings and sides of abdominal segments 6th to 9th rugosely punctate, obtuse angled posteriorly with a linear convexity, almost obsolete on 6th and 9th.

Aborolabis pervicina (Burr)

(Figs. 22-26)

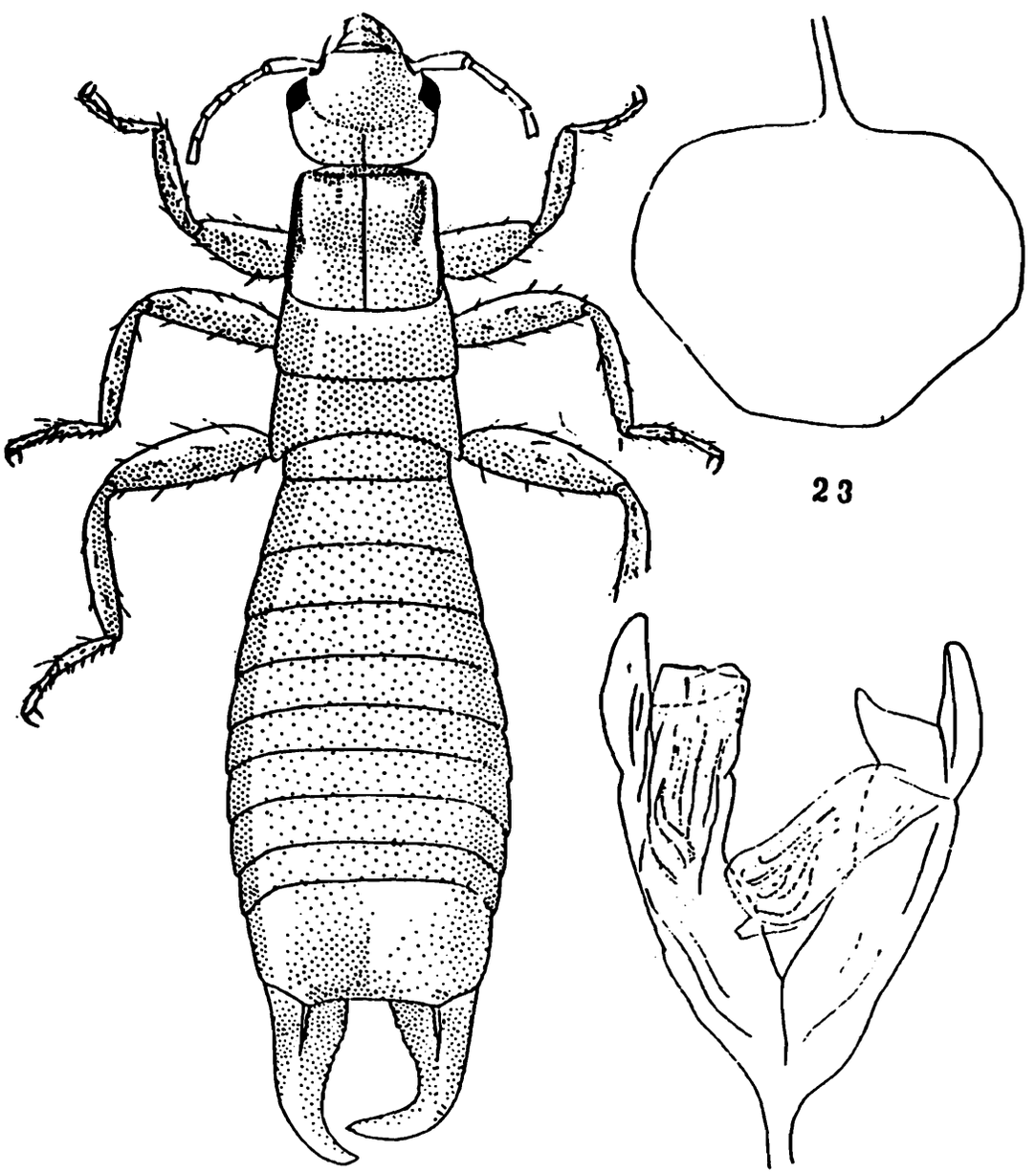
Anisolabis pervicina Burr, 1913, *Rec. Indian Mus.*, **8** (2) : 137 (o, o ; India : Assam and Arunachal pradesh, Siang Dist. - Type in the Zoological Survey of India, Calcutta); Brindle, 1975, *Ent. Basiliensia*, **1** : 18.

Paralabis pervicina ; Burr, 1915... *R. micr. Soc.*, **1915** : 540, pl. 12, Fig. 3.

Aborolabis pervicina ; Srivastava, 1969. *Entomologist's Rec.J.Var.*, **81** : 246, fig. 1; Srivastava, 1972, *Rec. zool. Surv. India*, **66**(1-4) : 131; Srivastava, 1976. *J.zool.Soc.India*, **26** (1 & 2) : 57; Brindle, 1983, *Senckenbergiana biol.*, **63** (1-2) : 98.

Aborolabis nigrescens Brindle, 1987, *Courier Forsch. - Inst. Senckenberg*, **93** : 337 (o, o ; Nepal, Nuwakot Dist., Trisuli, Kulturland, Waldreste, 600-650 m - Holotype o and Paratype 2 oo in Senckenberg Museum, Frankfurt a. M. and Paratype 1 o in Manchester Museum, Manchester) - **Syn. n.**

Material examined.—INDIA : Arunachal Pradesh : Kameng Dist., Tawang 3200 m, 2 ♂♂ , 2 ♀♀ , 29.IV.1966; Dunn Bridge, 1524 m, 3 ♂♂ , 2 nymphs, 21.IV.1966; Pinjuli, 244 m, 1 ♀ , 4.V.1966 (*A.N. T Joseph*); in and around Tawang



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Figs. 22-24 : *Aborolabis pervicina* (Burr), o, 22. Dorsal View ; 23. penultimate sternite ; 24. Genitalia.

Camp, 2 ♀♀ , 3 nymphs, 13.XII.1965, ex under stones, Tanga River—side, 1 ♂ , 1 ♀ , 3 nymphs, 19.XII.1965; In and around Rupa Camp, Tenga, 5 ♂♂, 20.XII.65, ex under stones; Shaitan Bridge, Tenga Valley, 1 ♀ , 21.XII.1965, ex under stones; Elephant Flat, Bhalukpong, 1 ♀ , 25.XII.1965, ex under stones, Dahang, 1 ♂ , 9.III.1973; Dirang, 5000 ft. 8 ♂♂, 13 ♀♀, 1 nymph,11.III.1973; 1526 m, 3 ♂♂, 5 nymphs, 12.III.1973; Sappen, 1800 m, 3 ♂♂, 1 ♀ , 13.III.1973; Rupa, 1 ♂ , 2 ♀♀ , 2 nymph, 15.III.1973; Tenga Valley, 5500 ft., 1 nymph, 6.III.1973; Bomdile, 6500 ft., 2 ♂♂, 7 ♀♀, 3 nymphs, 18.III.1973 (*S.K. Bhattacharyya*); Subansiri Dist., Chukru, 1128 m, 3 ♀♀ , 2 nymphs, 22.V.1966; Tamen, 457 m, 1 ♂ , 1 ♀ , 20.V.1966; Ziro, 1585 m, 6 ♀♀ , 7 nymphs, 13.V.1966; 18 ♂♂ , 20 ♀♀ , 7 nymphs, 14.V.1966; Hapoli 1585 m 3 ♂♂ , 2 ♀♀ , 3 nymphs, 15.V.1966; Pamir Bridge, 564 m, 3 ♂♂ , 2 ♀♀, 12.V.1966; Kimin, 198 m, 1 ♂ , 1 ♀ , 1 nymph, Godak, 975 m, 2 ♀♀ , 23.V.1966 (*A.N.T Joseph*); Pakha camp, 150 m, 1 ♂ , 4 ♀♀ , 3 nymphs, 26.X.1966 (*S.K. Tandon & G.S. Arora*); Boju Buy, 1670 m, 1 ♂ , 15.XII.1974 ; Damia, 1100 m, 5 ♂ ; 22.1.1975 ; Gealeusiniak, 1350 m, 2 ♂♂, 4 ♀♀ , 9.XII.1974; 2 ♀♀ , 1 nymph, 12.XII.1974; Tongpa, 1 ♂ , 4 ♀♀ , 2100 m, 18.XII.1974; Lemeking, 140 m, 1 ♂ ,3.XII.1974; Subansiri River, Nacho, 500 m, 1 nymph, 20.XI.1974; Rui, 780 m, 1 ♂ , 3.II.1975 (*J.M. Julka*); Siang Dist., Tappi, 600 m, 1 specimen (hind portion broken), 23.X.1966; New Jenning, 2 nymphs, 19.X.1966; Lekhabali, 50 m, 1 ♂ , 7.X.1966; Dali Village, 200 m, 1 ♂ , 10.X.1966; Jeep Camp, 140 m, 1 ♀ , 6.X.1966; Bame Village, 600 m, 1 nymph, 30.X.1966 (*S.K. Tandon & G.S. Arora*); Tirap Dist., Hayilang, 2200 ft., 3 ♂♂, 14 ♀♀, 13 nymphs, 15.I.1970; 1 ♂ , ♀ , 1 nymph, 16.XI.1970 (*J.M. Julka coll.*); Hayliang R. (Teju), 700-1200 ft., 2 ♀♀, 12.III.1969; Teju, 150 m, 1 ♀ , 10.III.1969; Manbhum, Tengapani, Forest (Namsai), 106 m, 1 ♂ , 7 nymphs, 17.III.1969; Deopani (Roing), 350 m, 1 ♂ , 2 ♀♀ , 6.III.1969; Namsai, 160 m, 1 ♀ , 3 nymphs, 15.III.1969 (*S.K. Tandon*); Lohit Dist., Kamlang River, 2100 ft., 1 ♂ , 17.XII.1969, Kamlang, 2900 ft., 2 ♀♀, 2 nymphs, 1.II.1970; Wakro, 1700 ft., 1 ♂ , 3.XII.1969; 1 ♂, 4.XII.1970; Near Chakma Village, 800 ft., 1 ♀ , 25.XI.1969; Hawaii, 4100 ft., 3 ♂♂, 1 ♀ , 8 nymphs, 9.I.1970; Yatung, 2100 ft., 1 ♂ , 12 nymphs, 13.I.1970; Chowkham, 800 ft., 1 ♀ , 22.XI.1970, (*J.M. Julka*); W.B. : Darjeeling Dist., Singla 400 m, 1 ♀ , 5.I.1976 (*G.K. Srivastava*); Sikkim : Nayabazar, Likship Road, 400 m, 9 ♂♂, 11 ♀♀, 9 nymphs, 4.I.76 (*G.K. Srivastava*).

Brief description— ♂ : General colour shining reddish to blakish brown. Legs yellowish brown, femora and tibia banded with black.

Head triangular, convex, sutures faint, hind margin faintly emarginate in middle. Eyes shorter than the post-ocular area. Antennae 19-segmented, 1st segment equal to combined length of 2nd to 4th; 2nd short, about as long as broad; 3rd long; 4th about half as long as the preceding and equal to 5th, rest gradually increasing in length distally. Pronotum quadrate, anterior and lateral margins straight, gently widened posteriorly with margin truncate or briefly convex, median suture faint or well marked, prozona raised and metazona depressed. Apterous. Legs typical for the genus. Abdomen spindle shaped, moderately convex above, surface punctate or punctulate, sides of abdominal segments 6th to 9th acute angled posteriorly, striate and provided with a median carina, sparse pubescence present on under side only. Penultimate sternite broadly rounded, punctulate, posterior margin truncate. Ultimate tergite transverse, sparsely punctate, disc weakly convex, sides rugose with a longitudinal fold, posteriorly in middle

with a faint depression, striolate above the bases of forceps, median sulcus short. Forceps with branches remote and dilated at base, trigonal with ridge present in basal 1/3 to 1/2, afterwards depressed, tapering apically with tip gently hooked and pointed, asymmetrical, right branch more curved than the left, inner margin crenulate. Genitalia with parameres three times longer than broad, gently dilated at about middle and narrowed towares apex, tip rounded, outer margin convex, internally at base armed with a triangular tooth, almost equal to paramere in length with tip pointed and hooked; preputial sacs with rows of minute teeth.

♀ : Agrees with males in most characters except that sides of abdominal segments rounded, almost smooth and ecarinate; penultimate sternite obtusly pointed posteriorly; ultimate tergite narrowed posteriorly and forceps simple and straight.

Measurements.—(in mm)

	♂♂	♀♀
Length of body	8.0 - 16.0	7.0 - 18.0
Length of forceps	2.0 - 3.0	2.0 - 3.5

Distribution—India : W.B. (Darjeeling Dist.); Sikkim and Arunachal Pradesh

Also recorded from Bhutan. It has been reported in Himalayas between altitudes 100 m and a little over 3500 m.

Remarks.—This species occurs in large numbers under stones or bark of logs and standing trees.

In a large population often some specimens with weaker forms of forceps i.e., branches subcontiguous and almost straight with apices hooked are met with. It is noticed that in such specimens the median carina on the sides abdominal segments of 6th to 9th is poorly marked. Besides in males with normal development (with forceps strongly asymmetrical) the sides abdominal segments 6th to 9th are striate and strongly carinate and 5th segment has a small tubercle or convexity at extreme end which can not be considered as a carina.

In the light of above *Aborolabis nigrescens* Brindle is considered as a synonym which possesses carina on sides of abdominal segments 6th to 9th and more or less identical male genitalia, especially parameres.

Aborolabis kalaktangensis Srivastava

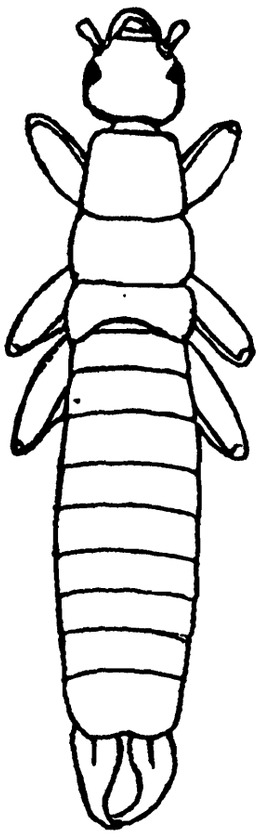
(Figs. 27 - 29)

Aborolabis kalaktangensis Srivastava, 1972. *Rec. zool. Surv. India*, **66**:(1-4) :134, Figs. 1, C-E (♂, ♀ : India : Arunachal Pradesh, Kameng Dist., Kalaktang Village-Types at Zoological Survey of India, Calcutta), Srivastava 1976. *J. zool. Soc. India*, **26**(1&2) : 59.

Material examined.—INDIA : Arunachal Pradesh, Kameng Dist., Kalaktang Village, Holotype ♂, Paratypes 2 ♀ ♀ 17.III.1961 ; Dirong Dzong, Paratypes 3 ♀ ♀, 1.II-III.1961 (*K.C. Jayaramakrishnan*); Subansiri Dist., Ziro, 1585 m, 1 ♂ , 1 ♀ , 2 nymphs, 14.V.1966 (*A.N.T Joseph*); Sikkim, Rangpo, 1 ♂ , 19.IX.1983 (*G.K. Srivastava*).

Brief description.— ♂ : General colour brownish with traces of black on

abdomen only. Head with frons tumid, sutures faint. Eyes shorter than genae in length. Antennae 17-segmented. Pronotum quadrate, anteriorly as well as posteriorly



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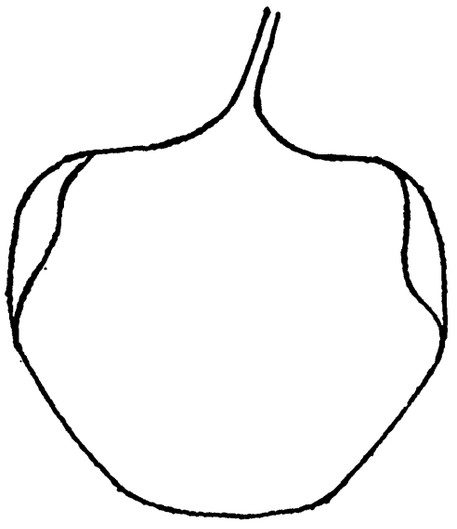

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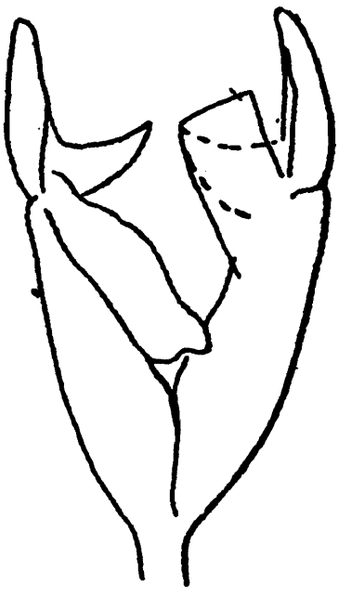

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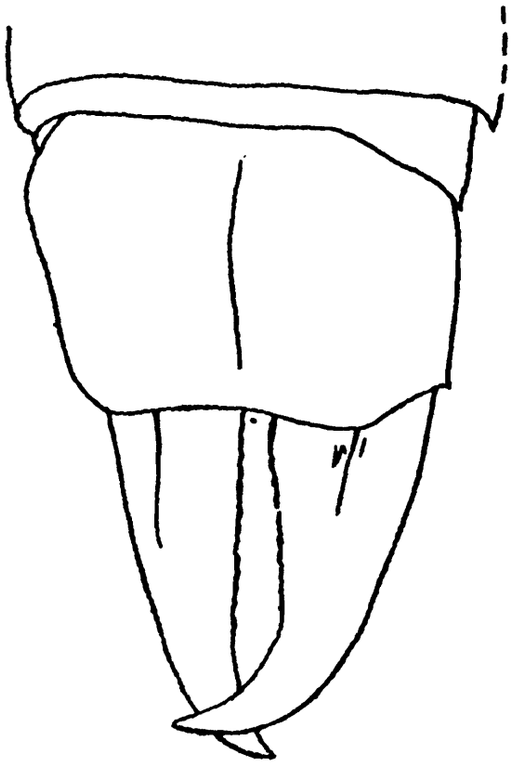

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Figs. 25-29 : *Aborolabis pervicina* (Burr), ♂, 25. Dorsal View ; 26. Genitalia ; *Aborolabis kalaktangensis* Srivastava, Holotype ♂, 27. Penultimate sternite ; 28. Ultimate tergite and forceps ; 29. Genitalia (Figs. 25-26 after Brindle, 1987 are from the Holotype ♂ of *Aborolabis nigrescens* Brindle).

truncate. Legs brownish yellow, femora proximally dark brown. Elytra and wings wanting. Legs typical for the genus. Abdomen long and slender, exceedingly finely punctulate, sides of segments 6th to 9th acute angled posteriorly, ecarinate and smooth. Last tergite quadrate. Penultimate sternite with posterior margin rounded. Forceps with branches subcontiguous, trigonal above in basal one third, afterwards depressed, internally finely crenulated. Genitalia with basal tooth of paramere large.

♀ : Agrees with male in most characters except that the sides of abdominal segments convex; penultimate sternite with hind margin obtusely rounded and forceps almost straight.

Measurements.—(in mm)

	♂♂	♀♀
Length of body	9.3-13.30	12.21-7.42
Length of forceps	1.6-1.72	1.33-1.72

Distribution—India : Arunachal Pradesh (Kameng and Subansiri Dists); Sikkim (Rangpo).

SUMMARY

Altogether six species of *Aborolabis* Srivastava, are dealt with, of which two viz., *A. meghalayaensis* and *A. sikkimensis* are described as new to science. Besides *A. nigrecens* Brindle is treated as synonym of *A. pervicina* (Burr). Description of all the species and a key for their dicrimination are provided.

ACKNOWLEDGEMENTS

My thanks are due to the Director, Zoological Survey of India, Calcutta for providing necessary facilities during the course of present study.

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Steinmann, H. 1979. A revision of the genus *Aborolabis* Srivastava 1969. *EOS, Madr.*, **53** : 213-222.

Rec. zool. surv. India, 90(1-4) : 37-42, 1992

SARCOPHAGID FLIES (DIPTERA : SARCOPHAGIDAE) FROM BHUTAN

B.C. NANDI
Department of Zoology, Darjeeling Govt. College, Darjeeling, India

INTRODUCTION

The knowledge of Bhutanese Sarcophagidae is meagre. The author has collected Sarcophagid flies from different parts of Eastern Bhutan in 1978 and this paper presents the result of the study of these flies. Eleven species under six genera are reported here. The type material will be deposited in the National Collection of Zoological Survey of India, Calcutta in due course.

ABBREVIATIONS USED IN THE TEXT

ac- acrostichal bristles, *dc*- dorsocentral bristles, *ia*- intra-alar bristles, *h*- humeral bristles, *ph*- posthumeral bristles, *np*- notopleural bristles, *sa*- supra-alar bristles, *pa*- postalar bristles, *st*- sternopleural bristles, *mpl*- mesopleural bristles, *hpl*- hypopleural bristles.

ABBREVIATIONS USED IN THE FIGURES

ap- apical plate of paraphallus, *lp*- lateral plate of paraphallus, *p*- paraphallus, *s*- styli of glans, *t*- theca of penis, *v*- ventralia of penis.

SYSTEMATIC ACCOUNTS

Subfamily SARCOPHAGINAE

Tribe SARCOPHAGINI

Subtribe PARASARCOPHAGINA

Bercaea haemorrhoidalis (Fallen)

1816. *Musca haemorrhoidalis* Fallen, *Sevensk. vet. Akad. Handl.*, p. 236.
1982. *Bercaea haemorrhoidalis* (Fallen) : Nandi, *Rec. zool. Surv. India, 79 :* 457.

Material : 50 ♂♂, Bhutan : Thimpu, 2,405 m., 20.x.1978; 5 ♂♂, Paro, 2,408 m., 28.x.1978; 6 ♂♂, Phuntsholing, 209 m., 18.x.1978; 12 ♂♂, Ha, 2.273 m., 31.x.1978; 7 ♂♂, Wangdiphodrong, 1,575 m., 25.x.1978; 5 ♂♂, Punakha, 1,576 m., 24.x.1978.

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*Present address : Krishnanagar Govt. College, Dt-Nadia, W.B., India.

Distribution : Austria, Baluchistan, Bhutan, Bulgaria, China, Denmark, England France, Germany, Hawaii, Hungary, India, Ireland, Italy, Japan, Madagascar Nepal, North America, Portugal, Rumania, Seychelles, South America, Spain Sweeden, U.S.S.R., Yugoslavia.

Boettcherisca (s. str.) peregrina (Robineau- Desvoidy)

1830. *Myophora peregrina* Robineau - Desvoidy, *Essai, Myodaires,* 1 : 356.

1982. *Boettcherisca (s.str.) peregrina* (Robineau-Desvoidy) : Nandi, *Rec. zool. Surv. India,* 79 : 457.

Material : 3♂♂, Bhutan : Phuntsholing, 209 m., 18.x.1978 ; 2♂♂, Punakha, 1,576 m., 27.x.1978.

Distribution : Austria, Bhutan, Bonin Islands, Borneo, Burma, China, Fiji, Formosa, Gilbert Islands, Hainan Island, Hawaii, India, Islands, japan, Java, Korea, Madagascar, Malaysia, Micronesia, Nepal, New Bretain, New Guinea, Philippine Islands, Samoa, Seychelles, Society Islands, South Mariana Islands, Sri Lanka, South China, U.S.S.R., Volcano Islands.

Boettcherisca (Coesica) khasiensis (Senior- White)

1924. *Sarcophaga khesiensis* Senior—White, *Rec. Indian Mus.,* **26**(3) : 246.

1982. *Boettcherisca (Coesica) khasiensis* (Senior—White) : Nandi, *Rec. zool. Surv. India,* 79 : 458.

Material : 1♂, Bhutan : Thimpu, 2,405 m., 20.x.1978.

Distribution : Bhutan, India.

Parasarcophaga (s.str.) albiceps (Meigen)

1825. *Sarcophaga albiceps* Meigen, *System. Beschr.,* **5** : 22.

1982. *Parasarcophaga (s.str.) albiceps* (Meigen) : Nandi, *Rec. zool. Surv. India,* **80** : 118.

Material : 18♂♂, Bhutan : Phuntsholing, 209 m., 18.x.1978.

Distribution : Australia, Bismarck Islands, Bhutan, Borneo, Europe, Formosa, Hawaii, India, Japan, Java, Korea, Lombok, Nepal, New Britain, New Guinea, North China, Philippine Islands, Poland, Solomon Islands, Sumatra, U.S.S.R.

Parasarcophaga (s.str.) orchidea (Boettcher)

1913. *Sarcophaga orchidea* Boettcher, *Ann. Hist. Mus. Nat. Hung.,* **11** : 375.

1982. *Parasarcophaga (s.str.) orchidea* (Boettcher) : Nandi, *Rec. zool. Surv. India,* **80** : 119.

Material : 7♂♂, Bhutan : Phuntsholing, 209 m., 18.x.1978 ; 1♂, Wangdiphodrong, 1,575 m., 24.x.1978.

Distribution : Australia, Bismarck Islands, Bhutan, Borneo, Burma, Caroline islands, China, Formosa, Hainan Island, India, Japan, Java, Korea, Lombok, Malaysia, Mariana Islands, Micronesia, Nepal, New Guinea, Philippine Islands, Sri Lanka, Sumatra, Thialand, U.S.S.R.

Parasarcophaga (s. str.) knabi (Parker)

1917. *Sarcophaga knabi* Parker, *Proc. U.S. natn. Mus.*, **54** : 96.

1982. *Parasarcophaga (s.str.) knabi* (Parker) : Nandi, *Rec. zool. Surv. India*, **80** : 118.

Material: 5 ♂♂, Bhutan : Phuntsholing, 209 m., 18.x.1978 ; 1 ♂, Wangdiphodrong, 1,575 m., 24.x.1978.

Distribution : Australia, Bangladesh, Bali, Bismarck Islands, Bhutan, Borneo, Burma, China, Caroline Islands, Hainan Island, Japan, Korea, Malaysia, Mariana Islands, Marshal Islands, Micronesia, Nepal, New Guinea, Philippine Islands, Sri Lanka, Society Islands, U.S.S.R.

Parasarcophaga (Liopygia) ruficornis (Fabricius)

1794. *Musca ruficornis* Fabricius, *Ent. Syst.*, **4** : 314.

1982. *Parasarcophaga (Liopygia) ruficornis* (Fabricius) : Nandi, *Rec. zool. Surv. India*, **80** : 119.

Material : 1 ♂, Bhutan : Wangdiphodrong, 1,575 m., 23.x.1978.

Distribution : Africa, Australia, Bhutan, Brasil, Chagos Archipelago, China, Hawaii, Hong Kong, India, Japan, Madagascar, Malaysia, Mariana Islands, Micronesia, Moluccas, Philippine Islands, Sri Lanka, Samoa, Socotra Islands.

Parasarcophaga (Liosarcophaga) dux (Thomson)

1868. *Sarcophaga dux* Thomson, *Kongl. Seven. Frea. Eugeg. Resa.*, p. 534.

1982. *Parasarcophaga (Liosarcophaga) dux* (Thomson) : Nandi, *Rec. zool. Surv. India*, **80** : 119.

Material : 3 ♂♂, Bhutan : Wangdiphodrong, 1,575 m., 25.x.1978.

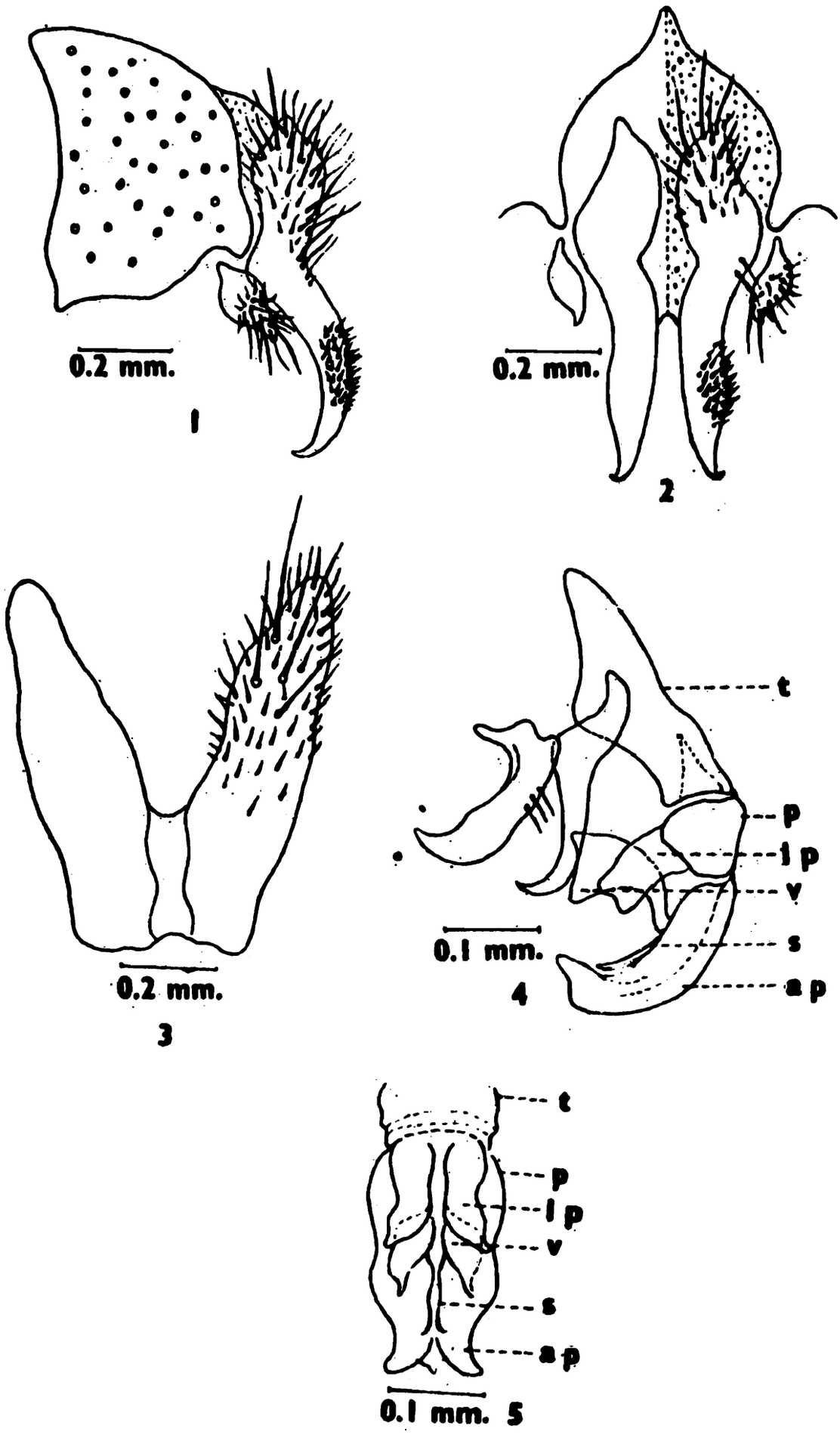
Distribution : Africa, Australia, Bali, Bhutan, Fiji, Guam, Hawaii, India, Japan, Java, Malaysia, Mozambique, Philippine Islands, Solomon Islands, Sri Lanka, Sudan, Taiwan, U.S.S.R.

Subtribe Blaesoxiphina

Blaesoxipha (s. str.) bhutanensis sp. nov.
(Text figs. 1-5).

Male : Body length 6.5 mm.

Head : Width of frons about two-fifths that of eye ; frontal vitta brownish, its length at narrowest point of frons about twice that of parafrontal ; parafrontal and parafacial brownish-black with white pollen, the former with short scattered hairs, the latter with a row of 4-5 short black hairs near the eye margin ; antennae brownish-black, reaching to about 0.85 distance to vibrissae ; 1st and 2nd segments brownish-black with black hairs, the latter with long hairs, 3rd segment brownish with numerous white pollen, length about four and half times that of the 2nd segment : arista long plumose in the basal three-fifths ; facial ridge brownish with silvery pollen and with short black hairs at the lower half ; vibrissae long, distance between vibrissae is greater than one parafacial width ; frontal bristles 13, arranged in a row on parafacial, upper four reclinate, lower three below the base of antennae,



Figs. 1-5 *Blaesoxipha (s. str.) bhutanensis* sp. nov. : 1, cercus, lateral view : 2, cercus, dorsal view : 3, v-th sternite : 4, penis, lateral view : 5, penis, ventral view.

reachingto about more than half of 2nd antennal segment, rest cruciate and directed forwards; gena black with long black hairs ; ocellar triangle black with short black hairs ; outer vertical not differentiated ; inner vertical well developed ; post vertical half the length of inner vertical ; ocellar bristles short ; post ocellar longer than the ocellars, almost half the inner vertical ; one row of regular post ocular setae besides postocular cilia ; rest of the area with brownish hairs.

Thorax : Black with three black longitudinal stripes ; *ac* 2+3 ; *dc* 4+4 ; *ia* 1+2; *ps* 1 ; *h* 3 ; *np* 4 ; *sa* 2 *pa* 2 ; *st* 1+1+1 ; *mpl* 8 ; *hpl* 8 ; propleura black with silvery pollen ; prostigmatic and propleural bristles black, well developed and accompanied with black hairs ; pro- and mesothoracic spiracles brown ; apicoscutellar and discoscutellar bristles one pair each, the former short ; lateroscutellar bristles 2 pairs.

Wing : Hyaline with brownish veins ; R_1 bare ; R4+5 with a row of short setae located dorsally and extending to about half the distance from the basal node to r-m 3 setae present on ventral surface of the basal node of R4+5 ; third costal segment equal to the fifth, the latter with short spines only on the basal one-third ; costal spines not stout ; epaulet black with short spines ; basicostal scale and squama white ; halter brown.

Legs : Black ; fore femur with two rows of bristles along posterodorsal surface and a row of bristles along posterior margin of ventral surface ; fore tibia with short bristles along the basal half of anterodorsal surface at about one-third the distance from the distal end ; mid femur with 1 bristle on the middle portion of anterodorsal surface, a row of bristles along the basal half of anterodorsal surface and a row of 5 bristles along the basal half of pasteroventral surface ; mid tibia with a row of short bristles along the posterodorsal surface at about one-third the distance from the distal end ; hind femur with a row of bristles along anterodorsal surface, a row of bristles along anteroventral surface, 1 bristle on posterodorsal surface at about one-fifth the distance from the distal end and a row of short hairs along the posterior margin of ventral surface ; hind tibia with 2 bristles on posteroventral surface, 1 bristle on posterodorsal and 1 on anteroventral surfaces at about one-third the distance from the distal end and a row of short hairs along the posterior margin of ventral surface at about three-fifths the distance from the distal end.

Abdoman : Black with silvery coloured; median marginal bristles on 2nd and 3rd abdominal tergites absent, but 2nd with a pair of lateral marginal bristles; 4th tergite with a pair of median and 3 lateral marginal bristles; 5th sternite v-shaped with 2-4 marginal bristles; 1st genital segment blackish with 4 marginal bristles; inner forcep elongated, curved at the end with marginal setaat the sub apical end, strongly curved at the middle; outer forcep slightly elongated with few hairs; posterior paramere elongated and curved strongly at the end; anterior paramere elongated, slightly curved at the end with few hairs on the middle; theca shorter than paraphallus, both are sclerotised; apical plate of paraphallus long and almost blunt at the end; lateral plate of paraphallus short and blunt; styli of glans long, without serration and reaching to about sub terminal end of paraphallus; ventralia long without serration at the end.

Female : Unknown.

Holotype : 1 ♂, Bhutan : Thimpu, 2,405 m., 21.x.1978.

Discussion : This species is quite similar to *Blaesoxipha* (*s.str.*) *aspinata* (Senior-White) but differs from it by the structure of apical and lateral plate of paraphallus. The structure of ventralia is also quite distinguishable from *aspinata*.

Distribution : Bhutan.

Subtribe Raviniina

Ravinia striata (Fabricius)

1794. *Musca striata* Fabricius; *Ent. Syst.*, 4 : 315.

1826. *Sarcophaga haematodes* Meigen, *Syst. Beschr.*, 5 : 29.

1967. *Ravinia striata* (Fabricius) : Kano, Field and Shinonaga, *Fan. Japo.*, p. 130.

Material : 6♂♂, Bhutan : Thimpu, 2,405 m., 20-21.x.1978; 3 ♂♂, Paro, 1,675 m., 27-28.x.1978 : 1 ♂, Wangdiphodrong, 1,575 m., 25.x.1978.

Distribution : Bhutan, China, Europe, India, Japan, Korea, N. Africa, U.S.S.R.

Subtribe Seniorwhiteina

Seniorwhitea krameri (Boettcher)

1912. *Sarcophaga krameri* Boettcher, *Ent. Mitt.*, 1 : 166.

1982. *Seniorwhitea krameri* (Boettcher) : Nandi, *Rec. zool. Surv. India*, 79 : 460.

Material : 14 ♂♂, Bhutan : Phuntsholing, 209 m., 18.x.1978 : 1 ♂, Wangdiphodrong, 1,575 m., 25.x.1978.

Distribution : Bhutan, Borneo, Burma, Formosa, Hainan Island, Hawaii, India, Loas, Malacca, Malaysia, Nepal, Singapore, Sri Lanka, Thailand, U.S.S.R.

SUMMARY

This paper reports eleven species under six genera, all of which are recorded for the first time from Bhutan. One species *Blaesoxipha* (*s.str.*) *bhutanensis* is new to science.

ACKNOWLEDGEMENTS

I am grateful to The Department of Forestry, Ministry of Trade, Industry and Forests, Royal Government of Bhutan for permission to collect the specimens from different parts of Eastern Bhutan. I am also indebted to D.r B. Dasgupta, Principal, Darjeeling Govt. College for constant encouragement during the research period. Financial help to me by the University Grants Commission, New Delhi, is also duly acknowledged.

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Rec. zool. surv. India, 90(1-4) : 43-45, 1992

ON AN UNDESCRIBED FEMALE OF *(CLETTHHARRA FLOCIFERA)* HAMPSON (LEPIDOPTERA : NOCTUIDAE) WITH NOTES ON MALE GENITLIA

S.K. GHOSH
AND
MRIDULA CHAUDHURY
Zoological Survey of India, Calcutta

The authors received a lot of specimens for identification from Kalyani University, Kalyani. Out of these, two specimens of either sex of the species, *Clettharra floccifera* Hampson are interesting as the female is reported for the first time from India and the species constitutes a new locality record for West Bengal. The paper deals with the description of a female of the aforesaid species alongwith the genitalia in male.

Clettharra floccifera Hampson

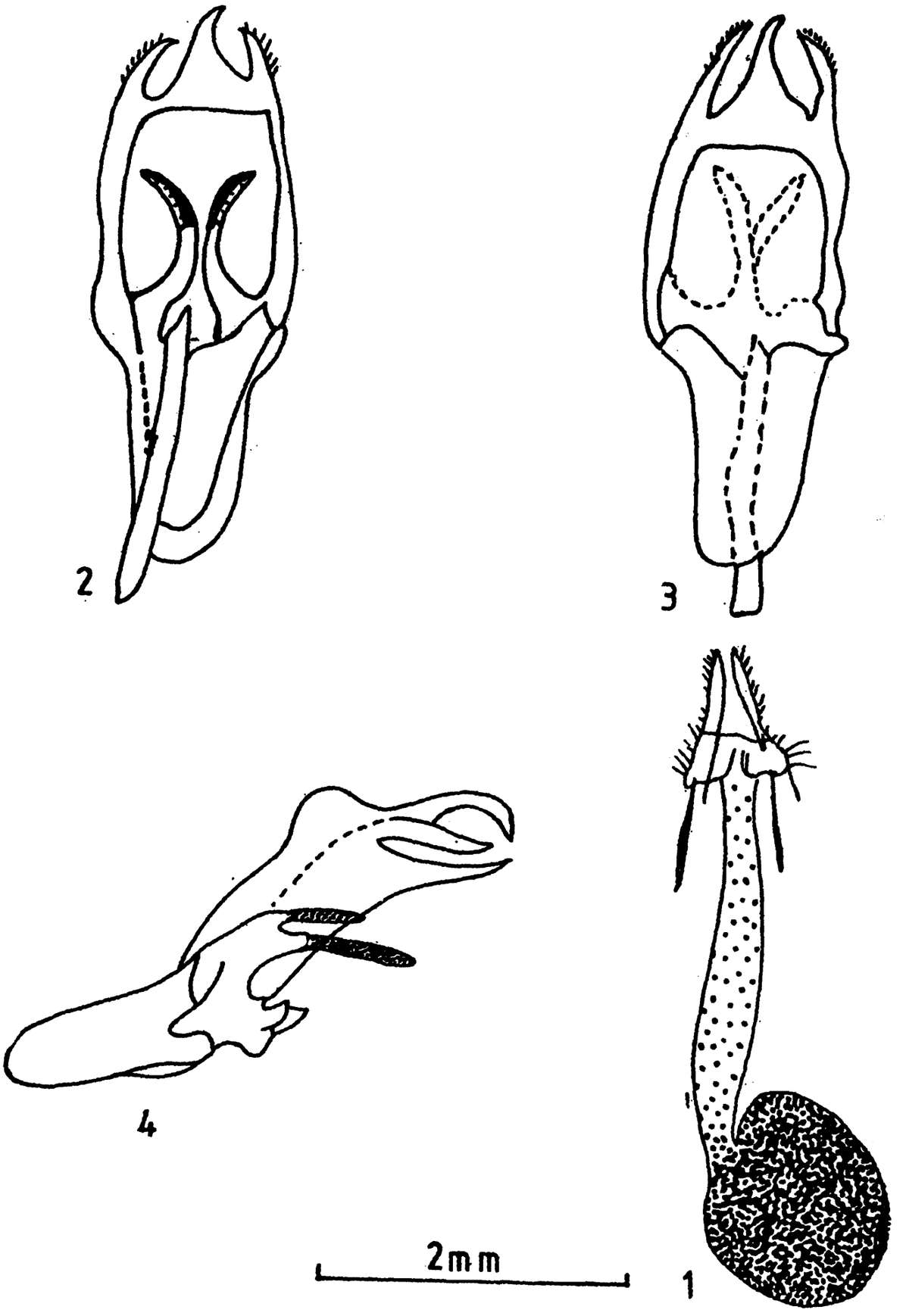
1894. *Clettharra floccifera* Hampson, *Fauna Brit. India*, Moths, **2** : 386.

Female : Antenna : simple and brown ; palpi : upturned ; collar : brown with black suffusion at the centre and on either side, thorax : brown, forewing : reddish brown ; the basal, medial and inner portion suffused with black; a tuft of raised scale in the basal portion ; faint traces of medial and postemedial oblique lines; costal area suffused with greyish black scales ventrally; R_1 from middle of cell; R_2-R_5 stalked; M_1 from upper angle of cell; M_2-M from lower angle of cell; Cu_{1a} from just before angle, Cu_{1b} from middle of cell; hindwing : white but slightly suffused with fuscous apically, without tuft of hair; ventrally white excepting for a black scales on costal area; $SC+R_1$ arising from middle of cell ; Rs and M_1 from upper angle of cell; M_2 and Cu_{1b} on a long stalk; M_2 arising from stalk of M_2+Cu_{1a}, Culb from middle of cell; leg : two apical tarsal segments of foreleg jet black but other segments dark brown; abdomen : anal tuft brown; female genitalia (Fig. 1) : ostium bursae and ductus bursae membranous; corpus bursae highly sclerotised and more or less ovate ; without signum; ovipositor beset with hairs; genital plate sclerotised ; posterior apodemes longer than anterior apodemes. Male genitalia (Figs. 2, 3, 4) : uncus sclerotised, hooked and gradually narrowing towards distal end; tegumen short and broad; vinculum 'U' shaped, asper simple and weakly sclerotised; anellus lobe long and highly sclerotised; juxta 'V' shaped; aedeagus simple and slender.

Material examined : India : West Bengal, Nadia district, Kalyani, Gayespur, 1 ♂, 1 ♀, date nil (Coll. *M.R. Ghosh*).

Wing expanse : ♂ — 24 mm, ♀ — 28 mm.

Distribution : India : West Bengal (Nadia), Nagaland (Nagas); Burma (Tenasserim).



Figs. 1-4. *Clettharra floccifera* Hampson 1. Genitalia, female 2-4. Genitalia, male 2. Ventral view 3. Dorsal view 4. Ventro-lateral view.

Remarks : Hampson (1894) described the species from Nagaland and Burma only on the basis of male specimens. The present discovery of the species from West Bengal is very interesting as it extends the range of distribution.

ACKNOWLEDGEMENT

The authors are grateful to the Director, Zoological Suryey of India, Calcutta, for providing laboratory facilities and to Dr. M.R. Ghosh, Reader, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia for the material.

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Rec. zool. surv. India, 90(1-4) : 47-56, 1992

A MORPHOMETRIC STUDY OF *CHANNA PUNCTATA* (BLOCH) (PISCES : CHANNIDAE)

RANI DHANZE* AND NIBEDITA SEN

Zoological Survey of India, Eastern Regional Station, Shillong.

INTRODUCTION

The genus *Channa* Scopoli (1777), forms a commercially important group of fishes, comprising of eight species from Indian waters (Jayaram, 1981). Day (1878) described only one species under this genus and eight species under the genus *Ophiocephatus*. Misra (1962) reported four species from India and Pakistan. However, Menon (1974) noticed only six species under this genus from the Gangetic Plain.

The present paper deals with the clinal variation in the species *Channa punctata* (Bloch). While studying the morphology of this species, authors came across a few interesting specimens. The meristic counts of these specimens are almost similar to that of *C. punctata* (Bloch) but differs interestingly in colour pattern being having lateral yellow stripes on either side Day. (1875-78) also observed brilliant orange bands in immature specimens of *C. marulius*. Willey (1908) and Deraniyagala (1929) noticed such stripes in the juveniles of *Channa punctata* (Bloch). Howeverr, Hora (1921), Jones (1946) and Misra (1962) overlooked these colour variations among *Channa* species. An endeavour has been made here to ascertain the systematic identity of such morphovariant which are distinctly unique particularly in respect of colour pattern, based on the morphometric evaluation of different characters.

MATERIAL & METHODS :

The present study is based on 103 specimens of *Channa punctata* (24 mm to 200 mm SL) present in the National Zoological collections of E.R.S./Z.S.I., Shillong collected from different localities of North Eastern Region of India. The specimens with lateral yellow stripes were compared with the specimens of different size groups at the intervals of 20 mm SL. A total of 23 characters were mensurated and subjected to statistical analysis by calculating the mean, standard 'deviation and standard error. The data were pooled together for students 't' test as a result, probability at 95% confidence intervals were determined (after Simpson *et. al.*,

*Present address : Assistant Scientist, Deptt. of Animal Production, HP Krishi Vishvavidyalaya, Palampur-176062.

1960). Further, the numerical interpretations for each character were compared by employing geometrical expression proposed by Dice and Leraas (1936) and adopted by Hubbs and Hubbs (1952). In this method for each character the range, mean, one standard deviation and one standard error on either side of the mean were delineated on the graphs.

RESULTS

1. *Population of 20 to 30 mm. SL vs. 31 to 50 mm SL.*

It is seen that except predorsal distance, prepelvic distance, base of anal fin, length of caudal fin in standard length and width of head in length of head in respect of all other characters the two populations have a probability of less than 5%. From the Dice Diagram it would appear that there is a gradual variation in respect of the length of head, preanal, pre-pelvic, pectoral-pelvic, pelvic-anal distance, base of dorsal fin, height of body, length of pectoral fin, length of caudal peduncle in standard length; height of head in length of head and the length of caudal peduncle in height of caudal peduncle (Graphs I, III, IV, VI-VIII, X, XI, XIII, XV-XIX, Dice diagram A & B in each).

2. *Population of 20 to 30 mm SL vs. 51 to 70 mm SL.*

From the data analysed for this population, it can be seen that except the pelvic-anal distance, base of dorsal fin, base of anal fin, length of pelvic fin in standard length; height of head in length of head and the height of dorsal fin in its base in respect of other 17 characters, the two populations have probability of less than 5%. Graphs I-VI, VIII, X-XIV, XVI-XIX and Dice diagram A and C in each, indicate that out of 19 characters 16 characters represent gradual variations.

3. *Population of 20 to 30 mm SL vs. 71 to 90 mm SL.*

The two populations are similar in respect of 17 characters inasmuch as the probability is less than 5%. But differs in respect of base of dorsal fin, base of anal fin, length of caudal fin, length of caudal peduncle, in standard length; height of dorsal fin in its base and length of caudal peduncle in height of caudal peduncle. From the graphs I-VIII, X-XVII and Dice diagram A & D in each, it is seen that the 16 characters vary gradually according to size group. It is also observed that the length of snout and the interorbital width are having maximum variation among these populations.

4. *Population of 20 to 30 mm SL vs. 91 to 110 mm SL.*

The two populations are similar statistically in respect of 19 characters in the fact that their probability is less than 5%. The other four characters which in the two populations differ are preanal distance in standard length, width of head in its length, height of dorsal fin in its base and length of caudal peduncle in its height. From the graphs (I-III, V-VIII, X-XIII, and XV-XVIII) and Dice diagram (A & E in each), it has been noticed that 15 characters are having gradual variations. The characters showing the maximum variations includes length of pectoral fin in standard length, length of snout, interorbital width and the eye diameter in length of head.

Jones, S. 1946. Breeding and development of Indian fresh-water and Brackish water fishes, *J. Bomb. Nat. Hist. Soc.*, **46**(3) : 453-472.

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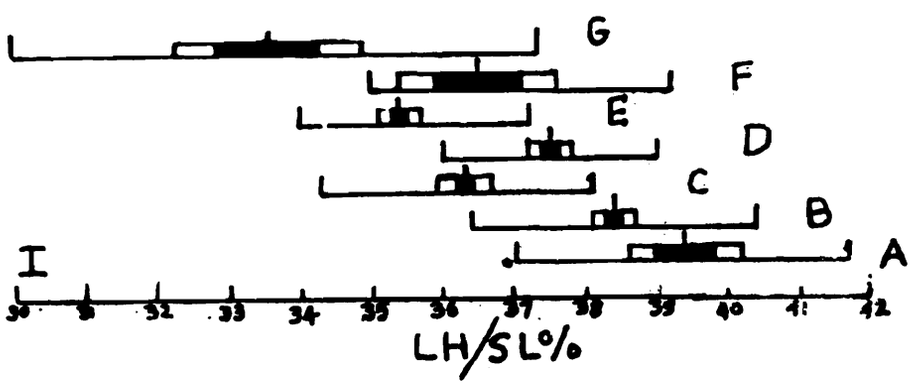
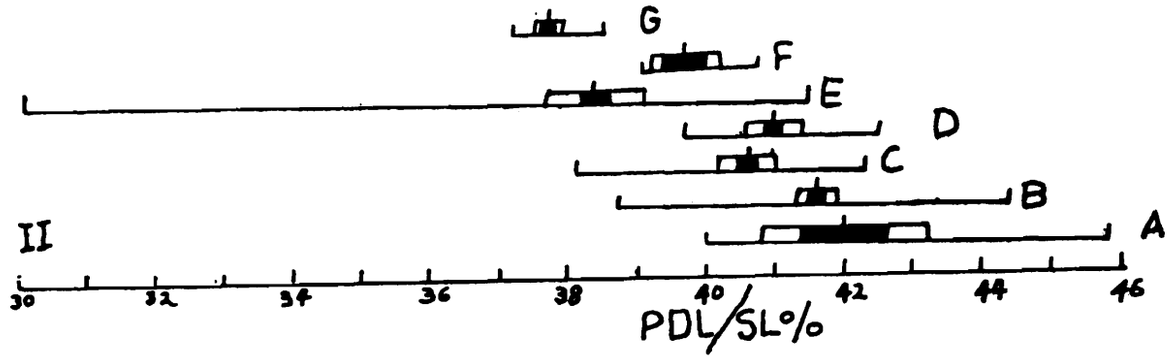
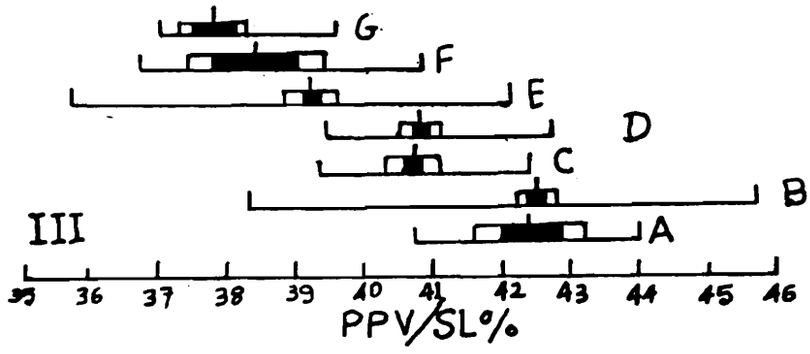
ABBREVIATION USED IN THE GRAPH :

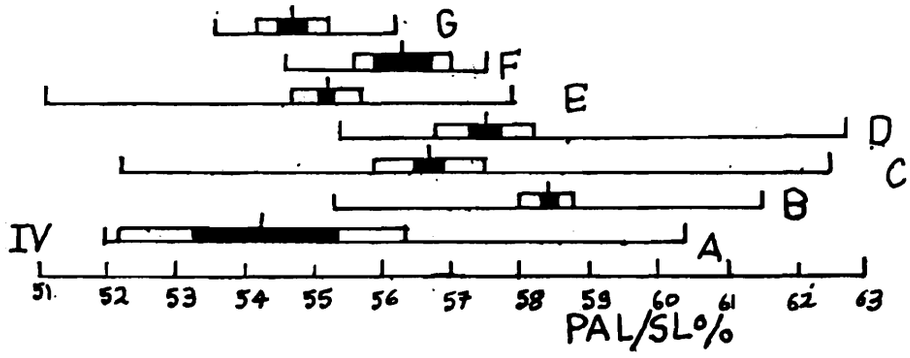
ALB=base of anal fin; ALH=height of anal fin : DH=height of dorsal fin; DB=base of dorsal fin; ED=eye diameter; HB=height of body; HCPD=least height of caudal peduncle; HH=height of head; IOW=interorbital width; LC=length of caudal fin; LCPD=length of caudal peduncle; LH=length of head; LS=length of snout; PAL=preanal distance; PDL=predorsal distance; PL=length of pectoral fin; PL-PV=pectoral-pelvic distance; PPL=prepectoral distance; PPV=prepelvic distance; PV=length of pelvic fin; PV-AL=pelvic-anal distance; PV-AN=pelvic-anal distance; SL=standard length, WH=width of head.

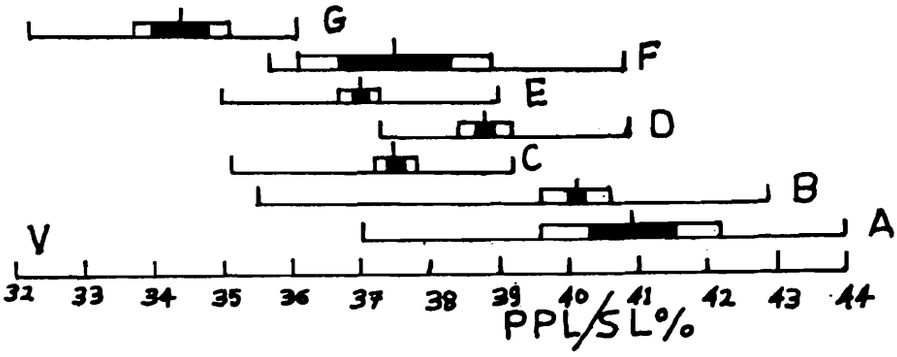
GRAPH I-XIX, Dice diagram showing the clinal variations and intergradation in respect of 19 characters in the different size group of *Channa punctata* (Bloch). In each diagram, the horizontal base line indicates the extreme range; the vertical line in the middle represents the arithmetic mean; the solid area on either side of the mean is the extent of one standard error. The hollow area delimits one standard deviation on either side of the mean; A=population of 20-30 mm SL; B=population of 31-50 mm SL; C=population of 51-70 mm SL; D=population of 71-90 mm SL; E=population of 91-110 mm SL; F=population of 111-130 mm SL; and G=population of 170-200 mm SL.

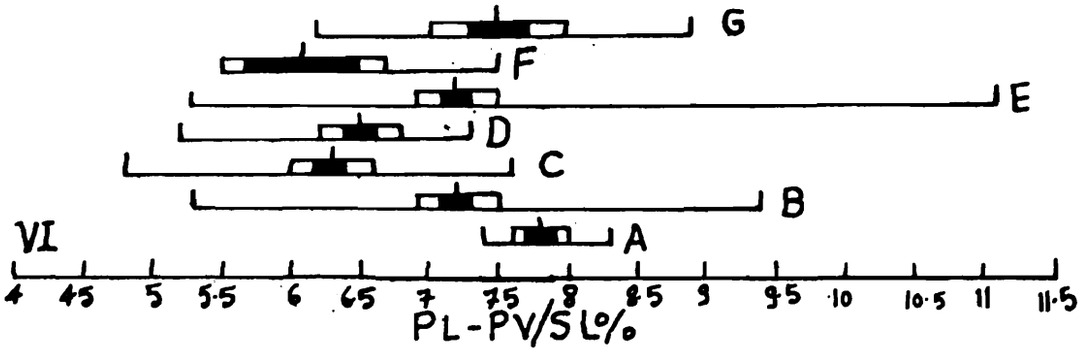


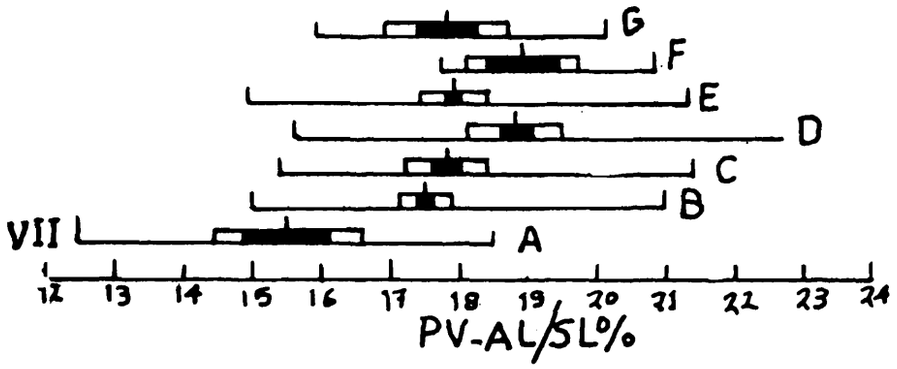

G
F
E
D
C
B
A
II
30 32 34 36 38 40 42 44 46
PDL/SL%

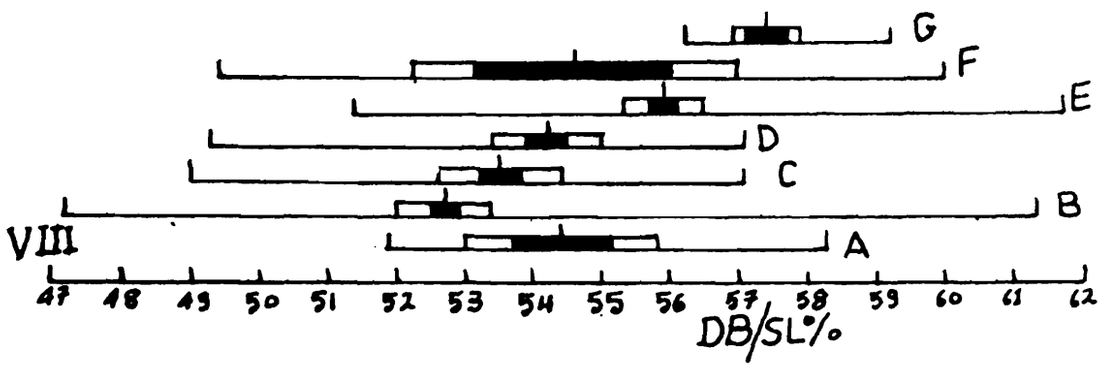

G
F
E
D
C
B
A
III
35 36 37 38 39 40 41 42 43 44 45 46
PPV/SL%

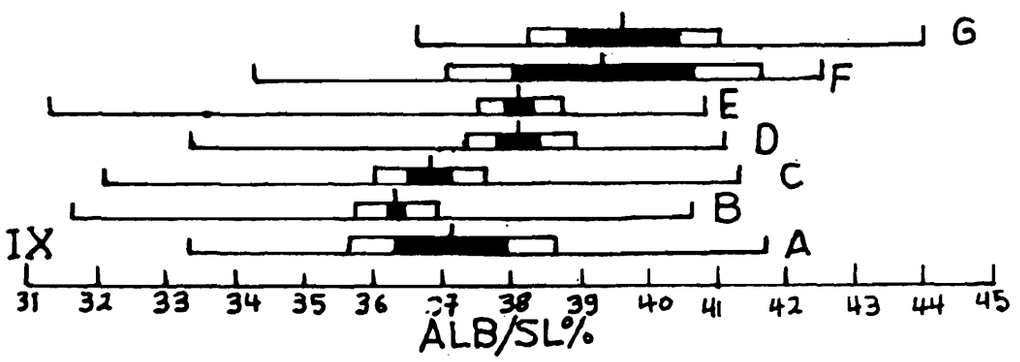

G
F
E
D
C
B
A
IV
51 52 53 54 55 56 57 58 59 60 61 62 63
PAL/SL%

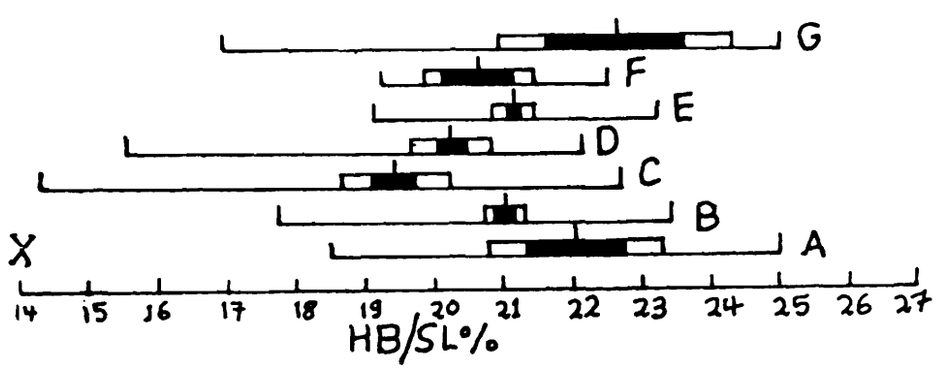

G
F
E
D
C
B
A
V
32 33 34 35 36 37 38 39 40 41 42 43 44
PPL/SL%

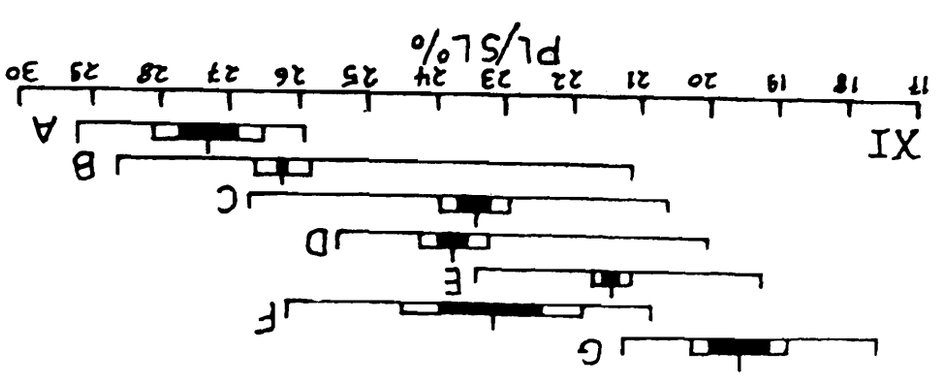

G
F
E
D
C
B
A
VI
4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5
PL-PV/SL%

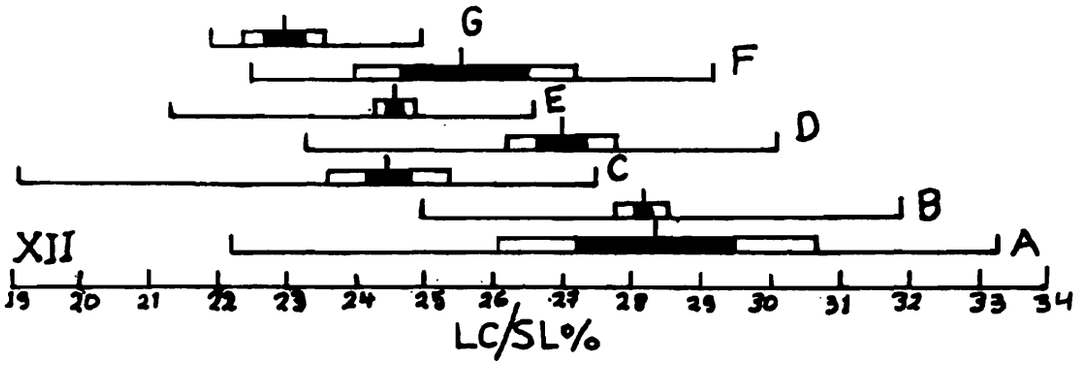

G
F
E
D
C
B
VII
A
12 13 14 15 16 17 18 19 20 21 22 23 24
PV-AL/SL%

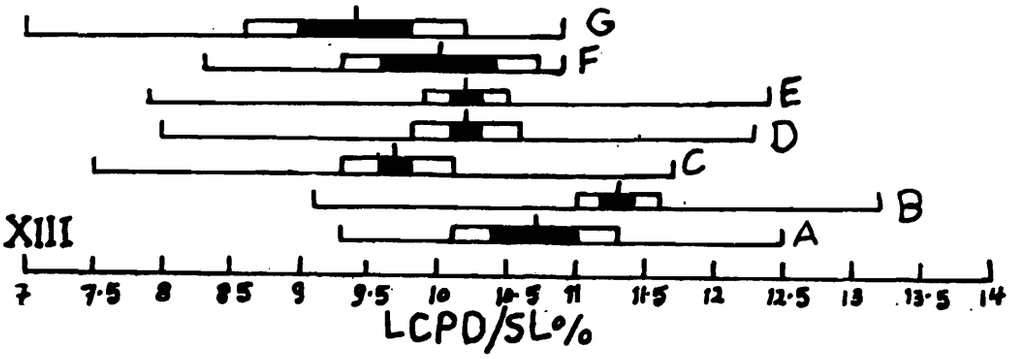

G
F
E
D
C
B
VIII
A
47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62
DB/SL%

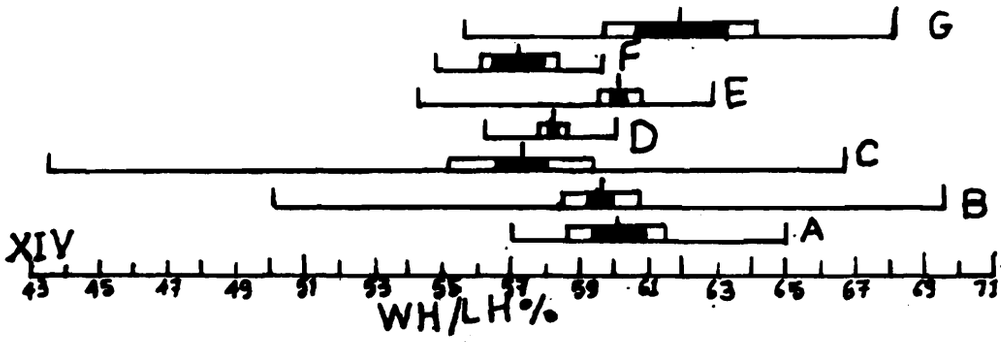

G
F
E
D
C
B
IX
A
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
ALB/SL%

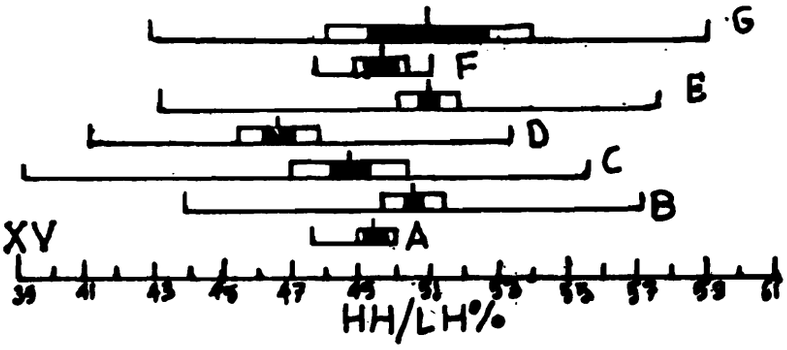

G
F
E
D
C
B
X
A
14 15 16 17 18 19 20 21 22 23 24 25 26 27
HB/SL%

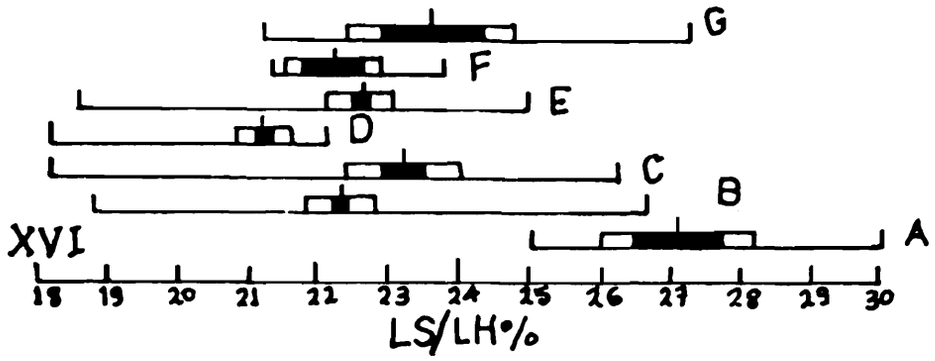

PL/SL%
17 18 19 20 21 22 23 24 25 26 27 28 29 30
XI
A
B
C
D
E
F
G

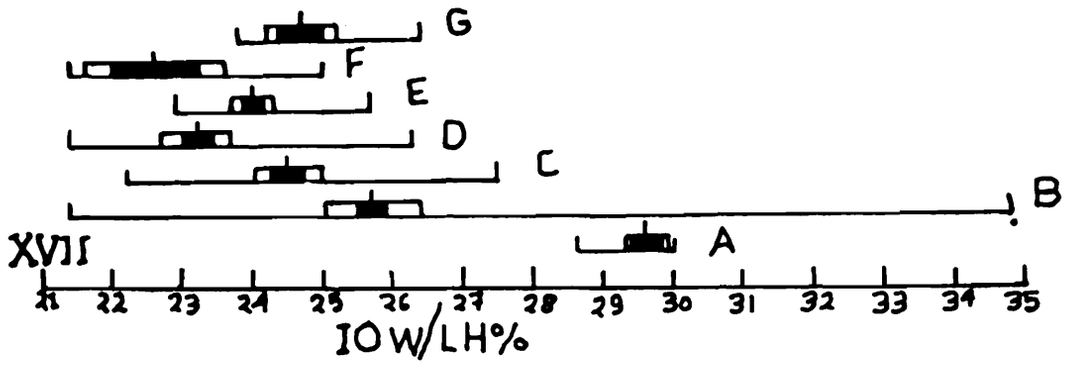

G
F
E
D
C
B
A
XII
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
LC/SL%


G
F
E
D
C
B
A
XIII
7 7·5 8 8·5 9 9·5 10 10·5 11 11·5 12 12·5 13 13·5 14
LCPD/SL%


G
F
E
D
C
B
A
XIV
43 45 47 49 51 53 55 57 59 61 63 65 67 69 71
WH/LH%


G
F
E
D
C
B
A
XV
39 41 43 45 47 49 51 53 55 57 59 61
HH/LH%


G
F
E
D
C
B
A
XVI
18 19 20 21 22 23 24 25 26 27 28 29 30
LS/LH%


G
F
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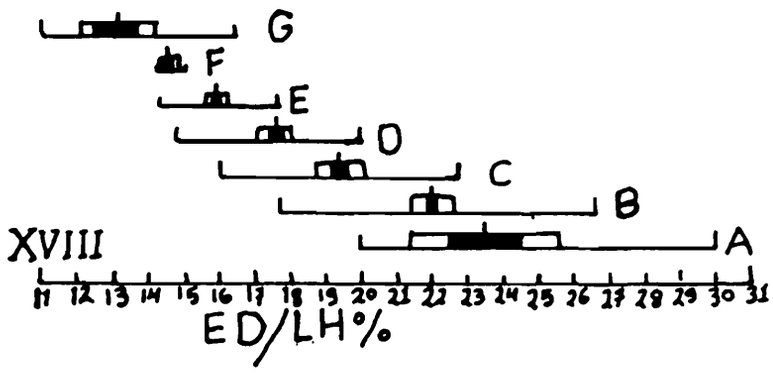
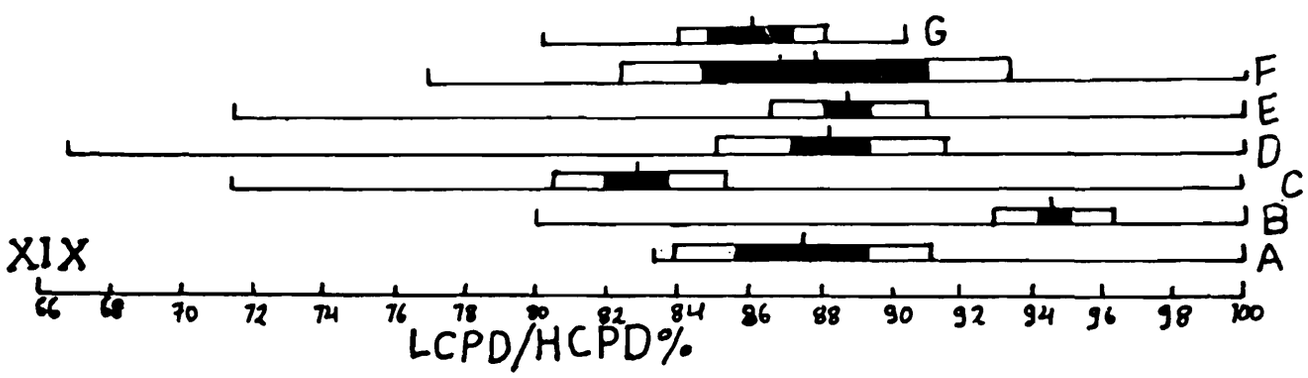
B
A
XVII
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
IOW/LH%


G
F
E
D
C
B
A
XVIII
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
ED/LH%


G
F
E
D
C
B
A
XIX
66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100
LCPD/HCPD%

5. *Population of 20 to 30 mm SL vs. 111 to 130 mm SL.*

From the data analysed, it is seen that these two populations differ in 11 characters having the probability of 10%-99%. In respect of other 12 characters they are similar. From the Dice diagram it would appear that there is a gradual variations in respect of 15 characters according to size group (Graph I-VI, VIII, IX-XII, XIV, XVI-XVIII and Dice diagram A & F in each). The eye diameter, length of snout and the interorbital width exhibit the maximum variation.

6. *Population of 20 to 30 mm SL vs. 170-200 mm SL.*

It is found that except preanal distance, pectoral-pelvic distance and height of body in standard length; width of head, height of head in length of head and length of caudal peduncle in its height, in respect of other 17 characters these two populations are having probability of less than 5%.

The graphs (I-III, V, VII-IX, XI-XIV, XVI-XVIII) and Dice diagram (A & G in each), indicate a gradual variation in respect of 14 characters and the maximum variations are noticed in respect of prepelvic distance, prepectoral distance, length of pectoral fin, eye diameter and the interorbital width.

DISCUSSION

The comparative statistical analysis of morphometric characters mensurated from seven different size groups of a species under the genus *Channa*, clearly indicates that despite certain morphological variations all the specimens studied belong to the same species. Generally, the specific status of various species under this genus is determined, based on the meristic characters such as the number of dorsal fin rays, pectoral fin rays, anal fin rays, lateral line scales and the predorsal scales. So much so, the present species under study belong to *Channa punctata* (Bloch) since all the specimens examined have constantly 28-30 dorsal fin rays, 16-17 pectoral fin rays, 19-23 anal fin rays, 37-40 lateral line scales and 12-13 predorsal scales irrespective of their size groups.

However, the statistical evaluation of 23 morphometric characters reveals that the first group (20-30 mm SL) varies significantly in respect of various characters from the other size groups. Further, the first group can be considered as a separate species if compared with only the size range of 111-130 mm SL as out of 23 morphometric characters 11 characters indicate the probability of 10%-99%. But it is a well known fact that the biological conclusion can not simply be determined in terms of numerical interpretation. Thus the numerical data delineated on the graphs would perhaps indicate that the significance of variations in respect of different morphometric character analysed are not species specific but a sort of intraspecific variations. These variations are clinal as revealed from the Dice diagram. However, the magnitude of variation itself varies in different characters since the divergence is more in respect of eye diameter, interorbital width and the length of snout as compared to other characters (Graphs XVI, XVIII, XVIII).

Morphologically, the specimens belonging to the size group (20-30 mm SL) are distinct in as much as they have lateral golden stripes extending from the snout, through eyes to middle of the caudal peduncle. Whereas the specimen above 30 mm SL do not have any such stripe. However, Day (1875-78) observed brilliant

orange band in *C. marulius*, Willey (1908) notified two lateral and one median stripe in younger specimens (21-26 mm) from Ceylon. Deraniyagala (1929) also reported similar number of stripes in the young (13 mm) from the same place. We have observed only two lateral stripes in the preserved specimens of 24-27 mm. SL. Perhaps the number of stripes also varies with the age.

In view of the foregoing discussion, it is concluded that all the specimens of different size groups from which morphometric data have been analysed belong to same species i.e. *Channa punctata* (Bloch). The morphological uniqueness specially in respect of the colour pattern may not be a good criterion for distinguishing the species of the genus. The morphometric variations in respect of various characters are intraspecific associated with the age and growth.

SUMMARY

The specimens of different size groups of *Channa punctata* (Bloch) have been studied in respect of 23 morphometric characters. The morphometric data were subjected to statistical analysis and the range of variation in respect of 19 characters as exhibited by each size group has been delineated on the graph. It is seen that these variations are clinal, associated with the age and growth as revealed from the Dice Diagram. It is also observed that the specimens with the lateral yellow stripes on either side are the larval forms of *C. punctata*, and the morphometric variations in respect of various characters are intraspecific.

ACKNOWLEDGEMENTS

We are thankful to the Director, Zoological Survey of India, Calcutta and the Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong for encouragement and necessary facilities. Thanks are also due to Dr. J.R. Dhanze, E.R.S./Z.S.I., Shillong for valuable suggestions.

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Rec. zool. surv. India, 90(1-4) : 57-60, 1992

FIRST RECORD OF A CRAB *SESARMA SMITHI* H.M. EDWARDS (CRUSTACEA : DECAPODA : GRAPSIDAE) FROM INDIAN COAST.

MAYA DEB AND SUNIL KUMAR GHOSH

Zoological Survey of India, Calcutta

INTRODUCTION

During a recent collection trip to Sundarban Tiger Reserve area, West Bengal, India undertaken by Sri S. Chattapadhyaya, one example of grapsid crab was collected. The crab has been identified as *Sesarma smithi* H.M. Edwares. It is a large crab, in spirit preserved condition reddish brown in colour. This species has not been recorded previously from India. The original and subsequent descriptions of the species are inadequate, no distinct plates and figures for its important diagnostic characters are illustrated anywhere in the available literature and no adequate descriptions are given before.

Order	DECAPODA
Family	GRAPSIDAE, Dana 1852
Subfamily	SESARMINAE, Dana
GENUS	**Searma**, Say 1817

Sesarma smithi H.M. Edwards
(Pl. 1-3, T Fig. 1)

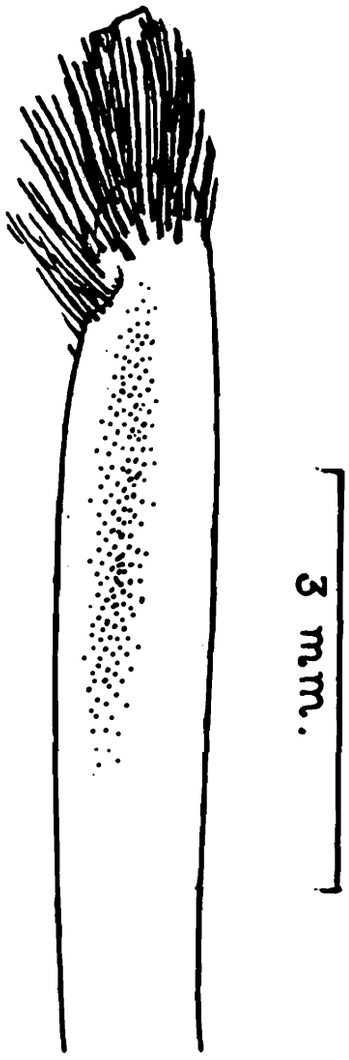
Sesarma smithi H. Milne Edwards, 1853 : 149 ; A. Milne Edwards 1873 : 305 ; de Man 1890 : 94 ; Rathbun, 1910 : 328 ; Tesch, 1917 : 199 ; Tweedie 1936 : 68 ; Miyake 1936 : 497 ; Sakai 1939 : 686.

Material : Seen one male from brakish Water of Baghmara Khal, Sundarban, West Bengal, India, 17.9.1983 ; Coll. S. Chattapadyyaya, Z.S.I. Regd. No. C 3221/1.

Dimensions :

Maximum width of carapace	— 35.75 mm
Maximum Length of carapace	— 34.5 mm
Width of frontal margin	— 16.5 mm
Distance between external	—
Orbital teeth	— 31.0 mm
Width of posterior margin	— 16.3 mm
Depth of carapace	— 29.0 mm

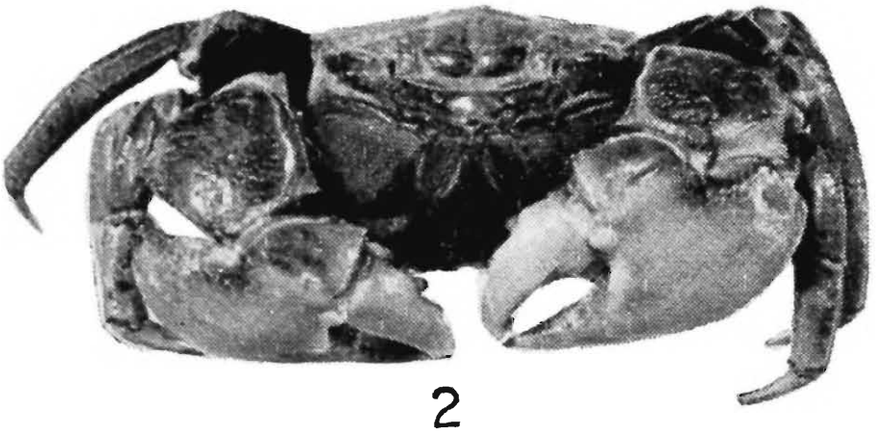
Diagnosis : Carapace square in shape, slightly broader than long, moderately convex in both the directions very deep. Meso-gastric area is distinctly outlined and



1. Anterior male pleopod. of *Sesar.na s.nithi* H.M. Edw.

markedly convex, bounded posteriorly by very deep cervical groove. Cardiac and intestinal regions are also outlined laterally by shallow grooves. Two median post frontal lobes are very broad, convex, smooth, shiny and rounded forwards and the outer pair of post frontal lobes are narrow and not at all prominent. Front deflexed downwards, free frontal edge deeply concave medially. Antennules vertically folded, epistome broad, Orbits large, diagonal ; elongate, upper edge sinuate lower edge finely crenulate, outer orbital corner acute angular. Epibranchial tooth two, last one smallest, antero-lateral sides of carapace sharp, crestlike and slightly concave just after the second anterolateral tooth and then little divergent posteriorly and meet at the base of third pair of legs. Last pair of legs are dorsal in position. Short oblique ridges from the posterolateral sides extend on the carapace towards the middle. Chelipeds massive and equal in male, in spirit dark brownish to reddish in colour, fingers and palms are light orange. Upper edge of arm of chelaeped ends in a sharp, subdistal spine and the distal corner is tooth like. Upper outer surfaces of arm and wrist transversely rugulose, inner side of arm hairy ; inner corner of wrist is dent-like, crenulate, angular, upper edge of wrist is also finely crenulate. Palms are very high, upper edge rough, lower edge granular. One more smooth ridge on upper outer side and another granular longitudinal ridge present on the middle of the palm. Fingers are broad, stout, distal end whitish, tips obtusely pointed and dark

1



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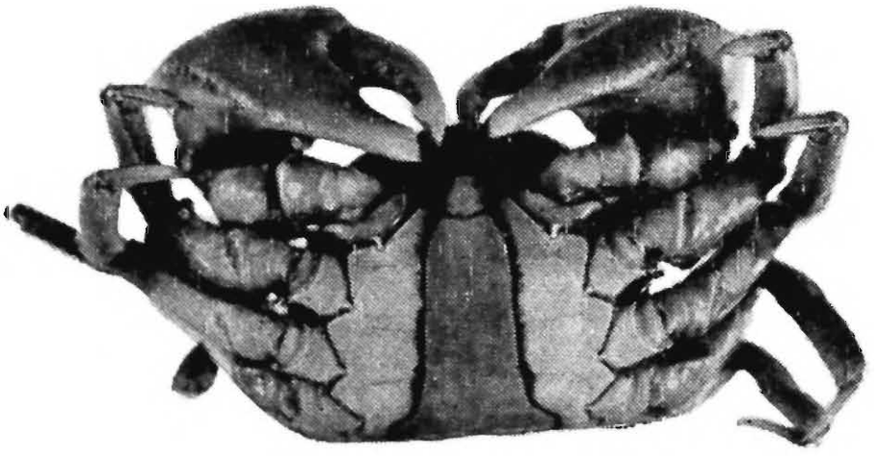

3

1. *Sesarma smithi* H. M. Edw. (Dorsal view).
3. Same frontal view.
4. Same ventral view.

brown in colour. Upper edge of dactylus of palm armed with two stout dark blunt spines. Cutting edges of fingers adorned with one tooth at the base and one tooth on subapical end, the closed fingers meet only at tips and leaves an eye shaped gap between them. Leg joints short, stout, anterior edges of merii of legs are armed with a subdistal, strong, sharp spine, upper edges of carpal joints adorned with 3-4 ridges. Upper surfaces of first three pairs of merii are rough, spinulose, of last pair smooth. Upper surfaces of last three leg joints are smooth, with one exception, i.e. dactylus which is having two rows of short hairs on their lateral sides; upper edge of dactylus smooth.

Male abdomen is very long, reaches upto the base of external maxillipeds, it is seven jointed, sixth joint is 10 mm long and 9 mm wide and lateral sides are convergent distally, seventh joint oblong. Anterior mele pleopod is a strong, stout and grooved process, apical and subapical regions are hairy.

Remarks : This newly recorded species is adequately described and illustrated here as it is recorded for the first time from India. It may easily be recognised by the distinctive shape of the carapace and the colourations. This species was so far unknown from Indian subcontinent. The recent collection of the species was made from the mangrove swamp. *Sesarma* species from India are essentially littoral, keeping quite close to the shore, in shallow-Water or haunting the sea beach.

Distribution : Sundarban, Lower Bengal, India (First record) ; South Africa, (type locality) ; New Caledonia ; Zanzebar ; Natal (A.M. Edwards) ; Madagascar (Hoffman, de Man) ; Queensl and (Mc Culloch) ; Java ; Celebes (de Man) ; Fizi (de Man, Ortman) ; Siam (Rathbun) ; Japan.

SUMMARY

A specimen of *Sesarma smithi* H.M. Edwards, 1853 has been recorded for the first time from Sundarban, West Bengal, India and its diagnostic features are discussed with suitable illustrations.

ACKNOWLEDGEMENT

We are grateful to Dr. B. S. Lamba, Jt. Director, Zoological Survey of India, Calcutta for providing laboratory facilities. We are also grateful to Drs. O.B. Chhotani, Scientist—'D' and K. Rai, Scientist 'C' for guidance and offering valuable suggestion. Thanks are due to Dr. S. Chattapadhyaya, Scientist 'B' for collecting the specimen.

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Rec. zool. surv. India, 90(1-4) : 61-67, 1992

REPORT ON THE ICHTHYOFAUNA FROM THE MOPPING SURVEYS OF KAMARAJAR AND PASUMPON RAMALINGAM DISTRICTS (TAMIL NADU)

T.J. INDRA

Zoological Survey of India
Southern Regional Station
Madras-600 028.

INTRODUCTION

During the years 1987-1988, Zoological Survey of India, Southern Regional Station, carried out two extensive surveys of Kamarajar and Pasumpon Districts in Tamil Nadu, under the Mopping Survey Scheme. These two districts are considered to be drought prone areas in the State as there is very poor natural water resources. River Arjuna, a small tributary of River Vaippar flows through Kamarajar District and River Vaigai flows through Pasumpon district. These are seasonal rivers and for the most part of the year they are dry. Zoological Survey of India tour parties collected material from these two districts. Collections were made from water falls and takes on the Western Ghat border (eastern facing), dams and reservoirs built across these rivers.

The fish fauna of these two districts specially the eastern side of the Western Ghats is scarcely known and therefore a list of fishes of these areas is of interest. The collection comprising a total of 624 specimens assignable to 20 species under 6 families.

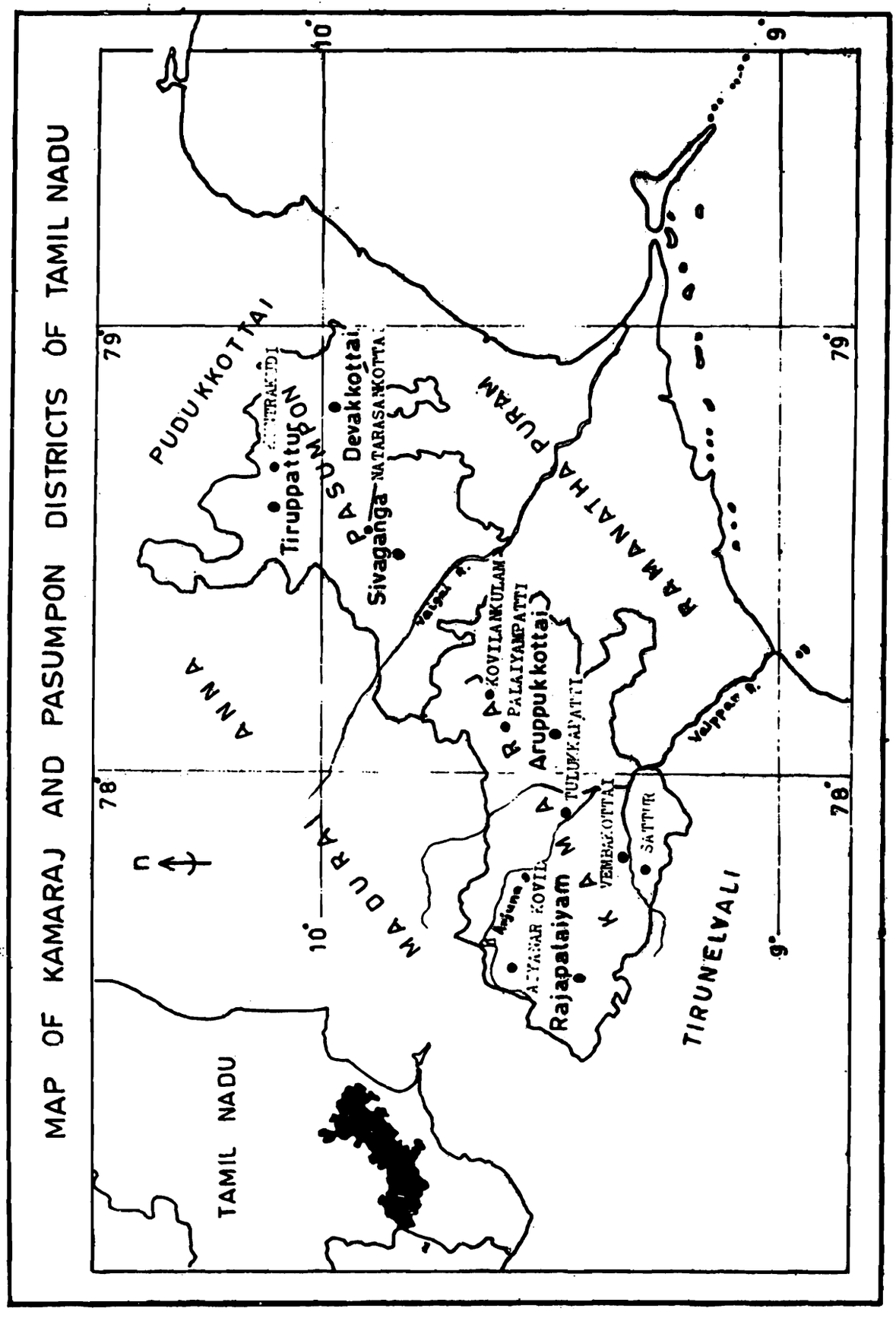
LIST OF SPECIES

Super Order OSTARIOPHYSI
Order CYPRINIFORMES
Family CYPRINIDAE
Subfamily CULTRINAE

1. *Salmostoma clupeoides* (Bloch) 12 exs.

Subfamily RASBORINAE

2. *Amblypharyngodon microlepis* (Blk.) 30 exs.
3. *Esomus barbatus* (Jerdon) 12 exs.
4. *rasbora (Rasbora) caverii* (Jerdon) 2 exs.
5. *Rasbora* (*Rasbora*) *daniconius* (Ham.) 13 exs.



Subfamily CYPRININAE

6. *Catla catla* (Ham.).. 1 ex.
7. *Cirrhinus mrigala* (Ham.) 63 exs.
8. *Cyprinus carpio communis* L 5 exs.

9. *Labeo rohita* (Ham.) 1 ex.
10. *Puntius amphibius* (Val.) 2 exs.
11. *Puntius chola* (Ham.) 5 exs.
12. *Puntius dorsalis* (Jerdon) 61 exs.
13. *Puntius sarana subnasutus* (Val.) 2 exs.

Subfamily GARRINAE

14. *Garra mullya* (Sykes) 80 exs.

Family COBITIDAE

15. *Lepidocephalus thermalis* (Val.) 99 exs.

Order SILURIFORMES
Family BAGRIDAE

16. *Mystus vittatus* (Bloch) 4 exs.

Order CHANNIFORMES
Family CHANNIDAE

17. *Channa orientalis* (Schneider) 5 exs.
18. *Channa punctatus* (Bloch) 3 exs.

Order ATHERINIFORMES
Family POECILIDAE

19. *Gambusia affinis patruelis* (Baird & Girard) 5 exs.

Order PERCIFORMES
Family CICHLIDAE

20. *Sarotherodon mossambica* (Peters) 219 exs.

SYSTEMATIC ACCOUNT

Salmostoma clupeoides (Bloch)

1795. *Cyprinus clupeoides* Bloch, *Nasturg. Ausland. Fishe*, 12, p. 49, pl. 408, Fig. 2. (Type locality : Tranquebar).

Material : 8 exs., 52-96 mm. SL., Kullur santhai reservoir., 11.8.87 ; 1 exs., 60.0 mm. S.L., Kullur Santhai reservoir. 12.8.87 ; 1 ex., 78.0 mm. SL., Vembakkotai reservoir., 12.8.87 ; 3 exs., 49-77 mm. SL., Sivaganga town., 22.8.87.

Distribution : India : Narmada, Tapi, Krishna, Godavari and Cauvery river systems.

Amblypharyngodon microlepis (Bleeker)

1853. *Leuciscus microlepis* Bleeker, *Verh. batav. Genoot. Kunst. wet.*, 25. p. 41.-(Type locality : River Hooghly).

Material : 14 exs., 36-80 mm. SL., Kullur Santhai reservoir., 11.8.87 ; 16 exs., 42-

77 mm. SL., Vembakkottai reservoir., 12.8.87.

Distribution : India : Hooghly, Eastern and Southern India, Bangladesh.

Esomus barbatus (Jerdon)

1849. *Leuciscus barbatus*, Jerdon, *Madras J. Lit. & Sci.*, 15, p. 322. (Type locality : Rivers and tanks all over Mysore and Carnatic).

Material : 1 ex., 36.0 mm. SL., Tulukapatti., 10.8.87 ; 7 exs., 53-64 mm. SL., Kullur Santhai reservoir., 11.8.87 ; 3 exs., 57-72 mm. SL., Vembakkottai reservoir., 12.8.87 ; 1 ex., 46.0 mm. SL., Sivaganga Town., 22.8.87.

Distribution : India : Confined to South India. Recorded so far from Nellore dist., Andhra Pradesh. Chengleput and Mysore.

Rasbora (Rasbora) *caverii* (Jerdon)

1848. *Leucisus caverii* Jerdon, *Madras J. Lit. & Sci.*, 15, p. 320. (Type locality : Cauvery river, Coorg state).

Material : 1 ex., 21.0 mm. SL., Palayampatti., 31.1.88 ; 1 ex., 52.0 mm. SL., Pilavakal Dam., 6.2.88.

Distribution : India : Southern India, notably Karnataka, especially the Cauvery Basin. Sri Lanka.

Rasbora (Rasbora) daniconius (Hamilton)

1822. *Cyprinus daniconius* Hamilton, *Fish Ganges*, p. 327. pl. 15, Fig. 89. (Type locality : Rivers of Southern Bengal).

Material : 5 exs., 22-34 mm. SL., Aruppukkotai., 8.8.87 ; 1 ex., 52.0 mm. SL., Kullur Santhai Reservoir., 12.8.87 ; 1 ex., 40.0 mm. SL., Pilavukal Dam., 14.8.87 ; 1 ex., 86.0 mm. SL., Sivaganga town., 22.8.87 ; 5 exs., 62-75 mm. SL., Shasta Kovil., 5.2.88.

Distribution : India : Throughout India ; Pakistan ; Nepal ; Bangladesh ; Sri Lanka ; Burma ; Malay Archipelago ; Zanzibar.

Catla catla (Hamilton)

1822. *Cyprinus catla* Hamilton, *Fish Ganges*, p. 287, 387, pl. 13, Fig. 81. (Type locality : The rivers and tanks of Bengal).

Material : 1 ex., 225.0 mm. SL., Pilavukal Dam., 14.8.87.

Distribution : India : Throughout India, upto Krishna River but introduced into the Cauvery river system. Pakistan. Nepal ; Bangladesh ; Thailand.

Cirrhinus mrigala (Hamilton)

1822. *Cyprinus mrigala* Hamilton, *Fish Ganges*, p. 279, 386, pl. 6, Fig. 78 (Type locality : Ponds and freshwater river of the Gangetic province).

Material : 63 exs., 19-270 mm. SL., Pilavukal Dam., 14.8.87.

Distribution : India : Throughout India ; Pakistan ; Bangladesh ; Burma.

Cyprinus carpio communis Linnaeus

1758. *Cyprinus carpio* Linnaeus, *Syst. Nat.* Ed., 10, I, p. 525. (Type locality : Europe).

Material : 1 ex., 142.0 mm. SL., Vembakkotai Reservoir., 12.8.87 ; 4 exs., 20-155 mm. SL., Pilavukal Dam., 14.8.87.

Distribution : Naturally found all over China ; Korea ; Taiwan ; Europe ; America. Introduced into our waters.

Labeo rohita (Hamilton)

1822. *Cyprinus rohita* Hamilton, *Fish Ganges*, p. 301, Fig. 85. (Type locality : Freshwater rivers of the Gangetic province).

Material : 1 ex., 225.0 mm. SL., Pilavukal Dam., 14.8.87.

Distribution : India : Throughout northern India ; Pakistan ; Bangladesh ; Burma. Introduced into South Indian rivers and reservoirs.

Puntius amphibius (Valenciennes)

1842. *Capoeta amphibia* Valenciennes, *Hist. Nat. Poise.*, 16, p. 282, 478. (Type locality : Bombay).

Material: 1 ex., 39.0 mm. SL., Kular Santhai Reservoir., 11.8.87 ; 1 ex., 39.0 mm. SL., Kular Santhai Reservoir., 12.8.87.

Distribution : India : Freshwaters of Uttar Pradesh, Madhya Pradesh, Orissa, South India. Sri Lanka.

Puntius chola (Hamilton)

1822. *Cyprinus chola* Hamilton, *Fish Ganges*, (Type locality : northeastern parts of Bengal).

Material : 2 exs., 58-64 mm. Kullur Santhai Reservoir., 11.8.87 ; 1 ex., 55.0 mm. SL., Kullar Santhai Reservoir., 12.8.87 ; 2 exs., 61-64 mm. SL., Pilavakal., 6.2.88.

Distribution : India : Throughout India ; Pakistan ; Bangladesh ; Burma ; Sri Lanka.

Puntius dorsalis (Jerdon)

1849. *Systomus dorsalis* Jerdon, *Madras J. Lit. & Sci.*, p. 314, 316. (Type locality : Tanks and rivers in the neighbourhood of Madras).

Material : 15 exs., 44-94 mm. SL., Kullur Santhai Reservoir., 11.8.87 ; 2 exs., 57-79 mm. SL., Kullur Santhai Reservoir., 12.8.87 ; 12 exs., 58-123 mm. SL., Vembakkottai Reservoir., 12.8.87 ; 26 exs. 19-43 mm. SL., Iyanar Kovil., 16.8.87 ; 6 exs., 38-47 mm. SL., Shasta Kovil., 5.2.88.

Distribution : India : Krishna, Cauvery, Coleroon, river systems in South India.

Puntius sarana subnasutus (Valenciennes)

1865. *Cyclochelichthya pinnauratus* Day, *Proc. zool. Soc. Lond.*, (Type locality : Wynaad).

Material : 2 exs., 70-74 mm. SL., Palavakal., 6.2.88.

Distribution : India : Throughout India ; Pakistan ; Sri Lanka ; Bangladesh ; Burma ; Thailand ; China.

Garra mullya (Sykes)

1841. *Chondrostoma mullya* Sykes, *Trans. zool. Soc. Lond.*, 2, p. 359, pl. 62, Fig. 3. (Type locality : Poona waters).

Material : 72 exs., 21-65 mm. SL., Shasta Kovil., 5.2.88 ; 8 exs., 18-36 mm. SL., Iyanar Kovil., 16.8.87.

Distribution : India : Throughout India, except Assam and Himalaya.

Lepidocephalus thermalis (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. nat. Poiss.*, 17, p. 78. (Type locality : Ceylon).

Material : 3 exs., 42-48 mm. SL., Arupukottai., 8.8.87 ; 19 exs. 13-24 mm. SL., Tulukapatti., 10.8.87 ; 7 exs., 39-45 mm. SL., Kullur Santhai Reservoir 11.8.87 ; 1 ex., 36.0 mm. SL., Pilavukal Dam., 14.8.87 ; 26 exs., 21-52 mm. SL., Sivaganga town., 22.8.87 ; 1 ex., 26.0 mm SL., Dalayampatti., 31.1.88 ; 15 exs., 31.41 mm. SL., Shasta Kovil., 5.2.88 ; 1 ex., 20.0 mm. SL., Rajapalayam., 7.2.88 ; 8 exs., 20-30 mm. SL., Kovingkulam., 8.2.88 ; 6 exs. 10-30 mm. SL., Kattur., 8.2.88 ; 12 exs., 22-48 mm. SL., Devakottai., 12.2.88.

Distribution : India : Throughout India.

Mystus vittatus (Bloch)

1797. *Silurus vittatus* Bloch, *Ichthyol Hist. Nat.*, 11, p. 40, pl. 371, Fig. 2. (Type locality : Tranquebar, S. India).

Material : 3 exs., 78-86 mm. SL., Vembakkottai Reservoir., 12.8.87 ; 1 ex., 83.0 mm. SL., Arjuna River, Tulukampatti., 1.2.88.

Distribution : India : Throughout India ; Pakistan ; Burma ; Thailand ; Bangladesh Sri Lanka.

Channa orientalis (Schneider)

1801. *Channa orientalis* Schneider, *Syst. Ichth.* Bloch., p. 496, pl. 90, Fig. 2. (Type locality : not known).

Material : 3 exs., 22-30 mm. SL., Iyanar Kovil., 16.8.87 ; 1 ex., 125.0 mm. SL., Arjuna River., 1.2.88 ; 1 ex., 138.0 mm. SL., Shastar Kovil ; 5.2.88.

Distribution : India : Throughout India ; Pakistan ; Afganistan ; Bangladesh ; Sri Lanka ; Burma ; Thailand ; Malaya Archipelago ; Yunan ; Viet-nam ; Laos.

Channa punctatus (Bloch)

1793. *Opihiocephalus punctatus* Bloch, *Naturg. Ausland. Fisch.*, 2, p. 139, pl. 358. (Type locality : Coromandal coast).

Material : 3 exs., 49-64 mm. SL., Sivaganga Town., 22.8.87.

Distribution : India : Throughout India ; Pakistan ; Nepal ; Bangladesh ; Burma ; Sri Lanka.

Gambusia affinis patruelis (Baird & Girard)

1853. *Heterandria patruelis* Baird and Girard, *Proc. Acad. nat. Sci. Philad.* 6, p. 390 (Type locality : Rio Sabinal, Texas).

Material : 5 exs., 22-28 mm. SL., Aruppukottai., 8.8.87.

Distribution : India : Throughout India ; Pakistan ; Bangladesh ; Sri Lanka ; Burma.

Sarotheroon mossambica (Peters)

1852. *Chromis mossambicus* Peters, *Monatsb. Akad. Wirs. Berlin*, p. 681. (Type locality : Zambesi river).

Material : 102 exs., 6-49 mm. SL., Aruppu Kottai., 8.8.87 ; 4 exs., 82-118 mm. SL., Kullur Santhai Reservoir., 11.8.87 ; 3 exs., 92-97 mm. SL., Vembakottai Reservoir., 12.8.87 ; 2 exs., 108-109 SL., Pilavukal., Dam., 14.8.87 ; 38 exs., 21-118 mm. SL., Sivaganga Town., 22.8.87 ; 7 exs., 4-20 mm. SL., Natavasankottai ; 22.8.87 ; 45 exs., 15-53 mm. SL., Kuntrakudi., 24.8.87 ; 7 exs., 35-50 mm. SL., Pilavukal., 6.2.88 ; 1 ex., 92.0 mm. SL., Rajapalayam., 7.2.88 ; 6 exs., 10-30 mm. SL., Kattur., 8.2.88 ; 4 exs., 18-22 mm. SL., Devakkottai., 12.2.88.

Distribution : Widely introduced in India and Pakistan. East Africa to Natal.

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Thanks are due to Dr. R.S. Pillai, Scientist 'SE', Officer-in-Charge, Southern Regional Station, Madras, for providing facilities and encouragement. I am thankful to Dr K.V Lakshminarayana, Scientist 'SE' and Sri T Venkateswarlu, Scientist 'SD' for providing me the fish material for the study.

SUMMARY

The paper deals with 20 species belonging to 6 families, which were collected from Kamarajar and Pasumpon Ramalingam Districts, Tamil Nadu.

Rec. zool. surv. India, 90(1-4) : 69-89, 1992

ECOLOGICAL STUDIES ON THE DISTRIBUTIONS OF FAUNA IN THREE MAJOR ECOSYSTEMS ALONG THE NATIONAL HIGH WAY NO. 2 IN WEST BENGAL—A PRELIMINARY REPORT

A.K. HAZRA

Zoological Survey of India 'M' Block, New-Alipore Calcutta-700 053, India

INTRODUCTION

The historical Grand Trunk Road have an important economical and social functions in India and particularly in Eastern India. The major townships and industries have been set up on both side of the national high way since preindependent and post-independent period as a result the modifications of different ecosystems have taken place and is still going on along this national high way in West Bengal. So it is of importance to have ecological studies able to give us informations on the evolution of a disturbed aquatic, grassland and edaphic ecosystems which are frequently observed along the road side in Indian conditions. Although, some workers like Aoki and Kuriki (1980) in Japan and Molfetas and Bladin (1980) in France have done same work on some specific soil groups, but in India no attempt have sofar been made in consolidated way on this aspect. The aim of the present study is to analyse the relationship of different fauna of three major ecosystems which are under the influence of highly human pressurised national high way. And also the distribution and population fluctuations of different fauna in relation to some environmental factors.

LOCATION AND CHARACTERISTICS OF STUDIED LOCALITIES

Four study areas were selected along the Grand Trunk Road within 120 km away from Calcutta (Fig. 1). Three habitats in three different ecosystems (aquatic, grassland and edaphic) were chosen for sampling.

The ecosystems in each locality were selected in a area of heavy industries (Durgapur Steel Plant), heavy sand quarries activities area (Panduah), heavy agriculture prectice area (Burdwan) and in a rapidly growing new industrial cum urban area (Dankuni) of West Bengal. Soils of all the sites were gangetic alluvium except Durgapur which were laterite. Vegetations in each area were chaterised by typical road side trees like Sisoo, Jamun, banian, Sirish etc. and unmetaled areas of road were covered with some herbs, shrub and grasses, and the grasslands of all the four sites were dominated by the grasses and sedges like, *Sporobolus diander, Arundinella* sp., *Digitaria merginata, Eraorostis brachyphylla, Commelina obliga, Echinochola colonum, Cynodon dactylon, Vernonia cenerea* and *Digitaria royleans.*

MATERIAL AND METHODS

Sampling.

From each habitat in each ecosystems, samples were taken thrice in summer, monsoon and winter. In this way it was expected to include fauna with different life cycle pattern and to get representative account of faunal composition. It was also intention to compare the fauna quantitatively and qualitatively in all areas simultaneously. Samples were taken from March 1982 to February, 1983. Total length of the road surveyed were about 120 km.

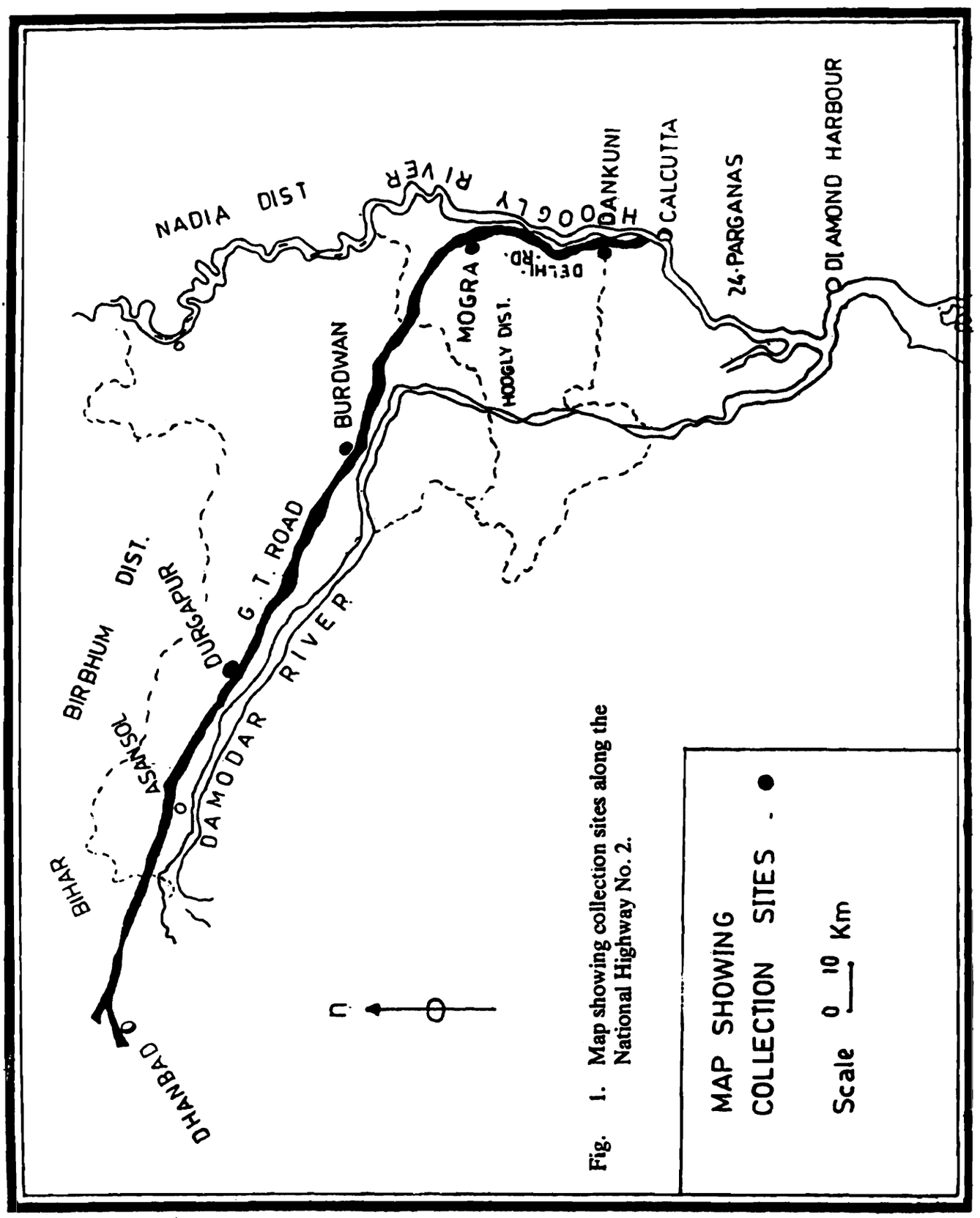

Fig. 1. Map showing collection sites along the National Highway No. 2.

COLLECTING TECHNIQUES IN THREE DIFFERENT ECOSYSTEMS

GRASSLAND ECOSYSTEM :

Random sampling was carried out for this survey once in each season from all the grasslands. Catch-count method by using a insect net (Andrewartha 1970) was employed for the collecting the fauna from grasslands. Four grasslands were selected for this analysis each measured *c* 55 m × 45 m. Air temperature and relative humidity were recorded by using a mercury thermometre and dial hygrometer respectively.

Soil ecosystem :

A total of 240 soil samples were drawn i.e. at the rate of 60 samples from each locality in three seasons. Soil samples were drawn with the help of stainless steel corer each measured 5 cm long and 2.5 cm in diameter. The cores were extrated in Tullgren tunnels as modified by Macfadyen (1953). Soil temperature was recorded by using soil thermometer, and relative humidity have been recorded by a dial hygrometer.

Aquatic ecosystem :

Random sampling was carried out for collecting fauna from road side water ponds. Twenty units were collected from each pool, once in each season. For collecting surface water fauna hand water-net have been used and for bottom fauna special drag net modified by Usinger and Needham (1956) have been used for the present study. Some weed dwellers and shore-line fauna have been collected by hand-pick methods. Soil temperature have been recorded by a mercury thermometer and PH were recorded by using a digital PH-meter.

OBSERVATIONS

Faunal make up :

The fauna obtained from all the three road side ecosystems are given in table 1. together with their group wise and order wise number expressed in percentage in each locality and those belonged to forty eight different groups. The family Acrididae was most dominant occupying 24.5% of the total fauna obtained from grassland ecosystems, where as in soil ecosystems Hymenoptera was most dominant order comprising 12.52% followed by Prostigmata (Acarina) 12.48% of the total fauna collected from this ecosystems. However, in aquatic ecosystems chironomid larvae (Diptera) was most dominant occupying 13.95% of the total fauna obtained in each season (Table 1, 2 and 3) showed maximum in monsoon in all the sites of each ecosystem. Population maximum were found in the monsoon months coinciding the maximum percentage of relative humidity in the grassland and soil ecosystems (Fig 2, 3 and 4) and in aquatic ecosystems with high precipitation rate during the monsoon.

TABLE – 1. Seasonal occureuce of different taxa fro.n grassland ecosyste.n expressed in percentage

Sites	DANKUNI			MOGRA			BURDWAN			DURGAPUR			
Groups													
INSECTA		S	M	W	S	M	W	S	M	W	S	M	W TOTAL
Odonata		.22	1.30	.09	.35	0.78	—	1.04	1.61	.30	.39	.96	.13 7.17
ORTHOPTERA													
Acrididae		1.43	2.39	.35	.52	1.65	.22	5.43	8.21	2.09	.30	1.78	.13 24.50
Gryllidae		.74	1.62	.48	.22	.52	.13	1.22	2.26	.96	.17	.48	.09 8.77
Tettigoniidae		.13	.52		—	.13	—	.35	.70	.13	.09	.17	— 2.22
DICTYOPTERA													
Blattidae		.09	.30	.13	.17	.22	.09	.26	.65	.17	.13	.22	— 2.43
Mantidae		—	.22	0.04	—	.13	.48	.09	.30	.04	—	.35	— 1.17
THYSANOPTERA	.38	1.65	1.17	.22	.52	.04	1.09	2.82	0.74	.30	.22	.35	9.90
HEMIPTERA													
Pentatomidae		—	.22	.09	—	.09	—	.13	.35	.17	—	.09	— 1.17
Coreidae		—	—	—	—	—	—	.09	.22	.04	—	—	— .35
Reduviidae		—	.09	—	—	—	.35	.04	.09	—	—	—	— .22
Aphidae		.30	.22	0.78	.22	.17	—	.52	1.65	1.91	.13	—	.22 6.47
Cicadellidae		—	—	—	—	—	.13	.13	.22	—	—	—	— .39
COLEOPTERA													
Coccinellidae	.09	.22	.35	—	.17	—	.48	0.74	.96	.09	.04	.13	3.39
Chrysomelidae		.09	.17	.04	—	.13	—	.17	.22	.09	—	.09	— 1.00
Curculionidae		—	.22	.13	—	—	—	.35	0.56	.39	—	.17	.09 1.91
NEUROPTERA		.09	.13	.04	—	.04	—	.17	.35	—	—	.13	— .96
LEPIDOPTERA													
Pyralidae		.13	.30	—	.09	.09	—	.13	.22	—	—	.04	— 1.00
Sphingidae		.17	.22	—	—	—	—	.09	.13	—	.04	.04	— .70
Papilionidae		—	—	.13	—	—	—	.22	.30	—	—	—	— .65
DIPTERA													
Tipulidae		.17	.09	—	.09	.09	—	.30	.22	—	.09	—	— 1.04

TABLE—I (Contd.)

Groups	DANKUNI			MOGRA			BURDWAN			DURGAPUR			
	S	M	W	S	M	W	S	M	W	S	M	W	TOTAL
Culicidae	.22	.35	.09	.13	.22	.09	.09	.13	.04	.09	.17	—	1.68
Muscidae	.30	.52	.22	.13	.43	.09	.78	1.35	.91	.74	.91	.22	6.21
Tabanidae	.04	—	.04	.09	.09	.04	.22	.13	.09	.04	—	.13	0.91
HYMENOPTERA													
Formicidae	.22	.13	.09	.35	.52	.43	1.43	.274	.65	—	—	—	6.47
Vespidae	.09	.04	—	.04	.04	—	.13	.09	—	.09	.04	—	.56
ARACHNIDA													
Araneidae	.22	.52	.13	.09	.30	.09	.48	1.04	.22	.04	.17	.09	3.39
REPTILES													
Calotes	.09	.13	—	.04	.09	—	.09	.39	.09	.09	.04	—	1.13
Mabuya	—	.17	.04	.09	.13	—	.22	.35	.13	—	.04	—	1.17
BIRDS													
Acridotheres tonstis	.09	.13	.17	.13	.17	.09	.52	.43	.30	.09	.04	.04	2.22
Dicrurus macroceras	—	.09	—	.04	.04	—	.13	.30	.04	.04	—	—	.70
	4.95	11.86	4.60	3.00	6.78	2.26	16.46	28.76	10.51	2.95	6.21	1.65	

TABLE—2. *Seasonal occurence of different taxa fro.n soil ecosyste.n expressed in percentage*

Sites													
Groups	DANKUNI			MOGRA			BURDWAN			DURGAPUR			
SOIL	S	M	W	S	M	W	S	M	W	S	M	W	TOTAL
Annelida	.4	.42	.11	.32	.64	.11	1.58	4.94	.53	—	.21	—	9.05
Diplura	—	—	—	—	—	—	—	.53	.32	—	.11	—	.95
Isopoda	.32	.4	.21	.11	.32	.11	.74	1.16	.21	.21	.42	—	4.00
Diptera (Larva)	.4	.74	—	.42	.74	—	.53	.84	—	.21	.74	—	4.42
Diptera (Adult)	—	—	—	—	—	—	—	1.27	—	—	—	—	1.27
Coleoptera (Larva)	.21	.42	—	.11	.21	—	.74	.53	.4	.11	.11	—	2.63
Coleoptera (Adult)	.53	.84	.32	.21	.11	.11	1.27	1.58	.42	.32	.21	.11	6.00
Hymenoptera	.74	1.27	.53	.53	.84	.21	1.79	4.21	.74	.53	.84	.32	12.52
Diplopoda	—	.32	—	.21	.32	.11	1.27	2.21	.32	.21	.42	.11	5.47
Chilopoda (Centiped)	—	—	—	.21	.11	—	.32	.53	—	.11	.21	—	1.47
COLLEMBOLA													
Entomobryidae	.53	.74	.53	.84	1.68	.53	1.58	2.95	2.10	.21	.53	.21	12.41
Hypogastruridae	.32	.32	.21	.53	.84	.42	1.27	1.68	.53	—	.21	—	6.31
Isotomidae	.53	.95	.32	.74	1.16	.84	1.58	2.21	.95	.21	.42	.21	10.10
Sminthuridae	—	.21	—	—	.32	.11	—	1.58	.32	—	.11	—	2.63
ACARINA													
Prostigmata	.84	1.16	.32	.53	.95	.53	1.06	4.00	1.47	.49	.95	.21	12.48
Mesostigmata	—	.4	—	—	.32	—	.53	.84	.4	—	.21	—	2.31
Cryptostigmata	.53	.95	.21	.74	1.16	.32	—	1.58	—	.21	.32	—	6.00
			2.74	5.47	9.72	3.37	14.20	32.61	8.31	2.81	6.00	1.16	

TABLE—3. *Seasonal occurence of different texa fro.n acguatic ecosyste.n expressed in percentage*

Sites													
Groups	DANKUNI			MOGRA			BURDWAN			DURGABUR			
INSECTA	S	M	W	S	M	W	S	M	W	S	M	W	TOTAL
Corixidae	0.14	0.86	—	1.22	3.02	0.86	0.72	1.51	0.22	—	—	—	8.55
Notonectidae	—	—	—	0.72	1.08	0.36	0.22	0.58	.14	—	.28	0.7	3.45
Geriidae	—	—	—	.36	1.22	.28	.14	.79	.22	.14	.36	—	3.52
Nepidae	.14	.36	—	.58	1.51	1.22	0.86	1.08	.36	.14	.43	—	6.69
Belostomitidae	—	—	—	.50	1.65	.14	.22	.65	.14	—	.50	—	4.03
odonata nymphs	—	1.15	.14	.28	3.09	.50	.36	1.58	.58	.22	.65	—	8.48
Chironomid (Larvae)	.22	1.08	.29	.86	3.74	1.15	1.94	1.80	.43	.14	1.87	.22	13.95
CRUSTACEA	.29	.86	.36	1.15	2.66	1.58	1.08	2.08	.93	.36	.86	.36	12.51
Mollusca	.36	.79	.29	1.15	2.23	1.80	.36	2.01	.86	.29	.14	—	10.21
Amphibia	.36	1.51	—	1.51	3.95	—	1.15	2.73	—	.22	.36	—	11.72
Pisces	.29	.86	.36	1.29	2.30	.86	1.51	2.66	.86	.14	•.79	—	12.29
REPTILIA													
Natrix sp.	—	.14	—	—	.29	—	0.07	.22	—	.50	—	—	72
BIRDS													
Metopidus sp.	—	—	—	.14	.22	.07	.29	.14	.22	—	.14	—	1.22
Egretta sp.	—	.14	.22	.22	.36	.14	.43	.58	.36	—	.14	—	2.66
	.80	7.78	1.65	9.99	27.32	8.99	9.35	18.40	5.32	2.23	6.54	.65	

Seasonal changes :

Figures 5, 6 and 7 shows the seasonal changes in number expressed in percentage of different groups obtained from all the three ecosystems in each localities. Acrididae, Chironomid larvae, Formicidae (Hymenoptera) and Prostigmata are the dominant fauna in different ecosystems shows their highest peak during monsoon even when their number considered in locality wise. It is seen apparently that major faunal groups obtained from different localities exhibited an irregular trend of fluctuations usually showing maximum in monsoon and minimum in summer season and moderately higher in winter season during the period of observations (Table 1, 2 and 3).

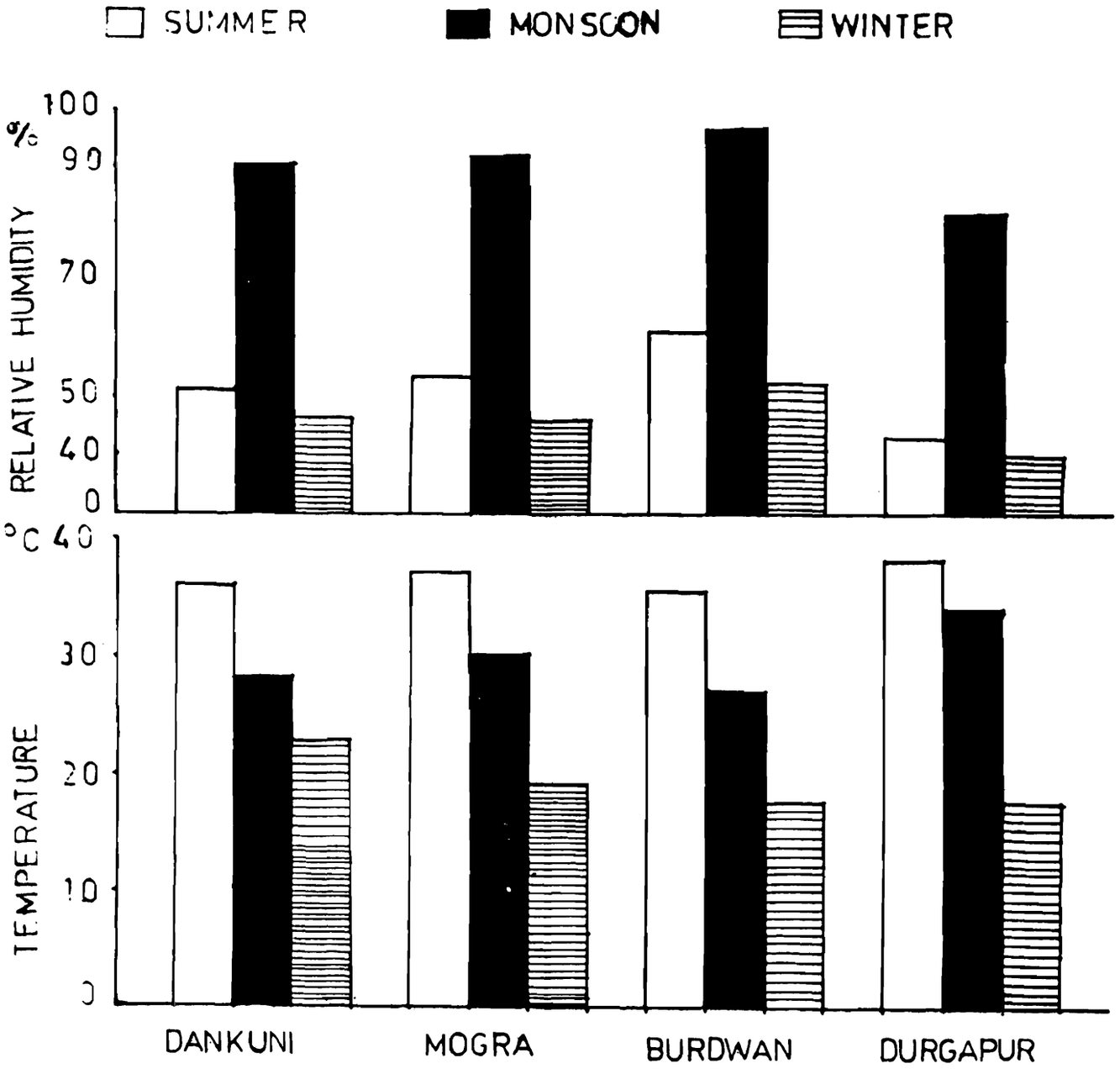

Fig. 2. Showing the seasonal fluctuations of Temperature and relative humidity at different localities of Grassland ecosystems.

Environmental factors :

In grassland air temperature was maximum in summer and minimum in winter in all the localities, similar results were also obtained for soil temperature and water temperature. Relative humidity was maximum in monsoon and minimum in winter in all localities of both grassland and soil ecosystems. PH of water were more or less same in all the localities (Fig. 2, 3 and 4).

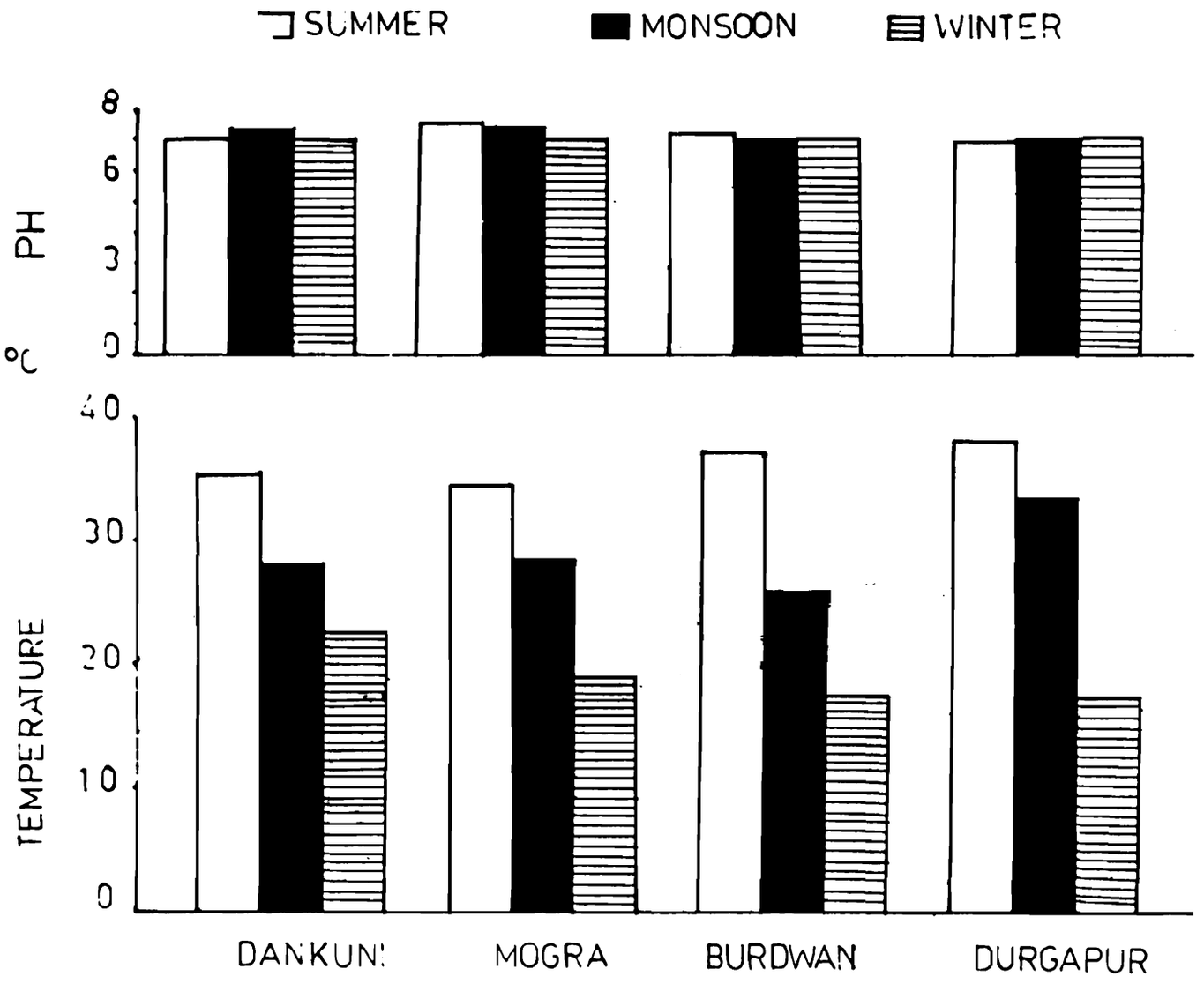

Fig. 3. Showing the seasonal fluctuations temperature and pH at different localities of acquatic ecosystems.

Regression and correlation analysis :

To ascertain whether the environmental factors influenced the distribution of different animal groups, the correlation and regression between the different groups and the environmental factors were analysed statistically (Table 4, 5 and 6, Figures 8-10). Regression lines of three predominant faunal groups (one group from each ecosystems) were obtained pulling together data for all three seasons observed in all the sites. The combined regression lines drawn along with the respective scattered diagrams were shown in Figures 8-10. Study of correlation coefficient (third coloumn of tables 4-6) between the population of individual groups, and the

variables showed majority positive significant correlations with all the variables except the following negetive correlation between Thysanoptera, Aphidae, Coccinellidae, Culicidae and air temperature in the grassland ecosystems. In aquatic ecosystem negetive correlation exists between Nepidae, odonata nymph, Crustacea, Mollusca dn water temperature, where as in soil ecosystem negetive correlations were found only between entomobryiidae, prostigmata and soil temperature.

DISCUSSION

The results presented in this study were based on sample survey of 4 localities from three contrasting ecosystems along Grand Trunk Road from Dankuni to Durgapur, West Bengal. The faunal group encountered in this investigation mainly belonged to the Reptilia, Birds, Pisces, Amphibia, Mollusca, Crustacea, Annelida, Arachnida and insecta. Some forms are markedly differed in their abundance from

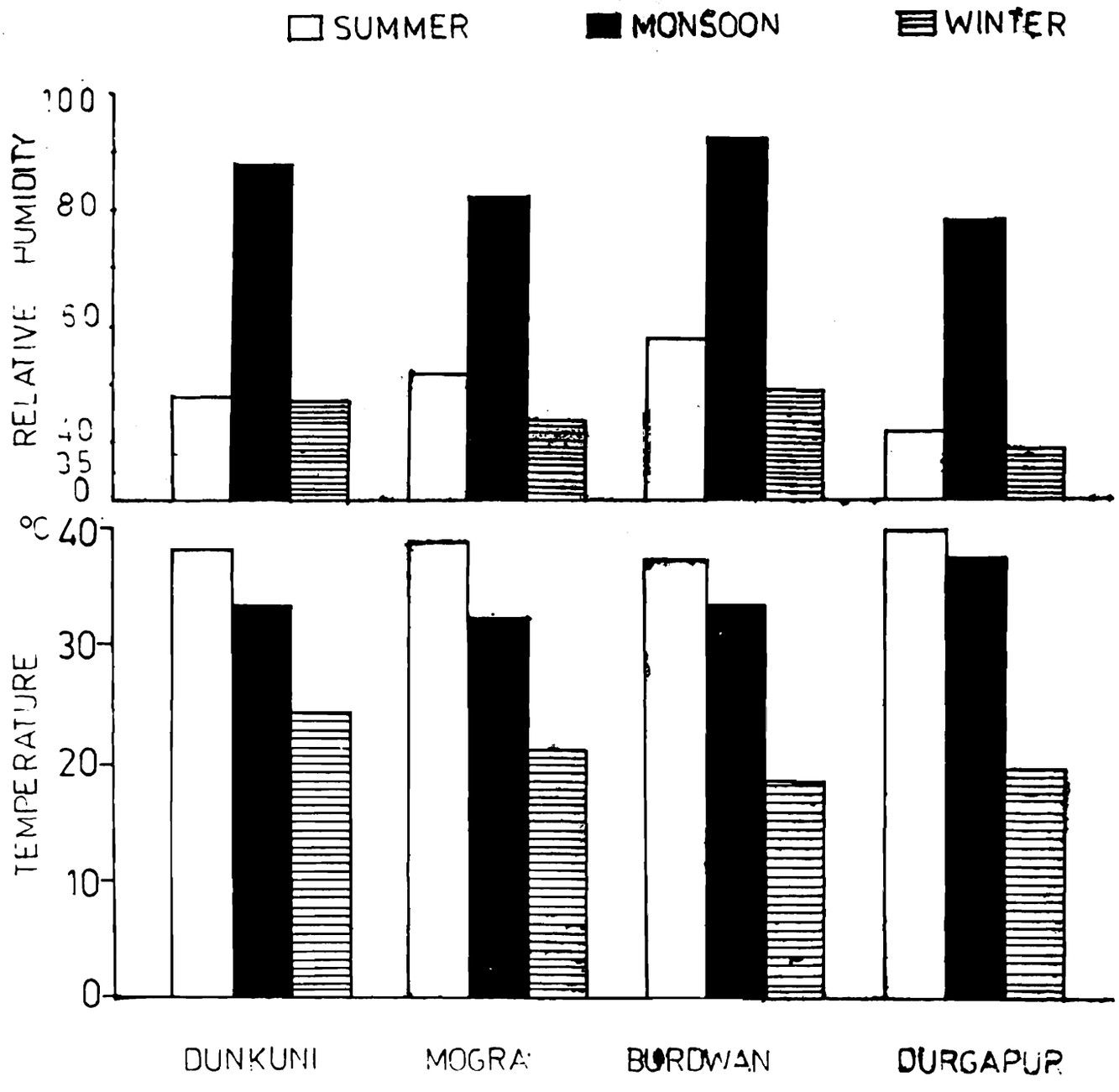

Fig. 4. Showing the seasonal fluctuations of temperature and relative humidity at different localities of soil ecosystems.

TABLE—4 Showing relationship between population of different faunal groups and two parameters in grassland ecosystem.

Groups	Mean + S.D.	'r' value	Y=a+bx
Y : No. of Odonata	13.75±12.12	— —	— —
Relative humidity	59.92±19.75	0.90**	Y=19.53+0.56x
Air temperature	31.33± 8.13	0.45*	Y= 7.26+0.67x
Y : No. of Acrididae	47.00±56.14	— —	— —
Relative humidity	59.92±19.75	0.64**	Y=61.28+1.81x
Air temperature	31.33± 8.13	0.25	Y= 6.08+1.69x
Y : No. of Gryllidae	16.83±15.15	— —	— —
Relative humidity	59.92±19.75	0.70**	−15.32+0.54x
Air temperature	31.33± 8.13	0.17	7.03+0.31x
Y : No. of Blattidae	4.67+ 3.77	— —	— —
Relative humidity	59.92±19.75	0.79**	−4.44+0.15x
Air temperature	31.33± 8.13	0.27	0.49+0.13x
Y : No. of Thysanoptera	19.00+17.77	— —	— —
Relative humidity	59.92±19.75	0.59**	−12.86+0.53x
Air temperature	31.33± 8.13	−0.43*	35.67−0.74x
Y : No. of Aphidae	12.42±14.18	— —	— —
Relative humidity	59.92±19.75	0.09	8.48+0.07x
Air temperature	31.33± 8.13	−0.43*	35.67−0.74x
Y : No. of Coccinellidae	6.50+ 6.87	— —	— —
Relative humidity	59.92±19.75	0.17	3.00+0.06x
Air temperature	31.33± 8.13	−0.40	17.04−0.34x
Y : No. of Muscidae	12.67+ 8.93	— —	— —
Relative humidity	59.92±19.75	0.56**	2.57+0.25x
Air Temperature	31.33± 8.13	0.23	4.76+0.23x
Y : No. of Formicidae	12.58+18.41	— —	— —
Relative humidity	59.92±19.75	0.47*	−13.82+0.44x
Air temperature	31.33± 8.13	0.09	6.00+0.21x
Y : No. of Araneidae	6.50+ 6.54	— —	— —
Relative humidity	59.92±19.75	0.75**	−8.44+0.25x
Air temperature	31.33± 8.13	0.19	1.74+0.15x

** Significant at 1% level
* Significant at 5% level

one site to other (Table 1, 2 and 3). Moreover, number of groups were maximum in grassland ecosystem (30) and minimum at aquatic ecosystem (14). The family like Coreidae, Cicadellidae, Reduviidae, Curculionidae, Sphingidae, Papilionidae and Formicidae were not obtained from the grassfields of Dankuni, Mogra, Durgapur etc. (Table 1, 2 and 3). Diplura, Diptera adult, chilopoda were not found from all the localities of soil ecosystem. Similarly, in aquatic ecosystems Notonectidae, Geriidae, Belostomitidae and *Metopidus* sp. were not present in all the localities. The reasons of disappaarance of these functionally and taxonomically very different groups have to identified. Quantitative faunal analysis (Fig. 11) showed maximum population in the soil ecosystem (43.58%) and minimum population were obtained from aquatic ecosystem (21.25%). This may be due to the fact that the soil fauna seems to be less affected by the road side trampling in comparison to other two ecosystems. Similar results were also obtained by Molfetas and Bladin 1980.

The sequence of faunal dominance in grass field were Burdwan, Dankuni, Mogra, Durgapur, in soil Burdwan Mogra Dankuni Durgapur, an in water Mogra Burdwan Dankuni Durgapur as evident from Figure 12. It is clear from this sequence that Durgapur area bounds minimum populations in all the ecosystems studied followed by Dankuni area, this shows that the road side trampling in conjunction with

TABLE—5 Showing relationship between population of faunal groups and two parameters in acquatic ecosystem.

Water Pool

Groups	Mean + S.D.	'r' value	Y = a+bx
Y : No. of Nepidae	7.75+6.98	— —	— —
Water temperature (0°PH)	28.13±7.66	−0.01	8.13−0.01x
PH	7.12±0.18	0.40	−101.09+15.29x
Y : No. of Odonata nymph	9.83±12.33	— —	— —
Water temperature	28.13± 7.66	−0.03	11.44−0.05x
PH	7.12± 0.18	0.33	−152.53+22.62x
Y : No. of Chironomid (Larvae	16.17±14.52	— —	— —
Water temperature	28.13± 7.66	0.19	6.24+0.35x
PH	7.12±0.88	0.48*	−255.04+38.10x
Y : No. of Crustacea	14.50±10.41	— —	— —
Water temperature	28.13± 7.66	−0.11	18.89−0.16x
PH	7.12± 0.18	0.39	−150.16+23.00x
Y : No. of Mollusca	11.83±10.83	— —	— —
Water temperature	28.13± 7.66	−0.22	20.71−0.32x
PH	7.12± 0.18	0.39	−152.15+23.03x
Y : No. of Pisces	14.25±12.14	— —	— —
Water temperature	28.13± 7.66	0.13	8.78+0.19x
PH	7.12± 0.18	0.43*	−172.86+26.28x

* Significant at 5% level.

industrial pollution may cause less number of fauna in all the three major ecosystems in this study. Similar results were also obtained by Novacova (1969) and Littel (1974).

As to the role of environmental factors considered in this study exerted significant effects either singly or jointly.

The influence of temperature may played an important role on the distribution of predominant faunal groups in the grass field as the temperature ranges from 18.5°C to 40°C (Table 3). Maximum population encountered in this study in the

TABLE—6 Showing relationship between population of different faunal groups and two parameters in soil ecosystem.

Groups	Mean±SD	'r' value	Y = a+bx
Y : No. of Annelida	10.92±12.27	— —	— —
Relative humidity	6.92±21.08	0.34	−2.23+0.20x
Soil temperature	29.03± 7.79	0.24	−0.28+0.38x
Y : No. of Isopoda	7.25± 5.34	— —	— —
Relative humidity	62.92±21.08	0.56**	−5.63+0.24x
Soil temperature	29.03± 7.79	0.51*	−2.91+0.35x
Y : No. of Coleoptera	14.25±13.78	— —	— —
Relative humidity	62.92±21.08	0.56*	−8.78+0.37x
Soil Temperature	29.03± 7.79	0.18	5.12+0.31x
Y : No. of Hymenoptera	29.75±30.90	— —	— —
Relative humidity	62.92±21.08	0.63**	−28.80+0.93x
Soil temperature	29.03± 7.79	0.10	17.88+0.41x
Y : No. of Diplopoda	13.00±18.37	— —	— —
Relative humidity	62.92±21.08	0.57**	−18.01+0.49x
Soil temperature	29.03± 7.79	0.11	5.34+0.26x
Y : No. of Entomobryidae	29.50±24.37	— —	— —
Relative humidity	52.92±21.08	0.57**	−12.11+0.66x
Soil temperature	29.03± 7.79	−0.12	40.65−0.38x
Y : No. Hypogastruridae	15.00±14.47	— —	— —
Relative humidity	62.92±21.08	0.57**	−9.68+0.39
Soil temperature	29.03± 7.79	0.10	9.70+0.18x
Y : No. of Isotomidae	24.00±16.97	— —	— —
Relative humidity	62.92±21.08	0.63**	−24.98+0.86x
Soil temperature	29.03± 7.79	0.01	23.09+0.03x
Y : No. of Prostigmata	30.67±28.23	— —	— —
Relative humidity	62.92±21.08	0.64**	8.42+0.52x
Soil temperature	29.03± 7.79	−0.08	39.06−0.29x

** Significant at 1% level
* Significant at 5% level

TABLE—7 Environmental factors recorded in different seasons in three ecosystems of various localities.

	Seasons	Grassland ecosystem		Soil ecosystem		Acquatic	
		Air Temp. (0°C)	R/H (%)	Soil Temp. (0°C)	R/H (%)	Temp. (0°C)	PH
DANKUNI	Summer	38.5	48.5	36.5	51.5	35.5	7.00
	Monsoon	33.5	88.2	28.5	90.5	28.00	7.3
	Winter	24.5	42.5	23.3	46.5	22.5	7.01
MOGRA	Summer	39.2	52.5	37.5	53.5	34.5	7.5
	Monsoon	32.5	82.5	30.5	92.00	28.5	7.4
	Winter	21.3	44.5	19.5	46.00	19.00	7.02
BURDWAN	Summer	37.5	58.2	36.00	61.5	37.00	7.2
	Monsoon	33.5	92.5	27.5	96.5	26.00	7.01
	Winter	18.5	49.5	18.00	52.5	17.5	7.00
DURGAPUR	Summer	40.00	42.1	38.5	43.00	38.00	6.98
	Monsoon	37.5	78.5	34.5	81.5	33.5	7.00
	Winter	19.5	39.5	18.00	40.00	17.5	7.01

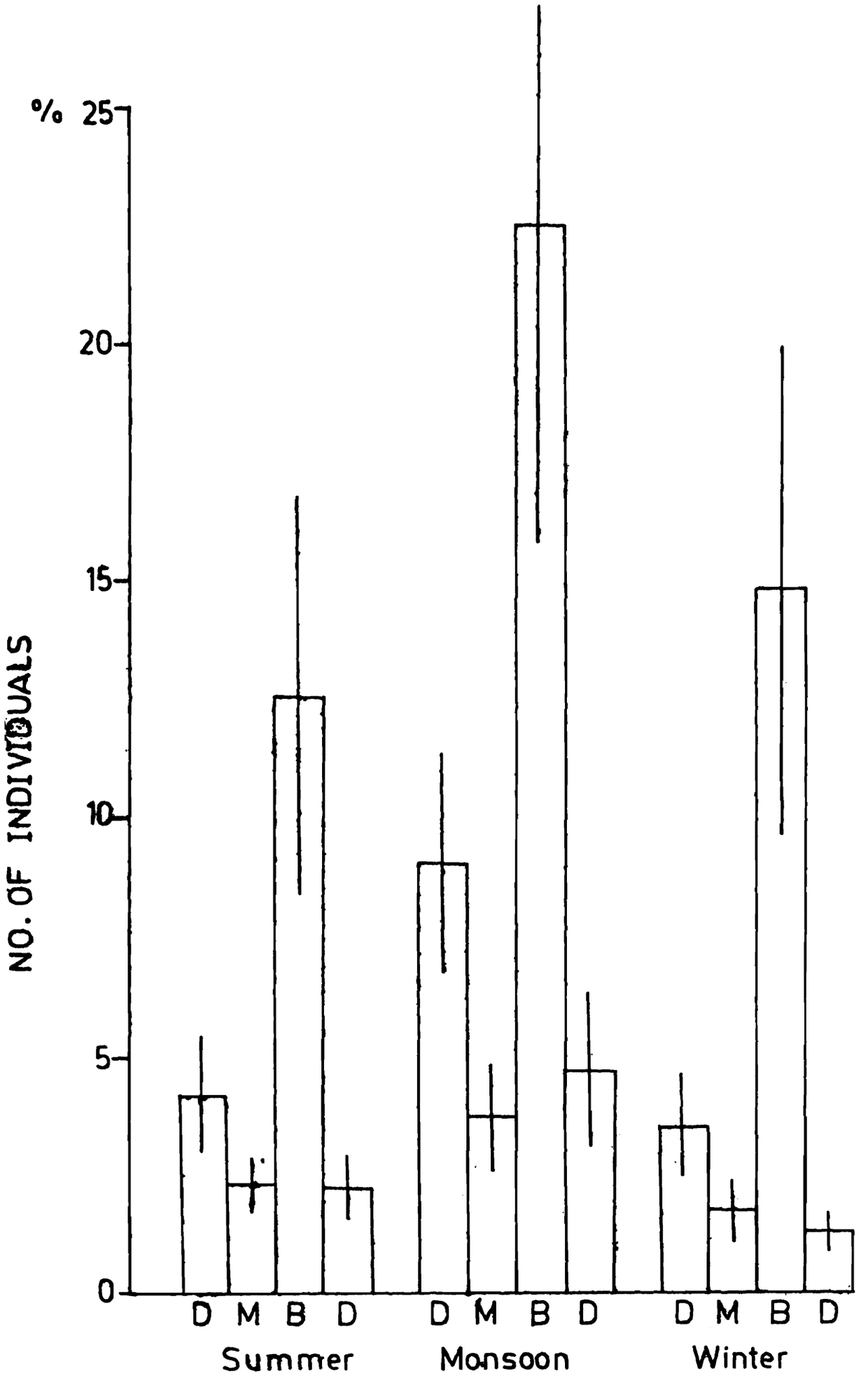

Fig. 5. Showing seasonal variations of faunal structure in different localities of grassland ecosystem (X ± SE).

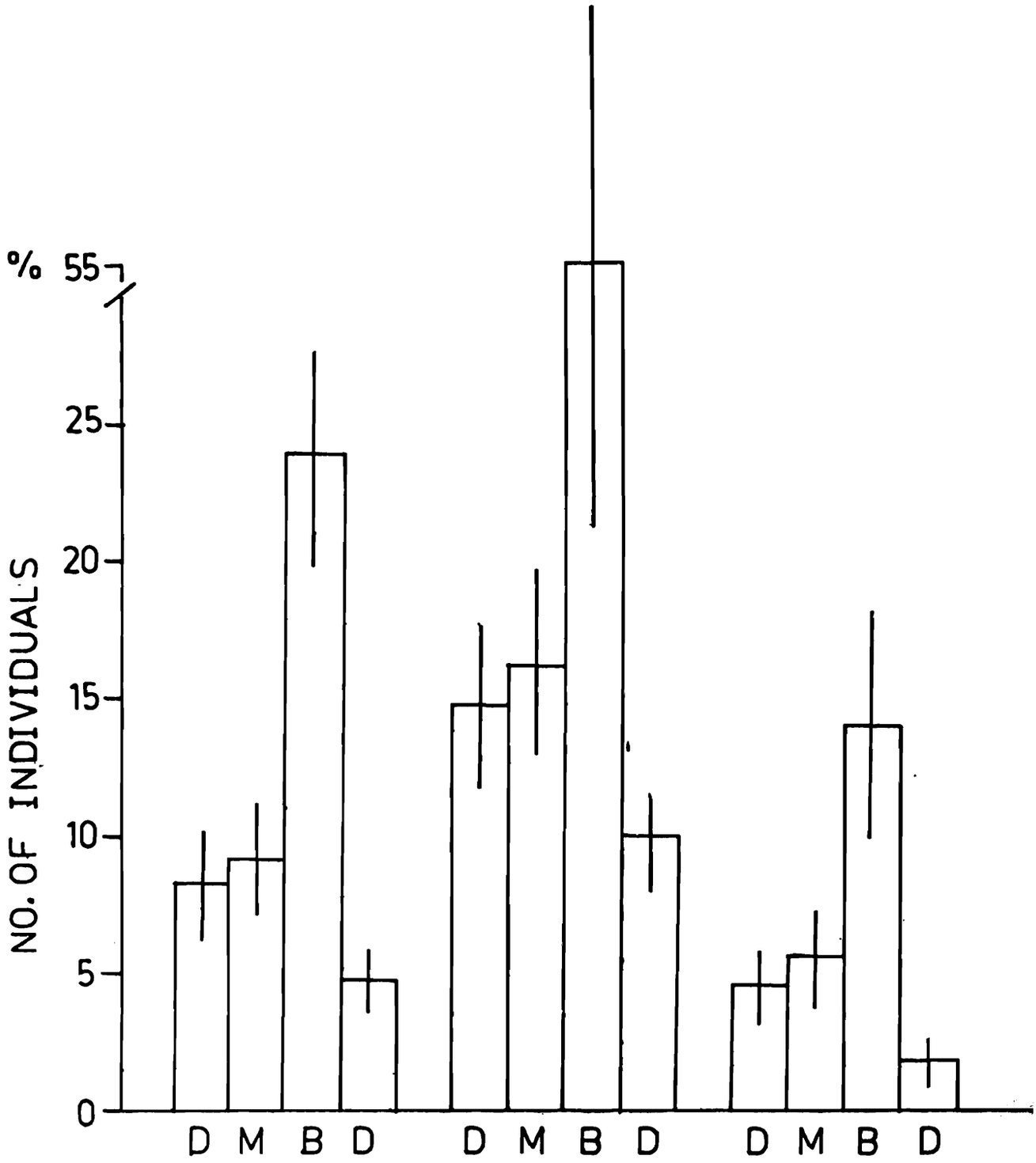

Fig. 6. Showing seasonal variations of faunal structure in different localities of soil ecosystem (X ± SE).

temperature ranges between 32.5°C-33.5°C is, moderate temperature which prevailed during monsoon. This supports the observations of Uvarov (1977) and Dwivedi (1977).

But the direct influence of temperature on the distribution of fauna in the soil ecosystem cannot be evaluated in the present study as the temperature alone did not show any significant correlation with the soil fauna. According to Christiansen (1964). Hazra and Choudhuri (1983) the relationship between micro-arthropod population and the temperature optima in soil were not clear. Maximum soil fauna were observed in this study when soil temperature ranges from 27.5°C to 30.5°C (Table 7).

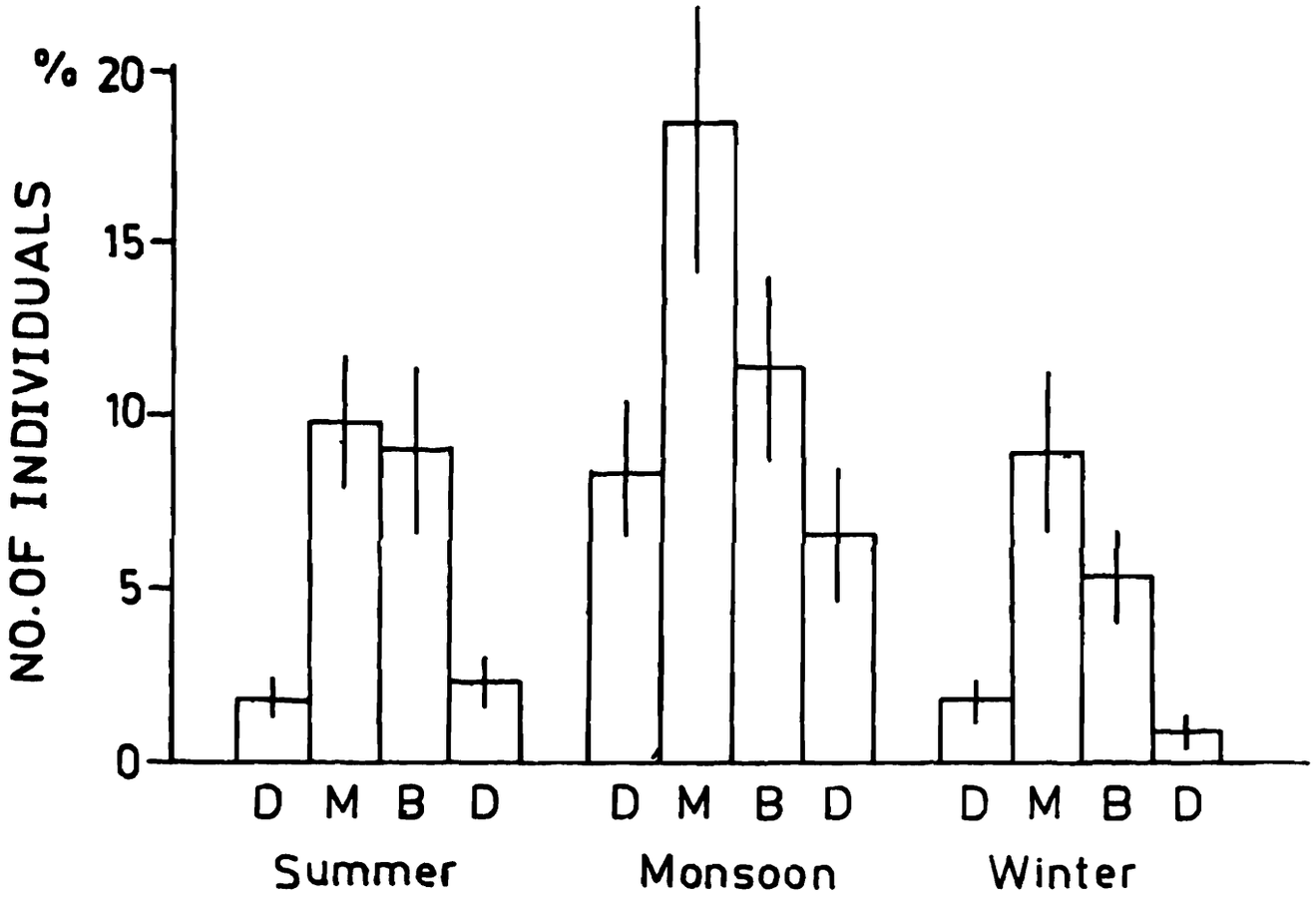

Fig. 7. Showing seasonal variations of faunal structure in different localities of aquatic ecosystem (X ± SE).

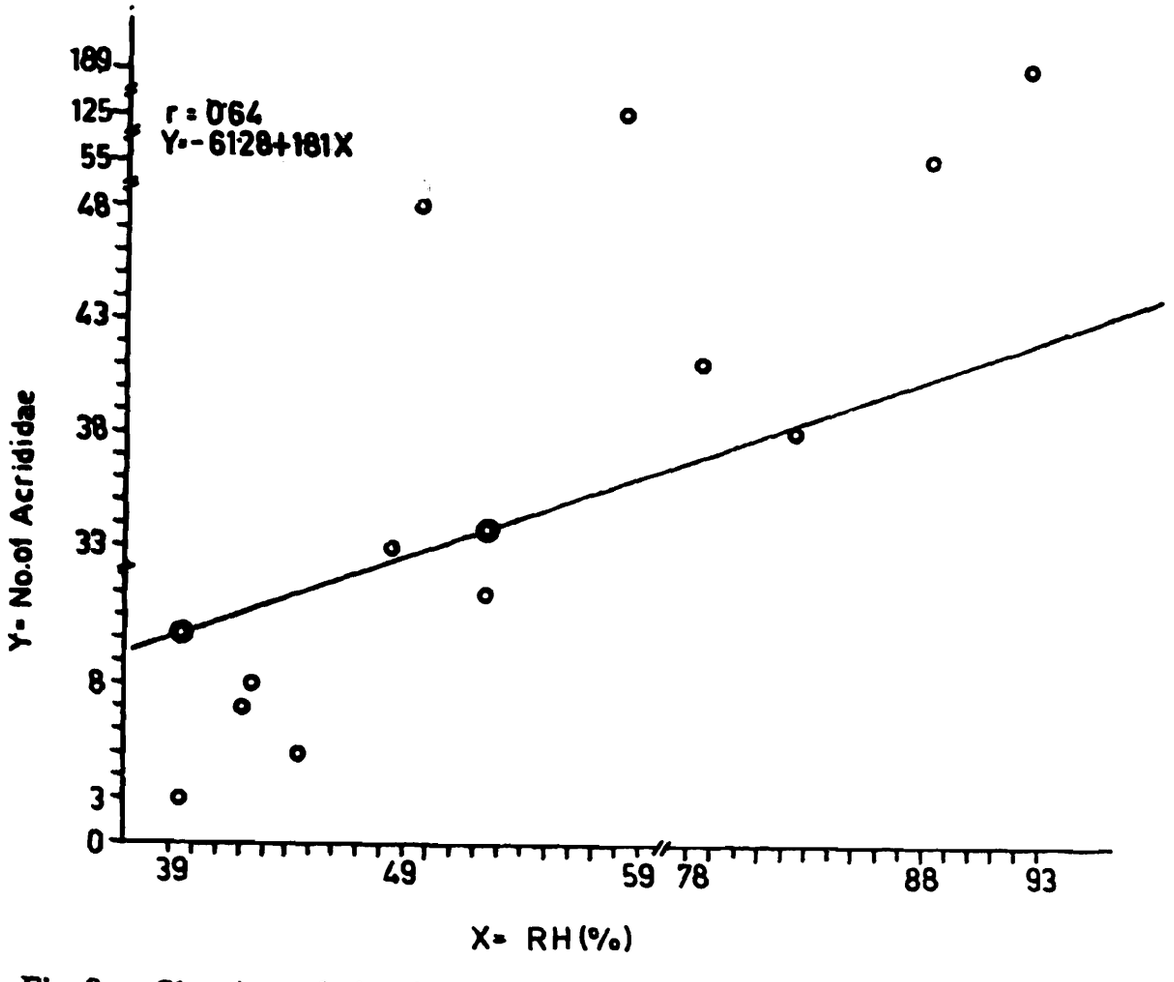

Fig 8. Showing relationship between number of Acrididae and the relative humidity in grassland ecosystem.

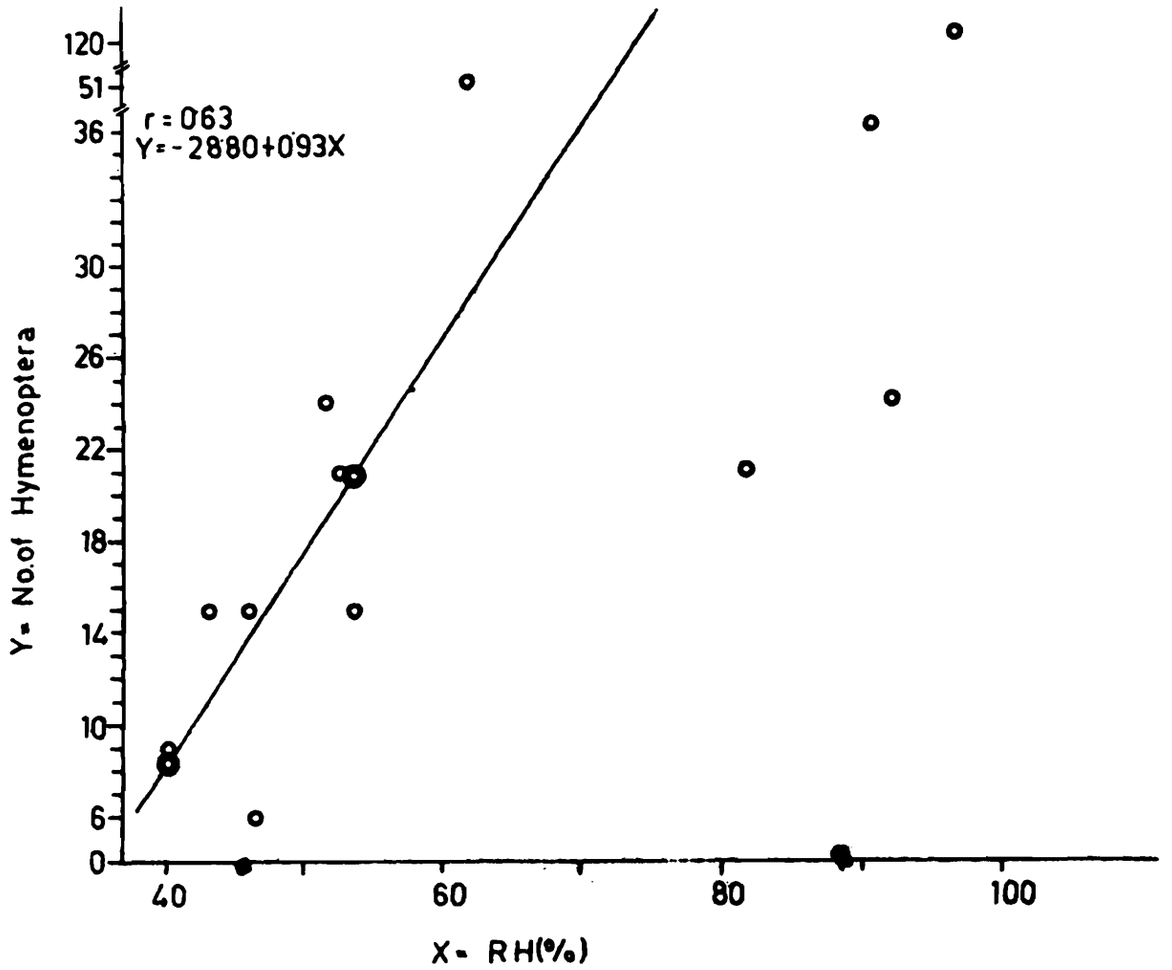

Fig. 9. Showing relationship between number of Hymenoptera and the relative humidity in soil ecosystem.

In aquatic ecosystem the temperature did not show any significant correlation in the present study, George (1966) reported that during the pre and post monsoons the maximum and minimum range of temperature variations over a period of 24 hrs was found to be 5.2°C and 2.2°C respectively and the variation reached 6.5°C in winter. PH in acquatic ecosystem showed a significant correlation with two major faunal group in the present study. According to Welsch (1952) in any fresh water medium PH is very offen determining factor by becoming a limiting factor, he also showed that high PH accompanied by a low dissolved O_2 content in water has a lethal influence on the fauna. The relative humidity content of both soil and grassland ecosystem are found to be significantly and positively correlated with the faunal populations. The results obtained in this study agreed well with those of Poole (1961) Davis (1963), Choudhuri and Roy (1972), Uvaroy (1977), Hazra et all (1981) and Hazra and Choudhuri (1983). Therefore, faunal composition, which do not show the same preferences in habitat and nutrition may not react in the same way in the road side environment. Through this study of these reactions and the faunal communities modifications, it may be possible to measure the effects and to characterize the impact of perturbation induced by trampling.

It might be also concluded that the biotic components evaluated here in collaboration with other factors not considered in this sutdy jointly acts as a limiting factors for the population fluctuations and distribution of fauna in poorest road side environment of national highway.

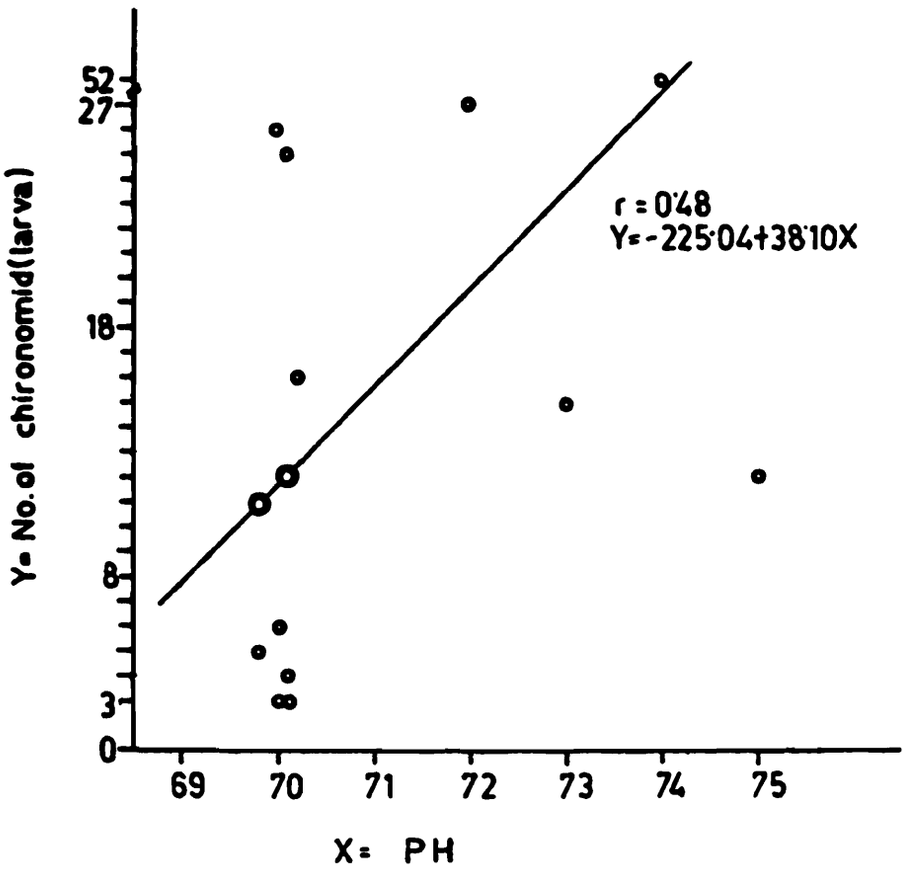

Fig. 10. Showing relationship between number of chironomid larvae and pH in acquatic ecosystem.

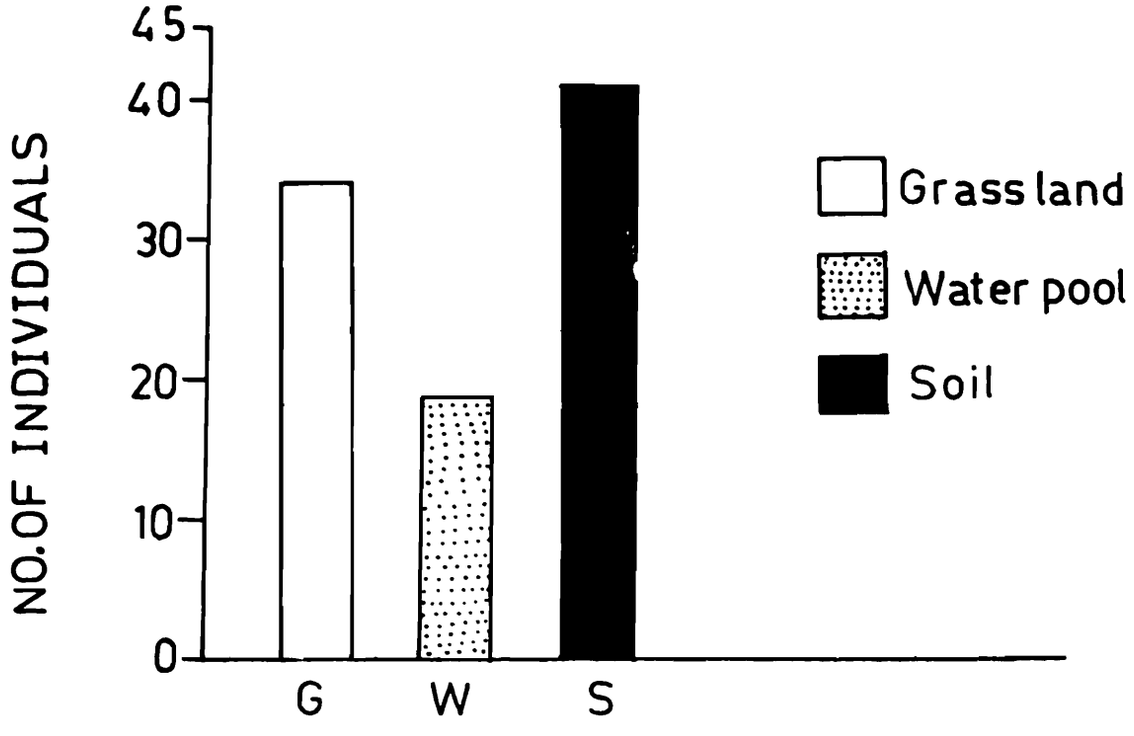

Fig. 11. Showing composition of total fauna in three major ecosystems (3).

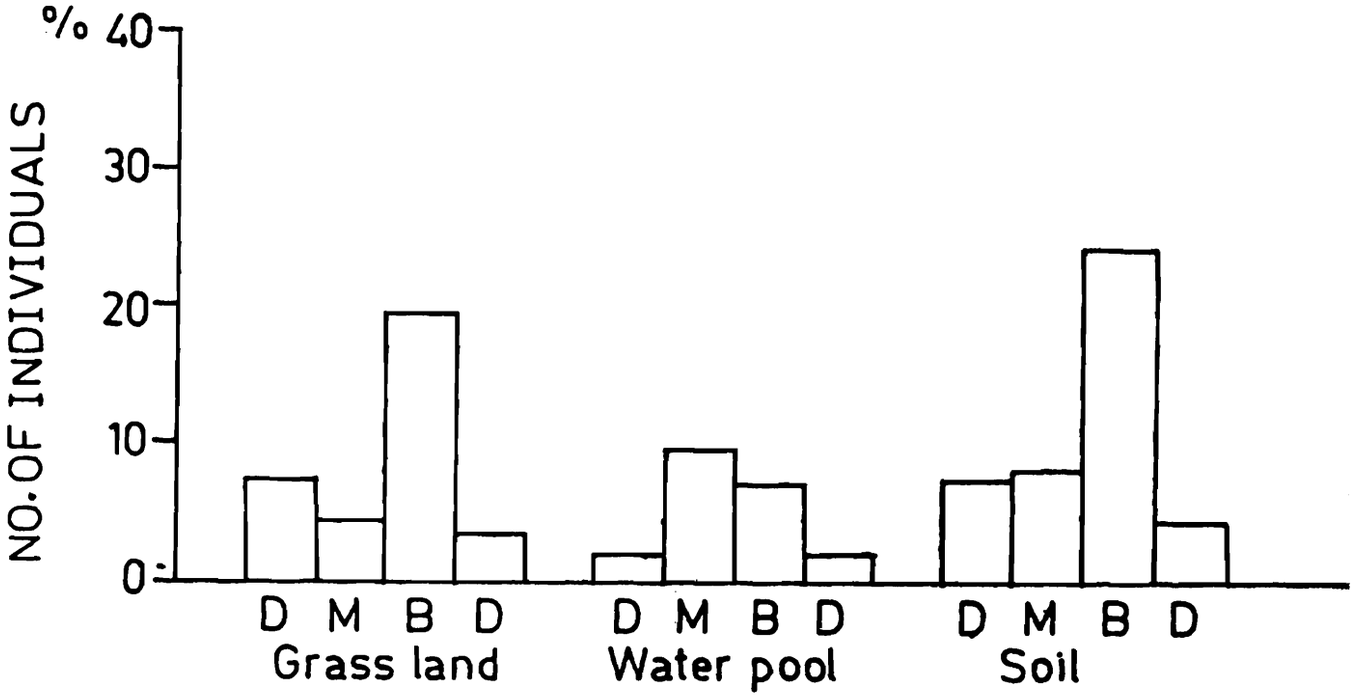

Fig. 12. Showing locality wise faunal composition in three ecosystems (%).

SUMMARY

Faunal analysis were made in three major ecosystems in some poor environment by the side of a national High way in West Bengal. Altogether 6,545 specimens were collected belonging to fifty eight different faunal groups. Maximum number of fauna were collected from the soil ecosystem (43.58%) and minimum from aquatic ecosystem (21.25%). Seasonal variations in the population structures were also studied. Statistical analysis showed a significant correlations between relative humidity and faunal distributions in grassland and soil ecosystems.

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SYSTEMATIC STATUS OF *BARILIUS JAYARAMI* BARMAN AND *BARILIUS HOWESI* BARMAN (PISCES : CYPRINIDAE : RASBORINAE)

AKHLAQ HUSAIN, RAJ TILAK AND SEEMA JAIN
Zoological Survey of India, Dehradun-248 195

INTRODUCTION

On a detailed study of the genus *Barilius* Hamilton-Buchanan, Husain (1987) and Jain (1987), while dealing with their projects on systematics of the fishes of Dehradun and systematics of the fishes of subfamily Rasborinae respectively, found that the two rasborine fishes, *Barilius jayarami* Barman (Barman, 1985) from Arunachal Pradesh (Namdapha Wildlife Sanctuary, Dist. Tirap) and *Barilius howesi* Barman (Barman, 1986) from West Bengal are not new taxa, but same as the widely distributed *Barilius barna* Hamilton-Buchanan and *Barilius bendilisis** Hamilton-Buchanan respectively. Most probably, Barman (1985, 1986) compared the material of his new species of the genus *Barilius* Hamilton-Buchanan from the two areas with unrelated species. According to him (Barman, 1985, 1986), *Barilius dogarsinghi* Hora and *Barilius infrafasciatus* Fowler were close allies of *Barilius jayarami*, and *Barilius barna* Hamilton-Buchanan and *Barilius barila* Hamilton-Buchanan were nearer to his *Barilius howesi*. This must have resulted in the creation of two new species i.e. *B. jayarami* and *B. howesi*.

In the present paper, a comparison of a long series of characters dealt with by Barman (1985, 1986) for his two species has been made with those of the correctly identified species. The present study clearly indicates that the two species described by Barman (1985, 1986) are invalid and belong to already known ones i.e. *Barilius barna* Hamilton-Buchanan and *B. bendilisis* Hamilton-Buchanan, respectively. The type material of both these taxa has been examined.

(i) Systematic Status of *Barilius jayarami* Barman

On examination of type material of the species *Barilius jayarami* Barmen (Regd. No. ZSI/FF 2151), the number of dorsal and pelvic fin rays, predorsal scales and rows of scales between dorsal base and lateral line were actually found to be 11/7 (instead of II-III/8 as counted by Barman, 1985), 1/7 (instead of 1/8), 16 scales (instead of 19-20 scales) and 8-8.5 rows of scales (instead of 6.5 rows), respectively.

The comparison of characters (meristic, morphometric, colouration) and distribution of *Barilius jayarami* Barman with those of *Barilius barna* Hamilton-

* Spelling followed after Hamilton, the author of the species.

TABLE showing overlapping of characters in *Barilius barna* Hamilton-Buchanan and *Barilius jayarami* Barman

Character	*Barilius barna* Hamilton				*Barilius jayarami*		
	Hamilton-Buchanan 1822	Gunther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
1	2	3	4	5	6	7	8
1. Dorsal fin rays	9	9	II/7	—	II-III/7	II/7	II-III/8(II/7 in paratype, Regd. No. ZSI/FF-215)
2. Pectoral fin rays	13	—	15	—	I/12-13	I/14	I/12-13
3. Pelvic fin rays	9	—	9	—	II/7	II/8	I/8 (I/7 in paratype)
4. Anal fin rays	II/10	13	III/10-11	—	III/10-11	III/10-11	III/11
5. Caudal fin rays	19	—	19	—	19	19	19
6. Cleft of mouth	—	Maxillary extends somewhat beyond vertical from front margin of orbit.	Posterior extremity of maxilla reaching to below 1/3rd of orbit.	—	Posterior extremity of maxilla reaching to below 1/3rd of orbit.	Posterior extremity of maxilla reaching to below 1/3rd of orbit.	Extending beyond anterior margin of eye.
7. Barbels	Absent	None.	Absent.	—	Minute rostral pair shorter than maxillary pair or even rudimentary, Absent or rudimentary (Barman, 1985)	Minute rostral pair of barbels.	Two pairs, anterior or rostral pair very short and posterior or maxillary pair absent, 1/5th in eye diameter (Both pairs minute in paratype).

Table (*Contd.*)

Character	*Barilius barna* Hamilton					*Barilius jayarami*
	Hamilton-Buchanan 1822	Günther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
1	2	3	4	5	6	7	8
8. Dorsal fin	—	—	Origin nearer caudal base than snout tip	—	Origin nearer caudal base than snout tip.	Origin nearer caudal base than snout tip	Origin nearer caudal base than snout tip
	—	Base of last 3 rays being above anal fin	—	—	Base extending over 1/3rd or middle anal base.	—	Base extending over middle of anal base in paratype
9. Pectoral fin	—	—	Extending slightly beyond pelvic base	—	Extending slightly beyond pelvic base	Extending to pelvics	Well extending pelvics
10. Pelvic fin	Origin nearer snout tip than caudal base. Fins do not reach the vent	—	Fin may or may not reach anal origin (Pl. CXLVIII, Figs. 1.2).	— —	Fin may or may not reach anal origin	Fin may or may not reach anal origin	Origin nearer snout tip than caudal base. Fin reaching anal fin
11. Head length in standard length	—	—	—	3.68–4.00	3.80–4.21	3.65–4.13	3.70–3.93
12. Body depth in standard length	—	4.00	—	3.32–3.68 3.50–4.00	3.17–4.25	3.05–3.71	3.52–3.70
13. Predorsal distance in standard length	—	—	—	—	1.77–1.88	1.74–1.87	1.81–1.85
14. Dorsal fin in standard length	—	—	—	—	5.23–6.67	—	4.84–5.90
15. Pectoral fin in standard length	—	—	—	—	4.53–5.50	—	5.36–5.72

Table (*Contd.*)

		Barilius barna Hamilton					*Barilius jayarami*
Character	Hamilton-Buchanan 1822	Gunther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
1	2	3	4	5	6	7	8
16. Prepelvic distance in standard length		–	–	–	2.11–2.33	2.12–2.52	2.25–2.36
17. Pelvic fin in standard length	–	–	–	–	4.60–5.90		4.91–5.25
18. Preanal distance in standard length	–	–	–	–	1.48–1.66	1.48–1.68	1.53–1.59
19. Anal fin in standard length	–	–	–	–	6.55–8.89	–	6.73–7.00
20. Caudal fin in standard length	–	–	–	–	3.92–4.81	3.30–4.38	4.50–4.91
21. Height of head in head length	–	–	–	–	1.09–1.27	–	1.15–1.23
22. Width of head in head length		–	–	–	1.60–2.00	1.71–2.31	1.87–2.12
23. Length of snout in head length	–	–	–	–	3.44–3.83	3.36–4.33	3.40–4.00
24. Eye diameter in head length	–	–	2.50–3.50	2.50–3.50	2.80–3.45	3.62–4.70	3.00–3.20
25. Length of snout in interorbital width	–	–	–	–	1.15–1.43	–	1.10–1.25

Table (*Contd.*)

		Barilius barna Hamilton					*Barilius jayarami*
	Character Hamilton-Buchanan 1822	Gunther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
1	2	3	4	5	6	7	8
27. Eye diameter in postorbital head length	—	—	—	—	1.33—1.58	—	1.20—1.60
28. Least height of caudal peduncle in its length	—	—	—	—	1.56—2.00	1.12—1.78	2.00—2.40
29. Lateral line scales	—	42	39—42	—	40	40—42	42—43
30. Scales between dorsal base and lateral line	—	9	8-9	—	7.5—8.5	8	6.5 (8.0 —8.5) in paratype)
31. Scales between lateral line and pelvic base	—	—	2.5	—	2.5—3.5	2.5	3.5
32. Predorsal scales	—	—	16	15—16	15—16	17	19-20 (16 in paratype)
33. Circum-peduncular scales	—	—	—	—	14	—	14
34. Colouration	Incomplete bars on the sides and with a golden	Body with about 8 narrow blackish vertical bands	Adult with 9-11 vertical dark bands on body;	8-9 vertical bands ; 9-10	7-10 bluish vertical bands vertical bars	7-11 bands on lateral sides	8-9 transverse dark bluish bands narrower than

Table (*Contd.*)

	Barilius barna Hamilton						*Barilius jayarami*
Character	Hamilton-Buchanan 1822	Gunther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
1	2	3	4	5	6	7	8
	stripe along the upper lateral line		young with 7-9 narrow deep blue vertical bands	vertical bars	of body crossing lateral line line		pale interspaces and extending from back to downwards till below lateral line, those on caudal peduncle shorter and last as dark blotch at base of caudal fin.
	A golden stripe along the upper lateral line	–	–	–	A dark horizontal line extending below between commencement of dorsal fin and caudal base	–	A dark longitudinal line extending from base of caudal fin to below commencement of dorsal fin
	Back fin stained with black especially on the edge	–	Dorsal fin edged with black	–	Upper half of dorsal fin except tip of few anterior rays dark grey	Dorsal fin edged with black	Dorsal fin provided with dark band across their rays.
	Three hinder fins of yellow colour	–	Pectoral, pelvic and anal fins yellowish	–	Pectoral, pelvic and anal fins yellowish or pale	–	Pectoral, pelvic and anal fins dull white
	Tail fin stained with balck especially on the edge	–	Caudal fin edged with black	–	Caudal fin light greyish, lower lobe more so	–	Dark longitudinal bandin lower lobe of caudal fin

Table (*Contd.*)

		Barilius barna Hamilton					*Barilius jayarami*
		Gunther, 1868	Day, 1878, 1889	Barman, 1985, 1986	Husain, 1987	Jain, 1987	Barman, 1985
		3	4	5	6	7	8
35.	Distribution	Yamuna and Brahmaputra rivers, the extreme branches of the Ganges	Ganges, Brahmaputra, Jumna, Kossye rivers	Assam, the Ganges & its branches, Bengal and Orissa.	—	Ganga and Yamuna-drainage system of Dehradun. Northern India, Orissa, Madhya Pradesh Maharashtra, Karnataka, Nepal, Bangladesh, Burma.	Namdapha Wild Life Sanctuary, Dist. Tirap, Arunachal Pradesh (Brahmaputra river system)

TABLE showing overlapping of characters in *Barilius bendilisis* Hamilton and *Barilius howesi* Barman

Character	*Barilius bendilisis* Hamilton							*howesi*
	Hamilton, 1822	Guenther, 1868	Day, 1878; 1889	Misra, 1962	Tilak at al 1984	Husain, 1987	Jain, 1987	Barman, 1986 1986
1	2	3	4	5	6	7	8	9
1. Dorsal fin rays	8-10	9	II/7	II/7	II/7	II/7	II/7	II/8 (II/7 in figure)
2. Pectoral fin rays	I/13-14	—	I/14	15	I/14	I/12	I/14	I/13
3. Pelvic fin rays	II/7	—	I/8	9	I/8	I/8	I/8	I/8
4. Anal fin III/7	10-11	II-III/7-8	II-III/7-8	II-III/7-8	III/7	III/7-8	III/9 (last one ray counted into two)	
5. Caudal fin rays	18-19	—	18	18	18	19	18	—
6. Barbels	4.2 or none	4 very short or minute, maxillary being rather longer, rostral frequently absent	Two pairs, minute rostral shorter than maxillary pair, occassionally rudimentary or absent	Two pairs, minute, rostral, shorter than maxillary pair, occassionally rudimentary or absent	Two pairs, minute, rostral shorter than maxillary pair, occassionally rudimentary or absent	Two pairs, minute, rostral shorter than maxillary pair, occassionally rudimentary or absent	Two pairs, minute, rostral shorter than maxillary pair, occassionally rudimentary or absent	Two pairs anterior pair 2.00-2.66 and posterior pair 2.33-4.00 in eye diameter (equal in figure)
7. Cleft of mouth (Maxilla)	— scarcely ex-	Maxillary below anterior tending beyond front margin of orbit or to vertical from front margin of orbit	Extending below anterior 1/3rd of eye	Extending to below anterior 1/3rd of eye	Extending to below anterior 1/3rd of eye	Extending to below anterior 1/3rd of eye	Extending to below middle of 1/3rd of eye	Extending to eye

Table (*Contd.*)

Character	Hamilton, 1822	*Barilius bendilisis* Hamilton						*howesi*
		Guenther, 1868	Day, 1878; 1889	Misra, 1962	Tilak at al 1984	Husain, 1987	Jain, 1987	Barman, 1986 1986
1	2	3	4	5	6	7	8	9
8. Dorsal fin	—	Terminating before or in front of the origin of anal fin	Commencing nearer caudal base than snout tip and not extending to over anal fin	Commencing nearer caudal base than snout tip and not extending to over anal fin	Commencing nearer caudal base than snout tip and not extending to over anal fin	Commencing nearer caudal base than snout tip and not extending to over anal fin	Commencing nearer caudal base than snout tip and not extending to over anal fin	Origin nearer snout tip than caudal base (nearer caudal snout as shown in figure)
9. Head length in standard length	—	4.20	—	—	—	3.89—4.57	3.72—4.68	4.35—4.71
10. Depth in standard length	—	4.00—4.67	—	—	—	3.52—4.52	2.32—4.34	3.00—4.25
11. Predorsal distance in standard length	—	—	—	—	—	1.70—1.86	1.64—2.30	1.73—1.75
12. Dorsal fin in dard length	—	—	—	—	—	4.52—6.00	—	5.50—5.83
13. Pectoral fin in standard length	—	—	—	—	—	4.25—5.10	—	4.71—5.08
14. Prepelvic distance in standard length	—	—	—	—	—	1.85—2.10	1.76—2.27	1.90—2.00
15. Pelvic fin in standard length	—	—	—	—	—	5.56—7.55	—	6.94—7.62

Table (*Contd.*)

Character	*Barilius bendilisis* Hamilton							*howesi*
	Hamilton, 1822	Guenther, 1868	Day, 1878; 1889	Misra, 1962	Tilak at al 1984	Husain, 1987	Jain, 1987	Barman, 1986 1986
1	2	3	4	5	6	7	8	9
16. Preanal distance in standard length	–	–	–	–	–	1.37–1.51	1.35–1.58	1.37–1.45
17. Anal fin	–	–	–	–	–	6.78–8.92	–	6.77–7.77
18. Caudal fin in standard length	–	–	–	–	–	3.67–5.10	3.78–7.73	4.06–4.66
19. Widthofhead in head length	–	–	–	–	–	1.40–2.00	1.37–2.00	1.76–1.88
20. Height of head in head length	–	–	–	–	–	1.12–1.29	–	1.14–1.16
21. Snout length in hed length	–	–	–	–	–	2.68–3.67	2.30–4.00	4.00–4.28
22. Eye diameter inheadlength	–	–	4.25–4.67	4.20–4.60	–	3.58–4.23	3.54–6.78	4.00–4.29
23. Snout length in inter-orbital width	–	–	–	–	–	0.93–1.22	–	1.28–1.57 (defective)
24. Eye diameter in inter-orbital width	–	–	–	–	–	1.20–1.54	1.18–2.55	1.28–1.37

Table (*Contd*)

		Barilius bendilisis Hamilton						*howesi*
		Guenther, 1868	Day, 1878; 1889	Misra, 1962	Tilak at al 1984	Husain, 1987	Jain, 1987	Barman, 1986 1986
		3	4	5	6	7	8	9
25. Postorbital headlengthin snout length	—	—	—	—	—	0.52–0.72	—	Twice (i.e. 0.50)
26. Least height of caudal peduncle in its length	—	—	—	—	—	1.41–1.82	1.24–1.92	1.62–1.71
27. Lat. line scales	—	42–43	40–43	40–43	40–45	40–43	40–43	43–45
28. Scales between dorsal base and lateral line	—	8.0–8.5	7–8	7–8	7–8	7.5–8.5	7–8	8.5
29. Scales between lateral line and pelvic base	—	—	2.5–3.5	2.5–3.5	2.5–3.5	3.5–4.5	2.5–3.5	3.5
30. Predorsal scales	—	—	20	20	20	19–20	20	20–21
31. Colour bands on body	14 (Pl. 3, fig. 77)	A series of short bluish bars along the side of the back	9 (1878, pl. CXLVIII, figs. 7, 9) slaty-grey bars	—	8-12 dark bands	9-12 vertical grey bands bands	8–12 bands	14–15 vertical dark bands dark bands

Table (*Contd.*)

		Barilius bendilsis Hamilton						*howesi*
		Guenther, 1868	Day, 1878; 1889	Misra, 1962	Tilak at al 1984	Husain, 1987	Jain, 1987	Barman, 1986 1986
		3	4	5	6	7	8	9
32. Distribution	RiversofMysore	Mysore, Ganges, East Indian Continent. Simla, Saharanpur, Calcutta, Nepal, Nilgiris.	Assam Himalayas, Continent of India as far as western ghats except from coast of Malabar or Canara or from Sind, Ceylon,	India, Assam, West Bengal, Punjab, Simla, U.P. Bihar, Coimbatore, Palghat, Mettupalayam, Nilgiris, Pakistan, East Pakistan, Ceylon.	India, Pakistan, Nepal, Bangladesh.	Ganga and Yamuna drainage systems (India), Pakistan, Nepal, Bangladesh, Sri Lanka, Burma	—	Stream near Sulkapura, Dist. jalpaiguri (North Bengal), West Bengal

Buchanan by various workers (Hamilton-Buchanan, 1822 ; Gunthur, 1868 ; Day, 1878, 1889 ; Barman, 1986; Husain, 1987 ; Jain, 1987) indicates that it falls within the range of *Barilius barna* Hamilton-Buchanan and hence in its synonymy. Barman (1985) erroneously made a comparison of his material with unrelated species like *Barilius dogarsinghi* Hora and *Barilius infrafasciatus* Fowler and on the basis of the observed differences created the new species, *Barilius jayarami* which is not valid as per the present assessment. The figure of *B. jayarami* given by Barmen (1985) closely resembles that of the male *B. barna*. This is indicated in the characters of the fins specially the dorsal, the pectorals and the pelvics which are well developed in the males of *B. barna*. Sexual dimorphism has been described in detail by Husain (1987, 1989), who observed that the mala of this species has well developed pelvic fins in addition to various other morphological features. *B. dogarsinghi* Hora is closer to *Barilius dogarsinghi* Hamilton-Buchanan.

(ii) Systematic Status of *Barilius howesi* Barman :

The figure of *Barilius howesi* given by Barman (1986) actually belongs to that of a female or an immature male in *cocsa* type of specimens of *barilius bendilisis* Hamilton-Buchanan as per the assessment made by Tilak et al. (1984) and Husain (1987). The type material of *B. howesi* has been examined. Barman (1986) has wrongly counted the last divided or branched rays of dorsal and anal fins by two in each case. The last rays of median fins are normally divided upto the base but are counted as one because, they have a single radial at the base. This fault of observation by Barman (1986) resulted in increase of one ray each in dorsal and anal fins. Further, the length of snout in the type material of *B. howesi* appears to have been also measured wrongly as it is 3.57 times in head length in figure instead of 4.00—4.28 times as given in the text. Besides, the author of the species (Barman, 1986) compared his material with unrelated species *Barilius barna* Hamilton-Buchanan and *B. barila* Hamilton-Buchanan, which resulted in the creation of a new species (*B. howesi)* and confusion among the ichthyologist. A comparison of the characters and distribution of this species mentioned by Barman (1986) with that of *B. bendilisis* Hamilton-Buchanan by various workers (Hamilton-Buchanan, 1822 ; Gunther, 1868 ; Day, 1878 ; 1889 ; Misra, 1962 ; Tilak *et al.*, 1984. Husain, 1987 ; Jain, 1987) clearly indicates that they are conspecific. Hence, *B. howesi* is a synonym of *B. bendilisis* Hamilton-Buchanan.

SUMMARY

The systematic status of two species viz., *Barilius jayarami* and *Barilius howesi* described recently by Barman (1985, 1986) has been assessed based on type and general material of the species and they are found to belong to well known species such as *Barilius barna* Hamilton-Buchanan and *ibarilius bendilisis* Hamilton-Buchanan, respectively. The observation of the meristic and morphometric characters by Barman (1985, 1986) have been found to be defective. The comparison of the material of new taxa from Arunachal Pradesh and West Bengal with unrelated species might have led to the creation of new taxa. The tables of comparison of related species are given.

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The authors feel grateful to Director, Zoological Survey of India, Calcutta for encouragement and facilities.

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Rec. zool. surv. India, 90(1-4) : 105-109, 1992

PREHISTORIC FAUNA EXCAVATED FROM HATIKRA DISTRICT, BIRBHUM, WEST BENGAL, INDIA

S. BANERJEE, S.K. ROY AND B. TALUKDER

Zoological Survey of India, Calcutta

INTRODUCTION

The department of Archaeology of the Vishva Bharati University, Santiniketan, West Bengal brought us some collection of animal remains excavated from a village called 'HATIKRA' in the year 1985 for study and identification.

Hatikra (Latitude 23° 49′ N., Longitude 87° 35′ E.) is situated 24 Km. away from Bolepur station by the side of Bolepur Siuri Road. It is a small village adjacent to village Ferry and on the bank of river Bakreswar. The village encompassed by Ushagram, Palsila, Parbatipur and Jinaipur etc., falls under the post office of Gadadharpur in Siuri Police Station of Birbhum. The excavation at the site was done during 1984, which revealed two Cultural sequences from Chalcolithic to Iron age culture dated 1200 B.C. to 700 B.C. Altogether four trenches were dug, *viz.*, HTR-1, HTR-2, HTR-3 and HTR-4. Majority of the animal remains ofcourse were collected from HTR-4.

A total of 31 animal remains were identified, majority of which belong to *Bos indicus* Linn, next is *Bubalus bubalis* (Linn.). Other species *viz., Chitra indica* (Gray), *Capra hircus aegagrus* Erxl. and *Sus scrofa cristatus* Wagner are represented by one example of each.

The skeletal remains are all fragmentary and unsuitable for measurement. Some remains have chopped marks, indicating they were slaughtered.

The identified species with their systematic positions and the archaeological data are listed and tabulated (See Table 1 & 2).

DESCRIPTION

The animal remains excavated from the site of Hatikra were compared with the recent specimens of the same species present in the Prehistoric Zoology Section of the Zoological Survey of India and were found similar in characteristic features and size.

DISCUSSION

From the Systematic account, we find that the species represented in this collection are *Chitra indica* Gray, *Bos indicus* Linn., *Bubalus bubalis* (Linn), *Capra*

Table shows the identified specimens unearthed from the site of Hatikra, Birbhum, West Bengal.

Sl. No.	Name of the Species Scientific	Common name	Class	Order	Family	Site	Locus	Depth	Date	Archaeo-logical data	Detail of the Specimen	No. of ex.	Remarks
1.	*Chitra indica* (Gray)	River Turtle	Reptilia	Testudines	Trionychidae	HTR-4	TR-41, Qd-1	68 cm.	—	—	Fragment of hypoplastron.	1 ex.	
2.	*Bos indicus* Linn.	Domestic humped cattle	Mammalia	Artiodactyla	Bovidae	HTR-1	TR-8, Qd-III	17 cm.	4.3.85	$B^2$7.51× $C^2$2.18	Left lower 1st & 2nd molar.	1 ex.	
	"	"	"	"	"	HTR-2	TR-B1, Qd-1	—	5.3.85	$B^1$4.10 × 1.65×9cm	Broken lower 1st molar.	1 ex.	ofjuvenile
	"	"	"	"	"	HTR-2	TR-B1, Qd-2	68 cm.	14.3.85	—	Head of the right femur.	1 ex.	
	"	"	"	"	"	"	"	"	"	—	Fragment of the Shaft of femur.	1 ex.	
	"	"	"	"	"	HTR-4	—	70 cm.	11.3.85	—	Fragment of the Proximal part of mandible.	1 ex.	
	"	"	"	"	"	"	TR-A1, Qd-1	1.32 mm.	18.3.85	—	Fragment of rib.	1 ex.	With Chopped mark.
	"	"	"	"	"	"	"	1.57 cm.	22.3.85	—	"	1 ex.	
	"	"	"	"	"	"	"	1.39 cm.	19.3.85	$A^1$1.77 cm	"	1 ex.	
	"	"	"	"	"	"	TR-B1, Qd-III	30 cm.	20.3.85	—	Fragement of tooth.	1 ex.	
	"	"	"	"	"	"	TR-A1, Qd-1	1.35 cm.	28.3.85	—	Fragment of rib.	1 ex.	
	"	"	"	"	"	"	"	"	"	—	Proximal end of 1st Phalanx.	1 ex.	
	"	"	"	"	"	"	"	1.53 cm.	"	—	Lower 1st & 2nd molar.	1 ex.	

Table shows the identified specimens unearthed from the site of Hatikra, Birbhum, West Bengal.

Sl.	*Name of the Species* Scientific	Common	*Class*	Order	Family	Site	Locus	Depth	Date data	Archaeo-logical	Detail of the specimen	No. of ex.	Remarks
	" "		"	"	"	"	TR-B1, Qd-III	—	—	—	proximal portion of left meta tarsal.	1 ex.	
3.	*Bos.* Sp.		"	"	"	"	TR-XA1, Qd-1	1.05 cm.	27.3.85	—	Broken piece of tooth.	1 ex.	
	" "		"	"	"	"	TR-B1, Qd-1	1.10 cm.	—	—	Distal end of Shaft of metatarsal.	1 ex.	With Chopped mark.
4.	*Bubalus bubalis Linn.*	Domestic Buffalo	Mammalia	Artiodactya	Bovidae	HTR-2	TR-B1, Qd-1	—	5.3.85	B14.10x	Right lower 2nd premolar	1 ex.	
			"	"	"	"	TR-B1, Qd-IV	30 cm.	9.3.85	—			
	" "		"	"	"	"	TR-B1, Qd-IV	30 cm.	9.3.85	—	Condylar portion of metacarpal.	1 ex.	
	" "		"	"	"	HTR-4	TR-XA1, Qd-1	1.35 cm.	20.3.85	—	Condylar portion with the Coronoid process of mandible.	1 ex.	
	" "		"	"	"	"	TR-XA1	1.05 cm.	—	—	Proximal fragment of the Shaft of tibia with distal end.	1 ex.	
	" "		"	"	"	"	TR-A1, Qd-1	—	25.3.85	—	Proximal portion of Shaft of femur.	1 ex.	
5.	*Capra hircus aegagrus* Erxleben	Domestic Goat	"	"	"	"	TT, TR-A1,	30 cm.	19.3.85	—	Broken piece of rib	1 ex.	Chopped from the middle.

Table (*Contd.*)

Sl.	*Name of the Species* Scientific Common name		Order	Family	Site	Locus	Depth	Date data	Archaeo-logical	Detail of the specimen	No. of ex.	Remarks
6.	Specimen tentatively identified as bovine remains (Genus and Species undetermined)		"	"	HTR-2	TR-B1, Qd-1	65 cm.	15.3.85	—	Fragment of humerus.	1 ex.	Chopped from the base.
			"	"	"	"	59 cm.	—	—	Fragment of the Shaft of Limb bone.	1 ex.	Chopped mark on the side and at middle.
			"	"	HTR-4	TT,	90 cm.	15.3.85	—	Fragment of Limb bone.	1 ex.	
			"	"	"	TT-A1, Qd-1	1.43 cm. to 11.57 cm.	22.3.85	—	Fragment of Shaft of Limb bone	1 ex.	Chopped on the side.
			"	"	"	TR-A1, Qd-1	69 cm.	24.3.85	—	Fragment of a Limb bone.	1 ex.	
			"	"	"	"	2.30 cm.	27.3.85	—	Broken piece of tooth.	1 ex.	
7.	*Sus scrofa* cristatus Wagner	The Indian Boar	"	Suidae	"	"	1.32 cm.	18.3.85	—	Right astragalus	1 ex.	

hircus aegagrus Erxl., *Sus scrofa cristatus* Wagner and some Bovid bones. Barring the first one, all the other species mentioned above are domesticated animals. Similar remains of demesticated animals were recorded earlier from a number of other prehistoric sites in India.

The cultural sequence of the site i.e. Chalcolithic to Iron age tallies those found at Bharatpur, in Burdwan District (Banerjee, 1981), and Mahisdal on the bank of river Kopai in Birbhum (Banerjee, in press).

It appears that during the Chalcolithic phase, the people practised mixed economy of food gathering-cum-agriculture as is evident from the occurence of a number of domestic animals like *Bos indicus, Bubalus bubalis, Capra hircus aegagrus* and *Sus scrofa cristatus.* They also used to practice fishing is proved by the remains of *Chitra indica.*

After studing this collection, it may be concluded that a number of prehistoric settlement in Birbhum, Bankura and Burdwan of West Bengal had experienced late stage of animal domestication during the Chalcolithic and Iron age.

SUMMARY

This paper deals with a small collection of animal remains excavated from Chalcolithic site at Hatikra. District Birbhum in West Bengal explored by Vishva Bharati University, Santiniketan. The study reveals the occurrence of five species of domesticated mammals and one species of river turtle, the chopping marks on some of the bones indicate positive sign of flesh consumption and it is also apparent that the people in the site, during the phase (Chalcolithic to Iron age : 1200 B.C. to 700 B.C.) already reached the stage of fulfledged animal firming.

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ANIMAL REMAINS EXCAVATED FROM BAHIRI DISTRICT BIRBHUM, WEST BENGAL, INDIA

M. GHOSH, K.D. SAHA AND S. BANERJEE
Zoological Survey of India, Calcutta-700 053

INTRODUCTION

The Archaeology and Museum Unit of the Department of History, Delhi University, Delhi, carried out excavation at Bahiri in Birbhum District, West Bengal in the year 1981 and collected some archaeological material and some animal remains. The animal remains were given to the Zoological Survey of India for study and report. This report deals with the animal remains.

The excavation reveals a cultural sequence from the Chalcolithic to Iron Age. The Radio-Carbon data obtained from the analysis of charcoal samples attest a chronology between 610 B.C. to 900 B.C. (Indian Archaeology - A Review 1982-83, p. 145 & 1984-85, p. 159). Seven trenches were dug from BHR-I to BHR-VII. In trench BHR-I no remains of animal were found. Trench BHR-IV, yielded maximum number of animal remains. Altogether 22 fragments of animal remains were identified. They belong to *Canis familiaris* Linnaeus, *Sus scrofa* Linnaeus, *Cervus duvauceli* Cuvier, *Axis axis* Erexleben, *Bos gaurus* H. Smith, *Bos indicus* Linnaeus and *Babalus bubalis* (Linnaeus). Maximum of the remains are of course of *Bubalus bubalis* (Linnaeus). The skeletal remains are fragmentary and not suitable for measurements. Except the remains of *Cervus duvauceli, Axis axis* and *Bos gaurus,* all the other remains are of domesticated animals.

SYSTEMATIC DESCRIPTION

Phylum CHORDATA
Class MAMMALIA
Order CARNIVORA
Family CANIDAE

Canis familiaris Linnaeus

BHR-III ; depth-1.55-1.65 m ; layer (3) ; dt. 15.3.81

Right ramus of mandible with 3rd premolar and carnassial teeth.

The short, slightly twisted ramus, without diastema ; laterally flattened and pointed 4th premolar ; medially raised carnassial (1st molar) with shearing cusps, etc. indicate that the mandible belongs to canids. Measurements and number of alveoli in the mandible confirm it as *Canis familiaris* Linnaeus, the Domestic Dog.

Order ARTIODACTYLA
Family SUIDAE
Sus scrofa Linnaeus

BHR-II ; depth-0.80-1.30 m ; layer (3)

Broken left femur without condylar ends (young specimen).

BHR-II ; depth-2.10-2.35 m ; layer (5) ; dt. 14.3.81

Portion of right ramus of mandible with 2nd and 3rd incisors and 3rd premolar teeth.

BHR-IV ; depth-2.05-2.25 m ; layer (4) ; dt. 14.3.81

Portion of left mandible with 3rd molar tooth.

The strongly curved head of the femur, distinct neck, absence of supra condyloid fossa, situation of the trochanteric major within the level of head ; the horizontal, convergent and deeply implanted lower incisors having the lingual surface slightly concave, the sectorial 3rd premolar, the bunodont 3rd molar with tuberculated cusps, etc. confirm that the remains belong to the Indian Pig. *Sus scrofa* Linnaeus.

Family CERVIDAE
Cervus duvauceli Cuvier

BHR-VII ; depth-1.55-1.75 m ; layer (4) ; dt. 14.3.81

1st and 2nd molar teeth of left upper jaw.

BHR-II ; depth-.50-.55 m ; layer (4) ; dt. 15.3.81

1st molar tooth of right upper jaw.

The cheek teeth with transversely thicker inner crescentic subdivisions in each lobe, wide crescentic islands, absence of internal accessory column, etc. indicate that the specimens belong to the Cervids and the size and measurements confirm it to be the Barasingha, *Cervus duvauceli* Cuvier.

Axis axis Erexleben

BHR-IV ; depth-1.10-1.25 m ; layer (2) ; dt. 19.3.81

Fragment of right mandible with 3rd and 4th premolar and 1st, 2nd and 3rd molar teeth (subadult).

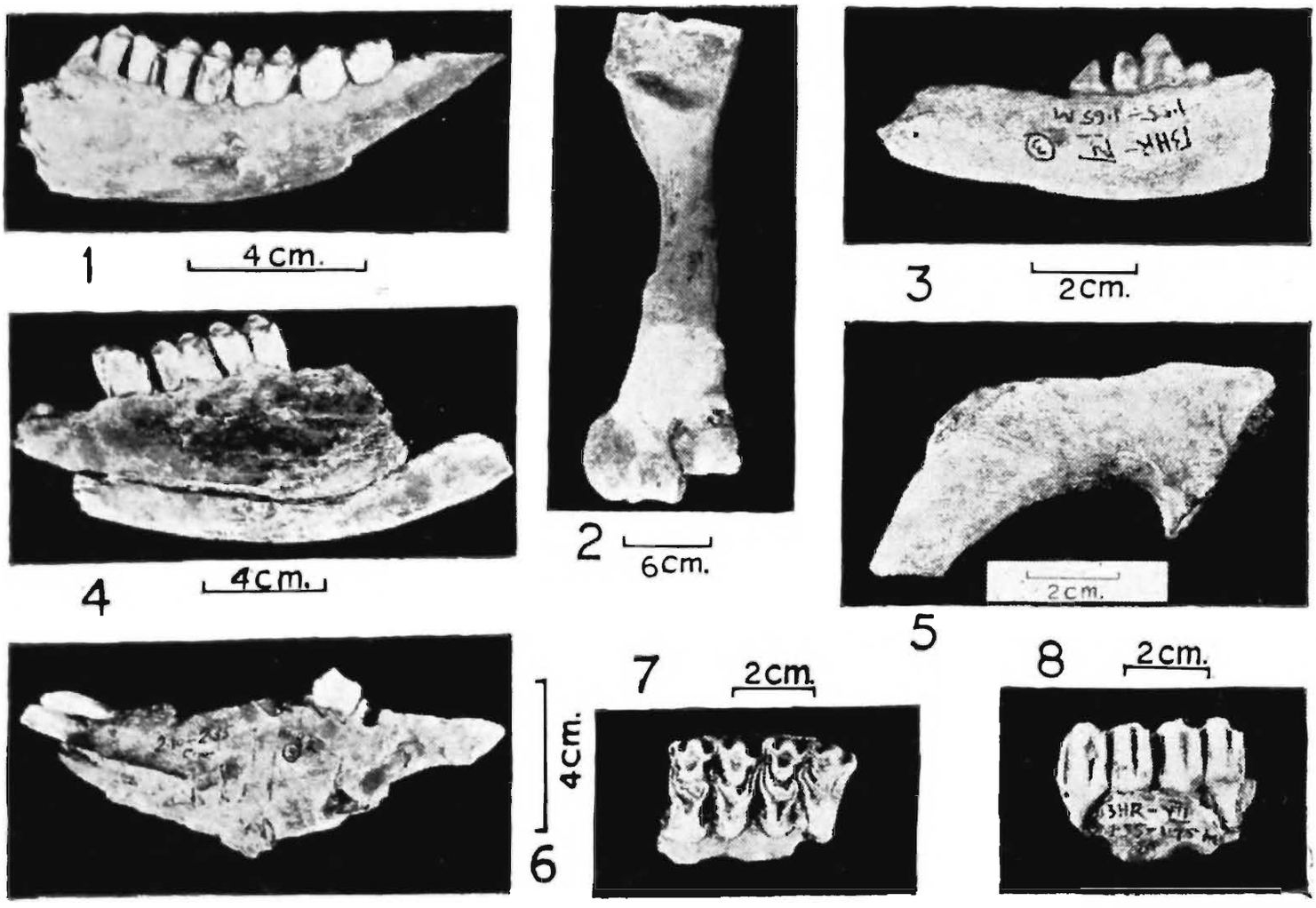
The very hypsodont cheek teeth with narrow crescentic islands, small accessory column in the outer inter spaces ; the sharp edged upper margin of diastema and scimitar-shaped horizontal ramus confirm that the mandible belongs to the Chital, *Axis axis* Erexleben.

Family BOVIDAE
Bos gaurus H. Smith

BHR-IV ; depth-1.85-1.95 m ; layer (3)

Left humerus (broken)

GHOSH, SAHA & BANERJEE PLATE I



Animal Remains from Bahiri, District Birbhum, West Bengal

Fig. 1. Fragment of right mandible with P_3—m_3 teeth of *Axis axis* Erexleben.

Fig. 2. Left humerus of *Bubalus bubalis* (Linnaeus).

Fig. 3. Right ramus of mandible with 3rd premolar and carnassial teeth of *Canis familiaris* Linnaeus.

Fig. 4. Left ramus of mandible with 3rd and 4th premolar and 1st molar teeth of *Bubalus bubalis* (Linnaeus).

Fig. 5. Fragment of left pubis of *Bos indicus* Linnaeus.

Fig. 6. Left symphyseal portion of mandible with 2nd, 3rd incisor and 3rd premolar teeth of *Sus scrofa* Linnaeus.

Fig. 7. Upper left 1st and 2nd molar teeth of *Cervus duvauceli* Cuvier (buccal view).

Fig. 8. Upper left 1st and 2nd malar teeth of *Cervus duvauceli* Cuvier.

BHR-IV ; depth-2.05-2.35 m ; layer (4)

Fragment of atlas vertebra (left portion) with alar foramen.

BHR-IV ; depth-1.65-1.85 m ; layer (3)

Fragment of the head of left femur.

The broader inter tuberal groove, more rounded and convex head, elevated external tuberosity, deeply notched olecranon fossa and condyles in the humerus ; the larger aperture of alar foramen (than that of cattle), its situation more towards the dorsal tubercle in the atlas ; the larger head (diameter 64 mm) and broader depression of the fovea capitis in the femur etc. confirm that the remains belong to the species of Indian Bison, *Bos gaurus* H. Smith., etc.

Bos indicus Linnaeus

BHR-I ; depth 5.0-5.5 m ; layer (4)

Right astragalus.

BHR-IV ; depth-2.05-2.25 m ; layer (4)

Distal end of right scapula.

BHR-V ; depth-1.45-1.75 m ; layer (4)

Proximal end of left metatarsal.

BHR-VII ; depth-2.40-2.60 m ; layer (7)

Fragment of left pubis.

The more circular glenoid cavity, absence of the notch in the scapula ; the four-sided shaft of metatarsal, its deep and wide vascular groove ; the relatively long, narrow and somewhat flatened astragalus from before backwards, having trochlea on both the ends and large oval facets on planter surface ; the presence of one transverse groove on the anterior broder, the narrow acetabular branch and the wide but thin symphyseal branch of the pubis etc. confirm that the remains belong to the species of Humped Cattle, *Bos indicus* Linnaeus.

Bubalus bubalis (Linnaeus)

BHR-III ; depth-1.12 m ; layer (3) ; dt. 15.3.81

Left lower mandible with 3rd premolar, 1st and 2nd molar teeth ; Right upper 2nd premolar tooth.

BHR-IV ; depth-2.05-2.35 m ; layer (4)

Apical portion of left and right mandibles.

BHR-V ; depth-1.65-1.80 m ; layer (5)

Distal end portion of the shaft of right humerus.

BHR-IV ; depth-1.28-1.35 m ; layer (5)

First phalanx.

BHR-IV ; depth-1.85-1.95 m ; layer (3)

Fragment of the blade of left scapula.

BHR-IV ; depth-1.55-1.65 m ; layer (3)

Proximal fragment of left ulna with olecranon process.

BHR-VII ; depth-1.90-2.20 m ; layer (7)

Left metacarpal without distal condyle.

The smooth and high horizontal portion of the ramus ; the comparatively thick-walled molar, having adequate cementum in the inter-spaces of the lobes and less wide but compressed crescentic islands ; the short and broad metacarpal, etc. confirm that the remains belong to the species of Domestic Buffalo, *Bubalus bubalis* (Linnaeus).

DISCUSSION

The excavation at Bahiri in the District of Birbhum, West Bengal, undertaken by the Archaeology Department of Delhi University reveals a cultural sequence from Chalcolithic to Iron Age Culture. Similar cultural sequence was found at Mahisdal on the bank of river Kopai: at Hatikra near Santiniketan both in the Birbhum District, and also at Bharatpur in Burdwan District of West Bengal (Banerjee, S. 1981)

The animal remains collected from Bahiri are of *Canis familiaris* Linnaeus. *Sus scrofa* Linnaeus, *Cervus duvauceli* Cuvier, *Axis axis* Erexleben, *Bos gaurus* H. Smith, *Bos indicus* Linnaeus and *Bubalsus bubalis* (Linnaeus). Almost similar animal remains were found at Mahisdal, Hatikra, Bharatpur as well as Tamluk in Midnapur District. West Bengal, which belong to Premauriyan and Mauriyan culture. Only exception is that the remains of *B. gaurus* are not reported from any of those cultural sites except Bahiri.

The above mentioned species reported from Bahiri, were also represented by many other collections from prehistoric sites of India. The occurrence of *Cervus duvauceli. Axis axis* and *Bos gaurus* further strengthens the idea that the area of Birbhum had thick forest in those days. The other species are of domestic animals which inhibitants evently used to maintain for food and milk. The remains of only one specimen of the oldest domesticated animal *Canis familiaris,* proves that dog was also a common pet in the area.

The fragments are not fossilised ; only in some samples the organic material is partially replaced by silica.

The occurrence of important domestic stock like the pig, cattle and buffalo evinces that the Chalcolithic and Iron Age periods in the district played a great economic role in the life of the people.

SUMMARY

The study of animal remains unearthed by the Archaeological Department of the University of Delhi from Bahiri, a Chalcolithic *cum* Iron Age site in Birbhum

District of West Bengal, revealed the presence of three wild mamalian species, *viz., Cervas duvauceli. Axis axis. Bos qaurus* and four domesticated, mammalian species, *viz., Canis familiaris, Sus scrofa, Bos indicus* and *Bubalus babalis.* However, the occurrence of the wild animals suggests that there persisted the natural forest in the vicinity. On the other hand, the remains of the domesticated stock like those of pig, cattle and buffalo testify that an agricultural — based animal husbandry had already ensued to promote the socio-economy of the people since about 900 years B.C.

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Rec. zool. surv. India, 90(1-4) : 117-119, 1992

NEW RECORD OF SPIDER *HERSILIA SAVIGNYI* LUCAS (FAMILY : HERSILIIDAE) FROM MADHYA PRADESH INDIA WITH A DESCRIPTION OF MALE.

U.A. GAJBE

Central Regional Station, Zoological Survey of India, Jabalpur (M.P.)

The spiders of the genus *Hersilia* Audouin are very little known in Indian fauna. Lucas (1836), Pocock (1900), Sinha (1950), Tikader & Biswas (1981) described the *Hersilia savignyi* from various parts of India but without the description of the male.

While studying the spiders of Madhya Pradesh the author came across many specimens of male as well as female of the species wiich, so far was not recorded from Madhya Pradesh. The illustrations of internal genitalia and male palp are also given here.

Hersilia savignyi Lucas.

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1900. *Hersilia savignyi* : Pecock, *Fauna Brit. India,* Arach : 241.

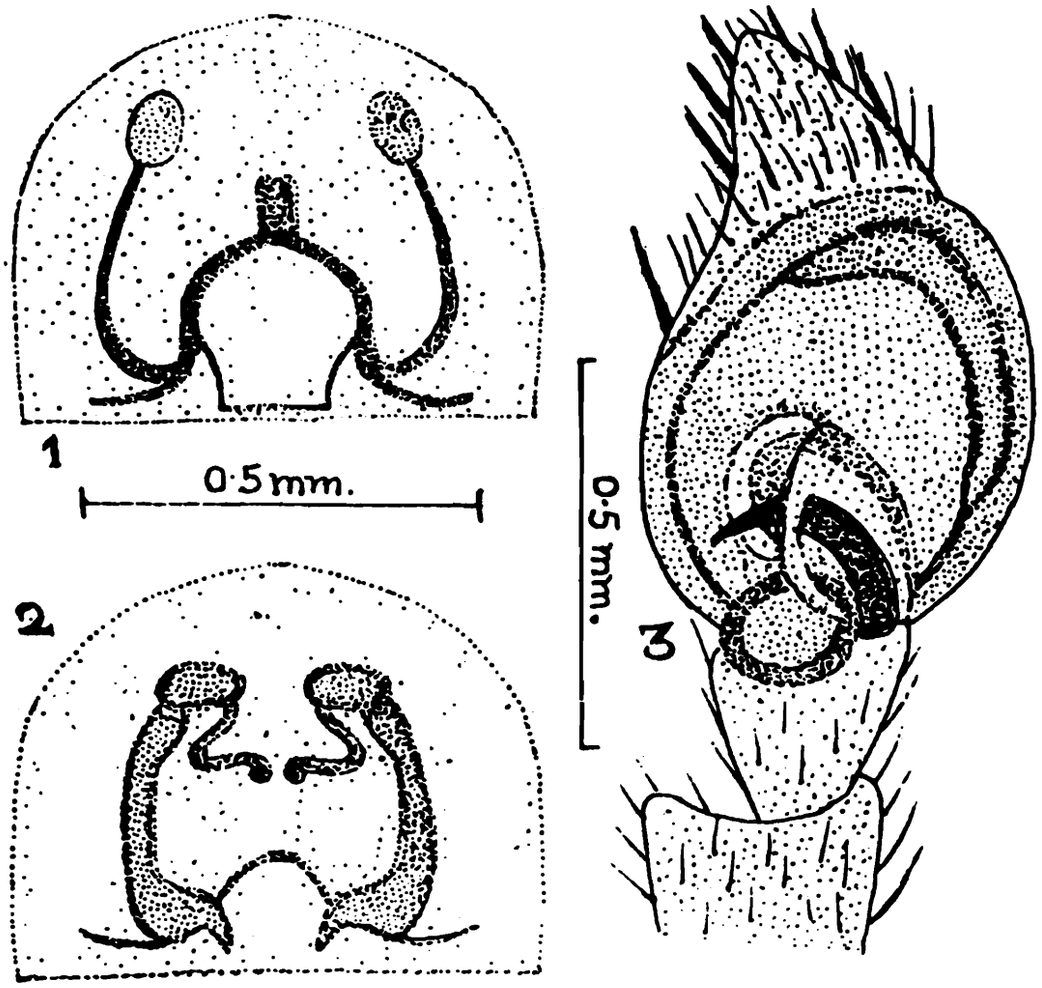
1950. *Hersilia savignyi* : Sinha, *Rec. Indian Mus.*, **48** : 122.

1981. *Hersilia savignyi* : Tikader & Biswas, *Rec. zool. Surv. India, Occ.* paper No. **30** : 47.

Specimens examined : 2♀♀, 1 ♂, Around hot water tank on Jabalpur Mandla Road, Dist. Mandla, 4.V.1982. 1♀, Narayanganj, Dist. Mandla, 23.I.1985. 1♀, Borla, Dist. Rajnandgaon, 7.I.1984. 3♂♂, Dhaurai village near Narayanpur, Dist. Bastar, 24.XII.1983. 1 ♀, Chotedonger, Dist. Bastar, 26.XII.1983, 2♂♂, Orchha, Dist. Bastar, 28.XII.1983. 2♀♀, Tondabeda village near Orccha, Dist. bastar, 29.XII.1983. 4♀♀, 1♂, Garhbengal Village near Narayanapur, Dist. Bastar, 30.XII.1983. 7♀♀, 1♂, Hatkachora village near Jagdalpur Dist. Bastar, 2.I.1984. 1♂, P.W.D. Rest House Compound, Jagdalpur Dist. Bastar, 2.I.1984 (All localities are from Madhya Pradesh) Coll. U.A. Gajbe.

General : Cephalothorax and legs brown, abdomen browbish-black. Total length 6.00 mm. Carapace 2.50 mm. long, 2.00 mm. wide ; abdomen 3.50 mm. long, 3.00 mm. wide.

Cephalothorax : Longer than wide, slightly narrowing in front, clothed with pubescence. Cephalic area very high, black. Both the eyes rows recurved. Anterior



Figs. 1-3 *Hersilia savignyi* Lucus ; 1. Epigyne ; 2. Internal genitalia ; 3. Male Palp, Ventral view.

median eyes are black, larger than the other eyes, laterals small and oval, equally spaced. Posterior row of eyes slightly recurved, equal in size and equidistant from each other. Median ocular quadrangle longer than wide, widest in front that behind. Clypeal height much greater than the diameter of the anterior medians eyes. Chelicerae strong, vertical narrowing in front, inner margin without tooth, outer margin with one tooth. Labium broader than long, triangular ; maxillae oblique, longer than wide and provided with black setae. Sternum heart shaped, pointed behind, clothed with long black setae. Legs long, clothed with hairs and some spines, protarsi of legs I, II and IV bisegmented.

Abdomen : Longer than wide, subpentagonal, narrowing behind, with black rim, transverse stripes and three pairs of sagilla. Ventral side very lighter than the dorsal, midventrally provided with brown coloured dots extending upto spinnerets. Spinnerets widely separated, posterior spinnerets very long and longer than the abdomen. The male palp as in Fig. 3. Females larger in size, same in colour as male. Epigyne bilobate, the lobes separated by deep emergination as in Fig. 1. Internal ganitalia as in Fig. 2.

This species is a active hunter living on tree trunks and walls of old houses. The body colour varies according to the colour of the substratum and spinning a scanty web of irregular threads.

Distribution : INDIA : Nilgiri Hills, Madras, Tamil Nadu ; Travancore, Bangalore, Karnataka ; Poona, Maharashtra ; Allhabad, Dehradun, Uttar Pradesh ; Calcutta, Serampur, Howrah, West Bengal ; Assam ; Ranchi, Chota Nagpur, Chakradharpur, Dinapur, Siripur, Pusa, Bihar ; Puri, Orissa ; SRI LANKA ; BURMA ; PAKISTAN.

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ON SOME NEW SPECIES OF SPIDERS OF THE GENERA *HIPPASA* SIMON, *LYCOSA* LATREILLE, *PARDOSA* KOCH AND *TROCHOSA* KOCH (FAMILY : LYCOSIDAE) FROM COASTAL ANDHRA PRADESH, INDIA

B. H. PATEL AND T. S. REDDY

Department of Zoology, Sir P. P. Institute of Science, Bhavnagar University, BHAVNAGAR 364-002, Gujarat, India

INTRODUCTION

The first record of the lycosid spider was of *Lycosa indagatrix* by Walckenaer in 1837. Later this species was synonimised as *Hogna indagatrix* (Walck.) by Roewer in 1954. The earlier contributions of Blackwall (1867), Cambridge (1870, 76, 85), Simon (1884, 85, 86, 92, 97), Thorell (1890, 91, 94, 95), Pocock (1899, 1900, 1901), Gravely (1924), Reimoser (1934), Dyal (1935) and Sinha (1951) accounted 63 species belonging to 21 genera of this family Lycosidae.

Recently Tikader (1964, 70, 77), Tikader & Mukerjee (1971) and Tikader & Malhotra (1976) described 13 more species from India.

Tikader and Malhotra (1980) in their revisonary work, Fauna of India, spiders : in Araneae, Vol. I (1) compiled 81 species belonging to 9 genera only, as many species have been synonimised ; out of which 18 were described as new species and recorded the genus *Flanona* Simon for the first time from India. While studying the spider collections made by one of us (TSR) from Coastal Andhra Pradesh, we came across six new species of the genera *Hippasa, Lycosa, Pardosa* and *Trochosa* which are described and illustrated here.

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

1. **Hippasa valiveruensis** sp. nov.

(Fig. 1, a-d)

General : Cephalothorax and legs brown, abdomen brown with yellow spots. Total length 4.80 mm. Carapace 2.23 mm long, 1.76 mm wide ; abdomen 2.60 mm long, 1.50 mm wide.

Cephalothorax : Brown, longer than wide, convex, clothed with pubescence. Cephalic region slightly high, abruptly narrowing in front, centre of the thorax provided with sharp fovea. Anterior row of eyes slightly procurved, as long as the second row (posterior medians), anterior medians slightly larger than the anterior

laterals, bases of anterior laterals provided with conspicuous black patches. Eyes of the second row (posterior medians) larger than the others, bases of posterior eyes provided with conspicuous black patches. The eyes of posterior row forms a trapizum with a broad base and narrowing in front. Ocular quad wider than long, wider behind and narrowing in front as in Fig. 1 a. Sternum heart-shaped, pointed behind, pale, clothed with hairs, provided with a midlongitudinal conspicuous black band. Labium slightly wider than long. Distal end of maxillae broader and provided with seopulae. Sternum, labium and maxillae as in Fig. 1 b. Chelicerae yellowish brown, strong, inner and outer margins of fang furrow provided with three teeth each. Legs thin and long, clothed with spines and hairs and provided with conspicuous greenish brown transverse patches. Tibiae and metatarsi I and II

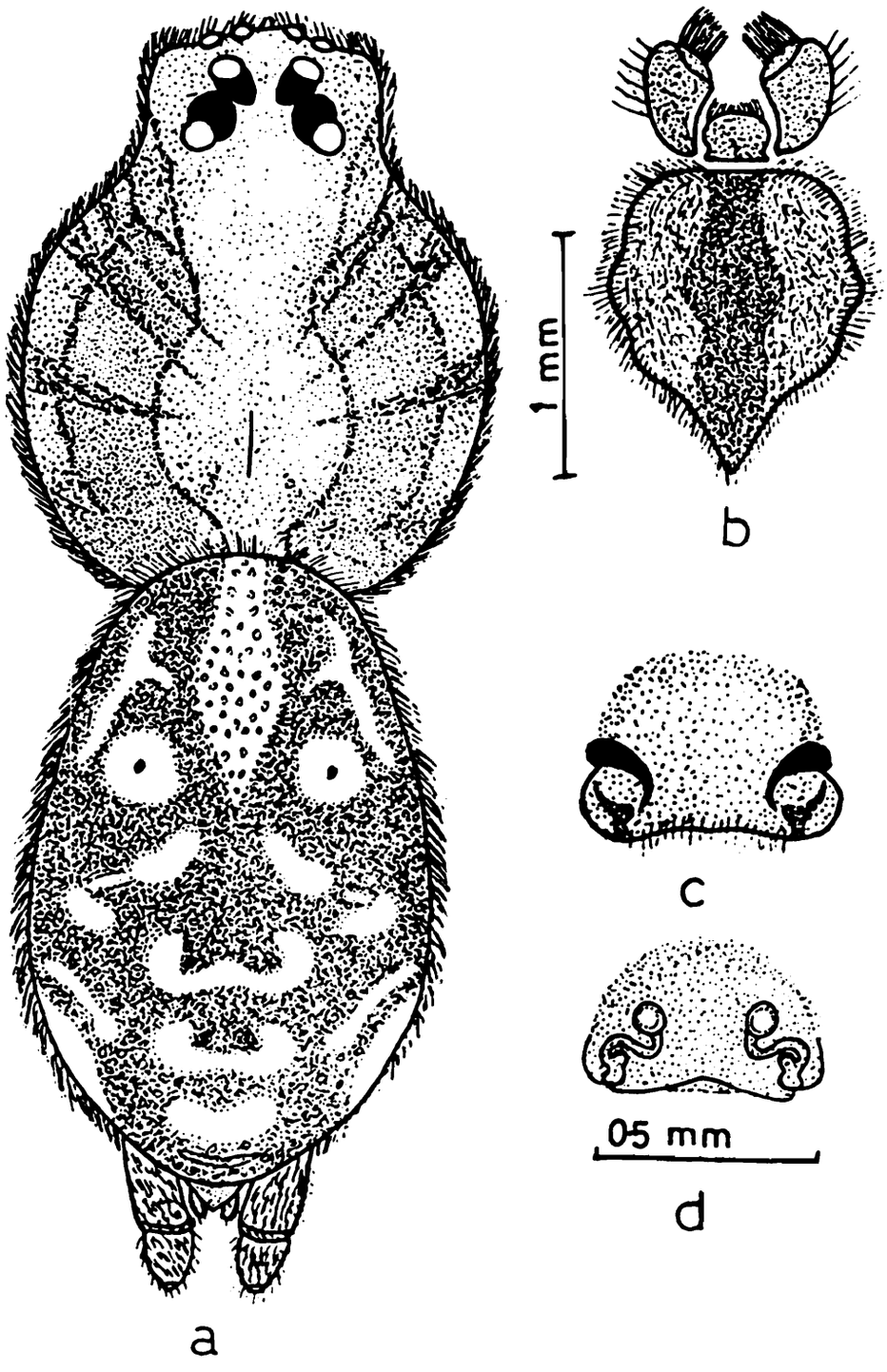

Fig. 1. *Hippasa valiveruensis* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia.

provided with three pairs of ventral spines. Tarsi of all legs provided with scopulae. Leg formula 4 2 1 3.

Male : Unknown.

Abdomen : Brown, longer than wide, narrowing behind, clothed with pubescence and hairs. Dorsum provided with yellowish brown patches and small black spots. Anteriorly provided with mid-dorsal lens-shaped brown marking as in Fig. 1 a. Ventral side pale in colour. Epigyne and internal genitalia as in Fig. 1 c and d.

Holotype 1 ♀ , *Paratype* : 5 ♀ in spirit.

Type-Locality : Valiveru, Dist. Guntur, 15.i.1985. Coll. T.S. Reddy.

Distribution : Known from the type-locality and Srikakulam District of Coastal Andhra Pradesh.

Diagnosis : This species resembles to *Hippasa agelenoides* (Simon) but it is separated as follows : (i) Dorsum of abdomen provided with yellowish brown patches, small black spots and mid-dorsal lens-shaped brown marking but in *H. agelenoides* with reddish brown patches and black spots present. (ii) Epigyne and internal genitalia are also structurally different.

2. **Lycosa balaramai** sp. nov.
(Fig. 2, a-d)

General : Cephalothorax and legs reddish brown, abdomen greyish brown. Total length 10.15 mm. Carapace 4.35 mm long, 3.20 mm wide ; abdomen 6.00 mm long, 4.00 mm wide,

Cephalothorax : Longer than wide, convex, clothed with pubescence. Middle of the cephalothorax provided with a light broad longitudinal band which extends from the base of second row (posterior medians) of eyes to the base of cephalothorax, centre with a conspicuous fovea and prominent brown bands radiate to the sublateral sides. Anterior row of eyes straight and almost as wide as the middle row, anterior medians larger than the anterior laterals. Eyes of the second row (posterior medians) larger than the others. Bases of posterior eyes provided with a conspicuous black patches. The square formed by the poasterior eyes, longer than wide and slightly wider behind than in front. Ocular quad wider than long, wider behind and narrowing in front as in Fig. 2 a. Spine like hairs present in the ocular area. Sternum heart shaped, pointed behind and clothed with spine like hairs. Labium dark in colour and slightly longer than wide, basal excavation prominent. Distal ends of maxillae wider and provided with scopulae, lateral sides with prominent spine like hairs. Sternum, labium and maxillae as in Fig. 2 b. Chelicerae strong, inner and outer margins of fang furrow provided with three teeth each. Legs thin and long, reddish brown and provided with spines and hairs, femora of all legs provided with transverse inconspicuous brown patches. Tibiae of all the legs with three pairs of ventral spines. Leg formula 4 1 2 3.

Male : Unknown.

Abdomen : Longer than wide, pointed behind, clothed with pubescence and some spine like hairs. Dorsal side provided with pale and greenish brown patches as in Fig. 2 a. Ventral side uniformly pale in colour. Epigyne and internal genitalia as in

Fig. 2 c. and d.

Holotype : 1 ♀ in spirit.

Type-Locality : Borraguhalu, Dist. Visakhapatnam, 27.ix.1985. Coll. T S. Reddy.

Diagnosis : This species resembles to *Lycosa himalayensis* Gravely but it differs as follows : (i) The anterior row of eyes straight and almost as wide as the middle

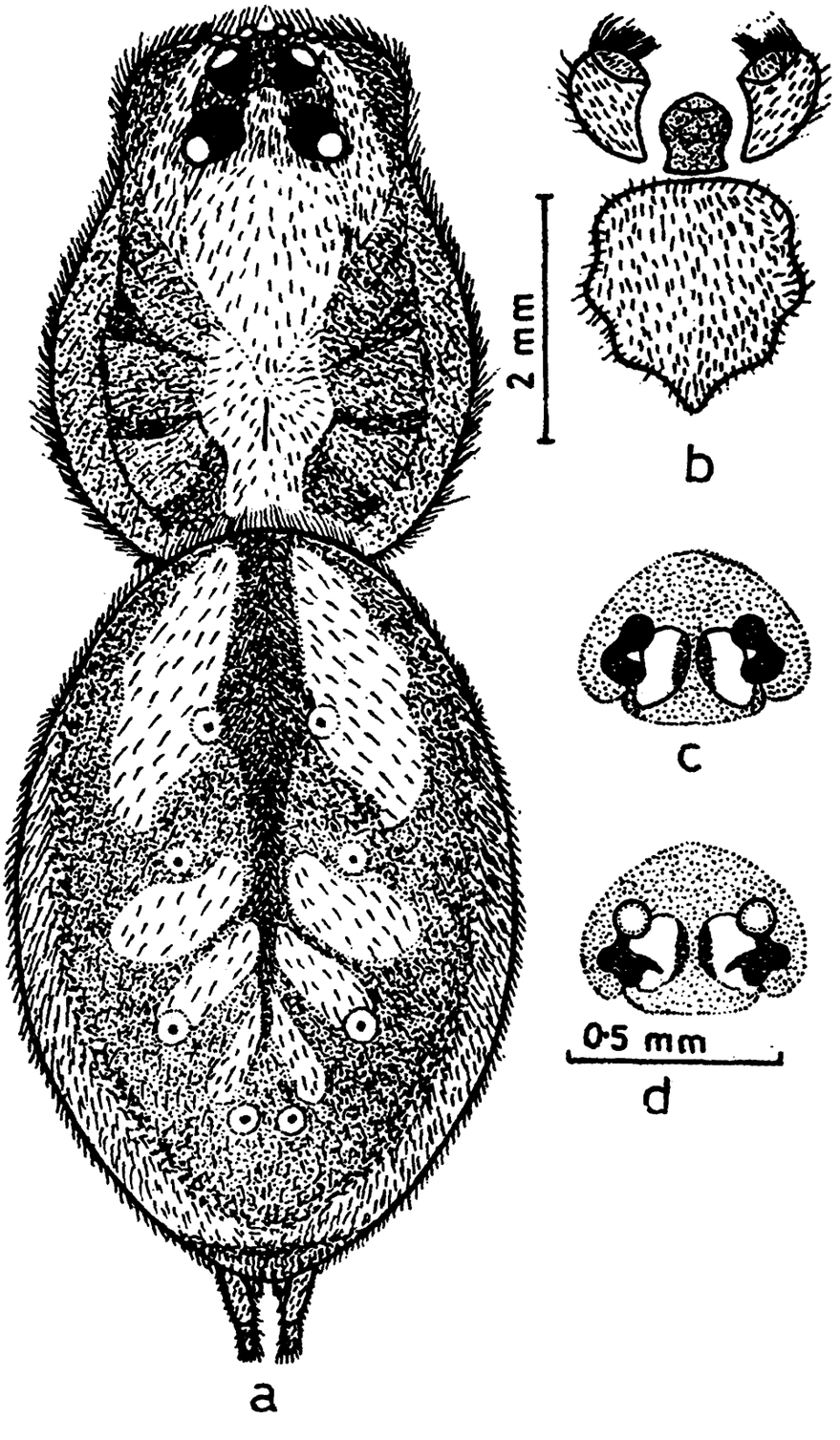

Fig. 2. *Lycosa balaramai* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia.

row but in *L. himalayensis* the anterior row of eyes straight and shorter than the middle row. (ii) Abdomen mid-dorsally pale and provided with greenish brown patches but in *L. himalayensis* posterior half of abdomen with black and deep brown patches. (iii) Epigyne and internal genitalia are also structurally different.

3. **Lycosa thoracica** sp. nov.
(Fig. 3, a-d)

General : Cephalothorax and legs brown, abdomen yellowish brown. Total

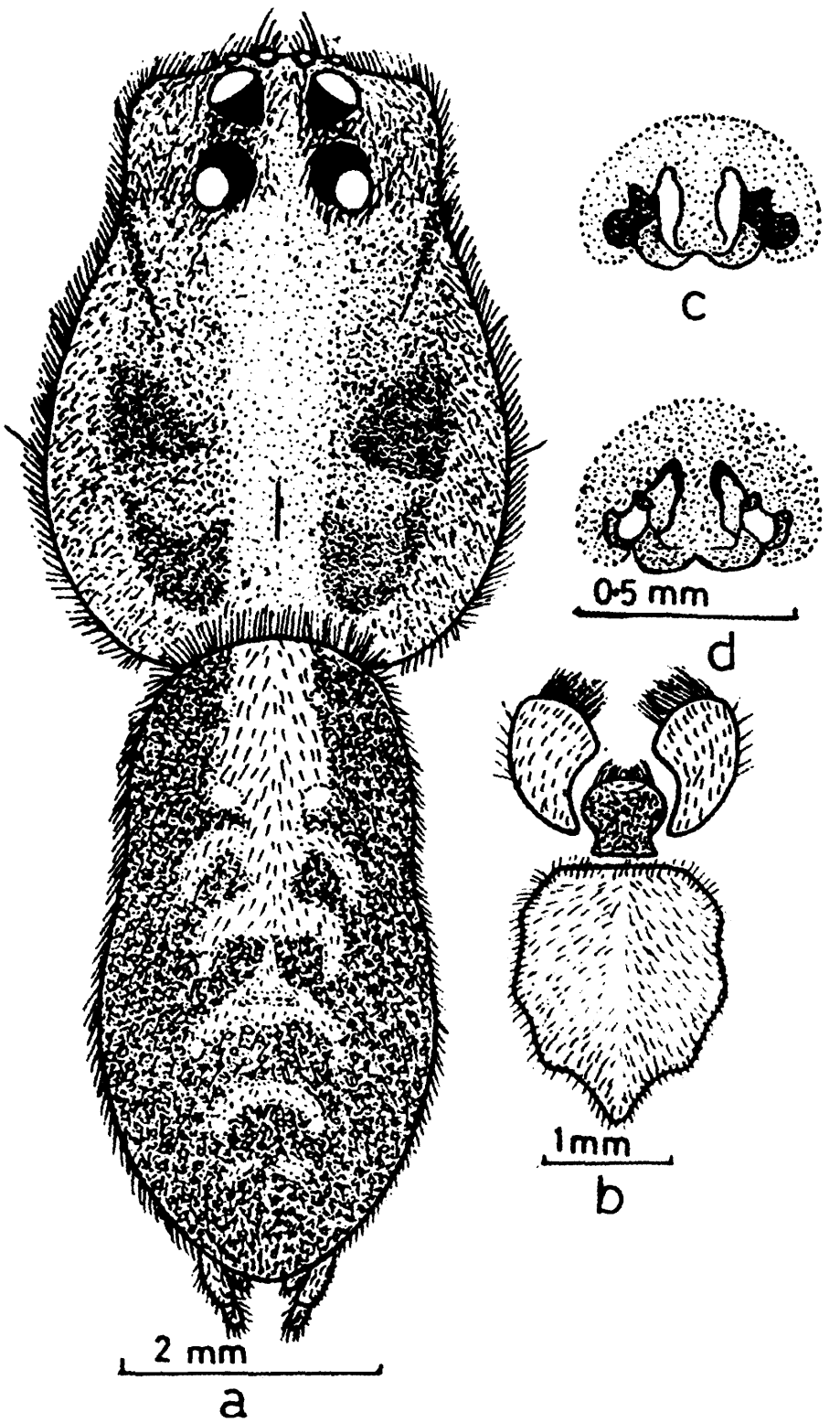

Fig. 3. *Lycosa thoracica* sp. nov. a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia.

length 9.40 mm. Carapace 4.70 mm long, 3.50 mm wide ; abdomen 5.00 mm long, 2.60 mm. wide.

Cephalothorax : Longer than wide, convex, clothed with pubescence, tapering anteriorly, centre of thorax provided with a sharp black fovea and brown bands extends from it to the lateral sides. Anterior row of eyes nearly straight, shorter than the second row (posterior medians), anterior medians larger than the anterior laterals. Eyes of the second row (posterior medians) larger than the others. Bases of posterior eyes provided with conspicuous black patches. The eyes of posterior row forms a rectangle which is longer than wide. Ocular quad wider than long, wider behind and narrowing in front as in Fig. 3 a. Sternum heart shaped, pointed behind, pale and clothed with hairs and spines. Labium longer than wide, brown with basal excavation. Distal end of maxillae broad, pale and provided with scopulae. Sternum, labium and maxillae as in Fig. 3 b. Chelicerae moderately strong, inner and outer margins of fang furrow provided with three and two teeth respectively. Legs stout, clothed with hairs and spines. Tibiae and metatarsi of all legs with three pairs of ventral spines. Leg formula 4 1 3 2.

Male : Unknown.

Abdomen : Longer than wide, oval, broad anteriorly, clothed with pubescence. Anteriorly, provided with a mid-dorsal brown lens-shaped marking followed posteriorly by greenish black patches alternating with pale colour and brown spots as in Fig. 3a. Ventral side pale. Epigyne and internal genitalia as in Fig. 3 c and d.

Holotype : 1 ♀ in spirit.

Type-Locality : Santhamagulur, Dist. Prakasam. 18.iii.1986. Coll. T S. Reddy.

Diagnosis : This species resembles to *Lycosa phipsoni* Pocock, but it is separated as follows : (i) The eyes of posterior row forms a rectangle which is longer than wide but in *L. phipsoni* the eyes of posterior row froms a rectangle which is longer than wide and wider behind than in front. (ii) Abdomen anteriorly with a mid-dorsal brown lens-shaped marking but in *L. phipsoni* abdomen anteriorly with a mid-dorsal pale few brown spots only. (iii) Epigyne and internal genitalia are also structurally different.

4. **Pardosa gopalai** sp. nov.
(Fig. 4, a-g)

General : Cephalothorax brown, legs greenish brown and abdomen pale in colour. Total length 6.90 mm. Carapace 3.00 mm long, 2.30 mm wide ; abdomen 4.00 mm long, 2.55 mm wide.

Cephalothorax : Longer than wide, convex, clothed with pubescence and some hairs anteriorly. Cephalic region narrowing in front and slightly high, centre of thoracic region light brown and middle provided with a sharp fovea. Lateral margins of thoracic region provided with white hairs. Anterior row of eyes straight, shorter than the second row (posterior medians), anterior medians slightly larger than the anterior laterals. Eyes of the second row (posterior medians) larger than the others. Bases of the posterior eyes are provided with conspicuous black patches and are equal in size. The eyes of posterior row forms a trapizum, with a wider base

and narrowing in front. Ocular quad wider than long, wider behind than in front as in Fig. 4 a. Sternum heart-shaped pointed behind, brown and clothed with hairs and pubescence. Labium nearly as long as wide. Distal end of maxillae broad and provided with scopulae. Sternum, labium and maxillae as in Fig. 4 b. Chelicerae moderately strong, inner and outer margins of fang furrow provided with three teeth each. Legs long, thin and provided with hairs and spines. Femora of all legs with very conspicuous black, transverse patches. Patellae and tibiae of all legs also provided with conspicuous transverse brown patches. Tibiae and metatarsi of legs with three pairs of stout ventral spines. Leg formula 4 1 3 2.

Male : It is similar to female but little smaller. Total length 5.50 mm. Male palp as in Fig. 4 e, f and g.

Abdomen : Oval, broadest just behind the middle, clothed with pubescence and few spine like hairs on dorsal side. Anterior mid-dorsal side of abdomen provided with a longitudinal brown lens-shaped marking followed by light brown irregular patches as in Fig. 4 a. Lateral sides with black patches. Ventral side pale in colour.

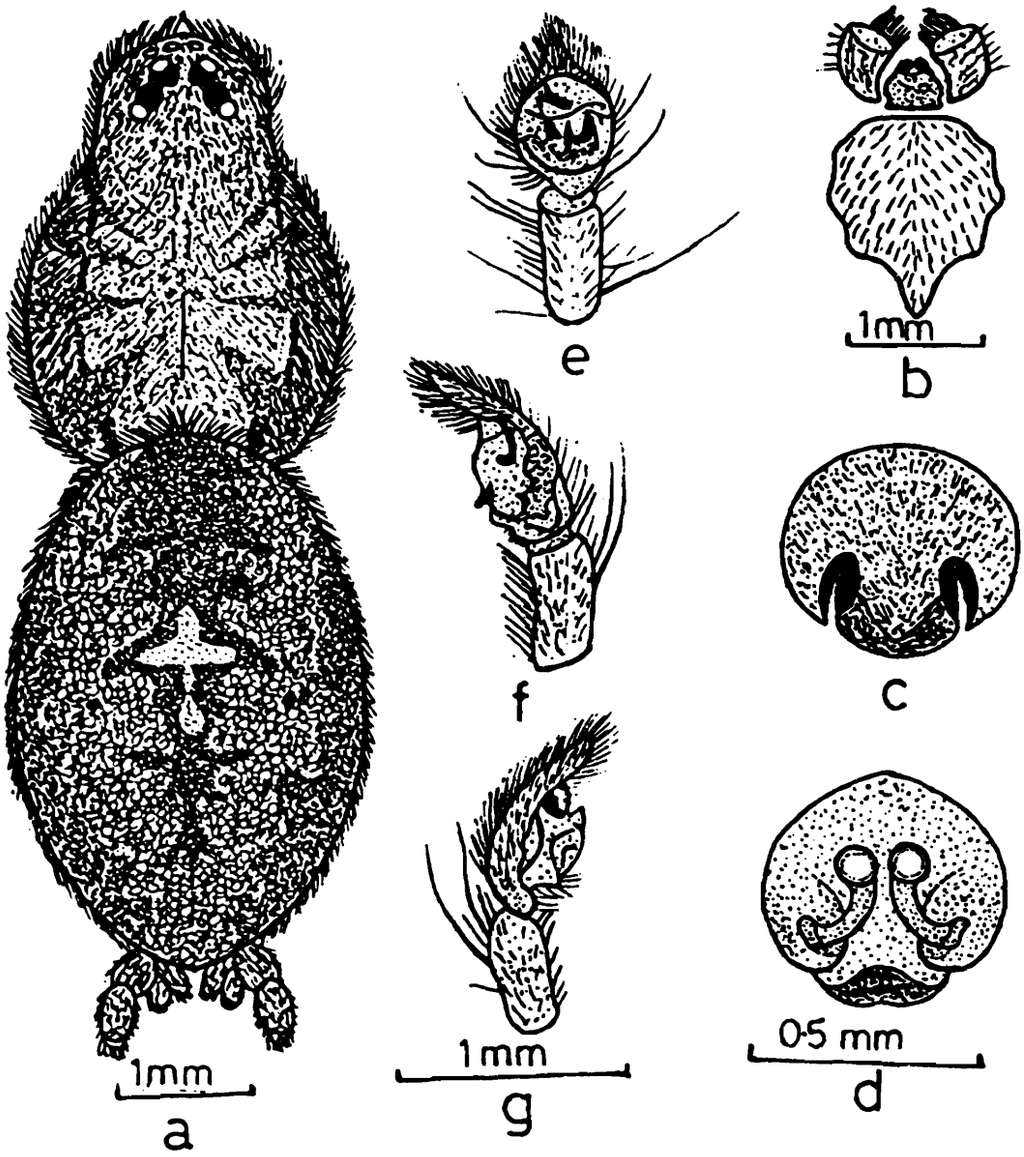

Fig. 4. *Pardosa gopalai* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia ; e. Right male palp - ventral view ; f. Right male palp - inner view ; g. right male palp - outer view.

Epigyne and internal genitalia as in Fig. 4 c and d.

Holotype : 1 ♀ , *paratype* : 44 ♀ , *allotype* : 12 ♂ in spirit.

Type-Locality : Draksharama, Dist. East Godavari, 7.ix.1985. Coll. T.S. Reddy.

Distribution : Known from the type-locality and all the Districts of Coastal Andhra Pradesh except Nellore District.

Diagnosis : This species resembles to *Pardosa mukundi* Tikader and Malhotra but it is separated as follows : (i) The eyes of posterior row forms a trapizum, with a wider base and narrowing in front but in *P. mukundi* the eyes of posterior row longer than wide and posterior eyes longitudinally parallel to each other. (ii) Anterior mid-dorsal side of abdomen provided with a longitudinal brown lens-shaped marking and light brown irregular patches but in *P. mukundi* anterior mid-dorsal side of abdomen provided with a broad longitudinal pale band and light brown irregular patches. (iii) Epigyne and internal genitalia are also structurally different.

5. **Pardosa subhadrae** sp. nov.
(Fig. 5, a-g)

General : Cephalothorax and legs yellowish brown, abdomen pale. Total length 7.45 mm. Carapace 2.70 mm long. 2.05 mm wide ; abdomen 4.35 mm long, 2.50 mm wide.

Cephalothorax : Longer than wide, clothed with fine hairs. Cephalic region high and almost entirely occupied by posterior two rows of eyes. Thoracic region provided with a sharp fovea. Anterior row of eyes almost straight and shorter than the second row (posterior medians), anterior medians slightly larger than the anterior laterals. Eyes of the second row (posterior medians) larger than the others. Bases of posterior eyes provided with conspicuous black patches. The eyes of posterior row forms a square shape slightly narrowed in front. Ocular quad wider than long and slightly wider behind than in front. Two broad longitudinal parallel brown patches extend from the base of posterior eyes to the base of cephalothorax on each side as in Fig. 5 a. Sternum heart-shaped, pointed behind, pale and clothed with hairs. Labium wider than long. Distal end of maxillae wider and provided with scopulae. Sternum, labium and maxillae as in Fig. 5 b. Chelicerae strong, inner and outer margins of fang furrow provided with three and two teeth respectively. Legs moderately strong, clothed with spines and hairs. Femora, tibiae and metatarsi of all the legs provided with concpicuous transverse brown patches. Tibiae and metatarsi of all legs provided with three pairs of ventral spines. Leg formula 4 1 3 2.

Male : It is similar to the temale but smaller. Total length 5.90 mm. Male palp as in Fig. 5 e, f and g.

Abdomen : Longer than wide, pointed behind, pale, clothed with pubescence and some spine like hairs. Anterior half mid-dorsally provided with a conspicuous lens-shaped brown marking and posterior half and lateral sides with few small white dots as in Fig. 5 a. Ventral side pale in colour. Epigyne and internal genitalia as in Fig. 5 c and d.

Holotype : 1 ♀ , ***paratype*** : 7 ♀ , ***allotype*** : 3 ♂ in spirit.

Type-Locality : Chirala, Dist. Prakasam, 11.ix.1986, Coll. T S. Reddy.

Distribution : Known from the type-locality and Visakhapatnam District of Coastal Andhra Pradesh.

Diagnosis : This species resembles to *Pardosa leucopalpis* Gravely but it is separated as follows : (i) Legs moderately strong, clothed with spines and hairs and femora, tibiae and metatatri of all the legs provided with conspicuous transverse brown patches but in *P. leucopalpis* legs moderately strong, clothed with spines and hairs and without any patches on femora, tibiae and metatarsi. (ii) Abdomen anterio-mid-dorsally provided with a conspicuous lens-shaped marking but in

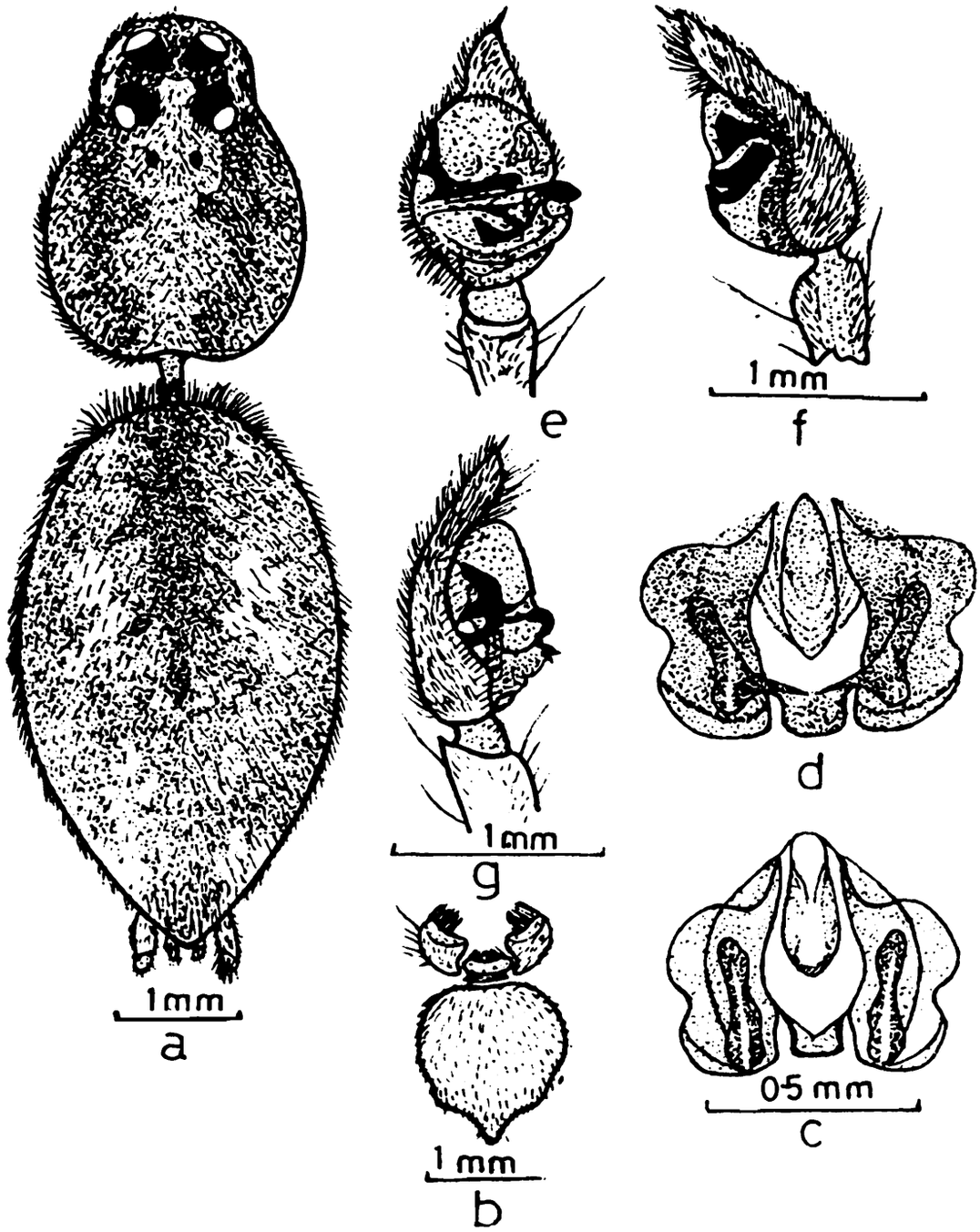

Fig. 5. *Pardosa subhadrae* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia ; e. Right male palp-ventral view ; f. Right male palp-inner view ; g. Right male palp-outer view.

P. leucopalpis anterio-mid-dorsally provided with a inconspicuous light lens-shaped marking. (iii) Epigyne and internal genitalia are also structurally different.

6. **Trochosa gunturensis** sp. nov.
(Fig. 6, a-d)

General : Cephalothorax and legs yellowish brown, abdomen brown with pale patches. Total length 9.20 mm. Carapace 3.20 mm long, 2.60 mm wide ; abdomen 6.00 mm long, 2.30 mm wide.

Cephalothorax : Longer than wide, tapering anteriorly, clothed with pubescence and hairs. Centre of thoracic region with a conspicuous fovea. Anterior row of eyes slightly recurved, wider than the second row (posterior medians), anterior medians larger than the anterior laterals and bases of anterior laterals provided with black patches. Eyes of the second row (posterior medians) larger than the others. Bases of posterior eyes provided with conspicuous black patches. Posterior eyes form a rectangle, wider behind than in front. Ocular area much hairy, wider than long, wider behind and narrowing in front. A broad brown longitudinal patch extend from base of posterior eyes to the base of cephalothorax as in Fig. 6 a. Sternum pale, heart-shaped, pointed behind and clothed with spine like hairs. Labium brown, longer than wide, distal end pale in colour. Distal end of maxillae broad, pale and provided with scopulae. Sternum, labium and maxillae as in Fig. 6 b. Chelicerae moderately strong, dark in colour, inner and outer margins of fang furrow provided with two teeth each. Legs clothed with pubescence, hairs and spines and all segments provided with irregular light brownish green inconspicuous patches. The proximal spine on the dorsal side of tibiae IV thin and reduced to a bristle. Tibiae and metatarsi III and IV provided with three pairs of ventral spines. Leg formula 4 1 2 3.

Male : Unknown.

Abdomen : Dark brown, oval, longer than wide, clothed with pubescence and hairs. Dorsally provided with two rows of irregular yellow patches as in Fig. 6 a. Ventral side pale in colour. Epigyne and internal genitalia as in Fig. 6 c and d.

Holotype : 1 ♀ in spirit.

Type-Locality : Valiveru, Dist. Guntur, 20.ii.1986. Coll. T. S. Reddy.

Diagnosis : This species resembles to *Trochosa himalayensis* Tikader and Malhotra but it is separated as follows : (i) Anterior row of eyes slightly recurved and wider than the posterior medians but in *T himalayensis* anterior row straight and shorter than the posterior medians. (ii) Chelicerae moderately strong, inner margin of fang furrow provided with two teeth but in *T himalayensis* inner margin of fang furrow with three teeth. (iii) Epigyne and internal genitalia are also structurally different.

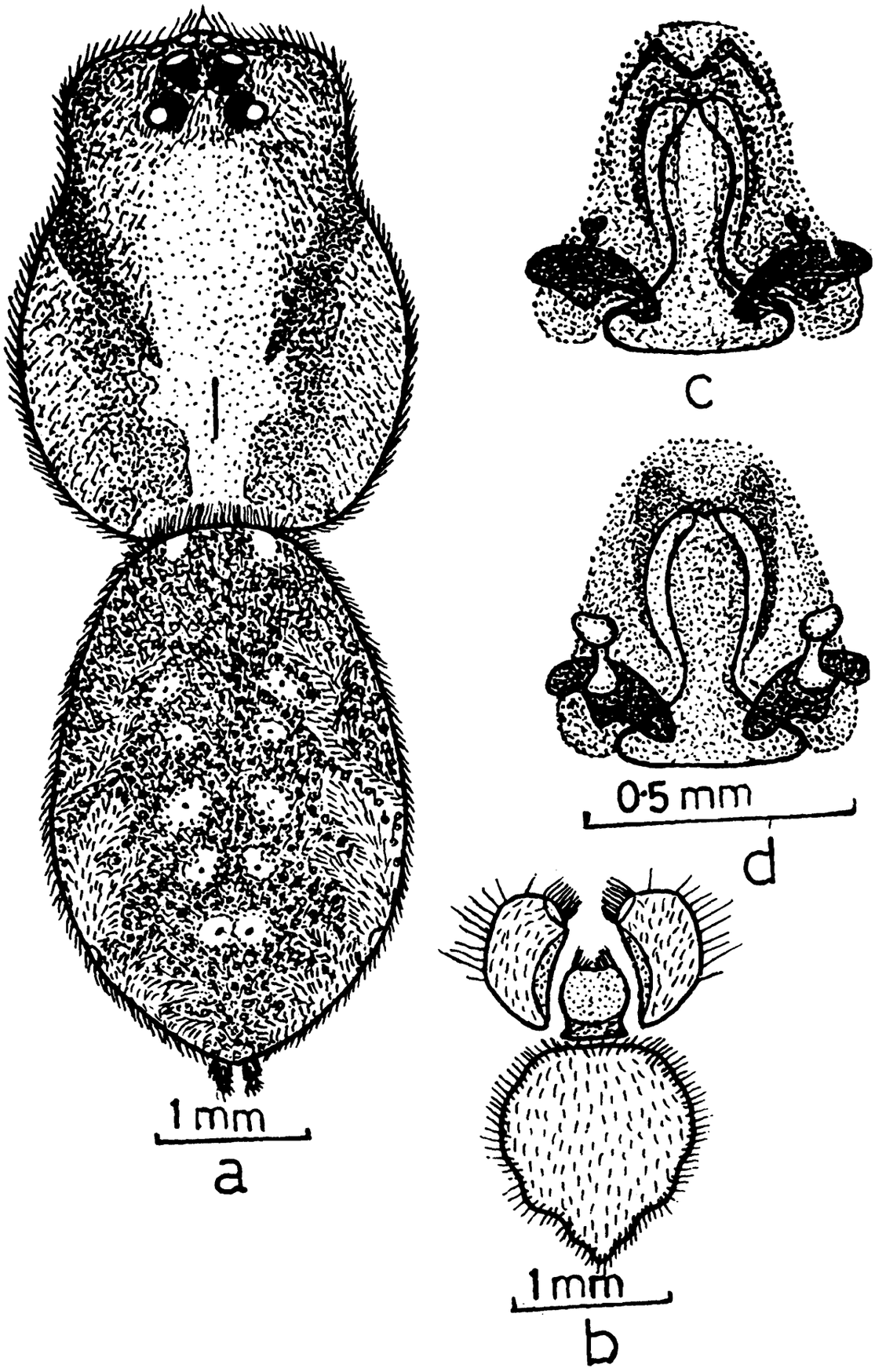

Fig. 6. *Trochosa gunturensis* sp. nov. : a. Dorsal view of female (legs omitted) ; b. Sternum, labium and maxillae ; c. Epigyne ; d. Internal genitalia.

SUMMARY

Six new species of spider genera *Hippasa, Lycosa, Pardosa* and *Trochosa* viz., *Hippasa valiveruensis, Lycosa balaramai, L. thoracica, Pardosa gopalai, P. subhadrae* and *Trochosa gunturensis* are described and illustrated here from Coastal Andhra Pradesh, India.

ACKNOWLEDGEMENTS

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ON A COLLECTION OF PASSALIDAE AND LUCANIDAE (INSECTA : COLEOPTERA) FROM ARUNACHAL PRADESH, INDIA

T. K. PAL

Zoological Survey of India
Arunachal Pradesh Field Station
Itanagar—791 111, India

INTRODUCTION

The Passalidae and Lucanidae are sharphy defined small families of the superfamily Lamellicornia (Scarabaeioidea). The representatives are generally heavily built with shining ribbed bodies of Pasaalidae and anteriorly projected large mandibles of Lucanidae, and lamelliform antenna of both differentiate them from other beetle groups. Although phylogenetically not closely related, they were earlier treated under a separate group, Pectinicornia. The representatives inhabit greater part of their lives in rotting wood. The adult lucanids are however not at all xylophagous, but are saprophogous and some probably attack foliage. The passalids on the contrary are capable of masticating wood material with their powerful jaws. They are moreover, often found in small or large groups with their immatures. These two groups are prevalent in tropical rain forests of both the hemispheres. Variety of vegetation in different altitudinal and ecological zones plus abundance of rotting tree stumps and decaying logs in humid forests of Arunachal Pradesh induced in developing a good assemblage of these two families in this region.

Following the publication of Arrow's "Fauna" in 1949 no important work has come out from the Indian region. Only recently, Biswas and Chatterjee (1985) have recorded 11 species of Passalidae and 3 species of Lucanidae from Namdapha Biosphere Reserve area (Changlang District) of Arunachal Pradesh. The present work is based mainly on some recent collection made by the author in different Districts of Arunachal Pradesh plus some collection already deposited in the A.P.F.S., Itanagar. This collection comprises 139 examples belonging to 16 species under 7 genera. Of these, 7 species under 5 genera are from Passalidae and 9 species under 2 genera are from Lucanidae, and 7 species of Lucanidne are first time recorded from Arunachal Pradesh. Uptil now 32 species of Passalidae and 138 species of Lucanidae are recorded from India and neighbouring countries.

SYSTEMATIC ACCOUNT

Family PASSALIDAE
Subfamily AULACOCYCLINAE

Genus I. **Aulacocyclus** Kaup

1868. *Aulacocylus* Kaup, *Col. Hefte* **3** : 4 (Type-species : *Passalus edentatus* Macleay)

1. **Aulacocyclus bicuspis** Kaup

1868. *Aulacocyclus bicuspis* Kaup *Col. Hefte* **3** : 5.

1914. *Taeniocerus bicuspis* : Gravely, *Mem. Indian Mus.* **3** : 210.

1949. *Aulacocylus bicuspis* : Arrow, *Fauna Brit. India.* Coleoptera : Iamellicornia **4** : 243.

Diagnostic characters : Body cylindrical, dorsum convex ; front margin of head bordered by a marginal groove, vertex bearing a short median erect process which is longitudinally grooved and bifid at tip, antennal club 3-segmented with moderately long lamellae, maxillary lacinia bidentate ; prothorax slightly broader than long and slightly converging anteriorly, pronotum completely margined with a median longitudinal groove, front coxae prominent and contiguous ; elytral striae deep and conspicuously punctate, punctures simple, intervals convex. Size : 20-25 mm. long and 7.5-10 mm. broad.

Material examined : 9 ex. INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Pitapol, 3 km. 0- Yazali, 4 ex., 15.ix.1988, T.K. Pal, decaying log ; East Siang District, 20 km. 0- Pasighat, 2 ex., 19.ii.1989, T.K. Pal, decaying log ; West Siang District, Darak, 10 km. 0- Basar, 1 ex., 9.iii.1989, T.K. Pal, Under bark of dead standing tree ; Sododoke, 24 km. 0- Basar, 2 ex., 10.iii.1989, T.K. Pal, dead tree stump (Reg. No. 733-741).

Distribution : INDIA : Arunachal Pradesh, Assam, West Bengal (Darjeeling Dist.) ; BURMA ; MALACCA.

Sub family PASSALINAE

Genus II. **Leptaulax** Kaup

1868. *Leptaulax* Kaup, *Col. Hefte* **3** : 11 (Type-species : *Passalus dentatus* Fabricius).

2. **Leptaulax dentatus** (Fabricius)

1792. *Passalus dentatus* Fabricius, *Ent. Syst.* **1**(2) : 241.

1868. *Leptaulax dentatus* : Kaup, *Col. Hefte* **3** : 11.

1914. *Leptaulax dentatus* : Gravely, *Mem. Indian. Mus.* **3** : 252.

1949. *Leptaulax dentatus* : Arrow, *Fauna Brit. India* Coleoptra : Lamellicornia **4** : 247.

Diagnostic characters : Body depressed, dorsum rather flat and shining ; front margin of head bears four equal teeth with a smaller one at middle, antennal club 3-segmented with long lemellae, maxillary lacinia with single lobe ; prothorax distinctly transverse with front angles modernately sharp and hind angles rounded, sides of pronotum coarsely and densely punctate, front coxae nut prominent and distinctly separate ; dorsal striae of elytra minutely punctate with intervals flat, punctures on lateral sides scalariform ; median area of metasternum impunctate. Size : 23-33 mm: long and 7-12 mm. broad.

Material examined : 34 ex. INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 1 ex:, 25.viii.1984, R.N. Bhargava ; Pitapol, 3 km. 0- Yazali, 9 ex.,

15.ix.1988, T.K. Pal, decaying log ; Yazali, 2 ex., 15 & 17.ix.1988, T.K. Pal, under bark ; Tago, 10 km. 0- Yazali, 2 ex., 17.ix.1988, T.K. Pal, under loose bark ; Kimin, 8 ex., 20.ix.1988, T.K. Pal, fallen log ; East Siang District, Sherki, 20 km. 0- Pasighat, 2 ex., 19.ii.1989, T.K. Pal, decaying log ; Lohit District, Mankao, Chowkom, 10 ex., 19.ix.1986, R.N. Bhargava (Reg. No. 697-730).

Distribution : INDIA : Arunachal Pradesh, Assam, West Bengal (Darjeeling Dist.), Andaman Is : BURMA ; THAILAND ; MALAYSIA ; INDONESIA ; PHILIPPINES ; SULAWESI ; NEW GUINEA.

3. **Leptaulax bicolor** (Fabricius)

1801. *Passalus bicolor* Fabricius, *Syst. Eleuth.* 2 : 256.

1914. *Leptaulax bicolor* : Gravely, *Mem. Indian Mus.* 3 : 257, 307.

1918. *Leptaulax bicolor* : Gravely, *Mem. Indian Mus.* 7 : 114.

1949. *Leptaulax bicolor* : Arrow, *Fauna Brit. India,* Coleoptera : Lamellicornia 4 : 249.

Diagnostic characters : Body flat and shining : front margin of head with five equidistant teeth of which second and fourth larger than others, supraorbital ridge toothed in front and broad behind, parietal ridge joins with supraorbital ridge, prothorax transverse with sides converge anteriorly, front angles rather pointed and hind angles rounded, sides of pronotum coarsely and densely punctate, lateral marginal grooves coarsely punctate ; dorsal striae of elytra finely punctate with intervals almost flat, lateral striae strongly punctate but not scalariform ; median area of metasternum almost smooth with sides coarsely and densely punctate. Size : 19 mm. long and 7 mm. broad.

Material examined : 1 ex. INDIA : ARUNACHAL PRADESH, West Siang District, Malinithan Forest, 2 km. 0- Likabali, 16.iii.1989, T.K. Pal, under bank of dead tree (Reg. No. 731).

Distribution : INDIA : Arunachal Pradesh, Assam, West Bengal (Darjeeling Dist.), Kerala, Nicober Is. ; CHINA ; BURMA ; THAILAND ; VIETNAM ; MALAYSIA ; INDONESIA ; PHILIPPINES ; SULAWESI ; GILOLO ; NEW GUINEA.

4. **Leptaulax reopstorffi** Kuw.

1898. *Leptaulax roepstorffi* Kuw. : *Nov. Zool.* 5 : 288.

1949. *Leptaulax roepstorifi* : Arrow, *Fauna Brit. India,* Coleoptera : Lamellicornia 4 : 249.

Diagnostic characters : Body flat and shining ; front margin of head bearing four almost equal but not equidistant teeth, median tooth insignificant, supraorbital ridge toothed in front and broad behind ; prothorax transverse and sides indistinctly converge anteriorly, front angles broadly pointed, sides of pronotum sparsely punctate with depressions at posterior third, marginal groove finely punctate ; dorsal striae of elytra minutely punctate with intervals flat, lateral striae strongly punctate and not scalariform. Size : 23 mm. long and 7.5 mm. broad.

Material examined : 1 ex. INDIA : ARUNACHAL PRADESH, East Siang District, Nambung, 7 km. 0- Boleng, 23.ii.1989, T.K. Pal, dead tree stump (Reg. No. 732).

Distribution : INDIA : Arunachal Pradesh, Andaman Is. ; BURMA.

Genus III. **Aceraius** Kaup

1868. *Aceraius* Kaup, *Col. Hefte* 3 : 26 (Type-species : *Passalus grandis* Burmeister).

5. **Aceraius grandis** (Burmeister)

1847. *Passalus grandis* Burmeister, *Handb. Ent.* 5 : 463.

1868. *Aceraius grandis* : Kaup, *Col. Hefte* 3 : 26.

1914. *Aceraius grandis* : Gravely, *Me.n. Indain Mus.* 3 : 231.

1918. *Aceraius grandis* : Gravely, *Me.n. Indian Mus.* 7 : 92.

1949. *Aceraius grandis* : Arrow, *Fauna Brit. India,* Coleoptera : Lamellicornia 4 : 260.

Diagnostic characters : Body rather flat and shining ; head asymmetrical, supraorbital ridges sharply elevated, united posteriorly by a continuous curved ridge and produced into outer marginal process in front, inner marginal process unequal with left one long and inclines outward, antennal club 6—segmented. maxillary lacinia with single lobe, head closely punctate with erect punctigerous setae ; prothorax transverse with feeble or incomplete median longitudinal groove, laterally and sides of front margin corarsely punctate, bristles at sides, front coxaenot prominent and separated ; elytral striae deep and impunctate with intervals flat. outer three intervals densely punctate and thickly hairy in the anterior part : metasternum densely punctate and hairy at sides, middle tibiae with dense hair on upper surface. Size : 38-50 mm. long and 14-19 mm. broad.

Material examined 58 ex. INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 2 ex., 6.v.1989, T.K. Pal ; 2 ex., 8.vii.1986, R.N. Bhargava; 2 ex., 2.v.1987, S. Ghosh ; Yazali, 1 ex., 17.ix.1988, T.K. Pal, under bark ; Kimin, 2 ex., 20.ix.1988, T.K. Pal, under bark ; 2 ex., 17.v.1989, P.T. Bhutia ; Jhumi Bustce, 5 km. 0- Kimin, 1 ex., 20.ix.1988, T.K. Pal, rotten wood ; East Siang District. Sherki, 20 km. 0- Pasighat, 6 ex., 19.ii.1989, T.K. Pal, dead tree stump ; West Siang District, Logum Jining, 11 km. 0- Along, 14 ex., 5.iii.1989, T.K. Pal. decaying log ; Doje, 21 km. 0- Along, 13 ex., 6.iii.1989, T.K. Pal, fallen log ; Malinithan Forest, 2 km. 0- Likabali, 1 ex., 16.iii.1989, T.K. Pal, under bark of dead tree (Reg. No. 742-799).

Distribution : INDIA : Arunachal Pradesh, Assam, West Bengal (Darjeeling Dist.) ; BURMA ; MALAYSIA ; INDONESIA ; VIETNAM ; FORMOSA.

Genus IV. **Macrolinus** Kaup

1868. *Macrolinus* Kaup, *Col. Hefte* 3 : 18 (Type-species : *Passalus latipennis* Perch).

6. **Macrolinus sikkimensis** (Stoliczka)

1873. *Basilianus sikkimensis* Stoliczka, *J. Asiat. Soc. Bengal* 42(2) :161.

1914. *Macrolinus sikkimensis* : Gravely, *Me.n. Indian Mus.* 3 : 243.

1949. *Macrolinus sikkimensis* : Arrow, *Fauna Brit. India,* Coleoptera : Lamellicornia 4 : 266.

Diagnostic characters : Body more or loss flattened ; head symmetrical, supraorbital ridges short and not united behind by a posterior ridge, front margin with two sharp triangular processes, antennal club 6-segmented, maxillary lacinia with single lobe,

head closely punctate and with fine setae ; prothorax transverse, convex, without median longitudinal groove on pronotum, coarsely and densely punctate on sides and near front angles, lateral scar beyond posterior angle, devoid of bristles but with minute setae on sides, front coxae not prominent and separated ; dorsal striae of elytra minutely punctate with intervals almost flat, punctures on lateral sides strong and scalariform ; middle tibiae bear scanty hairs ; mesosternum with a finely rugose patch in middle. Size : 27-32 mm. long and 10-11 mm. broad.

Material examined : 19 ex., INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Yazali, 1 ex., 15.ix.1988, T.K. Pal, under bark ; 2 ex., 17.ix.1988, T.K. Pal, under bark ; Tago, 10 km. 0- Yazali, 2 ex., 17.ix.1988, T.K. Pal, under loose bark ; East Siang District, Sherki, 20 km. 0- Pasighat, 1 ex., 19.ii.1989, T.K. Pal, decaying log ; Nambung, 7 km. 0- Bolong, 1 ex., 23.ii.1989, T.K. Pal, dead tree stump ; 6 km. 0- Yingkiong, 3 ex., 28.ii.1989, T.K. Pal, dead tree stump ; West Siang District, logum Jining, 11 km. 0- Along, 7 ex., 5.iii.1989, T.K. Pal, decaying log ; Sododoke, 24 km. 0- Basar, 1 ex., 10.iii.1989, dead tree stump ; Malinithen Forest, 2 km. 0- Likabali, 1 ex., 16.iii.1989, T.K. Pal, under bark of dead tree (Reg. No. 678-696).

Distribution : INDIA : Arunachal Pradesh, Assam, West Bengal (Darjeeling Dist.) ; BURMA ; CAMBODIA.

Genus V. **Tiberioides** Gravely

1913. *Tiberioides* Gravely, *J. Asiat. Soc. Bengal* (2) **8** : 405 (Type-species : *Tiberius kuwerti* Arrow).

7. **Tiberioides austeni** Gravely

1914. *Tiberioides austeni* Gravely, *Mem. Indian Mus.* **3** : 216.

1949. *Tiberioides austeni* ; Arrow, *Fauna Brit. India,* Coleoptera : Lamellicornia **4** : 254.

Diagnostic characters : Body rather flat, shining and devoid of hair above ; head symmetrical, supraorbital ridges united behind by a supraoccipital ridge, front margin with a pair of short, broad and pointed processes, antennal club 6- segmented with anterior three lamellae very long, maxillary lacinia with two lobes, no lateral grooves on mentum ; prothorax tranaverse, without complete median groove on pronotum and a few punctures near lateral scars only, front coxae not prominent and separated ; elytra not very dilated behind, deeply striate with dorsal intervals slightly convex, lateral striae with distinct small punctures, punctures not scalariform; middle tibiae thickly clothed with hair above, lateral depressed area of metasternum coarsely punctate but not densely hairy. Size 48 mm. long and 16 mm. broad.

Material examined : 1 ex. INDIA : ARUNACHAL PRADESH, East Siang District, Sherki, 20 km. O- Pasighat, 19.ii.1989, T.K. Pal, deep of a decaying log (Reg. No. 800).

Distribution : INDIA : Arunachal Pradesh ; BURMA.

Family	LUCANIDAE
Subfamily	LUCANINAE

Genus I. **Calcodes** Westwood

1834. *Calcodes* Westwood, *Ann. Sci. Nat.* (2) **1** : 116, 118 (Type-species :*Lucanus aeratus* Hope).

8. **Calcodes cuvera** (Hope)

1845. *Odontolabis cuvera* Hope, *Trans. Linn. Soc.* **19** : 105.

1845. *Lucanus prinsepii* Hope & Westwood, *Cat. Luc. Col.* ; 16.

1845. *Odontolabis saundersi* Hope, *Trans. Linn. Soc.* **19** : 105.

1847. *Anoplocnemus bicolor* Burmeister, *Handb. Ent.* **5** : 360.

1848. *Lucanus prinsepii* : Westwood, *Cab. Orient. Ent.* : 54.

1885. *Odontolabis cuvera* : Leuthner, *Trans. Zool. Soc.* 1885 : 452.

1902. *Anoplocnemus bicolor* var. *alticola* Moll., *Insektenbörse* **19** : 353.

1902. *Odontolabis gestroi* Boileau, *Le Naturaliste* **24** : 204.

1949. *Calcodes cuvera* : Arrow, *Fauna Brit. India,* Coleoptera : Iamellicornia **4** : 190.

Diagnostic characters : Black with bicoloured elytra ; front of head with a strongly elevated straight carina, canthus coaplotely dividing eye into upper and lower balves, a sharp process behind each eye, antennal club 3- segmented, long mandible of male with a small sharp oblique tooth little beyond base and a strong truncate process beyond middle and tip broadly forked, ligula with long fringe of hairs ; prothorax with lateral and hind angles spiniform, prosternal process produced obliquely downward, front tibiae armed with three or four sharp lateral teeth ; elytra yellowish with a triangular black sutural band, band not reaching shoulders at base and gradually tapering to a point at end of suture ; middle and hind tibiae devoid of lateral spines. Size- ♂ : 50-51 mm. long (excluding mandibles) and 21.5-22 mm. broad.

Material examined : 2 ♂♂ INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 10.viii & 20.viii.1988, T.K. Pal, at light (Reg. No. 803-804).

Distribution : INDIA : Arunachal Pradesh (New record), Meghalaya, Manipur, West Bengal (Darjeeling Dist.) ; BURMA.

9. **Calcodes siva** (Hope & Westwood)

1845. *Lucanus siva* Hope & Westwood, *Cat. Luc. Col.* : 16.

1885. *Odontolabis siva* : Leuthner, *Trans. Zool. Soc. Lond.* 1885 : 436.

1937. *Calcodes siva* : Arrow, *Trans. R. ent. Soc. Lond.* **86** : 241.

1949. *Calcodes siva* : Arrow, *Fauna Brit. India,* coleoptera : Lamellicornia **4** : 200.

Diagnostic characters : Black with head and sides of pronotum little dull and elytra glossy ; front margin of head little hollowed, side rounded in front of eye, canthus completely dividing eye, strong spiniform process beneath eye, antennal club 3- segmented ; lateral angles of prothorax sharply pointed, hind angles sharp but not spiniform, prosternum feebly pointed behind, front tibiae with three or four small teeth ; elytra shining except outer margin. Size- ♀ : 45-47 mm. long (excluding mandibles) and 20-22 mm. broad.

Material examined : ♀ ♀ . INDIA : ARUNACHAL PRADESH, West Siang District, Doje, 21 km. 0-Along, 1 ex., 6.iii.1989, T.K. Pal, decaying log ; Lower Subansiri District, Itanagar, 1 ex., 8.vii.1986, R.N. Bhargava (Reg. No. 801-802).

Distribution : INDIA : Arunachal Pradesh, Assam, Meghalaya, West Bengal (Darjeeling Dist.) ; BANGLADESH ; BURMA.

10. Calcodes baladeva (Hope)

1845. *Odontolabis baladeva* Hope, *Trans. Linn. Soc.* 19 : 105.

1845. *Lucanus angulatus* Hope & Westwood, *Cat. Luc. Col.* : 17.

1864. *Neolucanus saundersi* Parry, *Trans. ent. Soc. Lond.* 1864 : 20.

1885. *Neolucanus saundersi* : Leuthner, *Trans. Zool. Soc.* 1885 : 431.

1885. *Neolucanus lana* Leuthner, *Trans. Zool. Soc.* 1885 : 430.

1899. *Neoluconus waterhousei* Boileau, *Bull. Soc. ent. France* 1899 : 178.

1912. *Neolucanus maximus* Haulb., *Insecta* 2 : 193.

1913. *Neolucamus waterhousei* : Boileau, *Trans. ent. Soc. Lond.* 1913 : 247.

1929. *Neolucanus baladeva* : Didier, *Col. Luc. du Globe* : 83.

1937. *Calcodes baladeva* : Arrow, *Trans. R. ent. Soc. Lond.* 86 : 243.

1949. *Calcodes beladeva* : Arrow, *Fauna Brit. India*, coleoptera : lemellicornia 4 : 204.

Diagnostic characters : Dark brown or black ; head emarginate in front, canthus completely dividing eye, prominent laterally and broadly angular, head closely punctured in front and sparsely behind, antennal club 3 -segmented ; lateral angles of prothorax sharply pointed and hind angles sharp but not pointed, prosternum rounded behind but with a small conical process at tip ; elytra smooth and shining with margins opaque. This species closely resembles *C. siva* but can be readily distinguished by its laterally prominent canthus and absence of its spiniform process beneath eye. Size – ♀ : 38-45 mm. long (excluding mandibles) and 8-12 mm. broad.

Material examined : 6 ♀ ♀ . INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 1 ex., 10.ix.1988, T.K. Pal, at light ; 1 ex., 12.v.1989, O.B. Chhotani ; Yazali, 2 ex., 15 & 16.ix.1988, T.K. Pal, at light ; Kimin, 1 ex., 20.ix.1988, T.K. Pal, at light ; Lohit District, Kamlong, 1 ex., 23.ix.1986 , R.N. Bhargava (Reg. No. 805-810).

Genus II. Dorcus Macleay

11. Dorcus antaeus Hope

1842. *Dorcus antaeus* Hope, *Proc. ent. Soc. Lond.* 1842 : 83.

1845. *Dorcus antaeus* Hope & Westwood, *Cat. Luc. Col.* : 20.

1845. *Lucanus scaritides* Hope & Westwood, *Cat. Luc. Col.* : 24.

1902. *Rhaetus parryi* Boileau, *Mem. Soc. Ent. Belg.* 9 : 49.

1915. *Dorcus yaksha* Gravely, *Rec. Indian Mus.* 9 : 422.

1928. *Dorcus antaeus* : Didier, *Luc. du Globe* : 24.

1938. *Dorcus antaeus* : Arrow, *Ann. Mag. Nat. Hist.* (2) 2 : 53.

1949. *Dorcus antaeus* : Arrow, *Fauna Brit. India*, Colcoptera : Laauollicornia 4 : 86.

Diagnostic characters : Entirely black ; head shorter than prothorax, very short behind eyes and eyes are close to front angles of prothorax, eyes divided by canthus in front half, clypeus prominent and feebly bilobed, head coarsely and densely punctate in front and sparsely behind, 10 - segmented antenna with 3 - segmented club and seventh segment with a short supplementary process ; prothorax wider

posteriorly, sides gently rounded and indistinctly angulate behind middle, pronotum rather dull with sides densely punctate, front tibia forked at tip with lateral margin irregularly dentate ; elytra smooth and little shining, humeral angles angular but not acute ; middle and hind tibiae with single short spine near middle at outer margin. Size — ♀ : 22 mm. long (excluding mandibles) and 10 mm. broad.

Material examined : 1 ♀ . INDIA : ARUNACHAL PRADESH, West Siang District, Logum Jining, 21 km. ♀ —Along, 5.iii.1989, T.K. Pal, deep of a decaying log (Reg. No. 812).

Distribution : INDIA : Arunachal Pradesh (New record), Meghalaya, West Bengal (Darjeeling Dist.), Uttar Pradesh ; BURMA ; THAILAND.

12. **Dorcus foveatus** (Hope)

1841. *Lucanus foveatus* Hope. *Trans. Linn. Soc. Lond.* **18** : 590.
1841. *Lucanus astacoides* Hope. *Trans. Linn. Soc. Lond.* **18** : 590.
1841. *Lucanus onissus* Hope. *Trans. Linn. Soc. Lond.* **18** : 591.
1845. *Lucanus fraternus* : Hope & Westwood. *Cat. Luc. Col.* : 12.
1869. *Cladognathus impressus* Wat. *Trans. ent. Soc. Lond.* 1869 : 17.
1870. *Metopodontus impressus* Parry. *Trans. ent. Soc. Lond.* 1870 : 78.
1911. *Metopodontus poultoni* Boileau. *Bull. Soc. ent. France* 1911 : 63.
1913. *Metopodontus foveatus* : Boileau. *Trans. ent. Soc. Lond.* 1913 : 224.
1915. *Metopodontus foveatus* : Gravely. *Rec. Indian Mus.* **11** : 417.
1915. *Metopodontus foveatus birmanicus* Gravely. *Rec. Indian Mus.* **11** : 418.
1929. *Metopodontus croceus* Didier. *Col. Luc. du Globe* : 121.
1949. *Dorcus foveatus* : Arrow. *Fauna Brit. India.* Coleoptera : Lamellicornia **4** : 165.

Diagnostic characters : Brick-red or meroon with antennae, tarsi, front of head, edges of pronotum and elytra almost black ; head about as long as prothorax and depressed in front, lateral margin with a sharp angle before eye, anterior half of eye divided by canthus, sides produced behind eyes and feebly prominent laterally, strongly rugose in front, two pairs of minute tubercle in middle of vertex, 10-segmented antenna with 3-segmented club and seventh segment with a short process ; front angles of prothorax blunt, sides almost straight up to lateral angles, pronotum minutely punctate in middle and rugose towards sides, front tibia minutely serrate with small teeth at intervals ; elytra dull with fine dense punctures, humeral angles acute ; middle and hind tibiae with single minute spine near middle at outer margin. Size — ♂ : 20 mm. long (excluding mandibles) and 7.5 mm. broad.

Material examined : 1 ♂ . INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 12.v.1989, O.B. Chhotani (Reg. No. 813).

Distribution : INDIA : Arunachal Pradesh, Meghalaya, Manipur, West Bengal (Darjeeling Dist.) ; BHUTAN ; BURMA.

13. **Dorcus boileaui** (Didier)

1911. *Rhaetulus speciosus* Boileau, *Trans. ent. Soc. Lond.* 1911 : 437 (name preoccup.)

1925. *Rhaetulus speciosus* var. *boileaui* Didier, *Bull. Soc. ent. France* 1925 : 154.

1930. *Rhaetulus speciosus* var. *gardneri* Didier, *Col. Luc. du Globe* : 128.

1949. *Dorcus boileaui* : Arrow, *Fauna Brit. India.* Coleoptera : Lamellicornia 4 : 103.

Diagnostic characters : Glossy, orange coloured with mandibles, part of head, middle of pronotum, scutellum, narrow sutural stripe dilating towards base of elytra blackish ; head shorter than prothorax, ocular canthus prominent laterally and dividing anterior half of eye, frons and vertex rugosely punctate, head not hollowed in front, 10-segmented antenna with 3-segmented club ; front angles of prothorax blunt, sides gently rounded and finely serrate, pronotum strongly and closely punctate at sides and sparsely and minutely in middle, front tibia broadly forked at tip with numerous short teeth on outer margin ; elytra shining, finely and closely punctate with sides and apex more strongly punctate, humeral angles sharply angular ; middle and hind tibiae each with a strong spine near middle of outer edge. Size — ♀ : 17.5 mm. long (excluding mandibles) and 6 mm. broad.

Material examined : 1 ♀ . INDIA : ARUNACHAL PRADESH, West Siang District, Logum Jiaing, 21 km. 0- Along, 5.iii.1989, T.K. Pal, decaying log (Reg. No. 815).

Distribution : INDIA : Arunachal Pradesh (New record), Meghalaya ; BURMA; THAILAND ; LAOS ; VIETNAM ; MALAYSIA.

14. **Dorcus suturalis** (Olivier)

1789. *Lucanus suturalis Olivier. Ent.* (1) 1 : 16.

1864. *Cladognathus suturalis* : Parry, *Trans. ent. Soc. Lond.* 1864 : 25.

1899. *Metopodontus suturalis* : Planet, *Bull. Soc. ent. France* 1899 : 225.

1937. *Dorcus suturalis* : Arrow, *Trans. R. ent. Soc. Lond.* 86 : 240.

1949. *Dorcus suturalis* : Arrow, *Fauna Brit. India.* Coleoptera : Lamellicornia 4 : 136.

Diagnostic characters : Yellowish and not glossy with mandibles, legs and lower surface darker, and antenna, a V-shaped mark up on head, middle of pronotum, scutellum, sutural stripe not dilating towards apex blackish, also small lateral spots beyond hind angles of pronotum ; head depressed in front, lateral margin bluntly angular before eye, ocular canthus moderately prominent laterally and dividing anterior half of eye, frons and vertex finely and densely granular, 10-segmented antenna with 3-segmented club and seventh segment with a long process ; prothorax broader at base than elytra, front angles bluntly projected, sides feebly curved and not serrate, pronotum finely and densely granular, front tibia finely serrate at outer margin and rather narrowly forked at tip ; elytra not shining, finely and densely punctate except near suture where punctures spase, humeral angles sharply angular ; middle and hind tibia without lateral spines. This species resembles *D. boileaui* and the comparable differentiating characters are noted under the previous species. Size ♂ : 23 mm. long (excluding mandibles) and 9 mm. broad.

Material examined : 1 ♂ . INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Itanagar, 12.v.1989, O.B. Chhotani (Reg. No. 814).

Distribution : INDIA : Arunachal Pradesh (New record), Assam, Sikkim ; VIETNAM.

15. **Dorcus titanus** (Boisd.)

1835. *Lucanus titanus* Boisd., *Voy. de l'Astrolabe. Ent.* **2** : 237.

1843. *Dorcus westermanni* Hope, *Trans. Linn. Soc.* **19** : 106.

1847. *Dorcus titon* Burmeister, *Handb. Ent.* **5** : 384.

1854. *Platyprosopus platynelus* Saunders, *Trans. ent. Soc.* 1854 : 50.

1854. *Dorcus marginalis* Saunders, *Trans. ent. Soc.* 1854 : 52.

1854. *Dorcus obscurus* Saunders, *Trans. ent. Soc.* 1854 : 52.

1937. *Dorcus titanus* : Arrow, *Trans. R. ent. Soc. Lond.* **86** : 244.

1949. *Dorcus titanus* : Arrow, *Fauna Brit. India.* coleoptera : Lamellicornia **4** : 104.

Diagnostic characters : Black, rather depressed ; head densely granular, clypeal process short-broad notched in middle and sides angularly produced, eyes situated far from front margin of prothorax, ocular canthus narrow and dividing eye almost completely, mandibles much longer than head, seventh joint of antenna with a long setose process ; pronotum margined at base, lateral margin bisinuate to lateral angle which is sharp and placed before middle, hind angles sharp, front tibia sharply dentate at outer margin ; elytra smooth and densely punctate near basal margin, humeral angles sharp ; middle and hind tibiae with a prominent spine at outer margin. Size — ♂ : 56 mm. long (excluding mandibles) and 23 mm. broad.

Materal examined : 1 ♂. INDIA : ARUNACHAL PRADESH, Lower Subansiri District, Kimin, 16.v.1989, P.T. Bhutia (Reg. No. 811).

Distribution : INDIA : Arunachal Pradesh (New record), Assam, Meghalaya, West Bengal (Darjeeling Dist.) ; BURMA ; CHINA ; JAPAN ; VIETNAM ; MALAYSIA ; INDONESIA ; PHILIPPINES ; SULAWESI.

16. **Dorcus tityus** Hope

1842. *Dorcus tityus* Hope, *Proc. ent. Soc. Lond.* 1842 : 83.

1848. *Dorcus punctatostriatus* Hope, *Gray's Zool. Misc.* : 22.

1862. *Eurytrachelus serinugosus* Thomson, *Annls Soc. ent. Fr.* (4) **1** : 422.

1870. *Eurytrachelus tityus* : Parry, *Trans. ent. Soc. Lond.* 1870 : 61.

1913. *Eurytrachelus tityus* : Bolleau, *Trans. ent. Soc. Lond.* 1913 : 249.

1929. *Eurytrachellelus tethys* Didier, *Col. Luc. du Globe* : 115.

1930. *Eurytrachelus tethys* : Didier, *Col. Luc. du Globe* : 185.

1930. *Eurytrachelus fuliginosus* Didier, *Col. Luc. du Globe* : Fig. 33 (no description).

1949. *Dorcus tityus* : Arrow, *Fauna Brit. India.* Coleoptera : Lamellicornia **4** : 106.

Diagnostic characters : Rather depressed, balck, dull ; clypeal process of head short-broad and angularly produced on sides, sides of head rather obtusely angular in front and little contracted behind eyes, ocular canthus very narrow, not prominent laterally and extending up to anterior two-thirds of eye, vertex and frons densely granular, mandibles moderately long with a strong basai tooth, seventh antennal segment not long ; pronotum margined at base, side excised behind front angle forming a sharp angle behind excision, hind angles more or less sharp, front tibia

with broad blunt teeth ; elytra with minute punctures, humeral angles sharp ; middle and hind tibiae with a short spinuous projection at outer margin. Size— : 35 mm. long (excluding mandibles) and 14 mm. broad.

Material examined : 1 ♂. INDIA : ARUNACHAL PRADESH, West Kameng District, Dirong, 17.ix.1984, R.N. Bharghava (Reg. No. 816).

Distribution : INDIA : Arunachal Pradesh (New record), Assam, Sikkim, West Bengal (Darjeeling Dist.) ; BURMA ; NEPAL.

SUMMARY

139 examples of lamellicorn beetlos of the families Passalidae and Lucanidae collected from Arunachal Pradesh are worked out. These represent 7 species under 5 genera of Passalidae and 9 species under 2 genera of lucanidae with several new distributional records from Arunachal Pradesh. Salient diagnostic features of all the species are noted and habitat data as far as possible, are cited.

ACKNOWLEDGEMENTS

The author is indebted to the Director, Zoological Survey of India (ZSI) for providing necessary facilities, and to Dr. S. Biswas of ZSI, Calcutta for generous help extended to him.

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Biswas, S. and Chatterjee, S. K. 1985. Insecta : Coleoptera : Passalidae and Lucanidae. *In : Fauna of Namdapha : Arunachal Pradesh, A proposed Biosphere Reserve. Rec. zool. Surv. India* **82** : 179 — 184.

Rec. zool. surv. India, 90(1-4) : 147-153, 1992

NOTES ON A COLLECTION OF DERMAPTERA (INSECTA) FROM BRAZIL

G. K. SRIVASTAVA
Zoological Survey of India, Calcutta

The present study is based on a small collection of Dermaptera collected through pitfall traps near sugarcane fields or near its culture. It deals with six species belonging to six genera. Of these two species *viz.*, *Euborellia mendongai* and *Skilestes lozadai* are described as new to science.

I am thankful to Dr. J. P. Pinheiro, Biologist-in-Charge, Centro Taxionomico de Artropodos do Planalsugar, Araras, Brazil for placing this interesting collection at my disposal.

ANISOLABIDIDAE
CARCINOPHORINAE

Carcinophora scudderi (Bormans)

1900. *Psalis scudderi* Bormans, *annali Mus civ.Stor.nat.Giacomo Doria*, (2) **20** : 449.

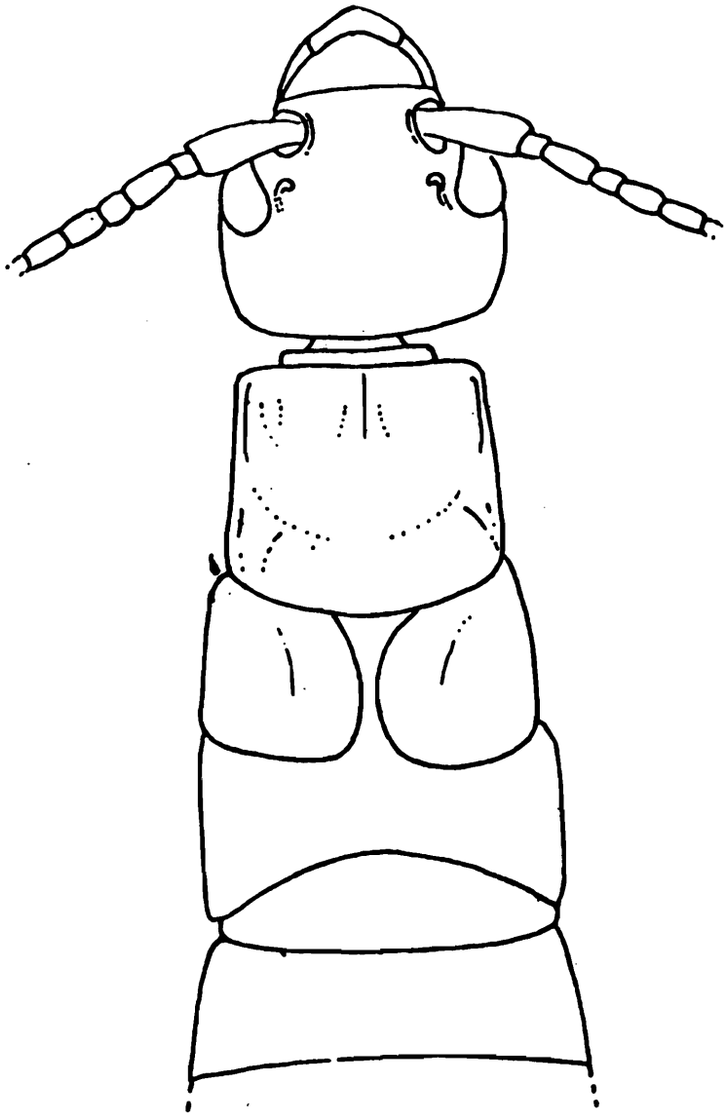
Material examined.- 1♀ labelled as : Araras - SP, 30.12.88, J.B. Pinheiro, Arm Luminosa.

Remarks.- With Brindle's (1971) key to the species of the New World Carcinophorinae and above specimen is referrable to this species. It's measurements are : Length - body 9.7 mm ; forceps - 1.75 mm. The elytra are unicolorous dark blackish brown and wings are yellow in basal 1/3.

Euborellia mendongai sp. n.
(Figs. 1-5)

♂ : General colour brownish black ; antennae with one or two pre-apical segments and legs yellow.

Head about as long as broad, smooth, sutures obsolete, frons and occiput weakly raised, hind margin emarginate in middle. Antennae 17-segmented, 1st stout, expanded apically, longer than the distance between antennal bases ; 2nd short, about as long as broad ; 3rd long and cylindrical ; 4th slightly shorter and stouter than preceding ; 5th stout, slightly longer than 4th but shorter than 3rd ; 6th equal to 5 and afterwards segments slightly increasing in length and comparatively thinning except a few apical ones shorter. Eyes shorter than genae. Pronotum about as long as broad, anterior margin straight, lateral margin slightly diverging posteriorly, hind margin rounded, median sulcus faint ; prozona and metazona not well differentiated. Elytra abbreviated, shorter than pronotum in length, not meeting along the middle line, hind margin convex. Legs typical for the



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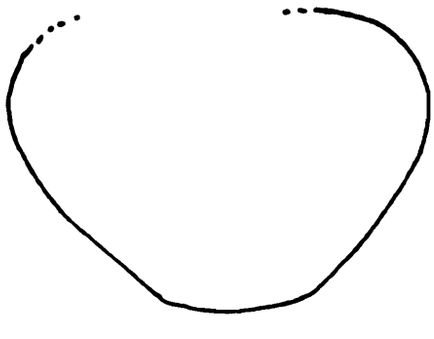

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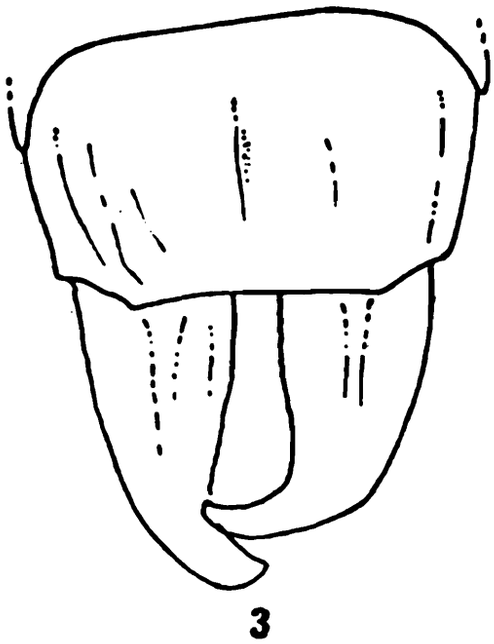

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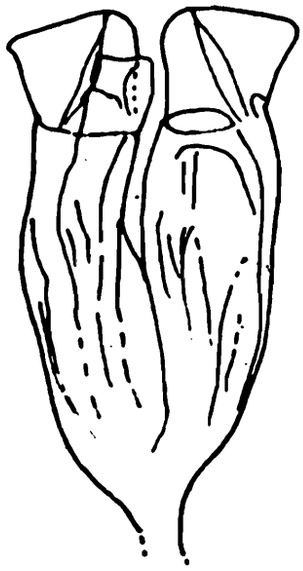

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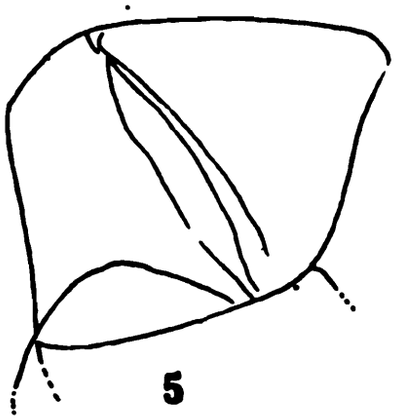

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Figs. 1-5. *Euborellia mendongai* sp.n., Holotype ♂, (1) Anterior portion of body ; (2) Penultimate sternite ; (3) Ultimate tergite and forceps ; (4) Genitalia ; (5) Paramere, enlarged.

genus, yellow ; in Holotype o fore-femora faintly brownish in middle. Abdomen gradually enlarging posteriorly, weakly convex, punctulation weakly marked, sides of abdominal segments 6th to 9th straite, acute angled posteriorly with a distinct, oblique ridge. Penultimate sternite triangular, narrowed posteriorly with hind margin in middle truncate. Ultimate tergite transverse, slightly narrowed posteriorly, hind margin trisinuate, laterally oblique, smooth and convex above, in the middle with a short discinct groove. Forceps remote and expanded at base, gently narrowing apicaly, trigonal in basal half, afterwards depressed, left branch almost straight, apices gently hooked, right branch strongly curved a little beyond middle, inner margin finely serrated. Genitalia as seen in the fig. 5 distal lobes without virga or denticulated pads.

Measurements.—(in mm)

	Holotype ♂	Paratype 1 ♂
Length of body	11.85	10.2
Length of forceps	2.0	1.8

Material examined.- Holotype ♂ labelled as : US Serra Grande, Faz. Sta. Rita, S.J. Da Laje, AL, 08/08/83, A.F. Mendonga (genitalia mounted between two coverslips and pinned with the specimen) ; Paratype 1 ♂ labelled as : US Sto. Antonio, Faz. Chchoeira S.L. Quintunde - AL, 21/05/81, R.M.L. Silva (genitalia mounted between two coverslips and pinned with the specimen) : Holotype ♂ deposited in Centro Taxonomico de Artropodos do Planalsugar. .raras, Brazil and Paratype 1 ♂ at Zoological Survey of India, Calcutta.

Remarks.- With Brindle's (1971) key to the species of New World Carcinophoriane this species comes near to *Carcinophora spitzi* (Menozi, 1932) And *Euborellia brazilensis* (Borelli, 1912) but differs from both in having the legs yellow ; slightly shorter in body size and distinctive ♂ genitalia, lacking virga and the parametes about as long as broad with external apical angle slightly projecting.

LABIDURIDAE
LABIDURINAE
Labidura xanthopus (Stall)

1855. *Labidura xanthopus* Stal, *Ofvers K.Vetensk.Akad.Forh.*, **12** : 348.

Material examined.- 1 ♂ lebelled as : Araras - SP, 9.2.82, M.B. S. Campos, Arm Luminosa ; 2♂♂, Araras - SP, 17, 19.2.81, J.B. Borges, Arm Luminosa ; 1♀ Araras - SP, 15.4.84, J.B. Pinheiro, Arm Luminosa ; 1♂, Araras - SP, 11.3.83, J.B. Pinheiro, Colecta Manual ; 1♀, Araras - SP, 11.1.83, M.A. Pascotti ; 2♂♂, Araras - SP, 11.3.83 and 29.4.83, L.B.L Marchetti, Arm Luminosa ; 1 nymph, Araras - SP, 16.VII.83, E.K.M. Manente, col. Cl Sugador.

Remarks.—The above material is referred to this species since the hind margin of 7th and 8th abdominal tergites in males possess a series of compressed tubercles.

FORFICULIDAE
OPISTHOCOSMIINAE

Kleter aterrimus (Bormans)

(Fig. 6-8)

1883. *Ancistrogaster aterrimus* Bormans, *Ann.Soc.ent.Belge.*, **27** : 83.
1911. *Kleter aterrimus.*, Burr. *Genera Ins.*: **122** : 90.

Material examined.- 1 ♂ labelled as : Araras-SP, 8.3.83, M.B.S. Campos, Arm Luminosa (genitalia mounted between two coverslips and pinned with the specimen).

Remarks.- The above specimen agrees with the original description and diagram (Bormans. 1983) of the species. However, following is the additional information :

General colour blackish borwn, on certain parts lighter : one ante-apical antennal segment yellow. Abdominal segments 6th to 8th with a convex ridge above laterally, on segment 5th ridge faintly marked.

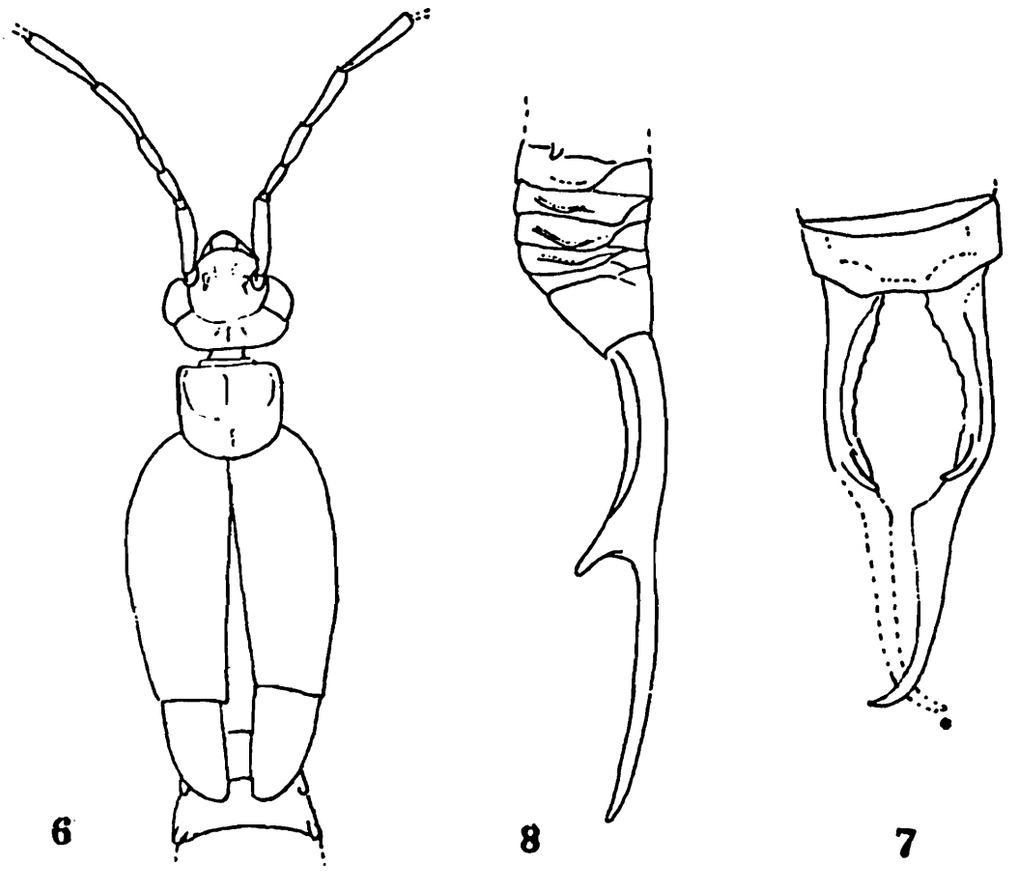
Distribution.- Peru, Ecudar and Brazil.

FORFICULINAE

Doru lineare (Eschscholtz)

1822. *Forficula lineare* Eschscholtz., *Entomographien*, Berlin, **1** : 81.

Material examined.- 1 ♀ labelled as : Dest, A. Alegre Colorado PR, 29.4.80, J.R. Araujo ; 1 ♀ US. Nova Amer., Assis-SP, 5.6.79, N. Macedo ; 2 ♂♂, US, Gurani



Figs. 6-8. *Kleter aterrimus* (Bormans), ♂, (6) Anterior portion of body ; (7) Ultimate tergite and forceps ; (8) Hind portion of abdomen and forceps, in profile.

Severina-SP, 3.6.82, J.S. Pinto ; 1♀, Araras, 3.1.83, J.S. Pinto, Coleta Manual ; 1♂ Araras-SP, 9.2.82, ,M.B.S. Campos Arm. Luminosa ; 1♂, 1♀, Araras-SP, 3.1 81 and 1.2.82, J. Borges, Arm. Luminosa ; 7 ♂♂, 8♀♀, Araras-SP, 5.11.82 - 3.1.84, J.B. Pinherio, Arm. Luminosa.

Distribution.- Brazil, Paraguay and Argentina.

Skalistes lozadai sp.n.
(Figs. 9-16)

o : General colour blackish brown ; antennae with basal segment, head, abdomen and forceps darker : hind legs yeliowish with femora in apical half brownish. Body covered with sparse pubescence.

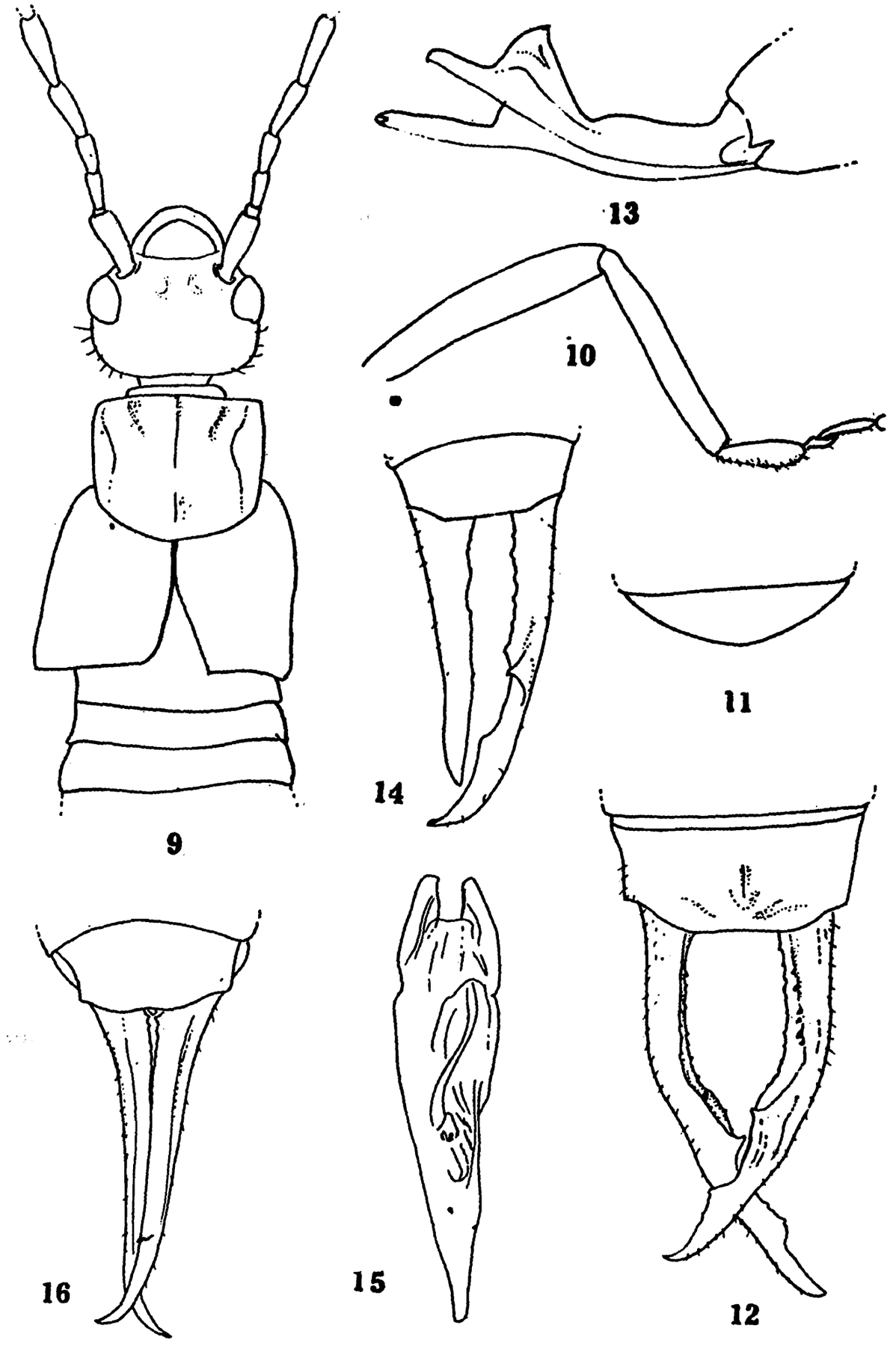
Head about as long as broad, smooth, sutwees, obsolete, hind margin feebly emarginate in middle. Antennae (in Holotype, right basal and on the left 9 segments remaining) with basal segment stout, expanded apically, slightly shorter than the distance between antennal bases ; 2nd short, about as long as broad ; 3rd long and cylindrical ; 4th slightly stouter and longer than preceding ; 5th onwards segments gradually increasing in lenght and thinning and each narrowed at base and expanded apically. Eyes prominent, shorter than post-ocular length. Pronotum transverse, smooth, a trifle narrowed posteriorly, anterior and lateral margin straight, latter gently reflexed ; prozona weakly raised and metazona depressed, median sulcus distinct. Elytra abbreviated, smooth, meeting along the middle line, hind margin truncate. Legs long and slender, hind tarsi with 1st segment compressed, longer than the 3rd and 2nd briefly lobed. Abdomen narrowed at base, gradually expanding posteriorly, weakly convex, impunctate, sides of segments rounded ; lateral folds on 3rd tergite weakly and on 4th well marked. Penultimate sternite transverse, broadly rounded posteriorly. Ultimate tergite transverse, gently sloping and narrowed backwards, impunctate, hind margin in midle between the branches of forceps straight and laterally concave and oblique ; a short median sulcus present. Forceps, (in Holotype ♂) stout, remote at base, narrowed gradually apically, almost straight and horizontal in basal half, afterward turned upwards and curved with apices hooked and crosing, internal margin in basal half showing dorsal and ventral borders with numerous small teeth, afterwards armed with a dorsal, vertical triagular tooth, followed by a blunt tooth, a little before apex and margin faintly serrated. Genitalia as in the fig. 15.

o : Agrees with males in most characters except that ultimate tergite more narrowed and forceps simple and straight.

Measurements.—(in mm)

	Holotype	Paratype	
	o	2 oo	2 oo
Length of body	10.1	7.3-9.6	7.5-8.8
Length of forceps	3.2	2.8-2.9	3.0-3.2

Material examined.- Holotype ♂ labelled as : Del Brando, Leme-SP, 27/07/88 L.B. Lozada : Paratype 1 ♂ labelled, same as the Holotype, P.R. Cancian ; Paratypes 1 ♂, 1 ♀ labelled, same as the Holotype, J.S. Pinto ; Paratype 1 ♀ : labelled same as the Holotype, 16/06/82, S.M. Nunes, Coleja Manuai.



Figs. 9-16. *Skalistes lozadai* sp.n., Holotype ♂, (9) Anterior portion of body ; (10) Hind leg ; (11) Penultimate sternite ; (12) Ultimate tergite and forceps ; (13) A portion of ultimate tergite and forceps, in profile ; paratypes ♂ ; (14) Ultimate tergite and forceps ; (15) Genitalia ; paratype ♀ ; (16) Ultimate tergite and forceps.

Remarks.- The paratype 1 ♂ possesses the forceps almost horizontal and the dorsal tooth is slightly weaker. In other paratypes 1♂ and 1♀, one branch of forceps does not show normal development.

The species comes close to *Skalistes vara* (Scudder, 1876) by the shape of elytra, impunctate abdominal terigtes and stout and undulate forceps but differs in having the pronotum transverse ; ultimate tergite lacking the postero-lateral projection ; pygidium short and posteriorly produced into a sharp tubercle and distinctive forceps with a dorsal trangular tooth at about middle.

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Bormans, A. 1883. Etude sur quelques Forficulaires noveaux ou peu connus, procedeed'un tableau synoptique des genres de cette famille - *Ann. Soc. Ent. Belg.*, **27**(2) : 50-90.

Rec. zool. surv. India, 90(1-4) : 155-159, 1992

SOME NEW AND KNOWN *EVIPHIS* FROM INDIA

S.K. BHATTACHARYYA
Zoological Survey of India, M Block, New Alipur, Calcutta 700 053, India

INTRODUCTION

Prior to this study five species of Eviphis under the family Eviphididae were known to occur in India. The present paper deals with two new species and new records for three species collected from different States and Union Territories of India.

The type series of the new species are in the repository of the Zoological Survey of India, Calcutta.

Family EVIPHIDIDAE Berlese

Eviphis sikkimensis sp. nov.
(Figs. 1-5)

Female : Dorsal shield 0.456-0.475 mm long, 0.313-0.323 mm wide, sclerotized, with 30 pairs of setae (Fig. 1).

Tritosternum with a pair of pilose laciniae. A pair of pre-sternal shields present. Sternal shield with anterior margin medially convex, posterior margin variable in shape, setae st. I and II simple, st. III spatulate (Fig. 2). Metasternal shield elongate, bearing a seta, not fused with corresponding endopodal shield. Genital shield truncate posteriorly, with a pair of setae. Anal shield almost as broad as long, post-anal seta somewhat spatulate. A pair of long metapodal plates present. Stigma lying between coxae III and IV, peritreme extending little beyond coxa I. Peritrematal shield strip-like and extending posteriorly beyond coxa IV Interscutal membrane bearing a pair of platelets situated adjacent to genital setae and 10 pairs of setae.

Tectum as in Fig. 3. Fixed and movable digits of chelicera (Fig. 4) bidentate and unidentate respectively.

Coxae II and III bearing a spatulate-like setae.

Male : Dorsal shield 0.415 mm long, 0.275 mm wide, chaetotactic pattern as in female.

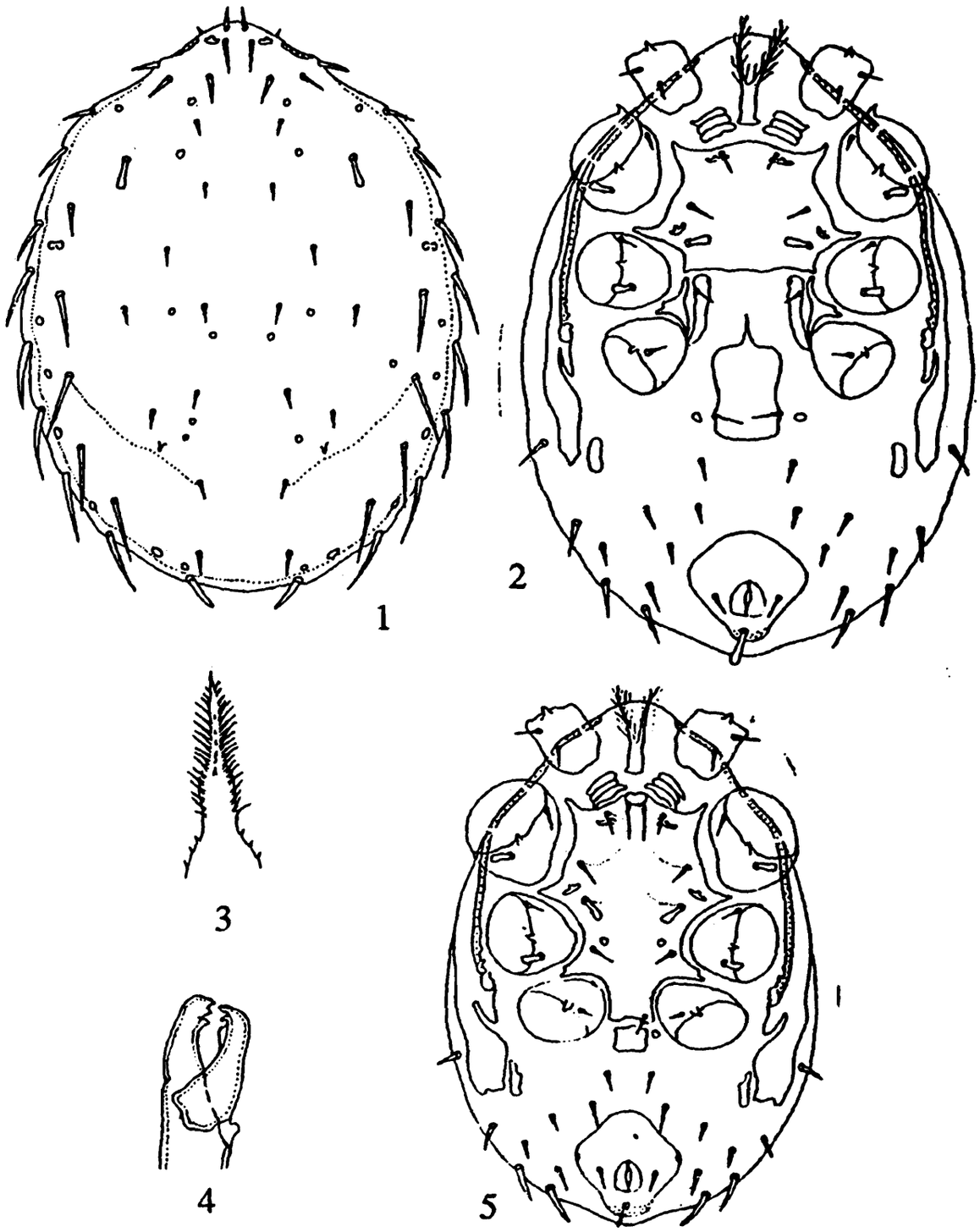
Tritosternum and presternal shield as in female. Sterniti-metasternal-genital shield bearing 9 setae (1 seta missing) of which st. III spatulate-like. A small rectangular shield situated behind sterniti-genital-metasternal shield. Anal shield somewhat longer than broad, postanal seta simple. A pair of metapodal plates

present. Placement of stigma, and peritreme as in female. Peritrematal shield much wider than that of female (Fig. 5). Interscutal membrane with 9 pairs of setae.

Tectum as in female. Chelicera of this unique specimen not examined.

Coxae II and III as in female.

Material examined : Holotype ♀ (Reg. No. 3745/17), allotype male (Reg. No. 3746/17). paratype female (Reg. No. 3747/17), from soil, Gangtok, Sikkim, 3.10.83, Dr. G.K. Srivastava.



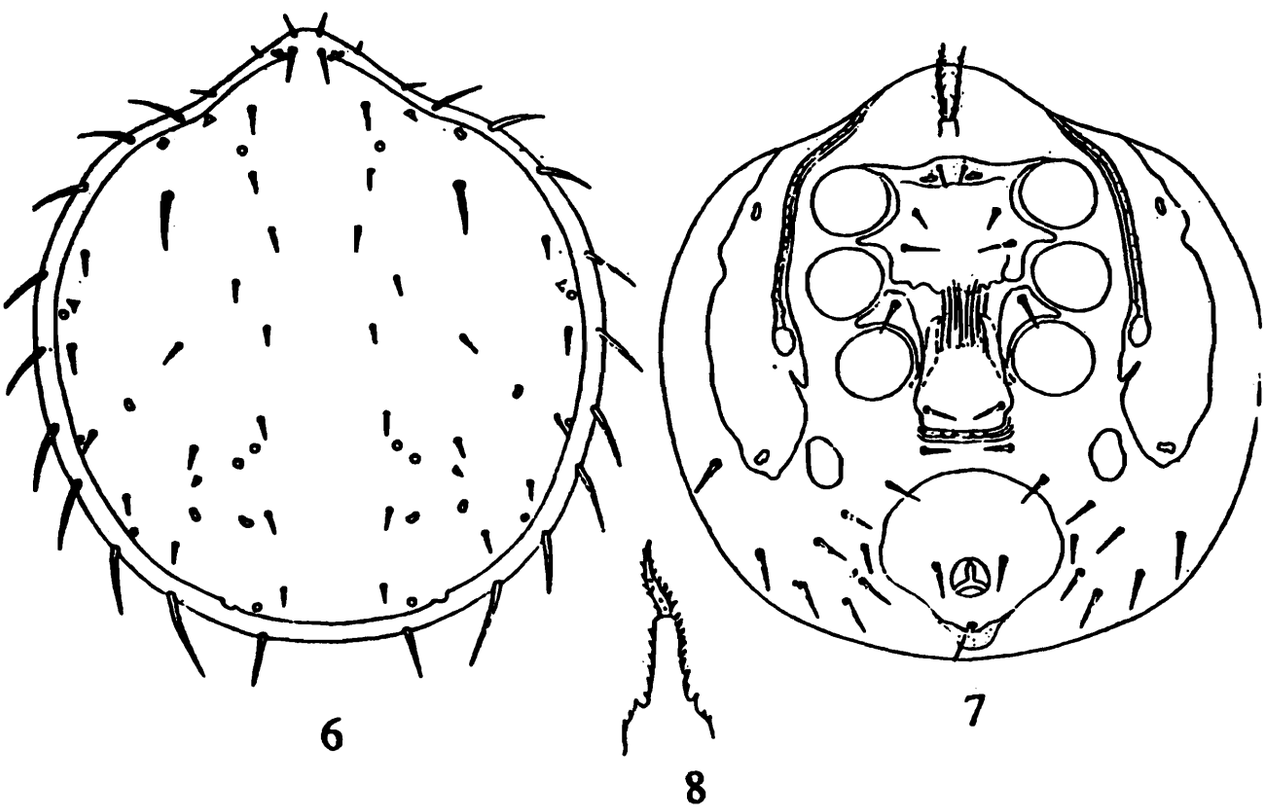
Figs. 1-5. *Eviphis sikkimensis* sp. nov. 1-4 (Male). 1. Dorsum, 2. Venter, 3. Tectum, 4. Chelicera. 5. (Female) Venter.

Remarks : This species differs from *E. cultratellus* (Berlese, 1910) by the presence of free metasternal shield, the setae st. III being spatulate where as metasternal and genital setae simple.

Eviphis parindicus sp. nov.
(Figs. 6-8)

Female : Dorsal shield 0.779 mm long, 0.674 mm wide, sclerotized, with 30 pairs of setae (Fig. 6).

Tritosternum with a pair of laciniae. Presternal shields not discernible. Sternal shield with anterior margin medially convex, posterior margin uneven, bearing 3 pairs of setae; metasternal shield fused with corresponding endopodal and carrying a seta. Epigynial shield truncate posteriorly, bearing a pair of setae. Anal shield as long as broad, with 3 anal setae. Setation of interscutal membrane as distributed in Fig. 7. A pair of large metapodal plates present. Stigma situated between coxae III and IV; peritreme extending beyond coxa I. Peritrematal shield strip-like and extending posteriorly well beyond coxa IV.



Figs. 6-8. *Eviphis parindicus* sp. nov. Female : 6. Dorsum, 7. Venter, 8. Tectum.

Tectum as in Fig. 8. Chelicera not examined.

Legs without any spur.

Male : Unknown.

Material examined : Holotype female, pine leaves litter, around Horticulture Department, East Delphine, Simla District, Himachal Pradesh, 9.11.78, Dr. S.K. Bhattacharyya (Reg. No. 3748/17).

Remarks : This species superficially resembles *E. indicus Bhattacharyya* 1971

but differs from it by the broader sternal, peritrematal and anal shields, larger metapodal plate and the shape of tectum.

Eviphis convergens Berlese, 1913

Material examined : One female, soil under grass, Batanagar, 24-Parganas, Dist. West Bengal, 30.7.64, Dr. S.K. Bhattacharyya (Reg. No. 2543/17). One female, soil under banana plant, Kovalum Beach, 14 km from Trivandrum, Trivandrum Dist. Kerala, 28. 1.76, Dr. T.D. Soota (Reg. No. 3006/17). One female, soil under grass, Radha Krishna Temple, Govt. Agriculture Farm, Camorta, Nancowry, Nicobar Dist., Andaman & Nicobar Islands, 18.1.75, Dr. S.K. Bhattacharyya (Reg. No. 3005/17).

Remarks : This species is first time recorded for Kerala State, Andaman & Nicobar Islands.

Eviphis cultratellus (Berlese, 1910)

Material examined : Three females, soil, Jeetlongbasti, Rangpo, Sikkim, 30.8.78, Dr. A.C. Mishra (Reg. No. 3402/17). Four females, four males, decaying dung, Bangbasti, Kalimpong, Darjeeling Dist., 24.8.78 Dr. A.C. Mishra (Reg. No. 3143/17). One female, cow dung, Loharband, Cachar Dist., Assam, 10.12.69, Dr. S.K. Bhattacharyya (Reg. No. 3035/17). Three females, one male, soil and moss litter, Edemon, Umpling, Nongthymmai, Shillong, United Khasi & Jaintia Hills Dist., Meghalaya, 1.12.69, Dr. S.K. Bhattacharyya (Reg. No. 3036/17). One female, cow dung, Edemon, Umpling, Nongthymmai, Shillong, United Khasi & Jaintia Hills District, Meghalaya, 1.12.69, Dr. S.K. Bhattacharyya (Reg. No. 3747/17). One male, cow dung, Gourangatalla. Telia Mora, Tripura, 15.12.69, Dr. S.K. Bhattacharyya (Reg. No. 3750/17). One female, pine leaf litter, Chitradurga, Chitradurga Dist., Karnataka, 18.12.80. Dr. S.K. Gupta (Reg. No. 3415/17). One female, associated with beetles, Madhumalai Wild Life Sanctuary, Nilgiri Dist., Tamil Nadu, 12.2.82, Dr. S.K. Bhattacharyya (Reg. No. 3751/17).

Remarks : This species is recorded for the first time from Sikkim, Assam Meghalaya, Tripura, Karnataka, Tamil Nadu.

Eviphis indicus Bhattacharyya, 1971

Material examined : One female, cow dung, Katrain, Kulu Dist., Himachal Pradesh, 21.11.78, Dr. S.K. Bhattacharyya (Reg. No. 3752/17). One male, pine leaf litter, St. Mary and St. Nicholus Church, Nainital, U.P., 10.4.71, Dr. S.K. Bhattacharyya (Reg. No. 2943/17). One female, pine leaf litter, Kilcut, Ranikhet, Almora Dist., U.P., 18.4.71, Dr. S.K. Bhattacharyya (Reg. No. 2944/17). One female, cow dung, Lohar Band, Cachar Dist., Assam, 10.12.69 , Dr. S.K. Bhattacharyya (Reg. No. 2941/17). Two females, cow dung, Madhurban, Silchar, Cachar Dist., Assam, 7.12.69, Dr. S.K. Bhattacharyya (Reg. No. 2946/17). One female, mule dung, Sonai Rupai Forest, Wild Life Sanctuary, Charduar Reserve Forest, Missamari, Assam, 2.12.65, Dr. S.K. Bhattacharyya (Reg. No. 2942/17). Three females, and four

males. cow dung, Moera Tetli, Tezpur Darang Dist., Assam, 31.12.65, Dr. S.K. Bhattacharyya (Reg. No. 2945/17). One female, mango leaf litter, Banamali, Karimganj, Assam, 9.12.69, Dr. S.K. Bhattacharyya (Reg. No. 1947/17). One female, one male, cow dung, Gourangatalla, Teliamora, Tripura, 15.12.69 , Dr. S.K. Bhattacharyya (Reg. No. 2949/17). Three females, two males, soil litter, Brindaban Garden, Karnataka, 1971, M.M. Paramanik (Reg. No. 2948/17). One female, soil under grass, Kalayani, Nadia Dist., W. Bengal, 20.9.68, Dr. S.K. Bhattacharyya (Reg. No. 2940/17). One female, leaf litter, near Aruvankadu Rail Station, Nilgiri Dist., Tamil Nadu, 8.2.82, Dr. S.K. Bhattacharyya (Reg. No. 3753/17). One female, soil litter, Madhumalai Wild Life Sanctuary, Nilgiri Dist., Tamil Nadu, 12.2.82, Dr. S.K. Bhattacharyya (Reg. No. 3754/17).

Remarks : This species is reported for the first time from Himachal Pradesh, Uttar Pradesh, Assam, Tripura, Karnataka, Tamil Nadu.

SUMMARY

Two new species of *Eviphis sikkimensis* and *E. parindicus* from Sikkim and Himachal Pradesh are described respectively and new records for three species are reported.

ACKNOWLEDGEMENT

I wish to thank Professor M.S. Jairajpuri, Director, Zoological Survey of India for the facilities.

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Rec. zool. surv. India, 90(1-4) : 161-189, 1992

GOBIOIDS OF ENNORE ESTUARY AND ITS VICINITY *.

K. REMA DEVI

Zoological Survey of India, Southern Regional station, Madras-600 028

INTRODUCTION

The reason for taking up the present study is the lack of a comprehensive and illustrated systematic account of the available gobioid fishes of Ennore estuary. From 1975 to 1978 regular fortnightly collections of gobioids were carried out in the Ennore estuary, about 28 km. north of Madras, on the east coast of India. Most of the gobioids were collected by operating a special type of fishing net locally known as 'konda 'valai which is primarily used for prawn fishing in the estuary. Collections were made from the estuary and its adjoining areas viz. South Buckingham canal Koratalayar river, Zamendar canal, North Buckingham canal and a creek near the sea mouth.

Since the monumental work by Day (1878, 1889), Koumans (1941, 1953) as a result of his extensive studies on the gobioid fishes of India, compiled the bulk of information on these fishes. He divided the gobioid fishes into 3 families (Gobidae, Tacniodidae and Eleotridae), seven subfamilies and 57 genera comprising 125 species. Of these 32 species have been described from the Madras coast and 16 species from Ennore estuary. Venkateswarlu et al. (1975) listed the fishes of Madras and its environs and has included 35 species under Gobiidae, 4 spp. under Periophthalmidae and 5 spp. under Taenioididae ; Venkateswarlu and Rama Rao (1976) recorded *Eleotriodes wardii* Playfair from the Central Indian Ocean ; Rama Rao and Venkateswarlu (1977) discussed the distributional range of *Waitea buchanani* Visweswara Rao in Indian waters ; Talwar (1985) critically studied the major estuarine systems in India and under Gobioidea he reported 9 spp. as belonging to the family Eleotridae, 63 species under Gobiidae, 6 species under Gobioididae and 4 species under Trypauchenidae.

The present collection made from Ennore estuary and its vicinity, is a valuable addition to our knowledge of the gobioid fauna. It contains 25 species, comprising 14 genera of which four species, viz. *Acentrogobius cyanomos* (Bleeker), *Boleophthalmus sculptus* Gunther, *Trypauchen vagina* (Bloch & Schneider), *Pseudapocryptes lanceolatus* (Bloch & Schneider) are recorded for the first time. *Acentrogobius ennorensis* Menon and Remae Devi and *Oxyurichthys nijsseni* Menon

* Formed part of the Ph.D. thesis submitted to the Madras University.

and Govindan are two new species recently discovered in the Ennore estuary and are re-described here, and key to the 40 species so far reported from Madras Coast is provided. A detailed list of the gobioid fauna of Ennore is given. For the systematic account the details of the number of specimens, the size range, the date of collection and the geographical distribution and affinites, if distinct from other forms are given.

Counts and measurements were taken from the left side and follow methods given by Hubbs amd Lagler (1958). Measurements were made with fine pointed dividers and recorded to the nearest one tenth of a millimetre. The morphometric characters which are considered important were studied. In most gobiids the last ray of the second dorsal and anal fins is branched at the base and is counted as a single element.

Cephalic sensory and cutaneous papillae system :

On the head of most gobioids is a series of sensory channels covered by transparent tissues with pores which open externally. Differences in the occurrence of these pores within approximate positions connote their systematic importance among genera and species and need to be carefully evaluated (Lachner and Mckinney 1974). The arrangement of the cephalic pit organs is sometimes an important character in distinguishing gobioids. On the basis of this character Prince Akihito and Meguro (1975) described a new species of *Glossogobius* and compared it with other related species. Due to difficulties arising in identifying gobies with free upper pectoral fin rays, the arrangement of the cephalic sensory pore system and cutaneous papillae system were found very useful in separating the species (Winterbottom, 1976). Subsequently several gobioid workers have sought the aid of these characters in addition to the morphometric and meristic characters in separating gobioid species.

In the present study the general arrangement of the papillae and cephalic pores of the 25 species of Ennore estuary is illustrated in Figures 1-4. It is found to vary in the different sub-families and genera and in different species of the same genus. Within species the cutaneous papillae occur predominantly in horizontal or vertical rows. These papillae are small, circular structures, the height usually about equal to or shorter than the basal diameter. The system has been referred to as the cutaneous papillae system, exposed neuromast organs, or pit organs, and particular rows or lines have been variously numbered or named. Since it is impossible to determine specific rows among different genera, in this study only the general pattern of distribution in the various genera has been described. The different mucous canal patterns in gobioids of Ennore estuary are illustrated.

KEY TO THE GOBIOID FAUNA OF ENNORE ESTUARY AND MADRAS COAST
(Classification as in Koumans, 1953)

KEY TO THE FAMILIES AND SUBFAMILIES OF GOBIOIDEA

1.	Ventral fins united	2
–	Ventral fins separate	Eleatridae
2.	Two dorsal fins	Gobiidae 3
–	One dorsal fin	Taenioididae 6
3.	Teeth in lower jaw in several rows	Gobiinae
–	Teeth in lower jaw in one row	4
4.	Second dorsal fin elongate, teeth in lower jaw subhorizontal	Apocrypteinae
–	Second dorsal fin not elongate.	5
5.	Eye prominent, free lower eye lid developed, base of ventral fin muscular	Periopthalminae
–	Eye not prominent, free eyelid wanting	Sicydiaphinae
6.	A pit in upper margin of opercle opening to a cavity separate from gill cavity	Trypaucheninae
–	No pit in upper margin of opercle	Taenioininae

KEY TO THE SPECIES OF THE SUBFAMILY GOBIINAE

1.	Caudal fin long, pointed or lanceolate, longer than head	2
–	Caudal fin short, obtuse, rounded or oblong, shorter than head	16
2.	Some fleshy palps on inner edge of shoulder girdle (Head and nape naked in median line)	*Stenogobius malabaricus* (Day)
–	No fleshy palps on inner edge of shoulder girdle	3
3.	Barbels on head	4
–	No barbels on head	5
4.	Barbels only along lower jaw; upper caudal base with a large oblong ocellus	*Parachaeturichthys polynema* (Blkr.)
–	Barbels along ramus of lower jaw and on cheek ; caudal obliquely pointed	*Obliquogobius comates* (Alcock)
5.	Teeth in upper jaw in one row	6
–	Teeth in upper jaw in several rows	7
6.	A tentacle on the upper margin of eye	*Oxyurichthys tentacularis* (C&V.)
–	No tentacle on upper margin of eye	*O. microlepis* (Blk
7.	Head scaled above behind eyes	8
–	Head naked above behind eyes	14
8.	40-42 scales in L. 1	*Acentrogobius griseus* (Day)
–	Less than 40 scales in L.1	9

9. About 30 predorsal scales — *Acentrogobius viridipunctatus* (C.&V.)
— Less than 30 predorsal scales — 10
10. More than 17 predorsal scales ; 5-8 narrow vertical black lines on body in females — *Acentrogobius madraspatenis* (Day)
— Less than 17 predorsal scales — 11
11. More than 14 predorsal scales ; D.2.1/10 ; A. 1/8-9; L.1.30 — *Acentrogobius cyanomos* (Blkr.)
— Less than 14 predorsal scales — 12
12. More than 9 predorsal scales — 13
— Less than 9 predorsal scales 4-5 vertical bands on sides of body; second dorsal and caudal with a white stripe — *Acentrogobius globiceps* (Hora)
13. Head somewhat depressed ; D.2.1/8 ; A. 1/8 — *Favonigobius reichei* (Blkr.)
— Head somewhat compressed ; D.2.1/9; A.1/9 — *Acentrogobius ennorensis* Menon & Rema Devi
14. 85 or more scales in L.1. ; D.2. & A. with more than 14 rays — *Cryptocentrus gymnocephalus* (Blkr.)
— Less than 85 scales in L.1. D.2. & A. with less than 14 rays — 15
15. L.1. scales about 27-30; L.tr. 7-8; D.2.1/10-11; A.1/10-11 — *Oligolepis acutipennis* (C&V.)
— L.1. scales 25; L.tr. 5; D.2.1/9 ; A.1/9 — *Oligolepis cylindriceps* (Hora)
16. Maxillary prolonged posteriorly (No barbels on head; upper rays of pectoral silk like) — *Paragobiopsis ostreicola* (Chaudhuri)
— Maxillary not prolonged posteriorly — 17
17. Tongue emarginate to bilobate — 18
— Tongue rounded to truncate (opercle with large etenoid scales) — *Brachygobius nunus* (Ham.)
18. Some fleshy palps in inner edge of shoulder girdle — *Awaous stamineus* (Val.)
— No fleshy palps — 19
19. Gill openings continued forward below, isthmus narrow — 20
— Gill openings not continued forward below; isthmus broad — 21
20. Gill membrane free and united across isthmus; 7-8 scales in L.tr. — *Glossogobius biocellatus* (C.&V.)
— Gill membrane connected to isthmus : 9-14 scales in L.tr. — *Glossogobius giuris* (Ham.)
21. Nape scaled, anterior scale of nape enlarged — *Stigmatogobius javanicus* (Blkr.)
— Nape naked — *Yongeichthys criniger* (C.&V.)

KEY TO THE SPECIES OF THE SUBFAMILY APOCRYPTEINAE

1. Free lower eye lid present — 2
— Free lower eye lid absent — 3

2. Dorsal fin with blue spots *Boleophthalmus boddarti* (Pallas)
— Dorsal fin without blue spots *Boleophthalmus sculptus* (Gunther)
3. Scales minute, more than 200 . *Pseudapocryptes lanceolatus* (Bloch & Schneider)
— Scales moderate, less than 150 in longitudinal line . . 4
4. Teeth in lower jaw pointed 5
— Teeth in lower jaw truncate, obtuse or bilobate 6
5. Height of body 7-9 in T.1., D.2.1/26 . . . . . *Parapocryptes serperaster* (Richardson)
— Height of body 11-14 in T.1; D.2.1/23-26; L.1. 75; maxillary extends to beyond eye . . . . *Parapocryptes rictuosus* (C&V.)
6. About 100 Scales in L.1; D.2.1/20 *Apocryptes bato* (Ham.)
— Less than 100 Scales in L.1; D.2.1/24-26 . . . *Apocryptichthys cantoris* (Day)

KEY TO THE SPECIES OF THE SUBFAMILY TAENIOININAE

1. Barbels on head; canines in both jaws 2
— No barbels on head, no canines; scales only on caudal part of body; D. VI. 32; A.1/33 . . *Brachyamblyopus urolepis* (Blkr.)
2. Height of body 13-15 in S.L.; on each side in upper jaw about 7 canines *Taenioides anguillaris* (Linne)
— Height of body less than 13 in S.L; on each side in upper jaw 4-5 canines; dorsal, anal and caudal black *Taenioides buchannani* (Day)

KEY TO THE SPECIES OF THE SUBFAMILY TRYPAUCHENINAE

1. Ventrals completely united forming a funnel shaped disc.; Height 9-10 in S.L. . . *Trypauchen vagina* (Bloch & Schneider)
— Ventrals united but emarginate at base; height 8 in S.L. . . . . *Ctenotrypauchen microcephalus* (Blkr.)

KEY TO THE SPECIES OF THE SUBFAMILY PERIOPHTHALMINAE AND SCICYDIAPHINAE

1. Eye prominent, free lower eye lid developed *(PERIOPHTHALMINAE)* 2
— Eye not prominent, free eye lid wanting; ventral fins not united to belly *Gobiopterus chuno* (Ham.)
2. Ventral fins totally united, basal membrane well developed . . *Periophthalmus chrysospilos* Blkr.
— Two halves of ventrals united by a narrow membrane; L.1. 60-70 *Periophthalmus variabilis* Eggert

KEY TO THE SPECIES OF THE FAMILY ELEOTRIDAE

1. A single downwards curved spine at angle of preopercle (Head scaled between the eyes, on cheek and opercle; L.1. 60-65; Ll.tr. 16-19).
Eleotris fusca (Bloch & Schneider)

— Preopercle without spines 2

2. Bony crests on head in interorbital space; head short, obtuse, jaws subequal
Prionobutis koilomatodon (Blkr.)

— No bony crests on head; scales small, more than 70 in L.1.; head naked
Eleotriodes wardii Playfair

DESCRIPTIONS OF THE GOBIES OF ENNORE ESTUARY

Family GOBIIDAE
Subfamily GOBIINAE
Genus **Acentrogobius** Bleeker

1874. *Acentrogobius* Bleeker, *Arch. neerl. Sc. ex. nat.* IX P. 321.

1. **Acentrogobius cyanomos** (Bleeker)
(Plate I, Figure 1)

1849. *Gobius cyanomos* Bleeker, Verth. Bat. Gen. XIII, P.25.
1953. *Acentrogobius cyanomos*, Koumans, *The Fishes of the Indo-Australian Archipelago, X, P. 64.*

Material : 1 ex., 49.0 mm. S.L., 8th June 1976 and 1 ex., 56.0 mm. S.L., 30th June 1976.

Description : D.1.VI ; D.2.1/10 ; A.1/9 ; P.17 ; L.1. about 25 ; L.tr.9 ; predorsal scales 16.

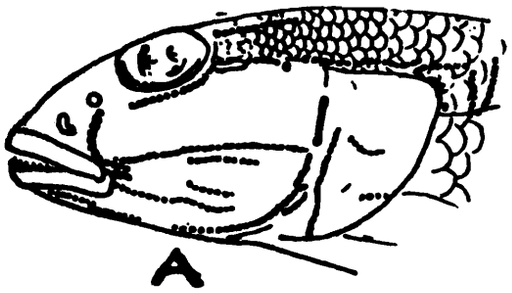
Body elongate, somewhat compressed ; height 4.30 in S.L. ; 5.38 in T.L. ; head compressed, obtuse, 3.70 in S.L., 4.60 in T.L. ; eye 4.43 in head ; interorbital 1.75 in eye diameter ; eye 1.30 in snout, snout being longer than eye ; anterior nostril a short tube ; jaws subequal ; mouth oblique ; maxilla extends to anterior margin of eye ; lips thickened ; teeth in both jaws with outer row enlarged, 2 canines on either side ; two rows of mucous canals on cheeks (Fig. 1.A) ; supraopercular groove with an open pore behind eye ; head scaled above behind the eyes, rest of head naked ; base of pectoral with two rows of large scales ; first and second dorsal fins and anal fin lower than body, pointed posteriorly; pectoral obtuse, longer than head without snout ; ventral rounded, a little shorter than pectoral ; caudal a little shorter than head.

Colour : Four dusky blotches on sides of body ; dusky blotch between the upper base of pectoral fin and opercle ; dusky blotch at the upper base of caudal fin.

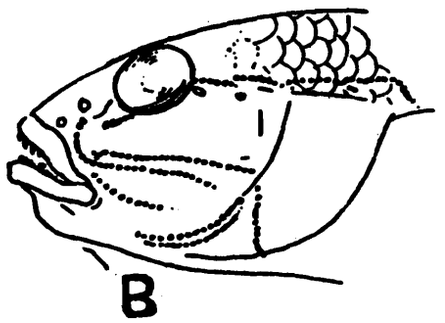
Affinities : These specimens have certain characters which are intermediate between that of *Acentrogobius cyanomos* (Bleeker) and *A. caninus* (C. & V.). The body colour resembles that of *A. caninus* (C. & V.) especially in the presence of a blotch at the caudal base but it deviates from it in the absence of scales on the upper part of the opercle.

Distribution : India, Thailand, Indo-Australian Archipelago.

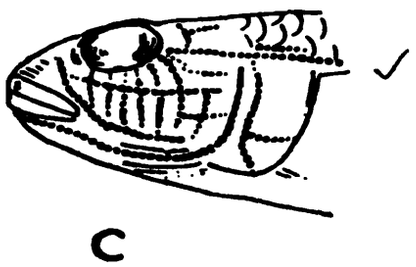
Acentrogobius cyanomos (Blkr.)



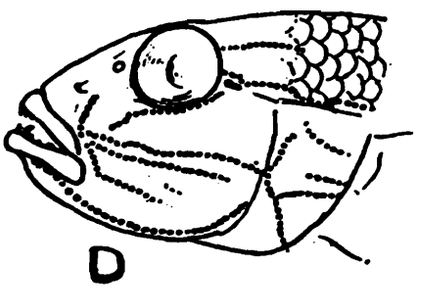
A. ennorensis Menon & Rema Devi



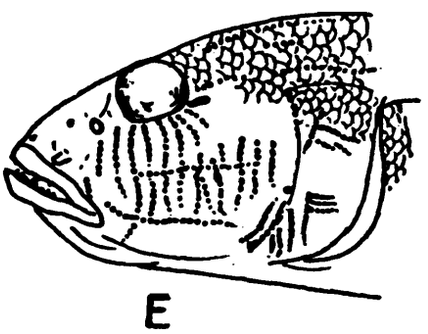
A. globiceps (Hora)



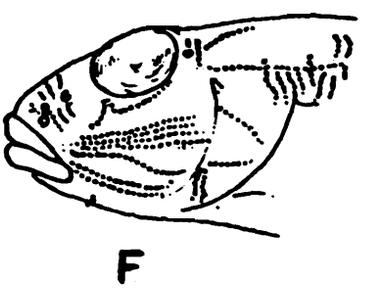
A. madraspatensis (Day)



A. viridipunctatus (C. & V.)



Yongeichthys criniger (C. & V.)



F *Favonigobius reichei* (Blkr.)

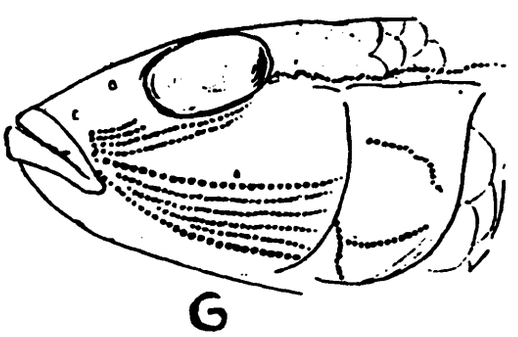


FIG-1

2. Acentrogabius ennorensis Menon and Rema Devi
(Plate I, Figure 2)

1980. *Acentrogobius ennorensis* Menon and Rema Devi, *Matsys*, 6 : 57 (Type locality : Ennore estuary)

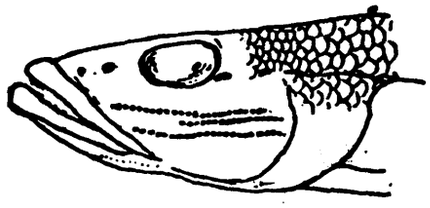
Material : Eight specimens including the holotype 39.0 mm. to 58.0 mm., 30th May 1978, Reg. No. F.555.

series being larger, in lower jaw outer row extends to half way, 2 canines on either side ; tongue rounded ; in first dorsal fin, 2nd, 3rd and 4th spines elongate, 3rd longest. Pectoral slightly longer than pelvic ; pelvic fin does not reach vent ; large ctenoid scales becoming smaller and cycloid on nape, cycloid on pectoral base and pre-pelvic ; pectoral base with 3 to 4 rows of sclaes ; cheek and opercle naked ; head scaled above from a little behind eyes.

Description : D.1.VI ; D.2.1/9 ; L.1.28 ; L.tr. 10-11 ; predorsal scales 8-11.

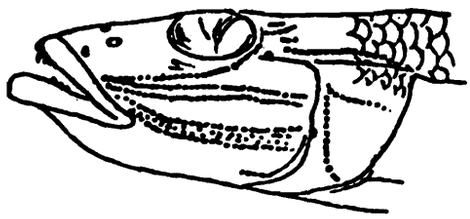
Body depth 4.18 (3.72-4.69), head 3.7 (3.46-3.9) ; pectoral 3.91 (3.59-4.50) and pelvic 4.49 (4.30-4.9) in S.L. ; eye 3.73 (3.50-4.0) in head, snout 1.11 (1.00-1.66), interorbital 2.71 (2.28-3.20) in eye ; head and body compressed ; a row of papillae

Glossogobius biocellatus (C. & V.)



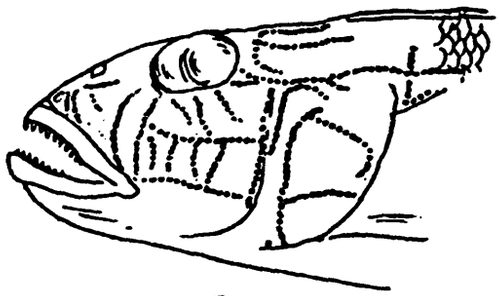
A

Glossogobius giuris (Hamilton)



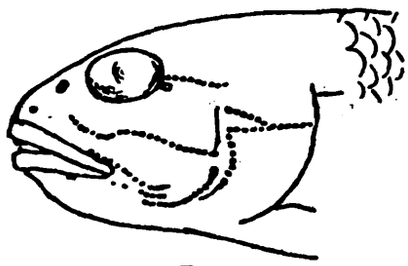
B

Oxyurichthys microlepis (Blkr.)



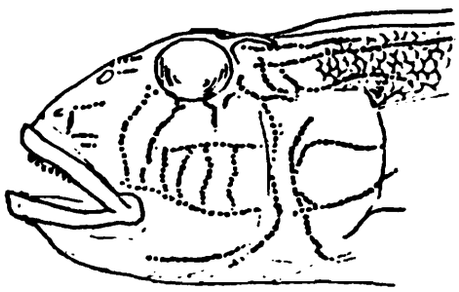
C

Oligolepis acutipennis (C. & V.)



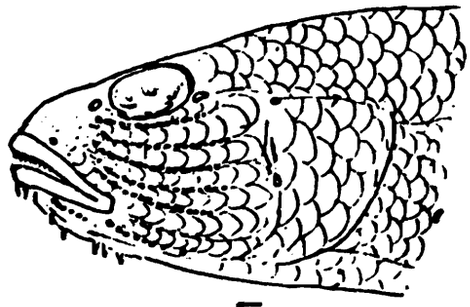
D

Oxyurichthys tentacularis (C. & V.)



E

Parachaeturichthys polynema (Blkr.)



F

FIG-2

below eye and two rows across middle of cheek (Fig. 1.B.) ; front nostril a short tube above and near the lip, hinder a pore before eye ; interorbital medially with an open pore ; another small pore is present behind this, an open pore behind eye at the beginning of the supra opercular groove, another pore a little behind this and one in the posterior margin of preopercle ; gill opening extends upto pectoral base ; mouth moderate ; maxilla extends to front of eye ; teeth in bands, outer series being larger, in lower jaw outer row extends to half way, 2 canines on either side ; tongue rounder ; in first dorsal fin, 2nd, 3rd and 4th spines elongate, 3rd longest. Pectoral slightly longer than pelvic ; pelvic fin does not reach vent ; large ctenoid scales becoming smaller and cycloid on nape, cycloid on pectiral base and pre-pelvic ; pectoral base with 3 to 4 rows of sclaes ; cheek and opercle naked ; head scaled above from a little behind eyes.

Colouration : 5 large blackish spots on the sides of body and irregular, ill-defined dots on the upper part of the body, lower half of the body without any blotches or dots ; first dorsal with a dark band towards the base of the fin becoming broader posteriorly ; second dorsal fin and caudal with 2 to 3 rows of dots ; pelvics black ; oblique bar on opercle, cheek and below eye ; the bars on opercle and below eye being prominent.

Distribution : Ennore estuary, Madras, Tamil Nadu, India.

Affinities : *A. ennorensis* has affinities with *A. audax* found in East Africa. It can however, be easily distinguished by its smaller pectoral and pelvic fins ; in *A. audax* pelvic extend to vent while in *A. ennorensis* it does not extend to vent. Also in *A. Audax* the gill opening extends forward almost below the pre-opercular margin whereas in *A. ennorensis* it extends only upto the pectoral base.

3. **Acentrogobius globiceps** (Hora)
(Plate I, Figure 3)

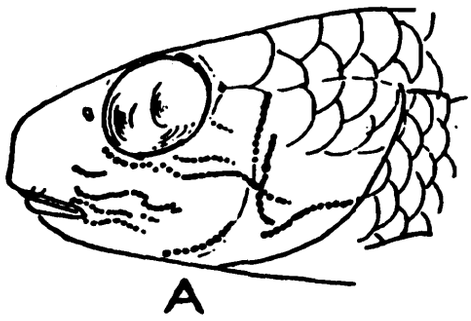
1923. *Stenogobius globiceps* Hora, *Mem. Ind. Mus.* V, P. 744, pp. 24, 25.
1941. *Acentrogobius globiceps*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, pp. 7576.

Material : 19 exs., 21.0 mm.-26.0 mm., 27th October 1977 ; 5 exs., 23.0 mm.-25.0 mm., 30th November 1977 ; 61 exs., 20.0 mm.-28.0 mm., 8th December 1977 and 3 exs., 24.0 mm.-28.0 mm., 26th April 1978.

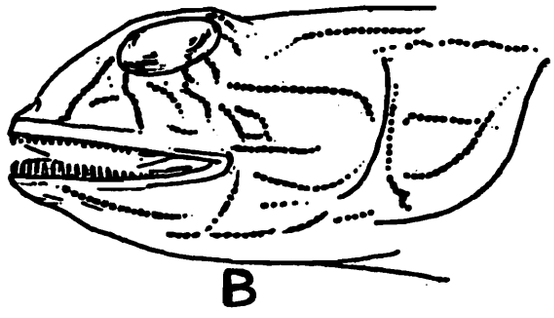
Description : D.1.VI ; D.2.1/10 ; A.1/9 ; P. 16-17 ; L.1.26-27 ; L.tr. 6 ; Predorsal scales 7-8.

A small-sized species, body a little compressed, height 4.90 (4.74-5.31) in S.L., 6.64 (6.31-7.19) in T.L. ; head cylindrical, 3.48 (3.31-3.68) in S.L., 4.72 (4.42-4.88) in T.L. ; eye 3.34 (3.0-3.72) in head ; interorbital 4.82 (3.54-5.86) in eye diameter ; snout short, rounded, less than eye diameter, 0.81 (0.72-0.93) in eye diameter, tip before lower margin of eye ; maxillary extends to anterior one fourth of the pupil ; teeth in several rows, outer enlarged, distant ; in lower jaw outer row extends to halfway of the jaw ; tongue emarginate ; two longitudinal rows of mucous canals on cheek, the lower extending from before eye to opercle, traversed by about 7 vertical rows (Fig. 1.c.) ; three short mucous cnanls extend from eye behind, a long canal extends from tip of mandible to the upper part of the opercle, another cnanal runs parallel to this on the opercle ; sensory pores paired in interorbital and a row of three pores in the supraopercular groove and three along the posterior margin of opercle ; first dorsal fin lower than body, second along the

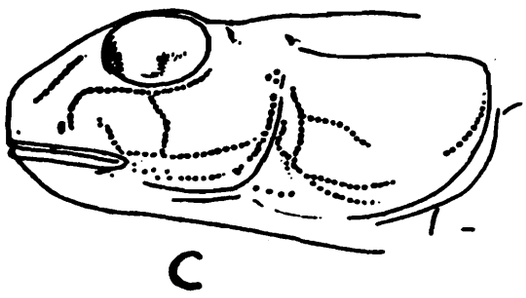
Stigmatogobius javanicus (Blkr.)



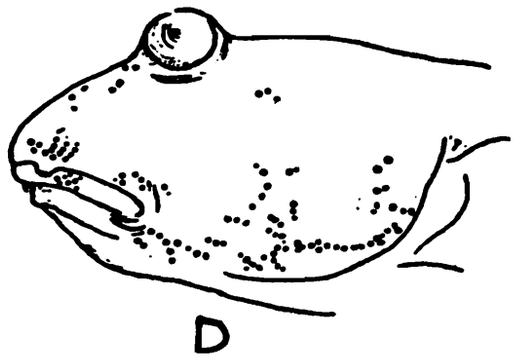
Parapocryptes rictuosus (C. & V.)



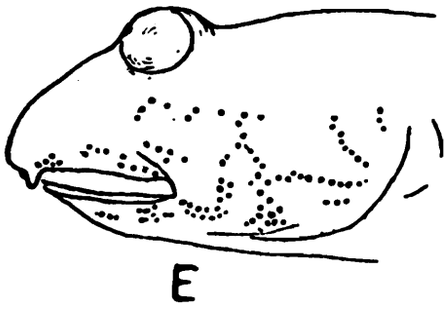
Pseudopocryptes lanceolatus (Bl. & Sch.)



Boleopthalmus boddarti (Pallas)



Boleopthalmus sculptus Günther



Periopthalmus variablis Eggert

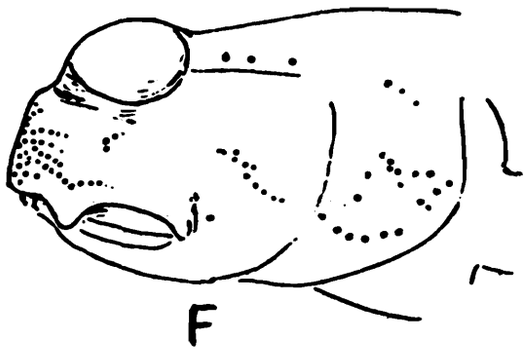


FIG-3

ray the longest, second dorsal and anal fins posteriorly higher than body ; caudal fin pointed 1.24 (1.10-1.43) in head length ; scales on body large, ctenoid in the posterior half, predorsal scaled to tip, a small portion behind eye scaleless, pelvic base scaled upto and between the branchiostegals.

Colouration : Body on sides with four vertical bands, three below the second dorsal and the fourth at the base of the caudal, body with spots above the lateral line, a streak from eye to the snout and another streak behind eye, second dorsal with a white band in the upper half which is found to continue obliquely from the upper half of caudal down to its tip, pelvic dark in some, anal edge darkened sometimes a white edge below the dark band.

Distribution : From the east coast of India to Java, Indonesia ; Singapore and Borneo..

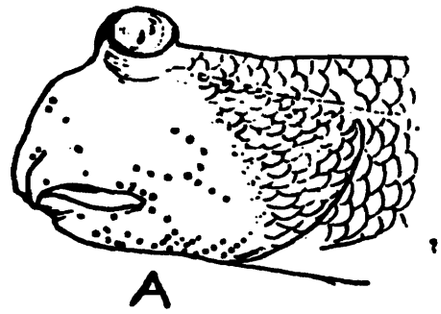
4. **Acentrogobius madraspatensis** (Day)
(Plate I, Figure 4)

1868. *Gobius madraspatensis* Day, *proc. Zool. Soc. London*, p. 152.
1941 *acentrogobius madraspatensis*, Koumans, *Mem. Indian Mus.* XIII, p. 229.

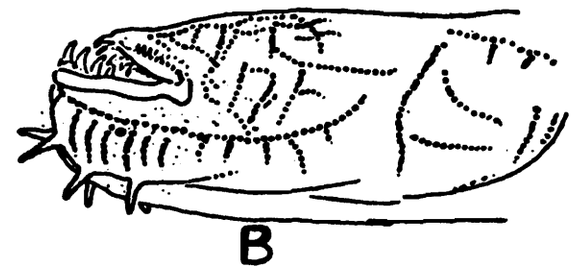
Material : 6 exs., 38.0 mm.—50.0 mm., 23rd December 1976.

Description : D.1.VI ; D.2.1/9 ; A. 1/9 ; P. 16-17 ; L.I. 27-28 ; L. tr. 7-8 ; Predorsal scales 10-11. Body elongate, compressed, height 3.85 (3.57-4.0) in S.L., 5.16 (4.7-5.43) in T.L. ; head compressed, profile convex, 3.48 (3.43-3.50) in S.L., 4.67 (4.6-4.75) in T.L. : 363 4.0 (3.92-4.08) in head ; interorbital 1.88 (1.50-2.0) in eye diameter ; snout obtuse, as long as eye, tip before lower margin of eye, 3.56 (3.43-

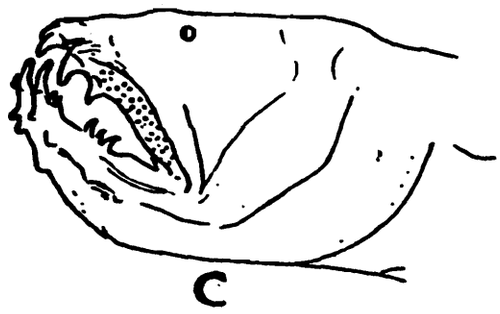
Periopthalmus chrysospilus (Blkr.)



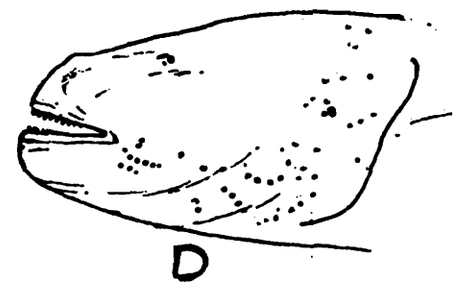
Taenioides anguillaris (Linn.)



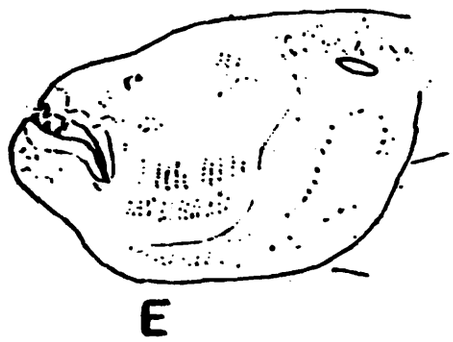
Taenioides buchannani (Day)



Brachyamblyopus urolepis (Blkr.)



Trypauchen vagina (Bl. & Sch.)



Ctenotrypauchen microcephalus (Blkr.)

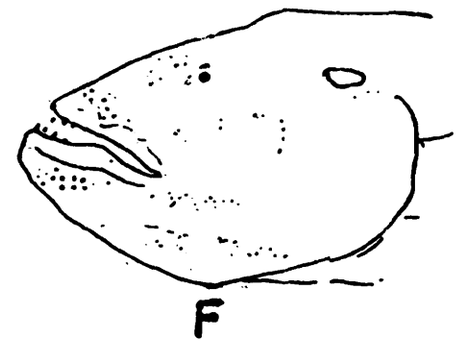


FIG - 4

3.69) in head length ; anterior nostril in a short tube ; mouth oblique, lower jaw prominent ; maxillary extends to below anterior margin of eye ; teeth in several rows, in upper jaw outer row enlarged ; in lower jaw outer row extends to half way the jaw, last tooth a recurved canine ; tongue rounded ; two longitudinal mucous canals over cheek (Fig. 1.D.), another row below eye and on the supraopercular groove ; scales of body ectenoid, of nape and breast cycloid ; head scaled above from behind the eyes ; cheek and opercle naked ; first dorsal fin a little lower than body, middle rays are the longest ; predorsal distance twice in post-dorsal distance ; height of caudal peduncle 1.25 in length of caudal peduncle ; pectoral slightly lower than ventral and longer than head without snout.

Colouration : Body with irregular, ill defined brownish blotches which extend as bands on either side ; about 6 dark and 3 faint black lines from side to abdomen extending from base of ventral and middle of anal in the females, this colouration is absent in the meles. On the other hand ventrals are tipped with black in the males which in the females are of a uniform brown shade ; first dorsal with a dark broad band in middle of the fin, base and tip colourless, another band is seen above this ; second dorsal in males with a dark blotch extending between 2nd and 3rd rays at the base ; D.2 and caudal minutely dotted in rows.

Distribution : Madras, Ennore backwaters.

5. **Acentrogobius viridipunctatus** (Cuv. & Val.)
(Plate I, Figure 5)

1837. *Gobius viridipunctatus* Cuvier & Valenciennes, *Hist. Nat. Poiss.* XII, p. 62.
1953. *Acentrogobius viridipunctatus*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 56.

Material : 3 exs., 81.0 mm., - 99.0 mm. S.L., 12th March 1976 and 1 ex., 80.0 mm. S.L., 30th November 1977.

Description : D.VI; D. .1/10; A. 1/9; P. 18-20; C. 13-15; L.I. 34-40; L. tr. 11; Predorsal scales 33-46.

Body elongate, posteriorly compressed, height 4.36 (4.17 - 4.76) in S.L., 5.82 (5.42-6.35) in T.L. ; head a little compressed, 3.30 (3.24-3.41) in S.L., 4.41 (4.4-4.65) in T.L. ; eye 5.39 (4.9 - 5.9) in head ; interorbital 1.18 (1.1 - 1.33) in eye ; snout 3.45 (3.26 - 3.62) in head length, longer than eye, tip before or below lower margin of eye ; nostrils tubular ; mouth oblique ; lower jaw prominent ; maxillary extends to anterior border of eye ; teeth in many rows, outer row enlarged, in lower jaw on each side 3 canines ; mucous canal (Fig. 1.E) from nostril to edge of mouth, longitudinal canal over cheek, crossed by transversal ones radiating under eye and many vertical short canals ; an open pore medially in interorbital ; open pores in supraopercular groove ; head scaled above behind eye and on upper part of pre-opercle and opercle with cycloid scales ; scales of nape, breast and belly cycloid, other scales ctenoid ; first dorsal fin much lower than body, middle rays are the longest ; second dorsal fin and anal fin pointed posteriorly, a little higher than first dorsal ; in male, rays of the second dorsal fins and anal fin reach the caudal ; ventral slightly shorter than pectoral ; caudal shorter than head in female.

Colouration : Body laterally spotted with dark spots in females from behind pectoral to caudal pecuncle, a longitudinal row of large dark spots in both

sexes ; scales with shiny spots ; base of first and second dorsal with blackish longitudinal stripes ; second dorsal with another longitudinal stripe ; base of anal blackish ; caudal with spots ; ventral darker in males.

Distribution : Zanzibar ; India, Andamans ; Philippines ; China ; Indo-Australian Archipalago.

6. **Favonigobius reichei** (Bleeker)
(Plate I, Figure 6)

1853. *Gobius reichei* Bleeker, *Nat. trjds. Ind.* v. p. 509.
1953. *Acentrogobius reichei*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 77.
1979. *Favonigobius reichei*, Hoese & Winterbottom, *Life Sciences Occasional papers*, 31, p. 13.

Material : 20 exs. 16.0 mm. - 55.0 mm. S.L. 20th December 1975.

Description : D.1.VI ; D.2.1/8 ; A.1/8 ; P. 16 ; L.I.27-29 ; L.tr. 7-8 ; Predorsal scales 12.

Body elongate, somewhat compressed, height 5.07 (4.71 - 5.63) in S.L., 6.49 (6.1 - 7.0) in T.L. ; head a little depressed, 3.49(3.3 - 3.77) in S.L., 4.61(4.3 - 5.0) in T.L. ; profile a little convex ; eye 4.12 (3.6 - 4.83) in head ; interorbital 2.07 (1.5 - 2.75) in eye diameter ; snout obtuse, 3.53 (3.25 - 4.0) in head, tip before middle of eye, anterior nostril in a rim ; mouth oblique, lower jaw prominent, maxillary extends to below anterior part of eye ; teeth in several rows, outer row enlarged, in lower jaw on each side a canine, below eye an oblique narrow band of mucous canals running to maxillary (Fig. 1.G.), a broad band bordered by two stronger developed canals runs engitudinally over cheek, 3 rows of longitudinal mucous canals on the opercle and a vertical row along margin of pre-opercle, an open pore on each side medially of nostrills, a pore behind eye, a large one close behind eye at the beginning of supraopercular groove ; head scaled from a little behind the eyes ; cheek and opercle naked ; in first dorsal fin, second and third rays are the longest ; second dorsal fin and anal fin lower than first dorsal, pointed posteriorly ; caudal rounded, shorter than head.

Colouration : Cheek and opercle with dark streaks, a stripe from eye over lips to chin which meet the stripe of the other side ; laterally on back many small spots, in middle of sides 5 larger spots in a longitudinal line ; in D.1. the second ray is prolonged ; in males it extends beyond the base of the second dorsal ; base of D. 1. with a row of bright big spots ; D.2 with 4 or more rows of spots ; anal tip dark ; pelvic with minute spots ; caudal spotted.

Distribution : S.E. Africa ; India ; Andamans ; Philippines ; Indo-Australian Archipelago.

Genus **Yongeichthys** Whitley

1932. *Yongeithus* Whitley, *Rep. Brit. Mus.* (N.H.) No. 9 : p. 302.

7. **Yongeichthys criniger** (Cuvier & Valenciennes)
(Plate II, Figure 1)

1775. *Gobius nebulosus* Forskal, *Decr. Anim.* p. 24.
1837. *Gobius Criniger* Cuvier and Valenciennes, *Hist. Nat. Poiss.* XII, p. 82.
1953. *Ctenogobius criniger*, *Koumans*, *The Fishes of the Indo-Australian Archipelago*, X, p. 178.
1979. *Yongeichthys criniger*, Hoese and Winterbottom, *Life Sciences Occasional Papers*, 31, p. 1-13.

Material : 26 exs., 26.0 mm. - 86.0 mm. 22nd August 1978 ; 5 exs., 55.0 - 78.0 mm, S.L., 9th October 1978.

Description : D.1.VI ; D.2.1/9 ; A.1/9 ; P.19 · L.1.30 ; L.tr. 11 ; C. 13.

Body elongate, compressed 4.0-4.5 in S.L., 5.25 - 5.5 in T.L. ; head compressed, 3.33 in S.L. ; 4.25 in T.L. ; eye 3.5 in head ; interorbital half eye diameter, anterior nostril in a short tube ; snout obtuse, equal to eye, tip before lower margin of eye ; mouth oblique ; maxillary extends to before pupil ; teeth in lower jaw on each side a curved canine, mucous canals in 4 to 5 longitudinal rows over cheek, (Fig. 1.F.), one row below eye and two more rows bordering the lower half of cheek ; in terorbital medially in front and behind with an open pore ; scales on nape cycloid, scales of back, sides and belly ctenoid ; dorsal fins close together ; in first dorsal, 2nd ray is the longest, filiform, second dorsal fin lower than body, pointed posteriorly ; anal fin much ; eower and shorter than second dorsal ; pectoral shorter than head.

Colouration : Head and dorsal part of body and sides with irregular blackish spots ; no spots on the ventral side, three large blackish spots, 1st below first dorsal, 2nd below second dorsal, 3rd at middle of base of caudal ; first dorsal with 3 rows of spots, the 2nd ray much filiform in males ; second dorsal with 4 rows of spots ; dorsal portion of caudal fin with 4 to 5 rows of spots ; caudal, dorsal and anal with blackish border.

Distribution : Red Sea, Mozambique to the Pacific.

Genus **Glossogobius** Gill

1862. *Glossogobius* Gill. *Ann. Lyn. Nat. Hist.* New York VII, p. 46.

8. **Glossogobius biocellatus** (Cuvier & Valenciennes) (Plate II, Figure 2)

1837. *Gobius biocellatus*, Cuvier & Valenciennes, Hist. Nat. Poiss. XII, P. 73.
1953. *Glossogobius biocellatus*, Koumans, *The Fishes of the Indo-Australian Archipelago*. X, p. 163.

Material : Total 32 exs., 27.0 - 104.0 mm. S.L.) 3 exs., 49.0 mm. - 71.0 mm., 17th November 1975 ; 1 ex., 32.5 mm. 11th December 1975 ; 4 exs., 60.0 mm. - 73.0 mm. 23rd January 1976, 5 exs., 47.0 mm. - 72.0 mm., 4th February 1976 ; 1 ex., 71.0 mm., 12th March 1976 ; 9 exs., 27.0 mm. - 74.0 mm., 25th March 1976 ; 2 exs., 55.0 mm. - 61.0 mm., 27th April 1976 ; 1 ex., 68.0 mm., 4th August 1976 ; 1 ex., 78.0 mm, 30th October, 1976 ; 1 ex., 59.0 mm., 22nd January 1977 ; 1 ex., 64.0 mm., 25th February 1977 ; 2 exs., 74.0 mm. and 79.0 mm., 28th April 1977 and 1 ex., 104.0 mm., 29th October 1977.

Description : D.1.VI ; D.2.1/9 ; A.1/8 ; P. 17-19 ; L.1.27-30 ; L.tr. 8-9 ; predorsal scales 14-17 ; C. 13.

Body elongate, posteriorly compressed ; head pointed, depressed ; height 6.19 (5.33 - 7.0) in S.L., 7.53 (6.33-8.7) in T.L., head 3.10 (3.0 - 3.5) in S.L., 3.77 (3.63 - 4.25) in T.L., frontal line straight, on snout a little convex ; eye 5.86 (4.0 - 6.33) in head, 0.57 (0.42 - 0.75) in interorbital width ; a circular process from upper part of iris into pupil of eye ; a crest from temporal region is distinct in interorbital ; snout pointed, longer than eye, 3.23 (2.92 - 3.55) in head length, tip before middle of eye ; lower jaw

prominent ; maxilla extends to below posterior margin of eye ; teeth in many rows, in maxilla, some rows caninoid ; in lower jaw outer and inner row can be flattened inwards ; about 3 longitudinal mucous canals on cheek, (Fig. 2.A) ; one pore in the interorbital, supra opercular groove begins with an open pore behind eye ; head scaled above behind eye and on upper part of opercle ; opercle free from isthmus ; first dorsal fin pointed, 2nd, 3rd and 4th rays are the longest ; second dorsal fin about as high as high as body ; pectoral rounded, about as long as head without snout ; ventral as long as pectoral ; anal equal to second dorsal ; caudal rounded, shorter than head.

Colouration : Dark with blackish spots on upper part, on body 5-6 larger blotches in a longitudinal row on upper part ; first dorsal with 2 large blotches ; second dorsal, pectoral and caudal fins with rows of spots.

Distribution : India, Andamans ; Philippines ; Indo-Australian Archipelago. Samoa.

9. **Glossogobius giuris** (Hamilton)

(Plate II, Figure 3)

Material : 5 exs., 35.0 mm.-51.0 mm. S.L.; 23.8.1975.

1822. *Gobius gutum*, Hamilton, *Fish. Ganges*. p. 50, 366.
1822. *Gobius giuris* Hamilton, *op.cit.* p. 51, 366.
1953. *Glossogobius giuris*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 165.

Material : (39 exs., 39.0 mm. - 136.0 mm. S.L.) 1 ex., 136.0 mm., 20th December 1975 ; 3 exs., 39.0 mm. - 77.0 mm., 23rd January 1976 ; 1 ex., 78.0 mm., 4th February 1976 ; 15 exs., 56.0 mm. - 115.0 mm., 12th March 1976 ; 1 ex., 81.0 mm., 25th May 1976 ; 1 ex., 81.0 mm., 28th May 1976 ; 2 exs., 68.0 mm. - 80.0 mm., 3rd November 1976 ; 1 ex., 77.0 mm., 20th November 1976 ; 3 exs., 95.0 mm. - 105.0 mm., 22nd January 1977 ; 1 ex., 53.0 mm., 31st March 1977 : 2 exs., 66.0 mm. and 84.0 mm., 25th May 1977 ; 1 ex., 61.0 mm., 8th June 1977 ; 1 ex 78.0 mm., 25th June 1977 ; 1 ex., 58.0 mm., 6th July 1977 ; 1 ex., 53.0 mm., 6th August 1977 ; 3 exs., 71.0 mm. - 84.0 mm., 18th August 1977 and 1 ex., 70.0 mm., 8th December 1977.

Description : D.1.VI ; D.2.1/9 ; A.1/8 ; P.18-20 ; C. 13-14 ; L.1. 31-35 ; L.tr. 11-13 ; predorsal scales 16-20.

Body elongate, anteriorly cylinderical, posteriorly compressed, height 6.06 (5.25 - 7.8) in S.L., 7.63 (6.28 - 8.58) in T.L., head pointed 2.96(2.71 - 3.19) in S.L., 3.73 (3.5 - 3.94) in T.L. ; eye 5.79 (4.16 - 7.2) in head, 0.67 (0.50 - 0.91) in interorbital ; snout pointed, convex, slightly longer than eye, 3.23 (2.85-3.66) in head length, tip of snout before lower part of eye ; lower jaw prominent ; maxillary extends to below anterior border of eye ; lips thick ; teeth of outer and inner row enlarged, in front caninoid : tongue bilobate ; about 3-5 longitudinal mucous canals over cheek, (Figure 2.B), a broad band bordered by stronger developed canals on cheek and along the suproopercular groove, and on opercle a vertical and a horizontal row ; head scaled above behind the eyes and on upper part of opercle ; opercle attached to isthmus ; dorsal fins close together ; first dorsal fin lower than body, 2nd, 3rd and 4th rays are the longest ; second dorsal and anal fins pointed posteriorly ; pectoral as long as or longer than head without snout ; ventral obtuse, a little shorter than pectoral ; caudaeshorter than head.

Colouration : Head laterally with irregular dark to violet spots ; laterally on body two alternating longitudinal rows, each of 4-6 dark blotches ; the rays of dorsal, caudal and pectoral fins spotted with 3-4 rows of spots ; anal fins with dark margin.

Distribution : From the East Coast of Africa to Australia ; Philippines ; China ; Japan ; New Caledonia.

Genus **Oxyurichthys** Bleeker
Sp. Typ. **Oxyurichthys belosso** Blkr.

1860, *Oxyurichthys* Bleeker, *Act. Soc. Sci. Indo. Neerl.* VIII, p. 44

10. **Oxyurichthys microlepis** (Bleeker)
(Plate II, Figure 4)

1849. *Gobius microlepis* Bleeker, *Verh. Bat. Gen.*, 22, p.35.
1857. *Oxyurichthys microlepis.* Bleeker, *Nat. tijdsche. Ned. India.*, 7, p. 436.
1953. *Oxyurichthys microlepis.* Koumans, *Fishes of the Indo-Australian Archipelago*, X, p. 42-44, fig. 9.

Material : (73 exs., 35.0 mm. - 84.0 mm. S.L.) 34 exs., 62.0 mm. - 75.0 mm., 25th June 1977 ; 15 exs., 60.0 mm. - 84.0 mm., 4th August 1976 ; 11 exs., 35.0 mm. - 83.0 mm., 23rd January 1976 and 13 exs., 42.0 mm. - 80.0 mm., 4th February 1976.

Description : D.1.VI ; D.2.1/12-13 ; A.1/13 ; P. 21-22 ; C. 15-16 ; L.I. 48-52 L.tr. 14-16 ; predorsal scales 13-20.

Body elongate, compressed, height 5.41 (4.60 - 6.56) mm. S.L., 7.92 (7.03-9.37) in T.L., head compressed 4.01 (3.5-4.44) in S.L., 5.83 (5.24-6.43) in T.L. ; eye 4.43 (3.83 - 5.29) in head, 0.58 (0.44 - 0.78) in interorbital ; no ocular tentacle ; snout convex, longer than eye ; eye 1.52 (1.07 - 2.33) in snout ; snout 2.97 (2.14 - 3.63) in head length, tip before lower margin of eye ; mouth a little oblique ; maxilla 2.07 (1.76 - 3.0) in head length, extends to below posterior half of eye ; teeth in upper jaw curved, on each side 16-20 ; in lower jaw 2-3 rows, inner row anteriorly enlarged ; tongue rounded ; longitudinal mucous canals over cheek, traversed by 3-4 vertical rows (Fig. 2.C.), 2-3 oblique rows below eye, two vertical canals from below eye to posterior end of maxilla, three horizontal rows from behind eye on either side of the dermal crest and along the suproopercular groove, 2 horizontal and two vertical rows on opercle ; head scaled above behind eye, median line of head and nape naked ; nape in median line with a low dermal crest ; scales of head and anterior part of body cycloid, on posterior part of body very weakly ctenoid ; first dorsal fin lower or higher than body , 1.05 (0.71 - 1.75) in body depth ; second dorsal fin 1.0 (0.80 - 1.37) in body depth, pointed posteriorly ; pectoral fin longer than head 0.98 (0.81 - 1.22) in head length, 0.29 (3.26 - 4.71) in S.L. ; pelvic fin 1.08 (0.88 - 1.3) in head length, 4.35 (3.88 - 5.33) in S.L. ; predorsal distance 2.17 (1.88 - 2.41) in postdorsal distance ; caudal lanceolate, height of caudal peduncle 0.84 (0.63 - 1.36) in its length.

Colouration : On back and sides large blotches ; each scale of back and sides above with a black spot ; below eye and on scapula spots at the upper margin; first dorsal fin with three to four black bars only on the upper half and the lowermost row ends in a dark ocellus ; second dorsal fin with several rows of spots upto the base ; caudal with numerous black spots on the upper half ; a black triangular spot in iris at the upper part.

Distribution : India through the Malay Archipelago to Thailand ; China ; Japan and Philippines.

11. **Oxyurichthys tentacularis** (Cuv. & Val.)
(Plate II, Figure 5)

1837. *Gobius tentacularis* Cuvier & Valenciennes, *Hist. Nat. Poissons* 12, p. 128.
1856-1857. *Gobius ophthalmonema* Bleeker, *Nat. Tijdschr. Ned. India.* 12, p. 208.
1953. *Oxyurichthys tentacularis.* Koumans, *The Fishes of the Indo-Australian Archipelago,* X *Gobioidae,* p. 44-46, fig. 11.

Material : (70 exs., 56.0 mm. - 99.0 mm. S.L.) 1 ex., 91.0 mm. S.L., 21.5.1975 ; 1 ex., 94.0 mm., 18.10.1975 ; 3 exs., 85.0 mm. - 96.0 mm., 8.6.1976 ; 20 exs., 58.0 mm. - 99.0 mm., 20.11.1976 ; 7 exs., 81.0 mm. - 90.0 mm., 5.2.1977 ; 6 exs., 56.0 mm. - 88.0 mm., 31.3.1977 ; 26 exs., 57.0 mm. - 87.0 mm., 25.6.1977 ; and 6 exs., 58.0 mm. - 81.0 mm., 11.8.1978.

Description : D.1.VI ; D.2.1/12-13 ; A.1/13-14 ; P. 22-23 ; C. 14-15 ; L.I. 50-56 ; L.tr. 14-16 ; Predorsal scales 14-24.

Body very elongate, compressed, height 5.14 (4.62 - 5.81) in S.L., 7.66 (6.66 - 8.58) in T.L. ; head obtuse, compressed, profile convex, 3.77 (3.59 - 4.04) in S.L., 5.59 (5.13 - 5.96) in T.L., slightly less broad than high ; eye nearer snout, 4.66 (4.0 - 5.33) in head length, 0.54 (0.35 - 0.75) in interorbital ; tentacle on upper margin of eye, 1.91 (1.29 - 2.53) in eye diameter ; snout obtuse, longer than eye, 2.99 (2.27 - 3.75) in head length, tip before lower margin of eye ; anterior nostril in a short tube ; mouth oblique, lower jaw prominent ; maxillary extends to below middle or posterior part of eye, 1.97 (1.82 - 2.29) in head length ; on each side 20-24 curved teeth in upper jaw ; in lower jaw 2-3 rows, inner enlarged ; two longitudinal mucous canals over cheek and one along its lower edge ; an open pore on each side anteriorly in interorbital space, an open pore behind eye at the beginning of the supraopercular groove ; longitudinal sensory papillae over cheek treversed by 4-5 vertical rows, two of which extend from the lower border of eye to the posterior end of maxilla ; (Fig. 2.E.) about 4 oblique short rows from below eye behind this ; three longitudinal rows from behind eye on either side of the dermal crest and along the supraopercular groove ; two horizontal and two long vertical rows on opercle ; head scaled above behind eye, median line of head and nape naked ; on nape a low dermal crest to insertion of first dorsal ; scales on head and posterior part of body cycloid ; posteriorly ctenoid ; pectoral base and opercle naked ; pelvic base scaled with weak scales ; first dorsal fin higher or lower than body, 1.08 (0.88 - 1.42) in body depth ; second dorsal fin 1.14 (0.87 1.48) in body depth, posteriorly pointed ; pectoral fin 0.89 (0.81 - 1.05) in head length ; 3.37 (3.03 - 4.22) in S.L. ; pelvic fin 1.07 (0.94 - 1.24) in head length, 4.04 (3.46 - 4.9) in S.L., basal membrane fringed ; predorsal 1.97 (1.85 - 2.21) in postdorsal distance ; 2.97 (2.77 - 3.25) in S.L. ; height of caudal peduncle 0.73 (0.50 - 0.98) in length of caudal peduncle ; caudal lanceolate, longer than head.

Colouration : Each scale on back and sides above with a spot at the margin ; below eye an oblong dark spot ; body with blotches on sides which appear as alternating rows of thin and broad bands ; first dorsal fin spotted with three longitudinal rows of spots ; second dorsal fin with 5-6 alternating longitudinal rows of spots ; pectoral fin spotted in rows more on the lower half ; anal fin dark,

base of anal fin with a row of spots and with streaks along the border ; caudal with oblique streaks above.

Distribution : India ; Indo-Australian Archipelago ; Philippines ; Hongkong Polynesia ; North Australia.

Affinities : The study of *O. tentacularis* (C. & V.) from Ennore estuary reveals its close affinity to the Philippine counterpart i.e. *O. ophthalmonema* (Blkr.) ; the upper and the lower rims of the upper lip are almost parallel ; the premaxillary is like those of *O. ophthalmonema* (Blkr.) ; the head is long being 5.59 (5.13 — 5.96) in T.L. ; in typical *O. tentacularis* (C. & V.) it is 6 times and in typical *O. ophthalmonema* it is 5 1/2 ; the ocular tentacle is half to 1/3 eye diameter. Prince Akihito (1972) distinguishes *O. ophthalmonema* (Blkr.) from *O. tentacularis* on the basis of the shape of the upper lip, the height of the dorsal spine, head length and in the structure of the premaxillary. The height of first dorsal fin is found to be longer in *O. opthalmonema* (3.9 — 5.3) and shorter in *O. tentacularis* which is 7.1 — 9.7 in S.L. The number of pectoral fin rays were also observed to be fewer in *O. tentacularis* being 20 — 21 whereas 22 rays are invariably observed in *O. ophthalmonema*. In the Ennore specimens also the number of rays are either 22 or 23. The lateral line scales are never more than 56 ranging between 50-56. Gunther (1861) observed 55 scales in *O. ophthalmonema* and 60 — 70 in *O. tentacularis*. The present study also reveals another difference in squamation. In *O. tentacularis*, figured in Koumans, 1953 (after M. Weber) the pectoral base is scaled. In Gunther (1861) the head and pectoral base of *O. ophthalmonema* is observed to be naked. In the Ennore specimens with resemble *O. ophthalmonema*, the pectoral base is scaleless.

However, Koumans (1953) studying the species from several localities obviously felt the need to place the different geographical varients under *O. tentacularis*. Since *O. tentacularis* has priority over *O. ophthalmonema* the first name is retained. In Koumans (1953) the proportion of head to T.L. is given as 6-7, the lateral line between 52-65 and the number of pectoral rays 19-22. A study of the Indian specimens and the other synonyms necessitates the need to extend the range of head to T.L. from 5.1-7, the height of ocular tentacle 1/3 to as long as eye diameter, the lateral line scales 50-65 and the number of pectoral rays 19-23.

Genus **Oligolepis** Bleeker

1874. *Oligolepis* Bleeker, *Arch. Neerl. sc. ex. nat.* 9, p. 318.

12. **Oligolepis acutipennis** (Cuvier and Valenciennes) (Plate II, Figure 6)

1837. *Gobius acutipennis* Cuvier and Valenciennes, *Hist. Poissons*, 12, p. 80.
1878. *Gobius acutipinnis*, Day, *Fishes India*, P. 291, pl: 61. Fig. 1.
1916. *Gobius (Acentrogobius) acutipennis*, Sundara Raj, *Rec. Indian Mus.*, 12, pl. 6, p. 287.
1953. *Oligolepis acutipennis*, Koumans, *Fish. Indo-Aust. Arch*, 10, p. 92, Fig. 18.
1967. *Oxyurichthys jaarmanii* Talwar, *J. Bombay Nat. Hist. Soc.*, 65(3), p. 794.
1976. *Oxyurichthys nijsseni* Menon and Govindan, *Marsys*, 2, p. 13, Fig. 1.
1985. *Oxyurichthys formosanus*, Talwar, *proc. Workshop on Estuarine Biology, Berhampur (Orissa)* 18-22 Feb., Paper No. 23. p. 66.

Description : D. 1.VI ; D.2.1/10 ; P. 20-21 ; A. 1/11-12 ; C. 22-24 (15-16 branched) ; L.1.26-28; L.tr.7.

Material : (27 exs., 34.0 mm. - 76.0 mm. S.L.) 1 ex., 76.0 mm., 30.9 1975 ; 16 exs., 34.0 mm. — 69.0 mm., 23.1. 1976 ; 1 ex., 59.0 mm., 3.7.1977 and 1 ex., 59.0 mm., 22.7.1978.

Body elongate, compressed, height 4.6 (4.0 — 5.2) in S.L., 6.51 (5.8 — 7.3) in T.L. ; head obtuse, a little compressed, 3.8 (3.6 — 4.2) in S.L., 5.4 (5.1 — 6.1) in T.L. ; profile convex, eye 4.2 (3.5 — 5.4) in head length, 0.6 (0.4 — 0.8) in interorbital width ; snout about as long as eye ; eye 1.6 (1.2 — 2.0) in snout, tip before lower margin of eye ; anterior nostril in a short tube ; jaws subequal ; maxillary extends rarely to below posterior part of eye, 2.2 (1.9 — 2.6) in head length ; teeth in upper jaw in two to several rows, in lower jaw in 3 rows ; sensory canal pores paired in interorbital anteriorly, posteriorly an open pore in median line, an open pore behind eye at the beginning of the supraopercular groove ; 2 rows of mucous canals run longitudinally over cheek (Fig. 2. D.) no vertical rows of papillae as in *0. tentacularis* and *0. microlepis* ; head, nape and breast before pelvic naked, body scales ctenoid anteriorly ; first dorsal fini about as high or higher than body 1.24 (0.9 — 2.0) in body depth ; second dorsal fin middle rays are longest and prolonged 0.9 (0.8 — 1.1) in head length, 3.5 (3.1 — 4.1) in S.L., pelvic 1.0 (0.9 — 1.2) in head length, 3.9 (3.5 — 4.5) in S.L. ; caudal lanceolate, longer than head, height of caudal peduncle 1.0 (0.7 — 1.4) in length of caudal peduncle. The species is observed to exhibit marked sexual dimorphism, In the males the rays of the first dorsal fin are filamentous and sometimes reach the middle of the caudal fin.

Colouration : Brownish with a conspicuous dark vertical streak below eye to behind maxillary ; black dots along back and sides ; membrane of dorsal fins and caudal with rows of dark spots ; about 5-8 longitudinal streaks in first dorsal ; about 3-4 in second dorsal ; anal papilla pigmented.

Distribution : From coast of Natal, S. Africa, through India, Sri Lanka, Malay Peninsula and the Archipelago to Philippines and Riu-Kiu Islands and New Herbrides in the Pacific.

Notes on the genus and the junior synonyms.

Pezold and Larson, 1986 after a critical study of the genus concluded : "the species in this genus are characterized by a single fleshy epibranchial lobe, incomplete neural arches over the caudal vertebrae, a distinctly expanded fourth neural spine, a disjunct lateral occipital canal, a prepercular canal with two pores, a reduction of transverse papillae on the cheek and a loss of suborbital rows. The genus as delimited here includes *0. acutipennis, 0. jaarmanii* (= *Oxyurichthys jaarmanii), 0. nijssenii* (= *0, nijssenii,* perhaps a synonym of *0. acutipennis*) and *0. stomias* (= *Waitea stomias*).

In the papillae disposition *0. jaarmanii* and *0. nijssenii* are very closely similar to *Oligolepis acutipennis.*

The papillae on the cheek of *0. jaarmani* and *0. nijsseni* are characterized by longitudinal rows only (Fig. 2.D). The other *Oxyurichthys* spp. studied viz. *0. tentacularis* and *0. microlepis* show characteristic vertical rows between the longitudinal rows in addition to the suborbital rows (Fig. 2.E and Fig. 2.C). Also

the genus *Oxyurichthys* is characterized by a single row of teeth in the upper jaw ; it was observed that in both *O. jaarmani* and *nijjsseni* the number of rows of teeth in the upper jaw is more than one.

Genus **Parachaeturichthys** Bleeker.

1874. *Parachaeturichthys* Bleeker, *Arch. neerl. Sc. ex. nat.* IX, p. 325.

13. **Parachaeturichthys polynema (Bleeker)** (Plate III, Figure 1)

1853. *Chaeturichthys polynema* Bleeker, *Verh. Bat. Gen.* XXV. P. 44, text fig. 4.
1953. *Parachaeturichthys polynema*, Koumans, *The fishes of the Indo-Australian Archipelago*, X, p. 37.

Material : (18 exs., 42.0 mm.—97.0 mm. S.L.) 4 exs., 43.0 mm—89.0 mm., 8.6.1976 and 14 exs., 42.0 mm—97.0 mm. 18.12.1976.

Description : D.I.VI ; D.2. 1/10 ; A.1/8-9 ; P. 21-22 ; L.I. 26-28 ; L.tr. 8-9 ; Predorsal scales 11-16.

Body elongate, anteriorly cylinderical, posteriorly compressed, height 4.91 (4.42 — 5.52) in S.L., 6.75 (5.87 — 7.41) in T.L. ; head 3.62 (3.57 — 3.74) in S.L., 4.97 (4.85 — 5.82) in T.L. profile convex ; eye 5.14 (4.7 — 5.62) in head length ; interorbital 1.12 (0.94 — 1.50) in eye ; snout obtuse, slightly longer, eye 1.22 (1.11 — 1.37) in snout, snout 4.18 (3.8 — 4.64) in head, tip before or a little below lower margin of eye ; anterior nostril in a short tube, mouth oblique, lower jaw prominent ; maxillary extends to anterior border of eye 2.69 (2.42 — 3.06) in head length ; width of head 1.42 (1.32 — 1.62) in head length ; lower jaw with some short barbels under chin and on the ventral side of head ; in upper jaw on each side 4-5 caninoid teeth, in lower jaw outer row of teeth enlarged, last tooth a canine ; five rows of mucous canals on cheek, the first row single.the other two being paired and in between these mucous canals, scales are arranged in a row, (Fig. 2.F) lower border of cheek towards the ventral side with another row of mucous canal ; some open pores along supraopercular groove, and posterior margin of preopercle ; head scaled above between and behind the eyes ; cheek and opercle totally scaled ; scales of head, nape, breast and belly cycloid, other scales ctenoid ; bases of dorsal fins subcontinuous, first dorsal fin lower than body 1.43 (1.34 — 1.65) in body depth ; second dorsal fin 1.28 (1.14 — 1.40) in body depth ; anal fin similar to second dorsal 1.21 (1.1 — 1.37) in body depth ; second dorsal and anal fins posteriorly higher and pointed ; pectoral pointed, equal to or slightly longer than head 0.99 (0.93 — 1.08), pelvic 1.33 (1.19 — 1.58) in head ; predorsal distance 1.72 (1.50 — 1.92) in post dorsal distance ; caudal lanceolate, much longer than head ; height of caudal peduncle 1.65 (1.50 — 1.80) in length of caudal peduncle.

Colouration : Fish darker above, lighter below ; dorsal, and ventral tip and lower half of caudal tinged with black ; a large ocellus above at the base of the caudal, lower half and base of pectorals darker.

Distribution : India ; Japan ; China ; Ambon ; North Queensland.

Genus **Stigmatogobius** Bleeker

1874. *Stigmatogobius*, Bleeker, *Arch. neerl. Sc. ex. nat.* IX, p. 323.

14. **Stigmatogobius javanicus** (Bleeker)
(Plate III, Figure 2)

1856. *Gobius javanicus* Bleeker, *nat. Tijds. Ned. Ind.* XI, p. 88.
1953. *Stigmatogobius javanicus*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 122.

Material : (48 exs., 12.0 mm. — 31.5 mm. S.L.) 46 exs., 12.0 mm. — 31.5 mm., 11.2.1975 and 2 exs., 24.0 mm. and 25.5 mm., 12.9.1976.

Description : D.I.VI ; D.2.1/7-8 ; A. 1/7-8 ; P. 13-15 ; L.I. 25-28 ; L.tr. 7-7½ ; Predorsal scales 6-8.

Body elongate, anteriorly cylinderical, posteriorly compressed, height 4.46 (3.9—5.6) in S.L., head subcylinderical, 3.49 (3.23—4.14) in S.L., ; profile convex ; eye 3.65 (2.5 — 4.66) in head, 0.76 (0.5 — 1.0) in interorbital ; snout obtuse 3.51 (2.5 — 4.4) in head length, slightly longer than eye being 1.6 (1.0 — 1.33) in snout ; mouth a little oblique, upper jaw prominent, maxillary extends to anterior one third of eye, the snout forming a fold and a deep rostral groove, overhanging the upper lip ; external nostrils short tubes at the end of the snout ; teeth in front in several rows, outer row a little enlarged ; two to three-longitudinal mucous canals over cheek, where some are curved and discontinuous the lower one being very short, a canal runs along preopercle border, another vertical canal and an oblique canal on opercle, (Fig. 3.A) ; an unpaired interorbital pore ; one on the upper edge of the supra opercular groove and one between this and the interorbital ; head scaled above behind eye and on opercle with large scales ; cheek naked ; base of pectoral and pelvic scaled ; scales of head, breast and belly cycloid, laterally on body ctenoid ; first dorsal fin 1.36 (0.82—1.83) in body depth, second dorsal fin 1.22 (0.88—1.50) in body depth and anal fino 1.32 (1.0—1.62) in body depth ; middle rays of first dorsal the longest in males ; 2nd and 3rd rays are the longest reaching the base of the third branched ray of second dorsal ; pectoral as long as head 1.06 (0.86 — 1.23) in head length ; caudal obtuse, height of caudal peduncle 1.8 (1.14 — 2.20) in its length.

Colouration : Body with a reticulated pattern of dusky blotches, with 5 blotches dorsolaterally, and scattered among these are spotted scales forming a reticulate pattern ; head with a dark stripe from eye to maxilla ; dark oblique spots on cheek ; snout and lips with dark spots ; spots on cheek on close examination reveal dark circles closely opposed to one another and each with a dark central spot ; dorsal and caudal spotted with black, anal faintly spotted ; first dorsal with dark and another lighter streak extending from first ray and broadening and extending from 3rd to the 6th ray ; another streak from the first to the 4th, above the first streak ; second dorsal with about 5 rows of dusky spits caudal with about 5-8 rows of spots ; two spots in a vertical line at the base of caudal.

Distribution : India ; Philippines ; Indo-Australian Archipelago ; Queensland and Tasmania.

Subfamily APOCRYPTEINAE

Genus/**Parapocryptes** Bleeker

1874. *Parapocryptes* Bleeker, Arch. neerl. Sc. ex. nat. IX. p. 327.

15. **Parapocryptes rictuosus** (Cuvier and Valenciennes) (Plate III, Figure 3)

1837. *Apocryptes rictuosus*, Cuvier and Valenciennes, *Hist. Nat. Poiss.* XII, p. 151.
1941. *Parapocryptes rictuosus*, Koumans, *Mem. Indian Mus.* XIII, p. 275.

Material : 1 ex., 53.0 mm. S.L., 8.12.1977.

Description : D.1.VI ; D.2.1/26 ; A. 1/26 ; P. 20 ; L.I. about 75.

Height of body 8.5 in S.L., 11.5 in T.L. ; head 4.5 in S.L., 6.5 in T.L. ; Eye about 8 in head ; interorbital a little less than eye diameter ; snout longer than eye ; maxillary extends to one diameter behind eye ; teeth in upper jaw caninoid, about 13 on either side ; in lower jaw 17 on each side, a pair of canines behind symphysis ; several rows of vertical sensory canals radiating from below eye to maxilla (Fig. 3.B.) three longitudinal rows on cheek and opercle ; scales small, urregular anteriorly, posteriorly larger ; dorsal fins continuous at their bases ; caudal lanceolate ; some spots on the last rays of the second dorsal. Inner side of the mouth pigmented.

Distribution : India.

Genus **Pseudapocryptes** Bleeker

1874. *Pseudapocryptes* Bleeker, *Arch. Neerl. Sc. ex. nat.* IX. p. 328.

16. **Pseudapocryptes lanceolatus** (Bloch & Schneider) (Plate III, Figure 4)

1801. *Eleotris lanceolatus* Bloch and Schneider, *Syst. Ichth.*, P. 67, pl. xvi.
1941. *Pseudapocryptes lançeolatus*, Koumans, *Mem. Indian Mus.*, XIII, p. 272.

Material : 11 exs., 55.0 mm.-144.0 mm. S.L., 18.10.1975.

Description : D.1.VI ; D.2. 1/30 ; A.1/29 ; P.17.

Body very elongate, anteriorly cylinderical, posteriorly compressed, height 9.11 (6.93-12.01), head 5.96 (4.04-6.17) in S.L. ; eye 7.62 (6.57-10.50) in head ; interorbital less than eye diameter ; snout 4.78 (3.38-6.14) in head ; mouth nearly horizontal, upper jaw a little prominent ; mouth extends to below posterior margin of eye ; teeth in each jaw 24 or less, in lower jaw horizontal. behind symphysis a canine on each side ; two horizontal rows of mucous canals, one below eye (Fig. 3.C.) which curves round in front of eye to maxilla, a vertical canal between the two main horizontal canals, another horizontal canal borders the cheek and on opercle two vertical and three horizontal canals ; dorsal fins much lower than body ; caudal pointed, slightly longer than head.

Colouration : Brownish gray with brown markings on head and back ; six to seven vertical bands bent along the lateral line extends from back to three fourths the sides of the body ; between these dark bands a pair of faint streaks are present ; caudal with several rows of spots, base with an inclined streak at the lower half ; pectoral fin base with a curved streak, dorsal with spots.

Distribution : India ; Thailand ; China ; Indo-Australian Archipelago.

Genus **Boleophthalmus** Cuvier and Valenciennes

1837. *Boleophaalmus* Cuvier and Valenciennes, *Hist. Nat. Poiss.* XII, p. 198.

17. **Boleophthaemus bodarti** (Pallas)
(Plate III, Figure 5)

1770. *Gobius boddarti* Pallas, *Spicilegia*, VIII, p. 11. pl. ii, figs. 4, 5.
1953. *Boleophthalmus boddarti*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 259.

Material : (16 exs., 48.0 mm.-123.0 mm. S.L.) 7 exs., 49.0 mm.-76.0 mm., 10.3.1976 ; 3 exs., 48.0 mm.-93.0 mm., 25.8.1976 ; 1 ex., 110.0 mm., 4.9.1976 ; 3 exs., 115.0 mm.-123.0 mm., 5.2.1977 ; 1 ex., 79.0 mm., 29.10.1977 ; 1 ex., 119.0 mm. S.L., 8.12.1977.

Description : D.I.V ; D.2.1/23-24 ; A.1/24 ; P.18-19 ; L.1. about 75 ; L.tr. 20 or more.

Body elongate, sub-cylinderical anteriorly, compressed posteriorly, height 6.5 - 7.5 in T.L. ; head 4.5 - 4.75 in T.L. ; eye 6-7 in head ; interorbital less than half eye diameter ; snout longer than eye ; maxillary extends to behind eye ; teeth in upper jaw in front 4-6 canines ; in lower jaw about 30 teeth on each side ; cutaneous papillae on head low and poorly defined, scattered here and there on lower half of cheek and opercle and on snout (Fig. 3.D.) the various papillar tracts vary somewhat between specimens ; scales cycloid on head, and anterior part of body with tubercles, first dorsal fin higher than body, rays filiform, 3rd ray the longest, sometimes reaching to half way of the second dorsal.

Colouration : Dark with 6-7 oblique bands ; head with numerous spots, first dorsal fin with blue spots ; second dorsal fin with about 3 rows of oblon white spots ; pectoral tinged with black at the tip of the upper half ; caudal with three horizontal black streaks between the rays.

Distribution : India ; Malay Peninsula ; Indo-Australian Archipelago.

18. **Boleophthalmus sculptus** Gunther
(Plate III, Figure 6)

1861. *Boleophthalmus sculptus* Gunther, *Cat. Fish. Brit. Mus.* III, p. 104.
1953. *Boleophthalmus sculptus*, Koumans, *the Fishes of the Indo-Australian Archipelago*, X, p. 258.

Material : 1 ex., 46.5 mm., S.L., 25.9.1976.

Description : D.I.V ; D.2. 1/24 ; A.1/23 ; P.15 ; L.1. less than 75.

Body very elongate, height at dorsal fin origin 6.5 in T.L. ; head 4 in T.L. ; snout about as long as eye ; 6 canines in front of upper jaw ; cutaneous canals as in the other *Boleophthalmus* sp. not in specified rows (Fig. 3.E), they are found scattered along the lower half of cheek and opercle and border of mouth ; eye 6.66, snout 3.75 in head length ; scales cycloid, on head and anterior part of body rudimentary, becoming normal at posterior half of body ; third ray of first dorsal filiform.

Colouration : Six rather indistinct darker bands descend obliquely from the back towards the belly ; first dorsal fin without spots ; second dorsal fin with five white blotches at the base along its length ; caudal with three horizontal streaks ; head dark ; the lower one-third white.

Distribution : India.

Subfamily PERIOPHTHALMINAE
Genus **Periophthalmus** Bloch & Schneider

1801. *Periophtahlmus* Bloch and Schneider, *Syst. Ichth.* p. 63.

19. **Periophthalmus variabilis** Eggert
(Plate IV, Figure 1)

1935. *Periophthalmus variabilis* Eggert, *Zool. Jahrb. (Syst.)* LXVI, p. 63, pl. iii, Fig. 13, pl. iv. figs. 14, 15.
1953. *Periophthalmus variabilis*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 205.

Material : 3 exs., 38.0 mm.-55.0 mm. S.L., 8.6.1976.

Description : D.1.IX-XI ; D.2. 1/13 ; A.1/12 ; P. 12 ; L.I. about 70 ; L.tr. about 17 ; Predorsal scales about 25-28.

Body elongate, anteriorly cylinderical, posteriorly compressed, height 6 in T.L. ; head truncate, 4.75 in T.L. ; cutaneous papillae system limited to a scattering of papillae in the middle portion of the snout (Fig. 3.F.), very few are present scattered on the cheek and opercle ; first dorsal fin concave, convex posteriorly ; second dorsal fin lower than first dorsal ; anal fin lower than second dorsal ; basal membrane of ventrai weak, the two halves of the fins are united by a narrow membrane along the inner rays ; caudal longer than head.

Colouration : Body dark gray above lighter below and with numerous large blotches ; first dorsal fin with a broad border edged with white with spots in the lower half ; second dorsal with a black streak in the middle, base with a row of light blotches ; pectoral with black concave streak at the base and darker lines along the rays ; caudal spotted and with a dark horizontal streak in the centre.

Affinities & Distribution : There are 3 subspecies according to Eggert (1935) based on the shape and colour pattern of D.1. viz. *P. variablis* from Java (Tjilatop) ; *P. variabilis sumatranus* Eggert from Sumatra and Java and *P. variabilis tidemani* from Halmaheira, Kouman (1953) remarks that he has seen 3 specimens of *P. variabilis* from British India (Ennur, Vizagapatnam) which he could not bring into a subspecies.

The specimens studied from Ennore estuary again poses the same problem having a characteristic shape and colour pattern of its own in D.1.

20. **Periophthalmus chrysospilos** Bleeker
(Plate IV, Figure 2)

1853. *Periopthalmus chrysospilos* Bleeker, *Nat. Tijdschr. Ned. India*. 3, p. 728.
1953. *Periphthalmus chrysospilos*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 202.

Material : One example, 59.0 mm. S.L., 8.6.1976.

Description : D.1.IX ; D.2. 1/11 ; A.1/11 ; P. 15-16 ; C.14 L.1. about 62 ; L.tr. 16 ; Predorsal scales 32.

Body elongate, anteriorly cylinderical, posteriorly compresed, height 4.75 in S.L., almost 6 in T.L. ; head truncate, a little compressed, 3.5 in T.L. ; eye 4 in head ; teeth on each side in each jaw 8-9, anterior ones caninoid ; cutaneous papillae less numerous on snout and scattered more along the lower half of cheek and jaw (Fig. 4.A.) : scales on caudal peduncle not larger than those of front ;

dorsal fins separate ; first dorsal fin triangular, slightly lower than body depth ; second dorsal fin lower than first dorsal ; anal fin lower than second dorsal ; ventral fins totally united but slightly emarginate at the tip, basal membrane well developed ; pectoral about as long as the head, base totally scaled ; caudal slightly shorter than head.

Colouration : Dark brown above lighter below ; first dorsal fin dark with darker edge bordered with white ; second dorsal fin with a row of blotches between the middle of the rays ; body with about twelve longitudinal streak from behind eyes to base of caudal ; caudal spotted.

Affinities : The specimen from India belong to a variety of *Periophthalmus chrysospilos* which have the first dorsal fin totally black, except the first ray and outer margin of the fin between the first and the fifth ray, behind this, the margin is very narrow. These parts are white probably red in life (Koumans, 1953). The specimen from Ennore estuary answers to the colour pattern of the variety of *P. chrysospilos*. However certain differences (in body depth, height of dorsal, scalation and in dentition) are observed between this and the *P. chrysospilos* described by Koumans (1953). Since there is only one specimen this has been tentatively identified as *P. chrysospilos* by Dr. Edward O. Murdy of the Smithsonian Institution.

Distribution : Singapore, Malaysia ; Indonesia ; India (Vizagapatnam), Ennore estuary.

Family TAENIOIDIDAE
Subfamily TAENIOININAE
Genus **Taenioides**

1798. *Taenioides* lacepede, *Hist. Nat. Poiss.* II, p. 580.

21. Taenioides anguillaris (Linnaeus)
(Plate IV, Figure 3)

1958. *Gobius anguillaris* Linnaeus, Syst. Nat. ed. 10, p. 264.
1941. *Taenioides anguillaris*, Koumans, *Mem. Indian Mus.* XIII, p. 302.
1953. *Taenioides anguillaris*. Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 273.

Material : 7 exs., 43.0 mm.-232.0 mm. S.L., 18.10.1975.

Description : Body sub-cylinderical anteriorly, compressed posteriorly, height 12.5 in S.L., 13.5 in T.L. ; head 6.5 in S.L., 7 in T.L., 1.3 in distance from base of ventral to vent ; teeth on each side about 7 canines in outer row in upper jaw, in lower jaw on each side 4-5 ; behind these outer rows a band of smaller teeth ; the sensory papillae are prominent and in raised rows as cirrhose ridges on the head, (Fig. 4.B.), a long horizontal line extends from chin to cheek and from this numerous vertical rows extend along the lower jaw ; above this horizontal row a net-work of mucous canals are seen ; a row of three short barbels on each side below head ; pectoral short, about three in head ; dorsal and caudal fins continuous ; caudal pointed ; colour bluish pink.

Distribution : India, Andamans ; China ; Penang.

22. **Taenioides buchannani** (Day)
(Plate IV, Figure 4)

1873. *Amblyopus buchanani* Day *Proc. Zool. Soc. Londoan*, p. 110
1953. *Taenioides buchanani*, Koumans, *The Fishes of the Indo-Australian Archipelago*. X, p. 272.

Material : One example, 208.0 mm. S.L., 18.10.1975.

Description : Body sub-cylinderical anteriorly, compressed posteriorly, height about 11 in S.L., 12 in T.L. ; head about 6.5 in S.L., 7.15 in T.L. ; 1.75 in distance from base of ventral to vent ; teeth on each side 4-5 canines in outer row in upper jaw, in lower jaw on each side 5 ; behind these outer rows a band of small teeth ; a pair of canines at symphysis of lower jaw ; a row of 3 small barbels on each side below head, the first one close together at the base of the chin ; cutaneous papillae system limited to a scattering of papillae in the region of the upper lip Fig. 4.C. ; dorsal and anal fins continuous with caudal ; caudal pointed ; pectoral short, about 3 in head ; vertical fins black.

Distribution : India.

Genus **Brachyamblyopus** Bleeker

1874. *Brachyamblyopus*, Bleeker, *Arch. neerl. Sc. ex. nat.* IX, p. 329.

23. **Brachyamblyopus urolepis** (Bleeker)
(Plate IV, Figure 5)

1852. *Amblyopus urolepis* Bleeker, *Nat. Tijds. Ned. Ind.* III, p. 581.
1953. *Brachyamblyopus urolepis*, Koumans, *The Fishes of the Indo-Australian Archipelago*, X, p. 268.

Description : D.VI.32 ; A.1/33 ; P.18.

Body compressed 7.5-7.75 in S.L., 8.0-9.0 in T.L. ; head subcylinderical, 5-6 in S.L., 7.0-7.5 in T.L. ; eyes rudimentary ; mouth oblique ; lower jaw prominent ; lips thin ; maxillary three in head ; teeth subequal ; a little curved ; cephalic pit organs scattered on the lower half of cheek behind junction of the jaws and on opercle (Fig. 4.D.) ; body scaleless, only small scales on caudal part of the body ; dorsal and anal fins lower than body ; pectoral short, rounded, half of length of head ; caudal longer than head, pointed.

Distribution : India, Andamans ; Thailand ; Phillippines ; Sumatra ; Indonesia.

Subfamily TRYPAUCHENINAE
Genus **Trypauchen** Cuvier & Valencienne

1837. *Trypaucher* Cuvier & Valeociennes, Hist. Nat. Poiss. XII, p. 152.

24. **Trypauchen vagina** (Bloch & Schneider)
(Plate IV, Figure 6)

1801. *Gabius vagina* Blosh and Schneider, *Syst. Ichth.*, p. 73.
1953. *Trypauchen vagina*, Kaumans, The Fishes of the Indo-Australian Archipelago, X, p. 277.

Material : 3 exs., 99.0 mm.-190.0 mm. S.L., 18.10.1975.

Description : D.VI.48 ; A.1/44-45 ; P. 16-17 ; L.I. about 78-80 ; L.tr. about 23-24.

Body compressed, about 9.5 in S.L., 10.5 in T.L. ; head obtuse, compressed,

5.75-6.0 in S.L., 6.6-7.0 in T.L. ; eyes very small, covered by skin ; numerous small cephalic pit organs in parallel vertical rows arranged close to one another on cheek and some scattered on the head and opercle (Fig. 4.E.) ; mouth very oblique ; lower jaw prominent ; chin very convex ; maxillary extends to front border of eye ; teeth in many rows, pointed, outer row enlarged, caninoid ; head with a patch of scales above opercle on either side of dorsal ; abdomen scaled ; scales of body cycloid ; dorsal fin continuous, not emarginate between the two parts ; pectoral 1/3rd in head, the lower rays much shorter ; ventral more than three, about 3.5 in head ; caudal shorter than head.

Affinities : This differs from the known *Trypauchen vagina* in the presence of scales in abdomen, the maxillary not extending behind eye and in the presence of shorter pectorals and ventral.

Distribution : From Persian Gulf to Indo-Australian Archipelago ; China.

Genus **Ctenotrypauchen** Steindachner

1867. *Ctenotrypauchen* Steindachner, *Sitz. ber. Ak. Wiss. Wien* LV. p. 330.

25. **Ctenotrypauchen microcephalus** (Bleeker)
(Plate IV, Figure 7)

1860. *Trypauchen microcephalus* Bleeker, *Act. Soc. Indo-Neerl.* VIII, p. 62.
1922. *Ctenotrypauchen microcephalus,* Herre, *Monogr. 23 Bur. Sci. Manila;* p. 341.
1953. *Ctenotrypauchen microcephalus,* Koumans, *The Fishes of the Indo-Australian Archipelago,* X, p. 282.

Material : 9 exs., 49.0 mm.-85.0 mm. S.L., 18.10.1975.

Description : D.VI.47 ; A.1/43 ; P. 17-18 ; L.1. about 62 ; L.tr. 18-20.

Body compressed, height 7.50 in S.L., 9.0-9.25 in T.L. ; head obtuse, compressed, 5.25-5.50 in S.L., 6.25-6.60 in T.L. ; mouth very oblique, curved ; head, neck and abdomen naked ; on head an elevated crest ; a bony projection at the upper portion of the eye socket ; maxilla extends to before anterior border of eye ; some pores on head ; the mucous canals are more on the snout and chin, some faint vertical rows below eye ; on the lower half of cheek the canals from a cemicircular pattern of chain (Fig. 4.F.) ; dorsal fins continuous with caudal and anal fin ; lower rays of pectoral fin much shorter than the upper ; ventral fins separate, basal membrane very weak, caudal pointed.

Distribution : Ennore estuary.

SUMMARY

A systematic account of 25 species belonging to 14 genera found in the estuary are described and illustrated and a key to the gobioid fauna of Madras coast is provided. Four species are reported for the first time and tow recently described species from the estuary are redescribed. The cephalic sensory system of all the 25 species is mentioned in brief in addition to the other systematic characters, and are figured.

Family TAENIOIDIDAE
Subfamily TAENIOININAE
Genus **Taenioides** Lacepede

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Rec. zool. surv. India, 90(1-4) : 191-193, 1992

A NOTE ON *MOINODAPHNIA MECLEA YI* (KING) A LITTLE KNOWN CLADOCERAN SPECIES FROM INDIA

S.K. BATTISH
Department of Zoology
Punjab Agricultural University
Ludhiana

INTRODUCTION

The author is presently engaged in the study of crustacean fauna of India. Over 3000 samples of freshwater crustaceans have been collected from all over India. Of these, only a single sample which was collected from Ropar (Punjab) on 21.9.1985 contained 4 specimens of parthanoganic reproductive females of *Moinodaphnia meclavi* (King.). The literature search revealed that this taxon had only once been reported from India by Brehm in 1953.

Since this species is very rare in its occurrence in India, a short illustrated description of it is presented in this short note.

Moinodaphnia a closely related genus to *Moina* Baird was erected by Herrick in 1887. However, it differs from *Moina* in the shape of the head, carapace and in the possession of ocellus. *Moinodaphnia* has the unusual setation on the second antennae, the distal segment of the exopod has four rather short setae instead of three long setae. The abdominal folds are well developed serving to close off the brood pouch. The compressed body has the elliptical valves crested dorsally. Carapace covers the body but for the head. Head is conical.

Although under the genus *Moinodaphnia*, as many as seven species have been described yet six of these have either been transferred to the genus *Moina* or synonymised with *M. macleayi* (King) with the result *Moinodaphnia* remains monotypic (see Goulden, 1968).

SYSTEMATIC ACCOUNT

Class	CRUSTACEA
Subclass	BRANCHIOPODA
Order	CLADOCERA
Family	MOINIDAE

Moinodaphnia Macleayi (King, 1853)

Moina Macleayii King, 1953 *Roy.Soc. Van Diemens-Land papers* pp. 251-252, pl.5
Moina submicronata Brady, 1986 *Linn. Soc. Journ. Zool.* p. 294, pl. 3.

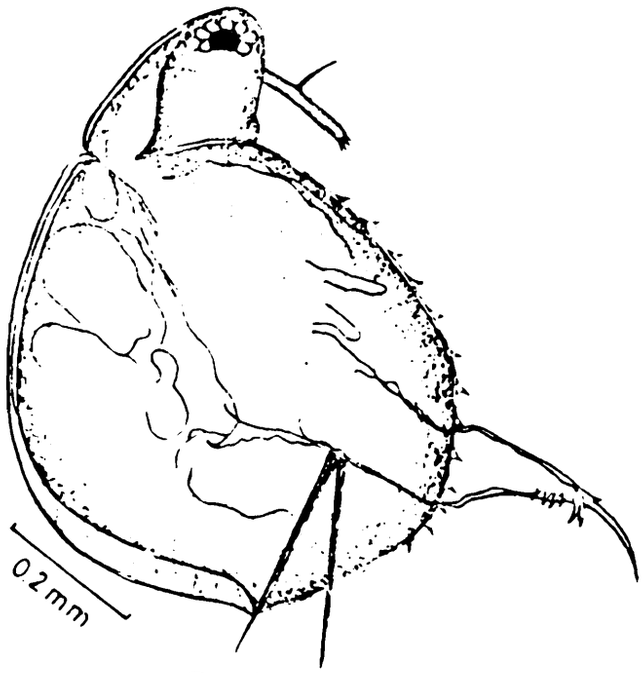

Fig.1

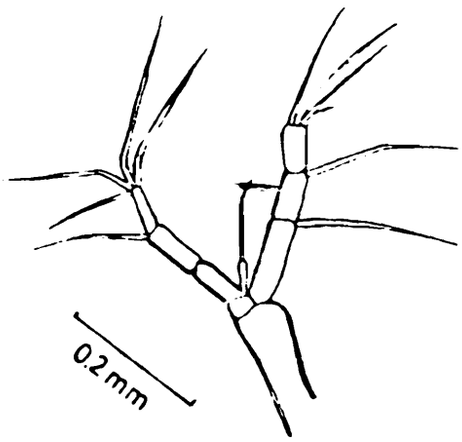

Fig.2

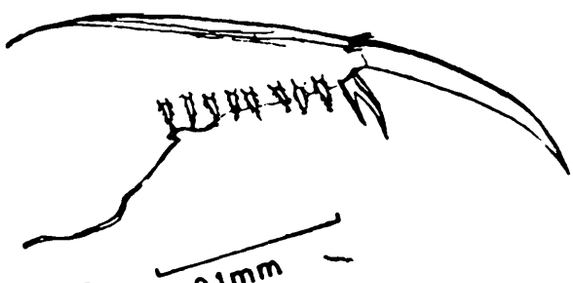

Fig.3

Fig. 1. Parthenogenic female from right side
Fig. 2. Antenna
Fig. 3. Postabdomen of female

Moinodaphnia alabamensis Herrick, 19887 *Mem. Soc. Zool. France* pp. 35-56.
Moinodaphnia mocqueryst Richard, 1892, *Mem. Soc. Zool. France* pp. 222-226, fig. 7-8.
Moinodaphnia macleayi Brehm, 1953 *Osterreichische Zool. Zeit.* pp. 324-325, fig. 92.

Material studies : Four reproductive females. Coll. ditch at Ropar (Punjab).

Female : (Compressed and crested dorsally with elliptical valves completely covering body except head; head triangular having flat ventral side carrying long and thin antennules, large eye present near the tip of the head, ocellus present; fornics well developed; antenna long, basal segment bearing two sensory setae, endopod three segmented and bearing normal setae, exopod distal segment with four setae, postabdomen having distal tapering end, ten feathered spines and a bident spine, claw without pectin but with fine hair. Ephippial female not found.

Size : 1.0-1.1 mm (Slides $C_{2i}F_{i}$, and $C_{2i}Fa$).

Male : Not found.

Distribution : Moinodaphnia has been reported from atleast four continents : Africa, Asia, Australia and South America and quite a few islands. In India it occurs rarely, the only previous record of it is by Brehm (1953).

According to Goulden (1968) *Moinodaphia* apparently has a completely different distribution and habitat from *Moina,* it occurs in small lakes, swamps and pools. Contrary to the Goulden's observation *M. mecleayi* for the present study was collected from a pond, about half acre in area and depth of 60 cm.

SUMMARY

Moinodaphnia mecleayi (King) has been reported from a pond at Ropar (Punjab). It is very rare in its occurrrence in India. The only previous record of it from India is of Brehm (1953).

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STUDIES ON THE ICHTHYOFAUNA OF NASIK DISTRICT, MAHARASHTRA, INDIA

D. F. SINGH & G. M. YAZDANI

Zoological Survey of India, Western Regional Station, Pune-5

INTRODUCTION

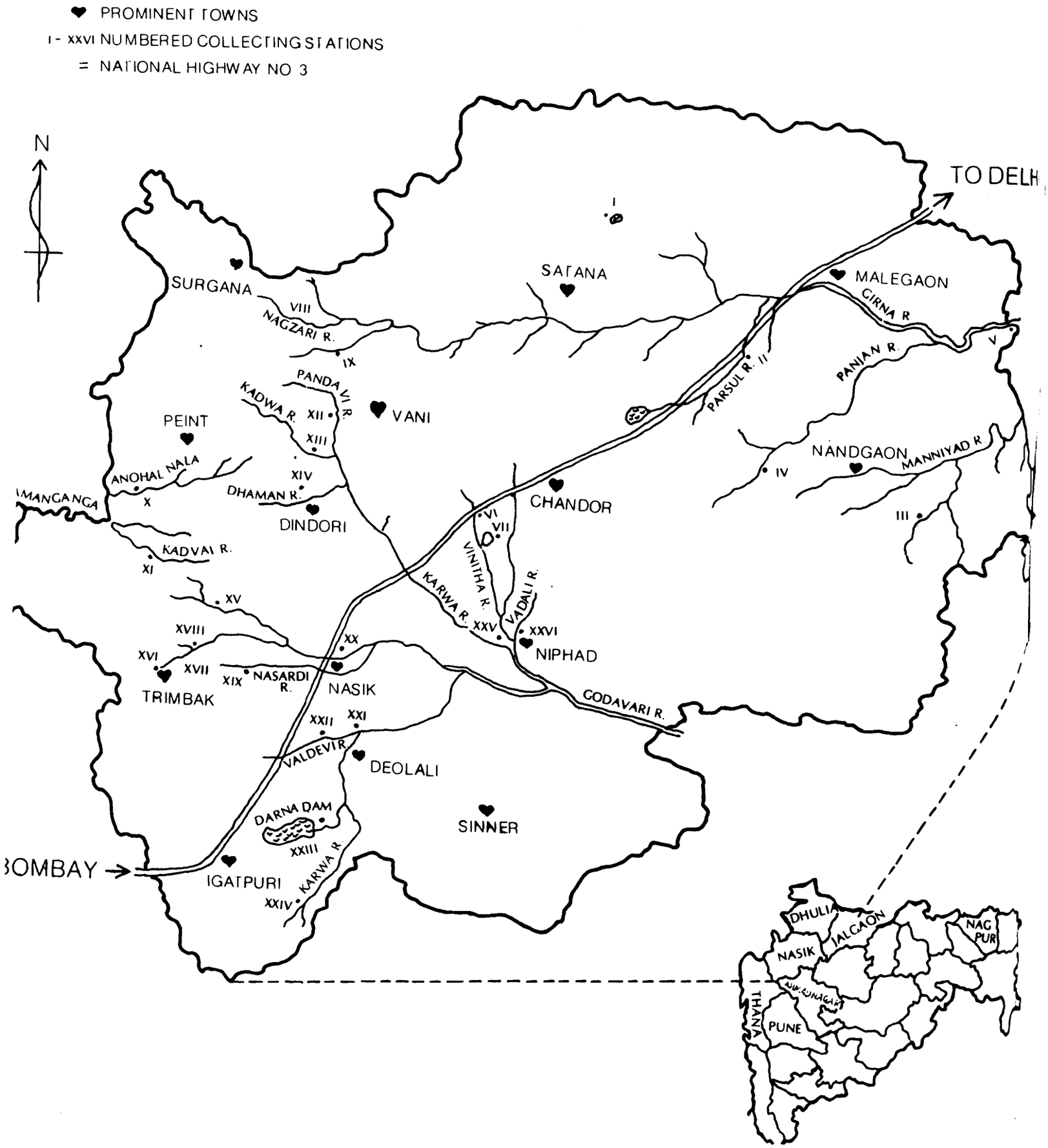
The Ichythyofauna of Maharashtra have been the subject of only a few studies. Annandale (1919) studied the fishes of Pune and Satara districts, Kalawar and Kelkar (1956) of Kolhapur while Frazer (1942), Tonapi & Mulherkar (1963), Tilak & Tiwari (1976) studied for Poona district. Recently Singh (in press) and Singh & Kamble (in press) surveyed the fish fauna of Dhulia and Jalgaon districts respectively.

Apart from a survey of fishes of Deolali (Hora & Misra 1937, 38) no attempt has been made so far to study the Ichythyofauna of Nasik district although the river Godavari which originates from this region is known to contain fish fauna of zoographical significance. Hora & Misra (1938) described the interesting hill stream Cyprinid fish *Parapsilorhynchus prateri* from Darna river near Deolali, which is a tributory of R. Godavari.

To explor the faunal wealth of this district 4 surveys were conducted (1973, 84, 87, 88). The present work is based on fish material collected during these four surveys. Nasik district (Fig. 1) lies between 19° 35' and 20° 52° north latitude and 73° 16' and 74° 56' east longitude, covering an area of about 15,582 km^2. To the north west Nasik district borders the Dangs and Surat districts of Gujarat while to its north lies Dhulia district of Maharashtra.

The district is drained by two chief rivers, the Girna and Godavari, their tributaries and a few small Konkan rivers. Godavari or the southern Ganga originates from the Sahyadris (Western ghats) at Trimbak, about 25 km west of Nasik. A few kilometers upstream from Nasik a dam (Gangapur) has been built across the river. From Nasik the river follows a east-south-easternly course. The principal tributaries of Godavari are the Nasardi, Darna and Kadwa rivers. The Girna rises at about 8 km east of Sugana in the Sahyadris mountains and flows eastwards along a wide bed. On its way it receives a number of tributaries like the Panjan and Manniyad. The Konkan rivers originate from the western side of the Sahyadris and flow westwards into the Arabnian sea. The chief river is the Damanganga which rises near Peint. It traverses a long winding and deeply entrenched course before turning westwards in Gujarat State.

NASIK DISTRICT



List of Collection stations.

A total of twentysix collecting stations were made from where the fish samples were taken for study. Cast net & bagnets were used for collecting.

Satana taluka

I. Changaon tank (Satana-Nampur road)

Malegaon taluka

II. Parsul river (Devia-Malegaon road)

Nandgaon taluka

III. Manniyad river (Nandgaon-Aurangabad road)
IV. Panjan river (Nagapur village)
V. Girna river (Pilkhod village)

Chandor taluka

VI. Vinitha river (Vadalibhol village)
VII. Kedaraya lake

Surgana taluka

VIII. Nagzari river (Vani-borgaon road)
IX. Girna river (Hiradpada village)

Peint taluka

X. Anohal nalla (13 km SW of Peint)
XI. Kadvai river (Hrasul)

Dindori taluka

XII. Pandave river (Vani-Borgaon road)
XIII. Kadwa river (Dindori-Vani road)
XIV. Dhaman river (Dindorl)

Nasik taluka

XV. Kashiganga river (Vaghera-Girnare road)
XVI. Godavari river (Trimbak)
XVII. Banganga stream (Trimbak)
XVIII. Pundi nalla (Trimbak)
XIX. Nasardi river (Trimbak-Nasik road)
XX. Godavari river, Nasik
XXI. Darna river, Deolali
XXII. Valdevi river, Deolali

Igatpuri taluka

XXIII. Darna dam
XXIV. Karwa river, (Pimpalgaon dukra)

Niphad taluka

XXV. Kadva river, Basalpur
XXVI. Vadali river (Niphad)

SYSTEMATIC ACCOUNT

Order : Osteoglossi formes

Family Notopleridae

1. **Notopterus notopterus** (Pallas)

1769. *Gymnotus notopterus* Pallas, *Spicll, Zool.*, Petersburg 7, p-40, Pl. 6, fig. 2 Typeloc. Indian Ocean.

Material XXV, ^

Order : Cypriniformes

Family : Cyprinidae

Subfamily Cultrinae

2. **Salmostoma untrahi** (Day)

1869. *Chelà untrahi* Day, *Proc. zool. Soc.*, p. 381.

Subfamily : Rasbnorinae

3. **Danio aequipinnatus** McClelland

1839. *Perilampus aequipinnatus* McClelland. *Asiatic Researches,* 19, p. 393. Type Loc : Assam.

Material : I-3; VI-46.

4. **Rasbora daniconius** (Ham.)

1822. *Cyprinus deniconius* Hamilton. *Fish. Ganges* p. 327. Type-Loc : rivers of Southern Bengal.

Material I-6; VII-8; VI-40; XIV-1; XV-2; XVI-13; XVIII-1.

5. **Barilius bendelisis** (Ham.)

1807. *Cyprinus bendelisis* Hamilton, *Journey Mysore,* 3, p. 345, pl. 32. Type-Loc : rivers of Mysore.

Material I-29; VI-2; VII-1; II-2; XXIV-1.

Subramily : Cyprininae

6. **Puntius conchonius** (Ham)

1822. *Cyprinus conchonius* Hamilton. *Fish Ganges,* pp. 317, 389. Type-Loc : North east Bengal and rivers Kosi & Ami.

Material I-23.

7. **Puntius ticto ticto** (Ham)

1822. *Cyprinus ticto* Hamilton, *Fish Ganges* pp. 314, 389, p. 18, Fig. 87. Type-Loc : South-eastern parts of Bengal.

Material XXIV-1.

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* The first Roman number denotes the station No., followed by the number of examples collected from that locality.

8. **Labeo boggut** (Sykes)

1841. *Chondrostoma boggut* Sykes, *trans. zool. Soc.*, London, 2, p. 359. Type-Loc : Poona.

Material : I-3; VII-7; XXV-1.

9. **Labeo pangusia** (Ham)

1822. *Cyprinus pangusia* Hamilton, *Fish Ganges*, pp. 285, 386. type-Loc ; River Kosi.

Material : XX-1.

10. **Parapsilorhynchus prateri** Hora & Misra

1938. *Parapsilorhynchus prateri* Hora and Misra *Jour. Bombay nat. Hist. Soc.* XI(1) : 20-38, Type-Loc : Deolaii, Nasik.

Material : XVII-53.

11. **Parapsilorhynchus tentaculatus** (Annandale)

1919. *Psilorhynchus tentaculatus*, Annandale, *Rec. Indian Mus.* XVI, p. 128. Type Loc : Khandalla, Poona.

Material : XI-14.

Subfamily Garrinae

12. **Crossocheilus latius latius** (Ham)

1822. *Cyprinus latius* Hamilton, *Fish, Ganges*, pp. 345, 393. Type-Loc : The Tista.

13. **Garra mullya** (Sykes)

1841. *Chondrostoma mullya* Sykes, *trans. zool. Soc.*, London, 2, p. 359, pl. 62, fig. 3.

Material : I-1; V-1; VII-1; XVI-1; XVII-2.

14. **Garra gotyla stenorhynchus** (Jerdon)

1849. *Gonorhynchus stenorhynchus* Jerdon, *Madras J.lit. Sci.* Madras, 15, p. 310, type-loc : Bhany river, Nilgiris.

Material XII-1.

Family : Cobitidae

Subfamily Noemacheilinae

15. **Oreonectes evezardi** (Day)

1878. *Nemachilus evezardi* Day, *Fish India*, p. 613, pl. 153, Fig. 11. Type-Loc : Poona.

Material II-8; IV-2; VIII-1; XI-9; XV-1; XVIII-10; XVI-28.

16. **Noemacheilus botia botia** (Hamilton)

1822. *Cobitis botia* Hamilton *Fish Ganges*, pp. 350, 358, 394, 394. Type-Loc : rivers of north-eastern parts of Bengal.

Material I-6; III-1; XXIII-1.

17. **Noemacheilus denisonii** Day

1867. *Nemacheilus denisonii* Day, *Procx. zool. Soc. London*, p. 287.

Material III-2; VI-2; XIII-1; XVI-5; XXI-8; XXIV-33.

Subfamily Cobitinae

18. Lepidocephalus (Lepidocephalichthys) guntea (Ham)

1822. *Cobitis guntea* Hamilton *Fish Ganges*, pp. 353, 394. Type-Loc : Ponds and freshwater rivers of Bengal.

Material I-2; III-2; XIII-1; XVI-50; IV-1; VIII-1.

19. Lepidocephalus (Lepidocephalichthys) thermalis (Val)

1846. *Cobitis thermalis* Valenciennes *Hist. nat. Poiss.* 18 p. 78. Type-loc : Ceylon.

Material : VI-24; XV-7; XVII-31.

Order : Siluriformes

Family : Bagridae

20. Mystus cavasitus (Hamilton)

1822. *Pimelodus cavasius* Hamilton *Fish Ganges*, pp. 203, 379, pl. 11 Fig. 67. Type-Loc. Larger feshwater rivers of Gangetic provinces.

Material I-1.

Order : Atheriniformes

Family Poecilidae

21. Gambusia affinis (Baird & Girard)

1853. *Heterandia patruelis* Baird and Girard, *Proc. Acad nat. Sci. Philad.* 6, p. 390. type-Loc : Rio Sabinal, Texas.

Material : IV-14; XXII-26.

Order : Perciformes

Family : Gobiidae

22. Glossobius giuris (Hamilton)

1822. *Gobius giuris* Hamilton, *Fish Ganges*, pp. 51, 366, pl. 33 fig. 15. Type-Loc : Ponds & freshwater rivers of Gangetic Provinces.

Material XXIV-9; XXV-4.

23. Chanda nama Hamilton

1822. *Chanda nama* Hamilton, *Fish Ganges*, pp. 109, 371, pl. 39, fig. 37. Type-Loc : Bengal.

Material XXIII-8.

Order Channiformes

Family Channidae

24. Channa orientalis Schneider

1801. *Channa orientalis* Schneider, *Syst. Ichth, Bloch.* p. 496, pl. 90. Fig. 2.

Material IV-1.

Hora and Misra (1938) described a new species *Parapsilorhynchus prateri* from Darna stream near Barnes High School estate, Deolali. In 1988 we visited the type locality but failed to get a single specimen. The stream (which ultimately meets Darna river near Deolali cantt). was chocked with weeds and was in a highly polluted stage due to sewage from nearby housing colonies. The present records of the allied species. *P. tentaculatus* (Annandale) form the first record from this district. It was collected from Kadvai river near Harsul (Peint taluka). The *Parapsilorhynchus* has a very restricted distribution, mainly occuring in the streams of the western ghats and the Satpura hill ranges.

SUMMARY

The fish fauna of Nasik district was surveyed at 26 collecting stations covering the entire area. Godavari river and its major tributaries were specially surveyed. 579 specimens were examined, comprising of 24 species. The presence of the Cyprinid fish *Parapsilorhynchus tentaculatus* (Annandale) is the first record from this region.

ACKNOWLEDGEMENT

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ON A COLLECTION OF CLAVICORN BEETLES (FAMILIES EROTYLIDAE, ENDOMYCHIDAE AND LANGURIIDAE) FROM ARUNACHAL PRADESH, INDIA

T.K. PAL

Zoological Survey of India, New Alipore, Calcutta 700 053

INTRODUCTION

The Erotylidae, Endomychidae and Languriidae are sharply defined moderately large families of the section Clavicornia under the superfamily Cucujoidae. The representatives of these families are small to large, elongate or elongate-ovoid, generally brightly coloured with slender legs and clavate antennae. Despite having distinct characteristics they are often confused with one another for many sharing characters and great similarity in appearance. The first two families (*viz.*, Erotylidae and Endomychidae) share the same habitat of fungal background and similar prevailing colouration therewith. The Languriidae on the other hand are not fungus-frequenting beetles but are phytophagous, especially in the larval stage. These immatures live within vegetal parts of plants and this narrow space of living might have contributed to the elongated body form of the languriids. These three families are largely tropical with very few representatives in temperate regions. The erotylids and endomychids being associated with fungus grown upon rotting woods and languriids dependent upon various shrubs or trees, are all primarily forest dwellers. Variety of vegetation in different altitudes plus abundance of rotting tree stumps in humid forests of Arunachal Pradesh have facilitated a good growth and assemblage of these families in this region.

Following the publication of Arrow's 'Fauna' in 1925 not much works have come out from the Indian region. Only recently Sengupta and Mukherjee (1977, 1979, 1985) have dealt with the languriines of Himalaya and described a new genus from this part; Vazirani and Saha (1972) described 1 new endomychid species, and Strohecker (1914, 1975, 1982, 1983) described 1 new genus, 11 new species and recorded 2 Sri Lankan species of Endomychidae from India. Though prevalent in parts of India including Arunachal Pradesh and less emphasized in recent studies, a renewed attention is given to these 3 families keeping in view of the destruction of climax forests in which most of these beetles specialize. Threat to many of them are thereby well apparent. The present work is based on some recent collection, made by the author in different districts of Arunachal Pradesh. This collection comprises 16 species under 11 genera. Of these, 10 species under 6 genera (including 2 new species) are from Erotylidae, 3 species under 2 genera are from Endomychidae and 3 species under 3 genera are from Languriidae. Uptil now about 79 species of Erotylidae, 66 species of Endomychidae and 76 species of Languriidae are recorded from the Indian territory.

SALIENT EXTERNAL DIFFERENCES OF THREE FAMILIES

	Erotylidae	*Endomychidae*	*Languriidae*
i)	Tarsal formula 5-5-5	Tarsal formula 4-4-4	Tarsal formula 5-5-5
ii)	Front coxal cavities closed	Front coxal cavities open	Front coxal cavities open
iii)	No fovae on pronotal base	A pair of fovae on pronotal base	Usually a pair of fovae on pronotal base; rarely absent (Cryptophilinae)

SYSTEMATIC ACCOUNT

Family EROTYLIDAE

Subfamily DACNINAE

Genus I. **Episcapha** Lacordaire

1842. *Episcapha* Lacordaire, *Monog. Erotyl.* : 48 [Type species : *Engis quadrimacula* Wiedemann]

1. **Episcapha xanthopustulata** Gorham

1890. *Episcapha xanthopustulata* Gorham, *Notes Leyd. Mus.*, **12** : 46.

1925. *Episcapha xanthopustulata* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 41.

Diagnosis : Facies elongate-ovoid, subdepressed and covered with fine velvetty pubescence; head with large eyes, 11-segmented antenna with 3-segmented club; transverse prothorax with lateral margins gently curved and converging in front but rather straight and parallel behind; elongate-ovoid elytra with linear straitions; entirely blackish body with orange spot in the middle of forehead, two transverse orange bands on each elytron - one at base and other before apex, bands rather irregular in outline. Length 11-13 mm.

Material examined : 2 ex. India : Arunachal Pradesh, Lower subansiri Distt., Tago, 10 km. O-Yazali, 1 ex., 17. ix. 1988, T.K. Pal, *ex.* fungusy log; Dibang Valley Distt., 3 km. O-Roing, 400 m., 1 ex., 8.ix.1991, T.K. Pal, *ex.* fungusy log.

Distribution : India : Arunachal Pradesh (New record); Myanmar; Indonesia; Singapore.

2. **Episcapha indica** Crotch

1876. *Episcapha indica* Crotch, *Cist. Ent.*, 1 : 408.
1878. *Episcapha chapuisi* Dohrn. *Stettin ent. Zeit.*, 39 : 449.
1925 *Episcapha indica* : Arrow, *Fauna Brit. India. Coleoptera, Clavicornia* : 43.

Diagnosis : Facies elongate-ovoid, subdepressed, moderately shiny, upper surface of elytra devoid of pubescence and head and pronotum with scanty short pubescence; head rather strongly punctate, antennal club little longer than segments 4 to 8 together; transverse prothorax with lateral margin evenly curved, pronotal border raised but not carinate, pronotal disc rather strongly punctate; elytral punctures fine and diffused; blackish body with each elytron possesses two yellow patches, one at base occupying humeral angle and enclosing a small black humeral spot, other patch behind middle and transverse, patches are irregular in outline. Length 14 mm.

Material examined : 1 ex. India : Arunachal Pradesh, Lower subansiri Distt., Tago, 10 km. O-Yazali, 17.ix.1988, T.K. Pal, ex. loose bark.

Distribution : India : West Bengal (Darjeeling Distt.), Arunachal Pradesh (New record); Myanmar.

3. **Episcapha nocte**, n. sp.

General appearance (Fig. 1) elongate-ovoid, subdepressed, covered with fine velvetty pubescence; blackish body and elytra decorated with two pairs of broad bands.

Head broader than long, apical margin truncate; eyes large and coarsely facetted, separated dorsally by little less than thrice its width; antennal insertions widely separated; puncturation on dorsal side moderately coarse and dense, interspaces about as wide as punctures. Antenna moderately long and slender, scape moderately large and broadly elongate, pedicel shorter and narrower than scape, segments 3-6 subequal and a little elongate, segments 7 and 8 subequal and about as broad as long, club 3-segmented and rather compact with segments more or less transverse.

Prothorax transverse, widest at base, moderately narrowed anteriorly, sides feedly rounded, front margin deeply emarginate, front angles acutely produced; lateral margin distinctly carinate, two pits on either extremity and third one near anterior third; base bisinuate with a broad median lobe, no prebasal impression; pronotum densely punctate but a little finer than that of head, setae projected towards middle line. Scutellum transverse, punctate pubescent.

Elytra broadly elongate, little wider than prothorax at base, sides nearly parallel or indistinctly curved in anterior two-thirds and narrowed at posterior third, elytral apices rounded separately; finely and densely punctate with puncture irregularly arranged, dense setae projected posteriorly; each elytron decorated with two large reddish-yellow spots, first one situated little below base, rather subquadrate and touching base by a broad stalk and leaving a black spot at humeral angle, second transverse and situated considerably above apex, coloured spots not touching either inner or outer margin.

Ventral surface shiny, punctures finer, entirely blackish.

Measurements of holytype : Total length 12.0 mm., width of head across eyes 2.0 mm., length of antenna 3.52 mm., length and width of prothorax 2.50 and 3.80 mm., length and width of elytra 8.40 and 4.80 mm.

Holotype 1 ex., India : Arunachal Pradesh, Tirap District, Tisa, 270 m., 16.iii.1990, T.K. Pal, *ex.* fungusy bark (Zoological Survey of India, Calcutta).

Etymology : This species is named after the ethnic aborigines of the area (Tirap district) from where the species is described.

Comments : This species resembles *quadrimacula* (Wiedemann) and *xanthopustulata* Gorham. It can be distinguished from *quadrimacula* by its prothorax proportionately less wide, gradually converging from posterior towards anterior side, posterior angles slightly acute (not right angle as in *quadrimacula*), front angles more acutely produced, lateral margin of pronotum distinctly carinate and devoid of submarginal border, pronotal disc more closely and densely punctate, and hairy clothing on body a little finer. In addition to above characters absence of orange spot on forehead and devoid of linear striated punctures of elytra separate this species from *xanthopustulata*.

Genus II. **Megalodacne** Crotch

1873. *Megalodacne* Crotch, *Trans. Amer. Ent. Soc.*, : 352 [Type species : *Ips fasciata* Fabricius].

4. **Megalodacne vitalisi** Arrow

1921. *Megalodacne vitalisi* Arrow, *Trans. Ent. Soc. London*, **1921** : 287.

1925. *Megalodacne vitalisi* Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 49.

Diagnosis : Elongate-oval and moderately convex in form, dorsum smooth and shining; head strongly punctate with coarsely facetted large eyes, 11 segmented slender antenna with 3-segmented loose club and 3rd antennal segment fairly longer than the 4th; prothorax slightly broader than long with sides little convergent in front and rather parallel behind, front angles acutely produced with pronotal disc rather strongly and evenly punctate; lateral margins of elytra narrowly flanked, punctures in longitudinal rows with interspaces minutely punctate; blackish body, each elytron with two reddish spots - one in both anterior and posterior halves, spots lateral but not reaching margin, anterior spot extends to near suture and reaching base leaving only a small black area, posterior spot placed before apex which is arched behind and produced at three points anteriorly. Length - 8-8.2 mm.

Material examined : 4 ex. India : Arunachal Pradesh, Dibang Valley Distt., 14 km. O-Mayodia, 1900 m., 4 ex., 17.ix.1991, T.K. Pal, *ex.* rotten wood.

Distribution : India : Arunachal Pradesh (New record), West Bengal (Darjeeling Distt.); Myanmar; Viet-Nam.

5. **Megalodacne consimilis** Arrow

1925. *Megalodacne consimilis* Arrow, *Fauna Brit. India. Coleoptera, Clavicornia* : 53.

Diagnosis : Elongate-oval and moderately convex in form, dorsum smooth and shining; head and antennal features similar to *M. vitalisi*; distinctly transverse prothorax (1 : 1.5) convergent in front with acutely produced front angles, pronotal disc strongly and evenly punctate; elytral punctures in rows with interspaces minutely punctate; blackish body, each elytron with two orange spots - anterior one behind shoulder which touches base by a branch leaving the humeral angle black, and the second spot before apex; abdomen, tarsi and base of antennae dark reddish. Length - 3.6 - 4.6 mm.

Material examined : 8 ex. India : Arunachal Pradesh, Dibang Valley Distt., Parbuk, 5 km.)-Shantipur, 150 m., 8 ex., 1.x.1991, T.K. Pal, *ex.* fungusy log.

Distribution : India : Arunachal Pradesh (New record), Uttar Pradesh.

Genus III. **Paracoptengis** Heller

1918. *Paracoptengis* Heller, *Arch. f. Nat.*, **84** : 54 [Type species : *Coptengis nigrolineatus* Allard].

6. **Paracoptengis brahminicus** (Gorham)

1883. *Triplatoma brahminica* Gorham, *Proc. Zool. Soc. London* **1883** : 80.

1925. *Paracoptengis brahminicus* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 65.

Diagnosis : Elongated, convex with slender legs and moderately long antennae, dorsum moderately smooth and devoid of pubescence; head with fine-dense punctures, finely facetted small eyes transversely placed and wide apart, 11 segmented antenna with 3-segmented club rather narrow elongate and flat; prothorax about as broad as long, nearly parallel-sided but a little contracted in front and behind, sides distinctly margined and base nearly straight, pronotum with fine-dense punctures; elytra with narrow base, gently and uniformly rounded sides and truncate apex, costae feebly prominent; dorsum black, each elytron decorated with two very narrow zigzag transverse orange bands extending almost from outer margin to near suture, anterior band little behind elytral base and posterior band before apex; tarsi little dilated and ventrally densely pubescent. Length - 18.2 mm.

Material examined : 1 ex. India : Arunachal Pradesh, Lohit Distt., Zerogaon, 12 km. O-Khupa, 700 m., 27.ii.1990, T.K.Pal, *ex.* under bark.

Distribution : India : Arunachal Pradesh (New record), Assam.

Subfamily TRITOMINAE

Tribe ENCAUSTINI

Genus IV. **Aulacochilus** Lacordaire

1842. *Aulacocheilus* Lacordaire, *Monog. Erotylines* : 242 [Type species : *Erotylus javanus* (Guerin-Moeneville)].

1871. *Aulacochilus* Bedel, *Trans. ent. Soc. Fr.*, (5) 1 : 271.

7. **Aulacochilus janthinus** Lacordaire

1842. *Aulacochilus janthinus* Lacordaire, *Monog. Erotylines* : 250

1858. *Aulacochilus atrocyaneus* Motschulsky, *Etudes Ent.*, 7 : 117.

1871. *Aulacochilus sericeus* Bedel, *Ann. Soc. ent. Fr.* (5) 1 : 282.

1871. *Aulacochilus atrocoeruleus* Bedel, *Ann. Soc. ent. Fr.* (5) 1 : 183.
1925. *Aulacochilus janthinus* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 90.

Diagnosis : Elongate-oval and convex in form with moderately long legs and antennae, dorsum not very shining or smooth; head rather coarsely and densely punctate, coarsely facetted large eyes separated by two and a half times their width, 11-segmented antenna with 3rd segment longer than segments 4 and 5 together and 3-segmented club flat but not much compact; transverse prothorax with sides divergent posteriorly and margins raised, pronotum coarsely punctate but a little finer than the head; entirely bluish-black species with the mouth parts and last tarsal segments little reddish. Length - 5 - 5.6 mm.

Material examined : 3 ex. India : Arunachal Pradesh, Changlang Distt., 3 mile, Miao-Vijoynagar Road, 300 m., 2 ex., 5.iii.1990, T.K. Pal, *ex.* rotten wood; Papum Pare Distt., Chimpu, Itanagar, 1 ex., 27.v.1992, T.K. Pal, *ex.* bracket fungi.

Distribution : India : Arunachal Pradesh (New record), Assam; Myanmar; Thailand; Cambodia; Malaysia; Indonesia.

8. Aulacochilus nigrorufus, n. sp.

General appearance (Fig. 2) elongate-ovoid and convex with moderately long legs and antennae, dorsum not very shining and smooth; blackish body and elytra decorated with two reddish-brown spots.

Head broader than long, apical margin of clypeus truncate, fronto-clypeal suture little arcuate; eyes large and coarsely facetted, separated dorsally by twice its length; antennal insertions widely separated; puncturation on vertex moderately coarse and dense and interspaces little wider than punctures, puncturation on clypeus little denser than on vertex. Antenna moderately long and slender, scape moderately large and broadly elongate, pedicel shorter and narrower than scape, segment 3 longer than segments 4 and 5 together, segments 4-8 short and subequal, club 3-segmented and rather compact with segments more or less transverse.

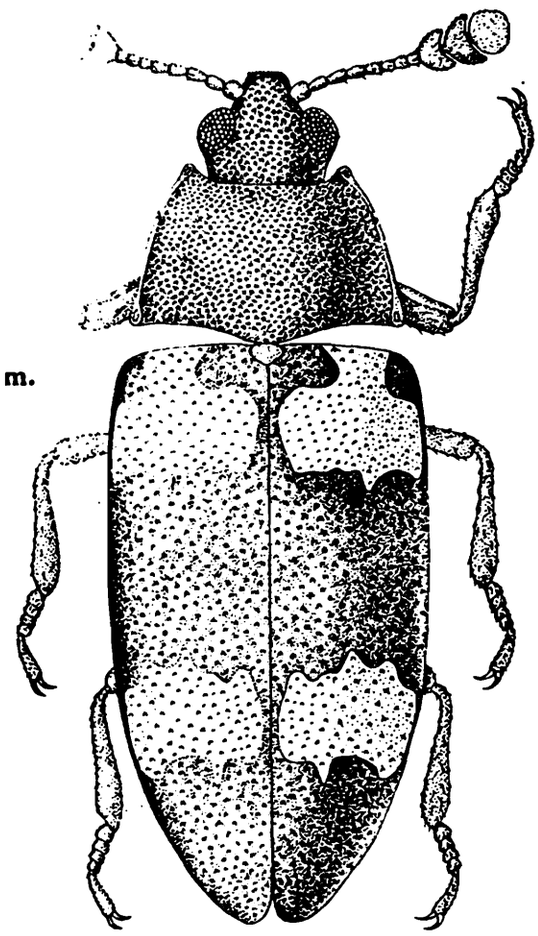

Fig. 1. *Ephiscapha nocte* n.sp., Dorsal view.

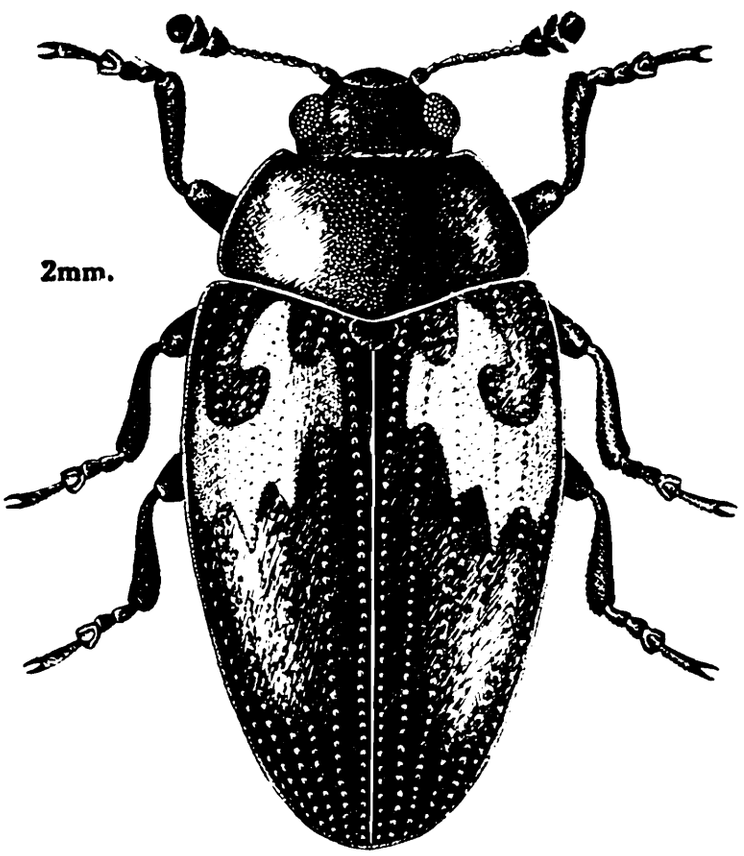

Fig. 2. *Aulacochilus nigrorufus* n.sp., Dorsal view.

Prothorax transverse, widest at base, moderately narrowed anteriorly, sides evenly rounded, front margin deeply emarginate, front angles produced and nearly right angle; lateral margin feebly raised, pits on either extremity very small; basal margin bi-emarginate with broad median lobe, no prebasal impression; pronotal disc moderately coarsely and densely punctate, puncturation denser on sides than on median part. Scutellum transverse and finely punctate.

Elytra broadly elongate, hardly wider than prothorax at base and closely fitting with it, sides evenly rounded to apex, lateral edges very narrowly flanked and finely bordered; distinct puncture rows visible, 8 in numbers and all becoming obsolete on apical fifth of elytra, intervals of rows bear very fine scattered punctures; each elytron decorated with a reddish-brown irregular but rather distinctly bordered spot occupying greater part of anterior half, spot not reaching either internal or external or basal margin, three incisions on posterior border and two incisions on anterior border of spot.

On ventral side pro- to metrasterna little coarse and rather sparsely punctate, abdomen and especially last ventrite rather densely punctate, entirely blackish.

Measurements of holotype : Total length 7.20 mm., width of head across eyes 1.60 mm., length of antenna 2.00 mm., length and width of prothorax 1.72 mm. and 3.04 mm., length and width of elytra 5.52 mm. and 3.72 mm.

Holotype 1 ex., India : Arunachal Pradesh, Dibang Valley District, 3 km. O-Roing, 400 m., 8.ix.1991, T.K. Pal, ex. fungus on log; *Paratypes* 3 ex., date same as holotype (Zoological Survey of India, Calcutta).

Etymology : The name *nigrorufus* refers to the reddish-brown spots on blackish body, or elytra in particular.

Comments : This species shows resemblances with *tricoloratus* Gorham but can be separated by its elytra bear a pair of reddish-brown spots in anterior half whose edges are rather well defined and pattern is somewhat different; the ground colour of the body is darker and black.

TRIBE TRITOMINI

Genus V. **Neotriplax** Lewis

1887. *Neotriplax* Lewis, *Ann. Mag. Nat. Hist.* (5)**20** : 60 [Type species : *Neotriplax atrata* Lewis].

9. **Neotriplax rubens** (Hope)

1831. *Erotylus rubens* Hope, *Gray's Zool. Misc.* : 31.
1876. *Amblyopus rubens* : Crotch, *Cist. Ent.*, **1** : 435.
1909. *Neotriplax rubens* : Arrow, *Ann. Mag. nat. Hist.* (8) **4** : 196.
1925. *Neotriplax rubens* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 114.

Diagnosis : Broad-oval and convex in form with stout long legs, dorsum smooth and shining; head finely punctate and with finely facetted rather small eyes placed distantly, rather short 11-segmented antenna with 3rd segment about twice as long as 4th and bearing a broad flat compact 3-segmented club, clypeal apex little emarginate; transverse prothorax with sides divergent backward and hind angles nearly right angle, pronotum finely punctate with well developed angle-pores; elytra bear lines of punctures with intervals more minutely punctate, scutellum semicircular; bright orange-red with front of head, antennae and legs blackish. Length - 7.2 mm.

Material examined :1 ex. India : Arunachal Pradesh, West Kameng Distt., Sangti, 1400 m., 9 km. O-Dirang, 23.xi.1990, T.K.Pal, *ex.* under bark.

Distribution : India : Arunachal Pradesh (New record), Uttar Pradesh, Himachal Pradesh; Nepal ; Viet-Nam.

Genus VI. **Tritoma** Fabricius

1775. *Tritoma* Fabricius, *Syst. Ent.* : 570 [Type species : *Tritoma bipustulata* Fabricius].

10. **Tritoma scutigera** Arrow

1925. **Tritoma scutigera** Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 140.

Diagnosis : Broadly elongate-oval and convex in form with short antennae and legs, dorsum smooth and shining; head finely punctate with finely facetted moderately large eyes placed far apart, 11-segmented antenna with 3-segmented club rather compact and flat; transverse prothorax divergent posteriorly with sides margined and hind angles bluntly obtuse, pronotum similarly puncate as the head; elytra bear lines of punctures with intervals more minutely punctate; all coxae widely separated; dorsum orange-yellow with pronotum, sides and apex of elytra, segment 6 onwards of antenna, and femora and tibiae black. Length 4.2 mm.

Material examined : 2 ex. India : Arunachal Pradesh, Papum Pare Distt., Chimpu, Itanagar, 400 m.,

27.v.1992, T.K. Pal, *ex.* bracket fungi.

Distribution : India : Arunachal Pradesh (New record), Assam.

Family ENDOMYCHIDAE
Subfamily ENDOMYCHINAE
Tribe EUMORPHINI

Genus I. **Eumorphus** Weber

1801. *Eumorphus* Weber, *Observ. Ent.* : 31 [Type species : *Erotylus quadrgquttatus* Illiger.].

1. **Eumorphus quadriguttatus** var. pulchripes Gerst

1800. *Erothlus quadriguattatus* Illigar, *Wiedemann's Arch.f.Zool.* (2) **1** : 124.
1801. *Eumorphus sumatrae* Weber, *Observ. Ent.* : 59.
1801. *Eumorphus imarginatus* Fabricius, *Syst. Eleuth.* **2** : 11.
1857. *Erotylus quadriguttatus var.* pulchripes Gerst., *Archiv. f. Nat.* **23** : 228.
1858. *Eumorphus quadriguttatus* : Gerst., *Mong. Endom.* : 110.
1858. *Eumorphus quadriguttatus* var. *pubchripes* Gerst., *Monog. Endom.* : 112.
1858. *Heterandrus quadriguttatus* : Guerin-Meneville, *Rev. Mag.Zool.* (2)**10** : 26.
1925. *Eumorphu quadriguttatus* var. *pulchripes* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 305, 306.

Diagnosis : Elongated-oval and moderately convex in form with legs and antennae slender and dorsum moderately shining; head with large eyes obliquely placed, 11-segmented antenna with 3rd segment about twice as long as 4th segment and segments 9-11 forming a flat, borad, abrupt club; transverse prothorax little contracted in posterior third, front angles bluntly produced and hind angles rather acutely, pronotal disc impunctate, lateral margins raised and rather carinate in unbroken manner; humeral angles of elytra little raised above surface, lateral margins narrowly flanked, dorsal surface minutely punctate; blackish body, each elytron with slightly transverse yellow spots - one in both anterior and posterior halves, spots are lateral but not reaching margins, first spot placed behind humerus and second before apex, legs blackish with distal halves of femora brightly reddish-brown. Length 9-11.5 mm.

Material examined :19 ex. India : Arunachal Pradesh, Papum Pare Distt., Itanagar, Chimpu, 400 m. 4 ex., 3.vii.1991, T.K. Pal, *ex.* Fungusy log; 3 ex., 27.v.1992, T.K.Pal, *ex.* under bark; Banderdewa, 10 ex., 25.vi.1991, T.K. Pal, *ex.* fungusy bark; West Kameng Distt., Sangti, 9 km. 0- Dirang, 1450 m., 1 ex., 23.ii.1990, T.K. Pal, *ex.* under bark; Dibang Valley Distt., Hunli, 1250m., 1 ex., 21.ix.1991, T.K. Pal, *ex.* under bark.

Distribution : India : Arunachal Pradesh (New record), West Bengal (Darjeeling Distt.), Karnataka, Andaman Is. ;Sri Lanka; Myanmar; Indonesia; Malaysia : Viet-Nam.

2. **Eumorphus assamensis** Gerst.

1857. *Eumorphus assamensis* Gerst., *Archiv. f. Nat.* **23** : 229.
1858. *Eumorphus assamensis* Gerst., *Monog. Endom.* : 121.
1858. *Eumorphus subguttatus* Gerst., *Monog. Endom.* : 121.
1925. *Eumorphus assamensis* Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 307.

Diagnosis : Elongate-oval and moderately convex in form with legs and antennae slender, dorsum rather dull and impunctate; head with eyes and antennae rather similar to *quadriguttatus* but the antennal club little narrower; transverse prothrax with lateral margin of pronotum rather irregular or broken, front angles rather sharp and hind angles very acute; lateral margins of elytra very narrow and the apices rounded; sooty black, each elytron with two shining yellow round spots, spots are little elevated above general surface and placed near lateral margins one in both anterior and posterior halves, first spot placed behind humerus and second before apex. Length - 8-9 mm.

Material examined : 2 ex. India : Arunachal Pradesh, West Kameng Distt., Sangti, 9 km. O-Dirang, 1450 m., 1 ex., 23.ii.1990, T.K. Pal, *ex.* under bark; Papum Pare Distt., Itanagar, Chimpu, 400 m., 1 ex., 27.v.1992, T.K. Pal, *ex.* under bark.

Distribution : India : Arunachal Pradesh (New record), Nagaland, Meghalaya; Myanmar; Thailand; Viet-Nam; Malaysia; Indonesia.

Genus II. **Ancylopus** Costa

1854. *Ancylopus* Costa, *Fauna del Regno di Napoli, Coleotteri* **1** : 14 [Type species : *Endomychus melanocephalus* Olivier].

3. **Ancylopus melanocephalus** (Olivier)

1808. *Endomychus melanocephalus* Olivier, *Entom.* **6** : 1073.

1854. *Ancylopus melanocephalus :* Costa, *Fauna del Regno di Napoli, Coleotteri* **1** : 14.
1858. *Ancylopus melanocephalus :* Gerst., *Monog. Endom.* : 190.
1886. *Ancylopus melanocephalus :* Fiori, *Bull. Soc. Ent. Ital.* **28** : 414.
1925. *Ancylopus melanocephalus :* Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 334.

Diagnosis : Elongated, oblong, subdepressed, dorsum smooth and shining, and antenna, head and l finely pubescent; head moderately densely punctate, eyes large, 11-segmented antenna with 3-segment loose and less pronounced club, 3rd antennal segment little longer than 4th and 5th together; transver prothorax broadly emarginated in front and with a conspicuous broad stridulatory membrane, little contract behind middle, pronotum finely punctate, pronotal sides finely bordered and base with a deep marginal str elytral margins narrow and apices rounded, rather closely and densely punctate and punctures confuse antenna, head and legs blackish, pronotum and elytra reddish-brown with blackish spots on elytra as follow basal margin and continued along suture except apical extremity, and two elongated marginal spots - one n middle and other before apex of each elytron. Length 5-5.5 mm.

Material examined : 2 ex. India : Arunachal Pradesh, West Kameng Distt., Moona, 9 km. O-Dirang, 14 m., 1 ex., 25.ii.1990, T.K. Pal, *ex.* under bark; Sapper, 15. km. O-Dirang, 1500 m., 1 ex., 22.ii.1990, T.K. P *ex.* decaying wood.

Distribution : India : Arunachal Pradesh; Uttar Pradesh, Bihar, Tamil Nadu; Sri Lanka; Banglade Myanmar; Tibet; China; Japan; New Guinea; Italy; Nigertia; South Africa.

Family LANGURIIDAE

Subfamily LANGURIINAE

Genus I. **Languriophasma** Arrow

1925. *Languriophasma* Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 203 [Type species : *Langur cyanea* Hope].

1. **Languriophasma laeta** Arrow

1925. *Languriophasma* laeta Arrow, Fauna Brit. India, *Coleoptera, Clavicornia* : 204.
1979. *Languriophasma* laeta : Sengupta and Mukherjee, *Rec. zool. Surv. India* **75** : 337.

Diagnosis : Long, Slender, moderately convex with rather long legs and antennae, dorsum smooth a very shining; head with finely facetted moderately large eyes, not dilated in front of eyes, finely and dens punctate, 11-segmented antenna with 4-segmented fairly broad and loose club; a little elongate prothor with front angles broadly rounded, contracted behind with hind angles nearly right angle, pronotal b moderately impressed and punctured and lateral fovae rather indistinct, pronotal disc finely and little l closely punctured than head; elytral shoulders prominent and sides gradually narrowed posteriorly, apic separately rounded, elytral punctures strong and in regular rows; blackish-brown with prothorax bri reddish-brown and elytra shining dark blue. Length - 4.5 mm.

Material examined : 1 ex. India : Arunachal Pradesh, West Kemeng Distt., Tipi Forest, 8 km. Bhalukpong, 230 m., 3.ii.1990, T.K. Pal, *ex.* bush.

Distribution : India : Arunachal Pradesh and North-Western India.

Remarks : The specimens on which Arrow (1925) described this species bear 'no exact' locality-nam and the material preserved in the Oxford Museum as presumed by him were taken probably from No Western India.

Genus II. **Anadastus** Gorham

1887. *Anadastus* Gorham, *Proc. zool. Soc. London* **1887** : 362 [Type species : *Languria cambodiae* Crotch

2. **Anadastus scutellatus** (Crotch)

1876. *Languria scutellata* Crotch, *Cist. Ent.* **1** : 388.
1896. *Anadastus nigrinus* Gorham (*sensu nec.* Wiedemann). *Ann. Mus.* civ. *Genova* **36** : 270.
1925. *Anadastus scutellatus* : Arrow, *Fauna Brit. India, Coleoptera, Clavicornia* : 234.

Diagnosis : Elongated, somewhat parallel-sided with moderately long legs and antennae, dorsum smoo and shining; head with finely facetted moderately large eyes, large mandibles partially exposed, clyp margin bidentate in middle, densely and moderately coarsely punctate, 11-segmented antenna with segmented narrow long club; feebly transverse prothorax with front angles rounded, contracted behind w acute hind angles, pronotal punctures a little sparser than those of head, lateral fovae divergent at prono base; elytra deeply striate-punctate with prominent shoulders, sides straight and apex uniformly round deep reddish-brown species with a greenish metallic black suffusion at elytral apex, legs and antenn reddish-black with femora and club more darker. Length - 9.1 mm.

Material examined : 1 ex. India : Arunachal Pradesh, Changlang Distt., 3 mile, Miao-Vijaynagar Road, 100 m., 5.iii.1990, T.K. Pal, *ex.* vegetable debris.

Distribution : India : Arunachal Pradesh (New record), Assam; Bhutan; Thailand; Cambodia; Viet-Nam; Malaysia; Indonesia.

Subfamily CRYPTOPHILINAE

Genus III. **Cryptophilus** Reitter

874. *Verh. zool.-bot. Ges. wien.* **14** : 381 [Type species : *Cryptophagus integer* Heer].

3. **Cryptophilus integer** (Heer)

838. *Cryptophagus integer* Heer, *Fauna Helvetia* **1** : 426

874. *Cryptophagus integer* : Reitter, *Verh. zool.-bot. Ges. Wien.* **14** : 381.

971. *Cryptophagus integer* : Sengupta & Crowson, *Mem. zool. Surv. India* **15** (2) : 24.

Diagnosis : Body elongate-ovoid, moderately depressed, head and pronotum punctate-pubescent and elytral puncture in regular rows; head with prominent fronto-clypeal suture, 11-segmented antenna with 3-segmented loose club; prothorax little transverse with sides gently rounded, anterior and posterior angles not pronounced, transverse scutellum impunctate; elytral epipleura narrow and complete upto apex; species reddish-brown. Length 2.3 - 2.5 mm.

Material examined : 4 ex. India : Arunachal Pradesh, West Kameng Distt., Elephant point, 15 km. O-Thalukpong, 250 m., 4 ex., 1.xii.1990, T.K. Pal, *ex.* under bark.

Distribution : Many parts of World through transport of food grains (Aitken, 1975).

SUMMARY

56 examples of clavicorn beetles of the families Erotylidae, Endomychidae and Languriidae collected from Arunachal Pradesh are worked out. These represent 10 species under 6 genera of Erotylidae (Including new species *viz.*, *Episcapha nocte* and *Aulacochilus nigrorufus*), 3 species under 2 genera of Endomychidae, and 3 species under 3 genera of Languriidae, with several new distributional records from Arunachal Pradesh as well as India.

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ZYGENTOMA FROM THE ORIENTAL REGION AND INDONESIA – ON SOME NEW AND POORLY KNOWN ATELURIDAE.

LUIS F. MENDES

Centro de Zoologia do Instituto de Investigacao Cientifica Tropical.
Departmento de Zoologia da Faculdade de Ciencias de Lisboa.
Fellow of the INIC – PL2.
Portugal

INTRODUCTION

This paper deals with the study of several samples of Ateluridae thysanurons (order ZYGENTOMA) collected in India, in Thailand, in the philippinese island of Luzon, in the malaysian Borneo and in the indonesian island of Sulawesi (or Celebes). The material from India has been collected by the author and is deposited in the entomological collection of the Centro de Zoologia of the Instituto de Investigacao Cientifica Tropical (CZ); in the same collection is the only specimen from Thailand, kindly offered by Dr. L. Deharveng, (University Paul Sabatier, Toulouse, France). The only specimen from the Sulawesi island and the sample from the Sabah area of Borneo, have been send by Dr. B. Hauser (Museum of Geneve, Swizerland) (MG). My very best thanks to Dr. Deharveng and to Dr. hauser who have offered and by the loaned the specimens. Thank is also due to Dr. A.K. Hazra of Zoological Survey of India, Calcutta for correcting the manuscript and proofs.

1. **Gastrotheus (G.) palpiseta** Silvestri, 1916

Specimens examined : INDIA, State of Karnataka, Bangalore, New Campus of the University of Agriculture, inside a mound of *Odontotermes* sp. (det. ABE), 10/VIII/1988, 1 ♀ (Reg. 4170), (CZ), col. L., Mendes.

Gastrotheus palpiseta was known only by its original description (SILVESTRI, 1916) based on a collected from a termite mound in Bahsoemboe, Sumatra. The specimen now under study is clearly larger than the holotypes (body length : 5.5 mm, thoracal length : 2.2 mm *versus* 3.8 mm and 1.6 mm) and presents minor differences mainly in the maxillary palp chaetotaxy and in the number of setae in the IIIrd urosternite.

The general aspect of the body (Fig. 1) is quite similar to what has been represented. The head is covered by a dense cloth of short spiniform acute setae as in Fig. 2. The maxillary palp, very short as it has been noticed, that in the Indian specimen with several thin setae (Fig. 3), although in the type it has been represented

(see Fig. IX. 3, SILVESTRI, 1916, p. 95) with clearly less hairy. The labial palp (Fig. 4), one of the most typical features of this species, is very similar to what has been described and figured in the original description, as it happens with the tibial chaetotaxy (Fig. 5). The macrochaetae of the hind margin of the urotergites attain 4 of the length of the sclerite. The infralateral chaetotaxy of the urotergites and that of the laterotergites have not been described. In the 1st urotergite (Fig. 6), there is no clear separation between uro and laterotergite; by comparison with the following segments, I can say that there are one long and one short macrochaetae in infralateral position (the second one longer as the hind border macrochaetae) and one thiner seta in laterotergal position. In the II and III abdominal segments (Fig. 7) there is already a clear separation between uro and laterotergite and there are two laterotergal setae. In the IV to VII abdominal segments (Fig. 8) there are 3 laterotergal setae besides the urotergal infralateral group. In the VIII urotergite (Fig. 9), the external macrochaeta is shorter than in the preceeding sclerites and there are 5 laterotergal setae, the 2 inner ones clearly stronger. The IX urotergite is provided with 6 macrochaetae only in the hind margin (20 in the 1st, 16 in the IInd and 10 in the VIII), and presents a strong acute infralateral macrochaeta, a very small inner seta and 7 stronger setae in the lateral margin (Fig. 10). Xth urotergite (Fig. 11) short, wider at base than long, with 1-2 minute cilia inner to the infralateral macrochaetae and with 5-6 lateral ventral setae.

The I and II urosternites are, as described, glabrous. The III, opposite to the SILVESTRI's description ("... *sternita 3-5 (Fig. IX.10) postice setis quator instructa...*") presents only 1+1 submedian macrochaetae (Fig. 12). The IVth and Vth urosternites have 1+1 submedian and 1+1 sublateral setae besides 1+1 minute setae (Fig. 13) and the VIth (Fig. 14) and the VIIth (Fig. 15) one only pair of submedian macrochaetae and 1+1 (the former) or 2+2 (the VIIth) infralateral thin setae. The subgenital plate is as represented by SILVESTRI (*op. cit.*), much wider than long, and the VIIIth and IXth coxites show in their stylets some strong spiniform setae (Figs. 16 and 17).

The ovipositor is extraordinarily swollen (Fig. 18) and the distal articles of the VIIIth gonapophyses show a great number of strong setae, the most apical ones almost cylindrical as there are not an acute point (Fig. 19); the IXth gonapophyses are provided with only a few thin setae, specially in the apical article, as in Fig. 20.

2. **Nipponatelura shirozui** (Uchida, 1966)

Specimens examined: PHILIPPINES, island of Luzon, Cueva Santa, in Quezon National Park, 21/II/1975, 1 ♀ (MG), col. P. Strinati.

Nipponatelura (UCHIDA, 1968) has been described to include 2 japanese species of Aterluridae, *Atelura kubotai* Uchida, 1949 from the Honchu island and *Atelurodes shirozui* Uchida, 1960 from the Riu-Kiu. Both species share four pairs of abdominal stylets, two pairs of lateral abdominal pseudovesicles (the VI and VII). besides a submedian pair of similar structures in the IInd urosternite, and present head, nota and urotergites (with the exception of the infralateral and laterotergal chaetotaxy glabrous; an unique combination. *Nipponatelura* is, so, new to the Philippines where it occurs in the northern of the big islands.

The only female from Luzon agrees well with the description of *N. shirozui*

(UCHIDA, 1960), although the pseudovesicles of the VI urosternite are impossible to locate (Fig. 29).

The original and unique description of *N. shirozui* and the generic description, are complemented by some figures of details of taxonomic interest, concerning the apical area of the maxilla (Fig. 21), the chaetotaxy of the infralateral area of the urotergites and laterotergites (Fig. 23 to 26), that of the urosternites and coxites (Figs. 27 to 32), and the shape of praetarsus (Fig. 22). The gonapophyses VIII and IX, with 8 and 10 articles, are of the classical primary type, as represented in Figs. 33 and 34.

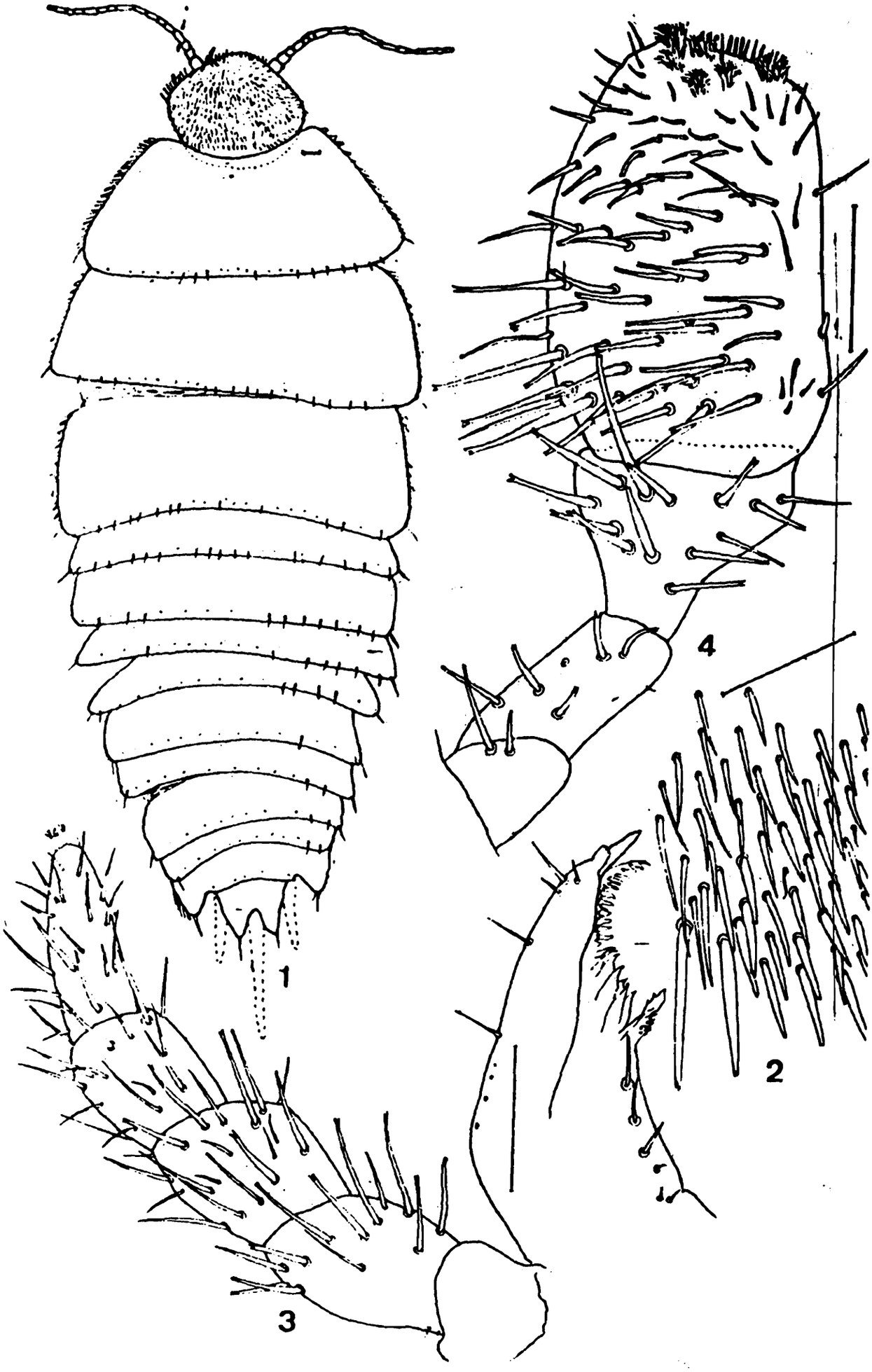
The male transformations in the X urotergite and in the posterior filaments remain undescribed, as they have been neglected by UCHIDA (1968). Accordingly to the quite possible closeness among *Nipponatelura*, *Proatelura* and *Atelurodes*, it seems probable that the transformed chaetotaxy will occur in the under surface of the X urotergite and in the upper-inner surface of cerci, but not in the base of the terminal filament.

3. **Atelurodes myrmicarius** Silvestri, 1916

Specimens examined : THAILAND, Chiang Mai/Doi Put, in forest, 22/VI/1986, 1 ♀, no. THAI 86 — CL 98, Reg. 4209 (CZ), col. L. Deharveng.

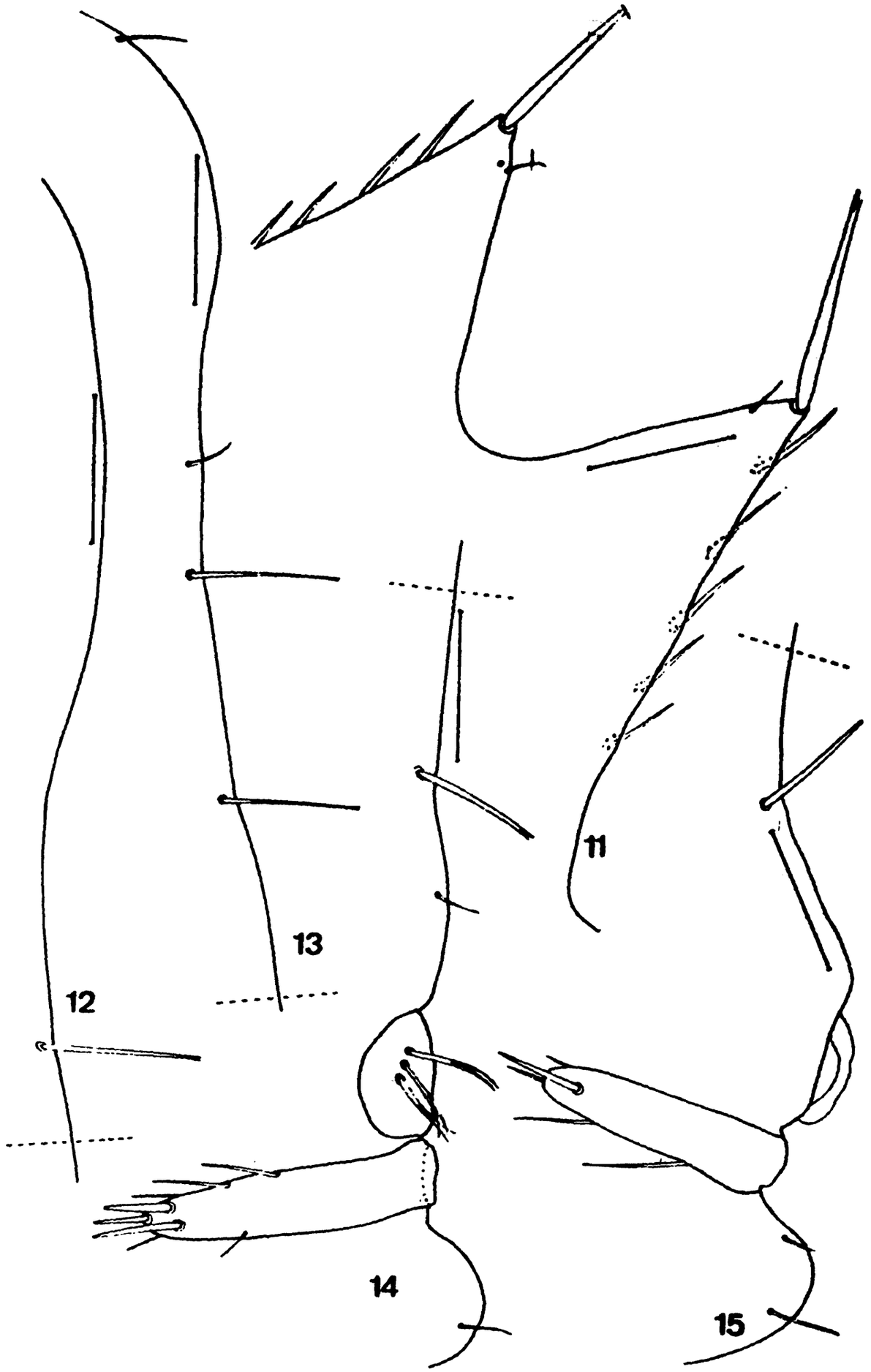
Only two species are known in the genus *Atelurodes*, *A. typhloponis* (Silvestri), from Northern India (SILVESTRI, 1913) and *A. myrmicarius* Silvestri, described from Sumatra (SILVESTRI, 1916) and also found in the Bismark island of New Britain (PACLT, 1971) and in the Solomon island of Guadalcanal (PACLT 1982), both from Melanesia. Thailand is, so, a new locality for *Atelurodes* and for *A. myrmicarius*.

The unique female collected in Doi Put, long as 3.2 mm, agrees well with the original description, mainly in the strongly emarginated Xth urotergite (Fig. 41) and also by the setae around the IInd urosternite pseudovesicles Fig. 42, but shows a more elongated subgenital plate (Fig. 43). The setal arrangement in the infralateral groups of the urosternites and in the laterotergites is similar in the IInd and IIIrd (Fig. 37) — 2 setae in the laterotergite — and in the IVth to VIIth (Fig. 38) — 4 setae in the laterotergite; in the VIIIth, there are 3 setae in the laterotergite (Fig. 39) and the IXth presents a strong posterolateral macrochaeta with 2 inner thin setae and 3 outer similar setae (Fig. 40). The Xth urotergite (Fig. 41), shows double row of thin setae along the under surface of each one of the lateral margins, character that has never been mentioned to the species. In the apex of the galea these is one only sensorial cone (Fig. 35); the morphology of the praetarsal empodium (Fig. 36), already noticed by SILVESTRI (1913 and 1916), is strongly similar to that presented by *Proatelura* and by *Nipponatelura* but quite different, however, from what has been drawn by PCLT (see Fig. 2, PACLT, 1971, p. 160). The VIIIth coxites are almost glabrous (2 setae only) (Fig. 44) but the IXth coxites present a sublongitudinal row of setae (Fig. 45). The anterior and posterior gonapophyses, with 8-9 articles, are as in Figs. 46 and 47.

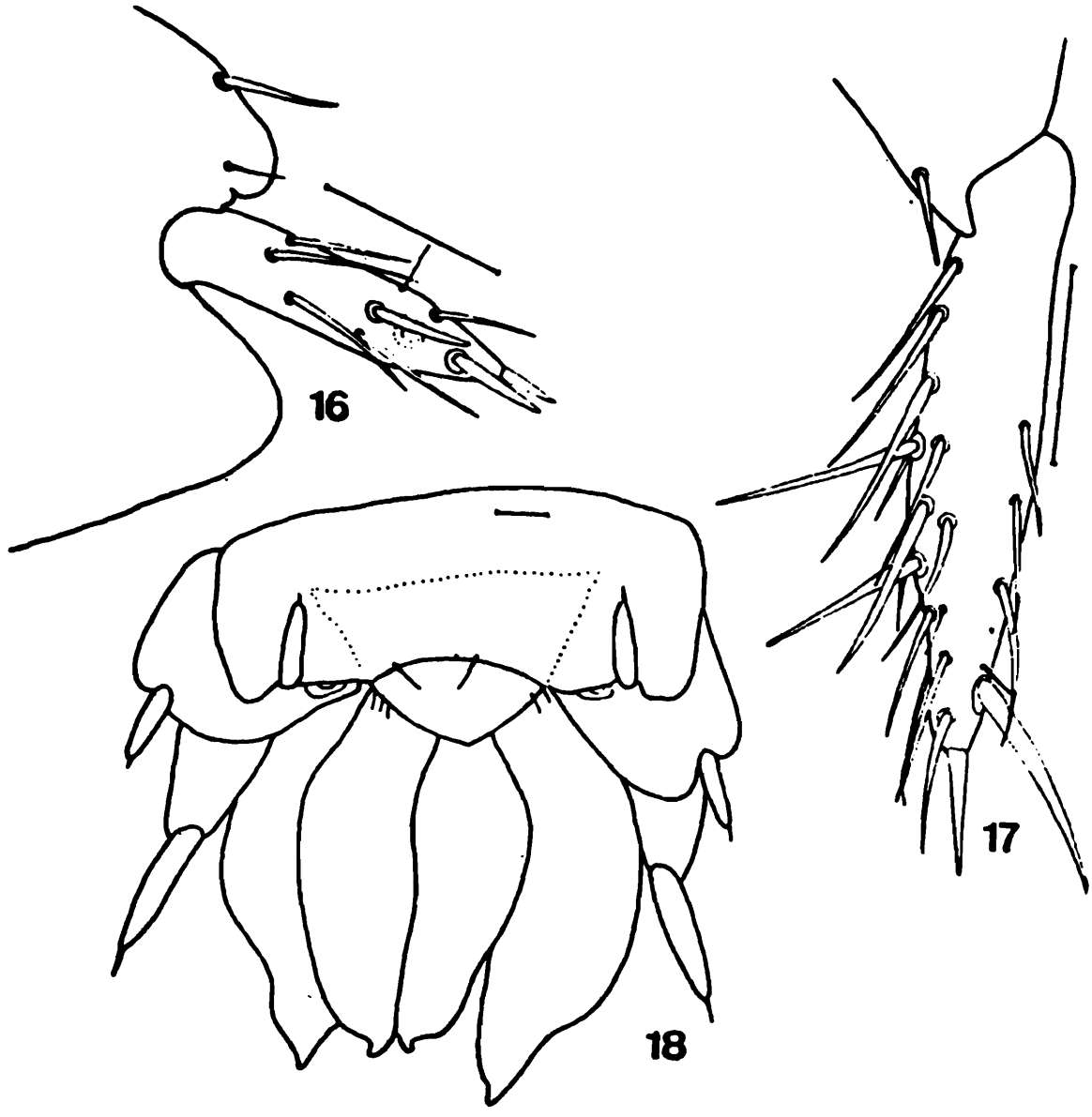


Figs. 1-4. *Gastrotheus (G.) palpiseta* Silvestri ♀. Fig. 1 - General dorsal aspect of body; Fig. 2 Detail of the cephalic chaetotaxy, posterolateral angle; Fig. 3 - Maxillary palp and maxilla; Fig. 4 Labial palp. Scales : 0.1 mm

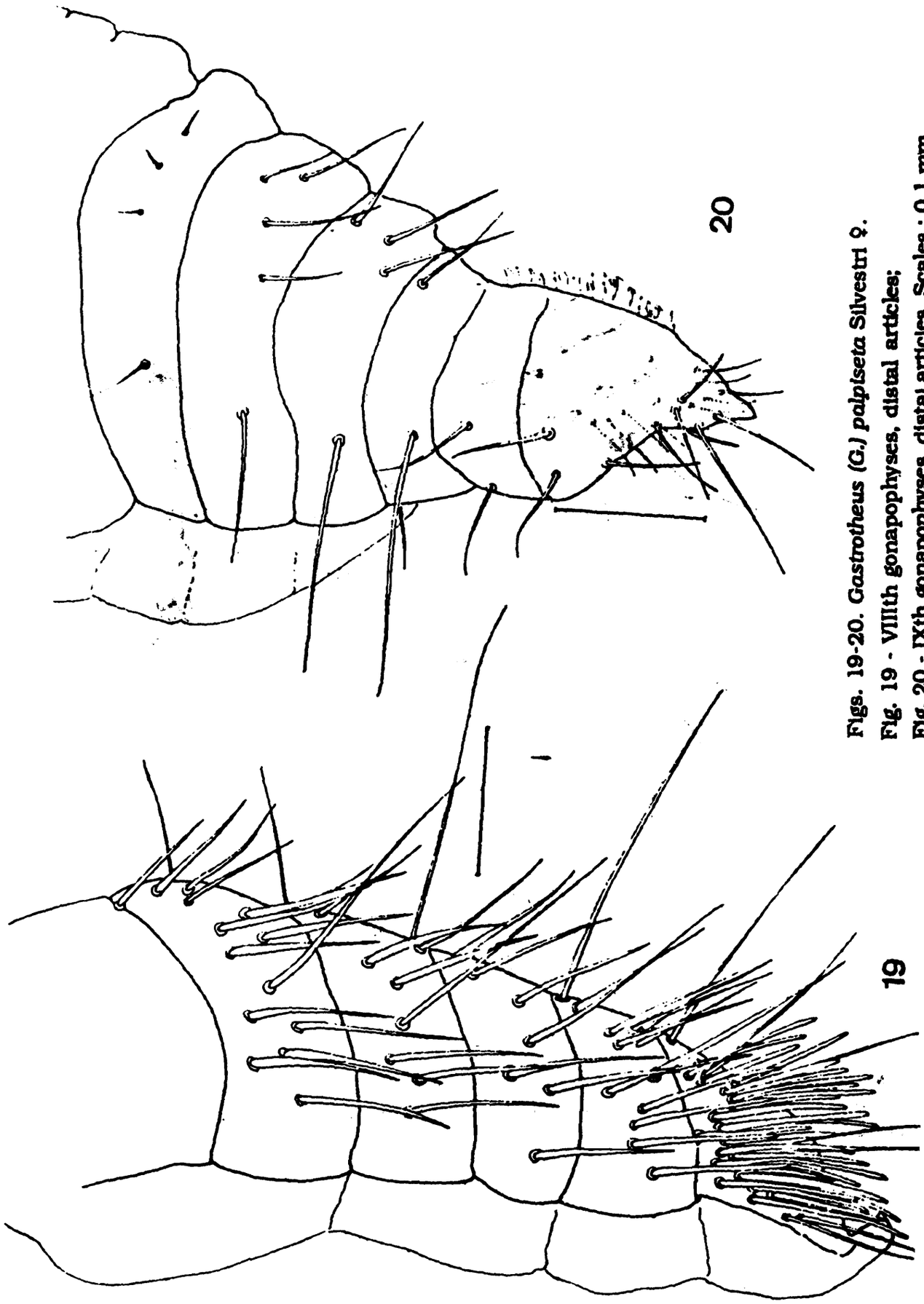
Figs. 5-10. *Gastrotheus (G.) palpiseta* Silvestri ♀. Fig. 5 - P II, tibia and tarsus; Fig 6 - Chaetotaxy of the laterotergite and of the infralateral group of 1st urotergite; Fig. 7 - Ibid., of the IIIrd urotergite; Fig. 8 Ibid., of the VIth urotergite; Fig. 9 - Ibid., of the VIIIth urotergite; Fig. 10 posterolateral angle of the IXth urotergite. Scales : 0.1 mm



Figs. 11-15. *Gastrotheus (G.) palpiseta* Silvestri ♀. Fig. 11 - Urotergite X; Fig. 12 - Urosternite III; Fig. 13 - Urosternite V; Fig. 14 - Urosternite VI; Fig. 15 - Urosternite VII. Scale : 0.1 mm



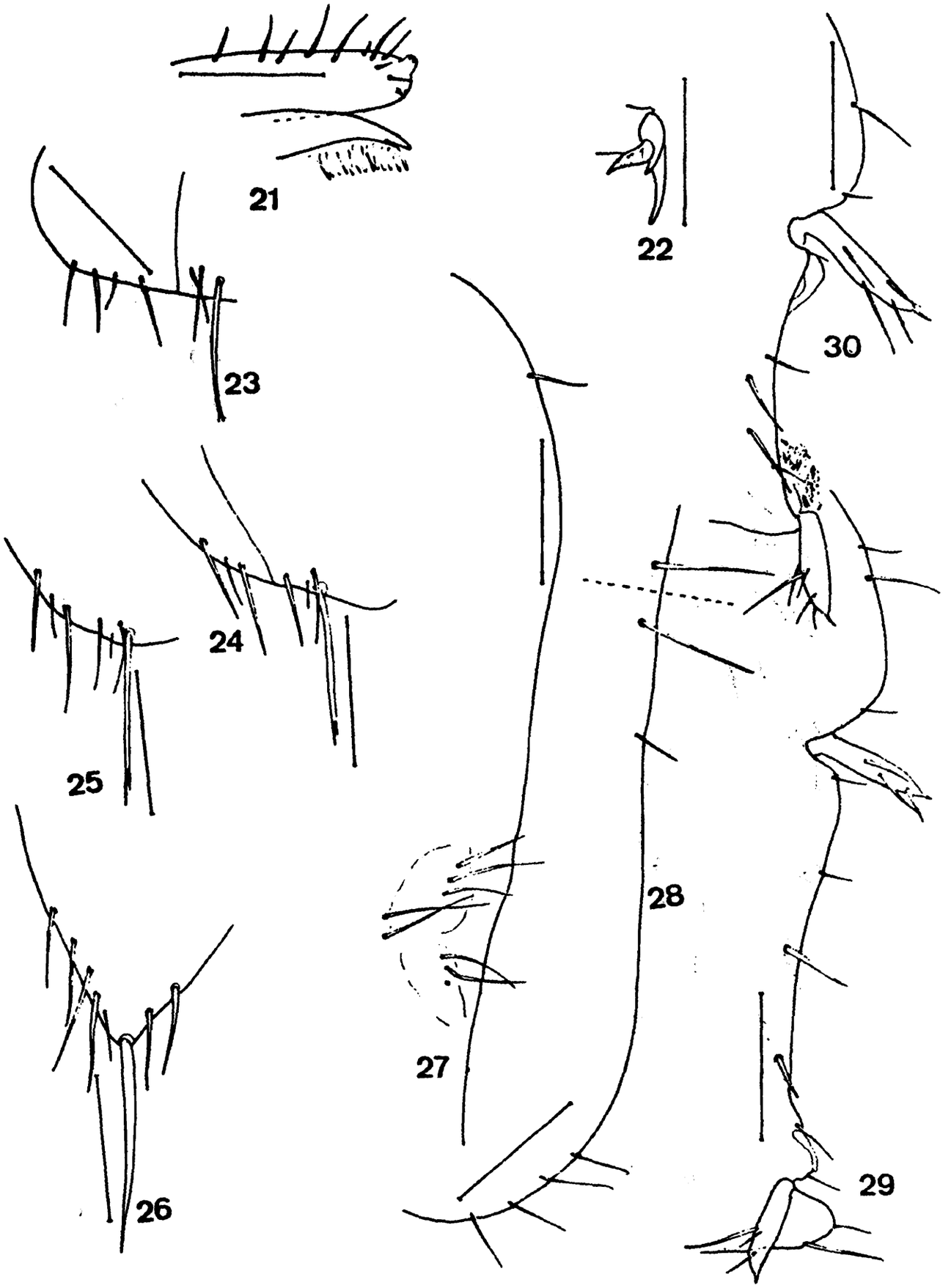
Figs. 16-18. ***Gastrotheus (G.) palpiseta*** **Silvestri ♀. Fig. 16 - VIIth coxite; Fig. 17 - Apica area and stylus of IXth coxite; Fig. 18 - General aspect of ventral abdominal area. Scales 0.1 mm**



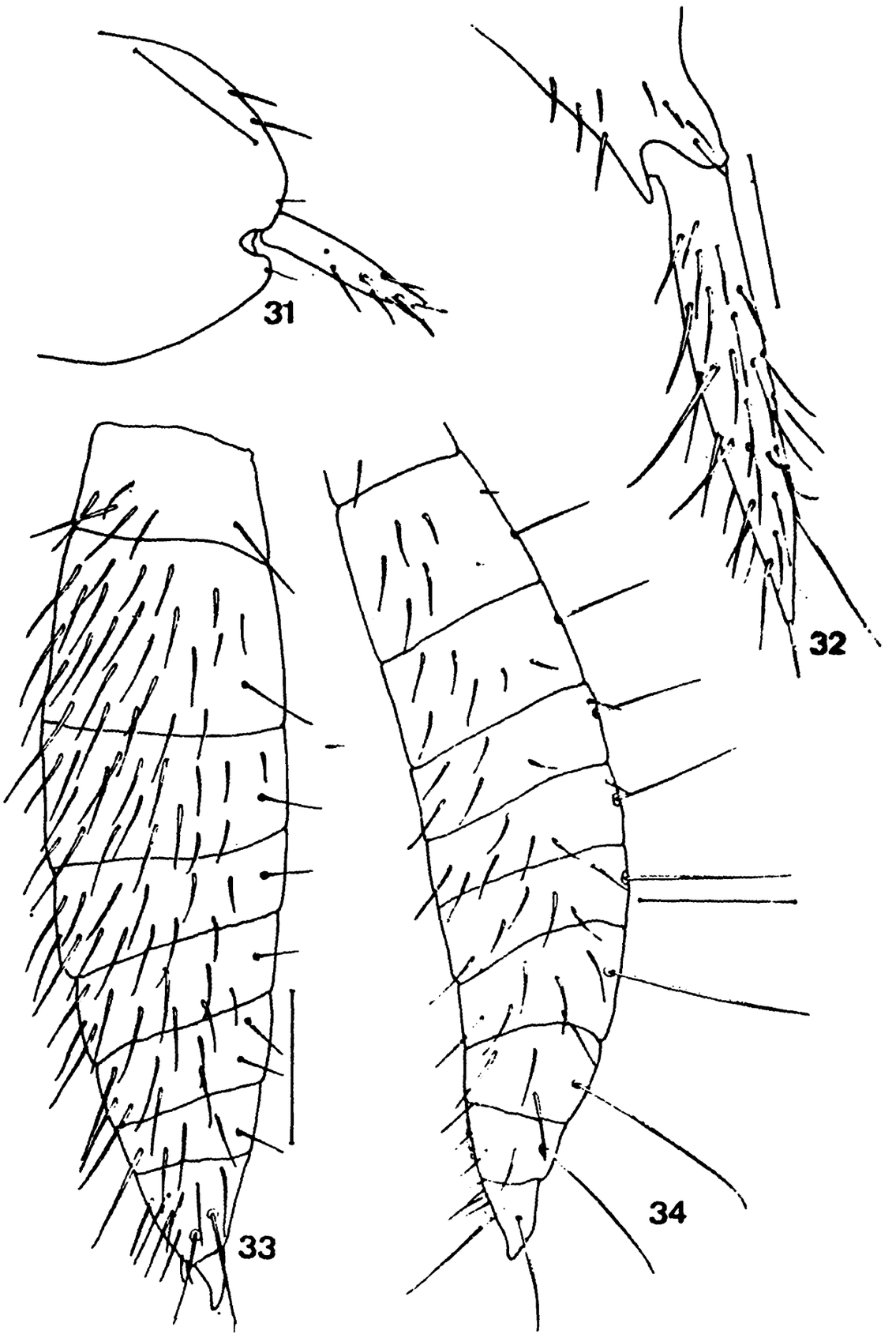
Figs. 19-20. *Gastrotheus (G.) palpiseta* Silvestri ♀.

Fig. 19 - VIIIth gonapophyses, distal article;

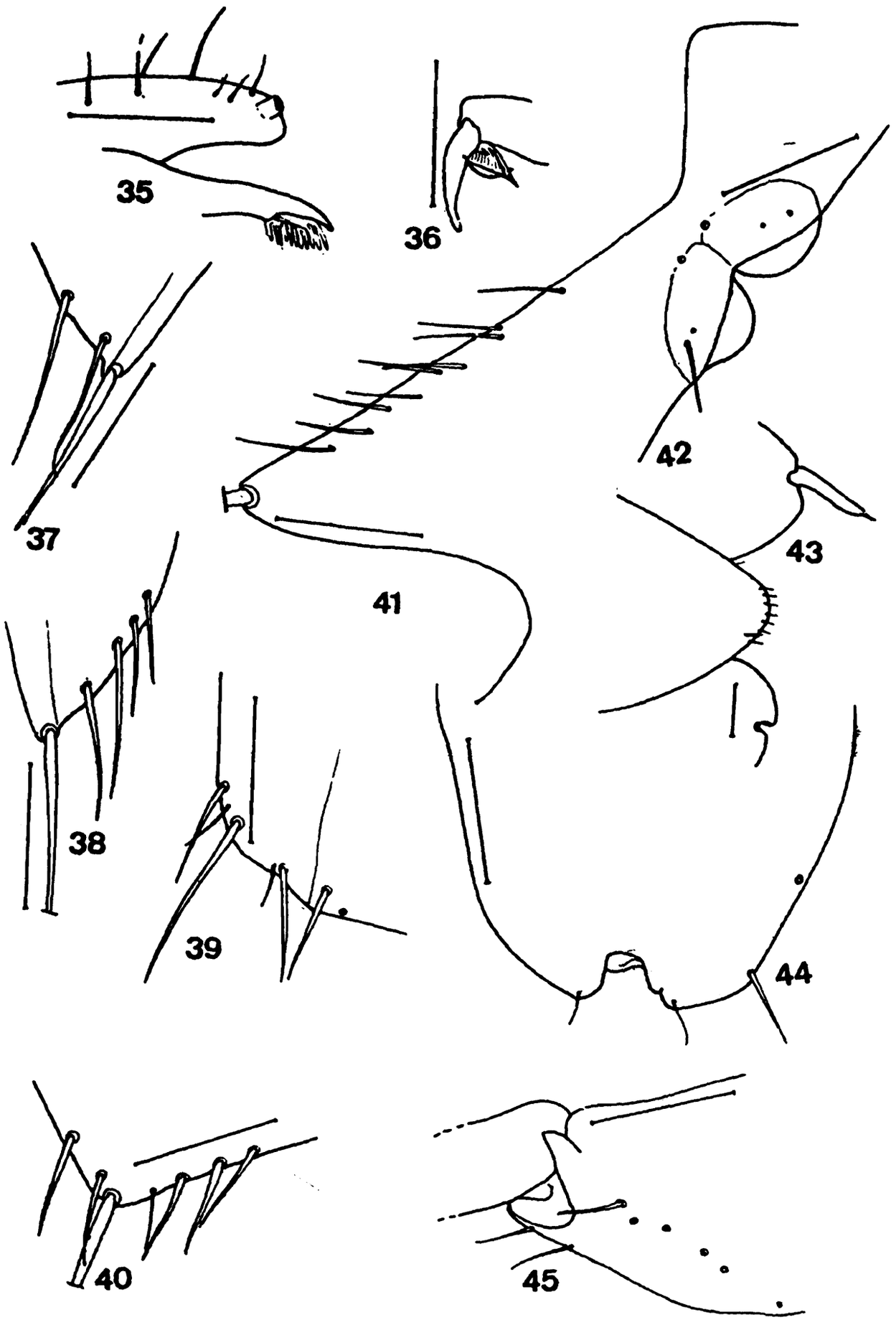
Fig. 20 - IXth gonapophyses, distal articles. Scales : 0.1 mm



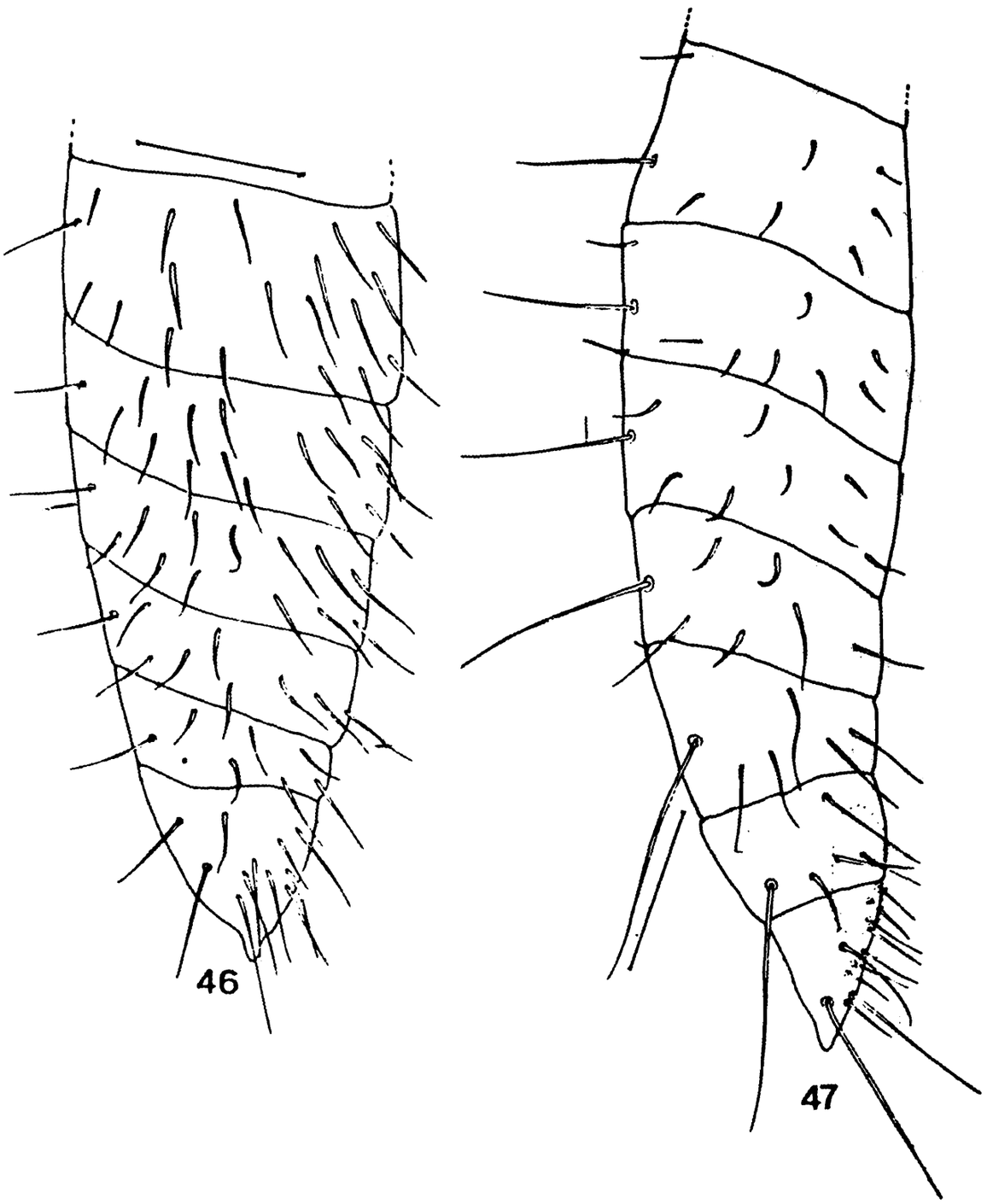
Figs. 21-30. *Nipponatelura shirozui* (Uchida) ♀. Fig. 21 - Apical area of maxilla; Fig. 22 Praetarsus of P II; Fig. 23 - Posterolateral area of Vth urotergite and laterotergite; Fig. 24 Ibid., VIIth urotergite; Fig. 25 Ibid., VIIIth urotergite; Fig. 26 Posterolateral angle of IXth urotergite; Fig. 27 IInd urosternite; Fig. 28 IIIrd urosternite; Fig. 29 VIth urosternite; Fig. 30 VIIth urosternite. Scales : 0.1 mm



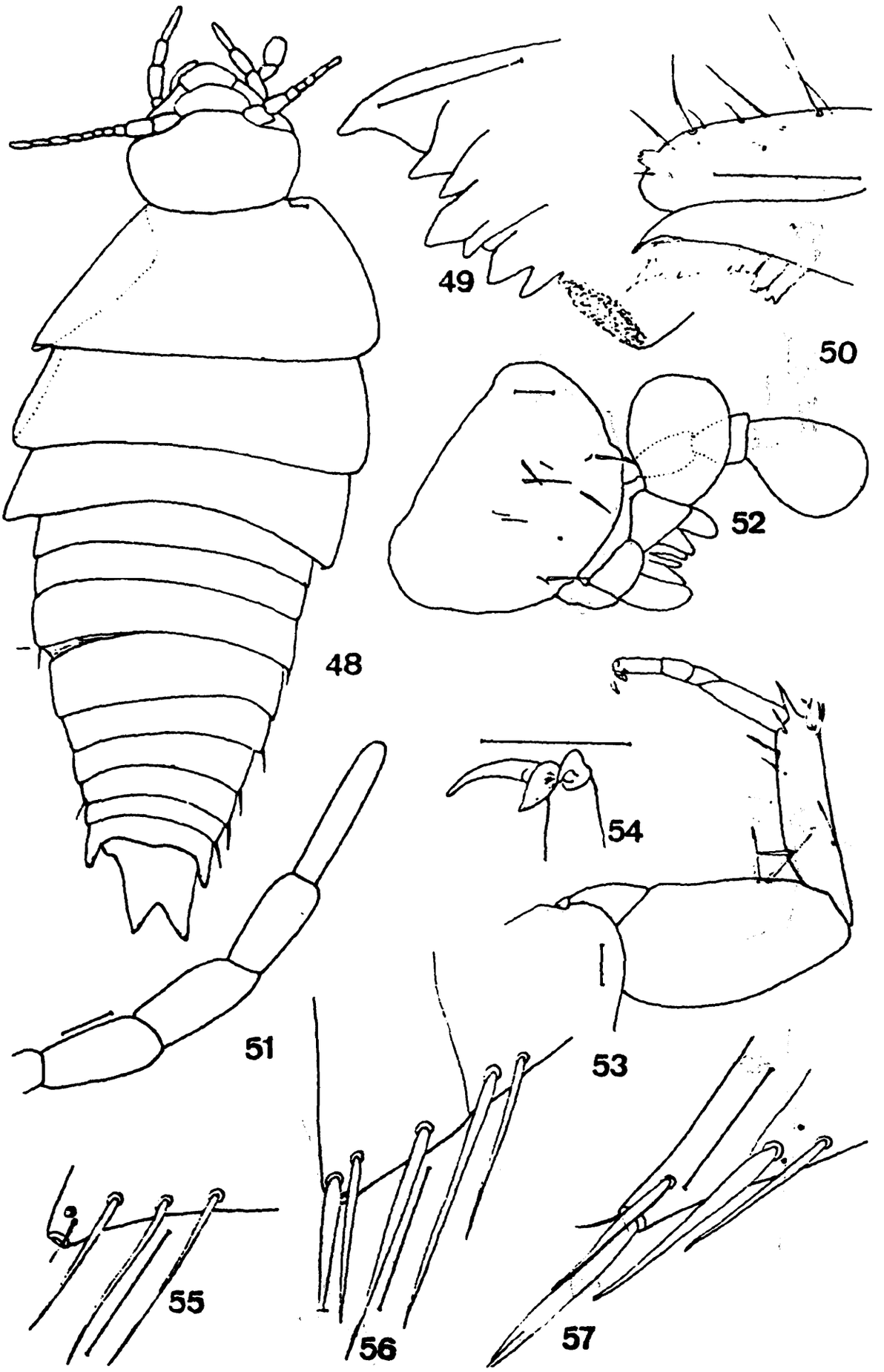
Figs. 31-34. *Nipponatelura shirozui* (Uchida) ♀. Fig. 31 VIIIth coxite and stylus; Fig. 32 - IXth coxite and stylus; Fig. 33 VIIIth gonapophyses, distal articles; Fig. 34 - IXth gonapophyses, distal articles. Scales : 0.1 mm



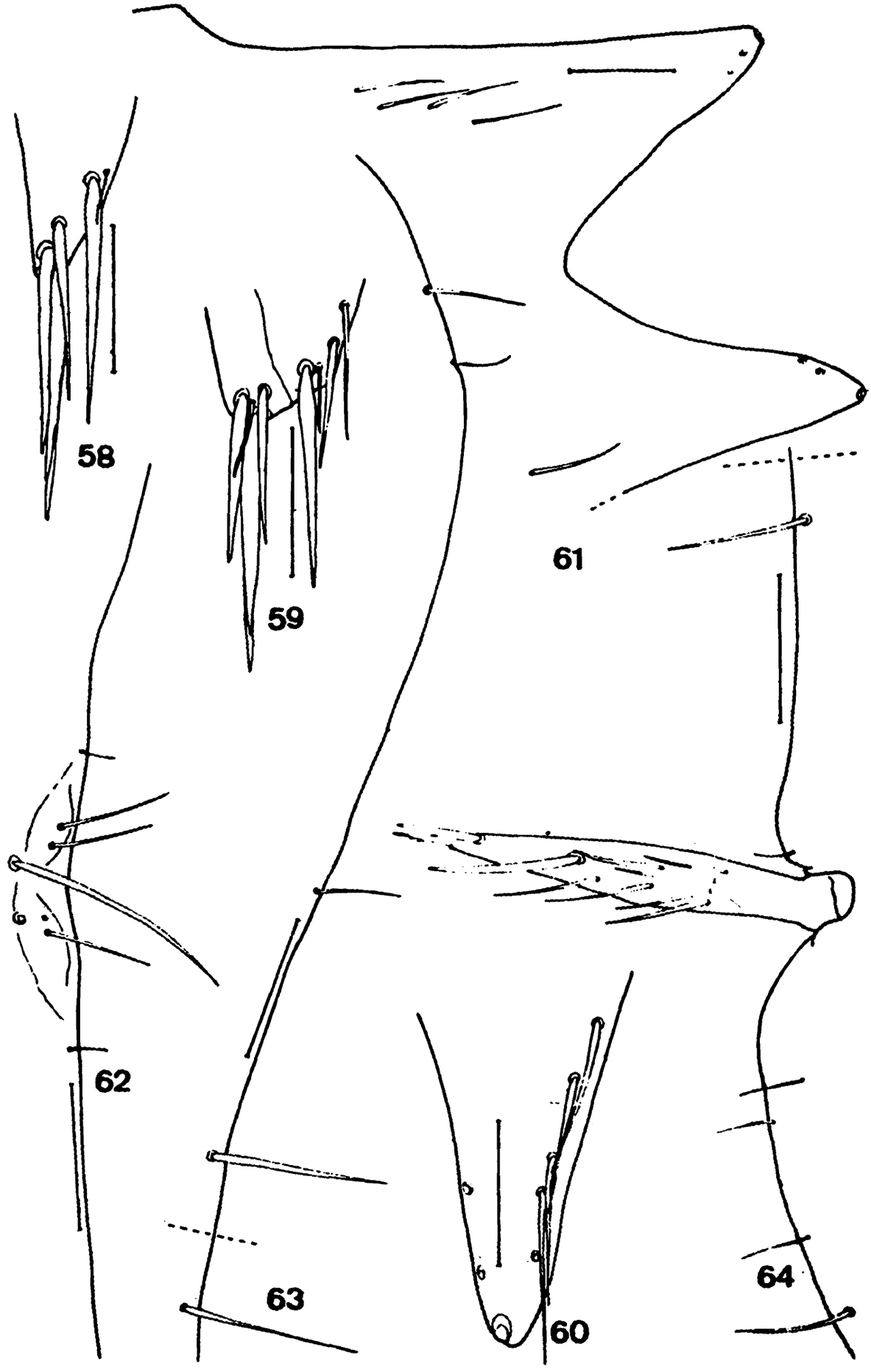
Figs. 35-45. *Atelurodes myrmicarius* Silvestri ♀. Fig. 35 Apical area of maxilla; Fig. 36 Praetarsus of P III; Fig. 37 - Laterotergite and infralateral area of IInd urotergite; Fig. 38 Ibid., of VIIth urotergite; Fig. 39 Ibid., of VIIIth urotergite; Fig. 40 - posterolateral angle of IXth urotergite; Fig. 41 - Xth urotergite; Fig. 42 IInd urosternite; Fig. 43 Subgential plate and VIIIth coxites; Fig. 44 - VIIIth coxite; Fig. 45 IXth coxite, distal area. Scales : 0.1 mm



Figs. 46-47. *Atelurodes myrmicarius* Silvestri ♀. Fig. 46 VIIIth gonapophyses, distal articles; Fig. 47 IXth gonapophyses, distal articles. Scales : 0.1 mm

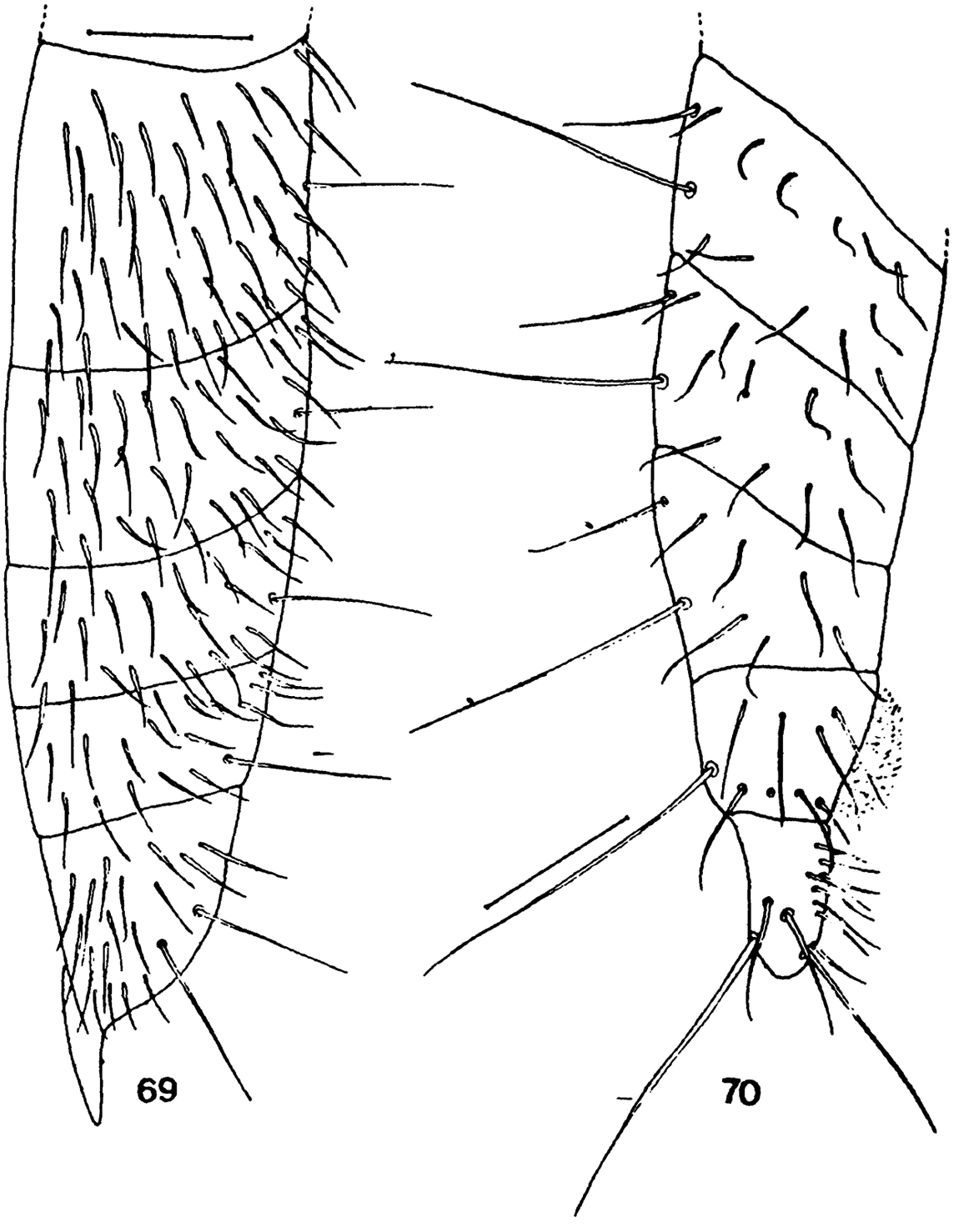


Figs. 48-57. *Pseudatelurodes celebensis* gen. n. sp.n.. Fig. 48 General dorsal aspect of the body; Fig. 49 Mandibula; Fig. 50 - Apical area of maxilla; Fig. 51 - Maxillary palp; Fig. 52 - labium and labial palp; Fig. 53 - Chaetotaxy of P II; Fig. 54 Ibid., detail of the praetarsus; Fig. 55 -Laterotergite and infralateral area of the 1st urotergite; Fig. 56 - Ibid., of the IIIrd urotergite; Fig. 57 Ibid., of the Vth urotergirte. Scales : 0.1 mm

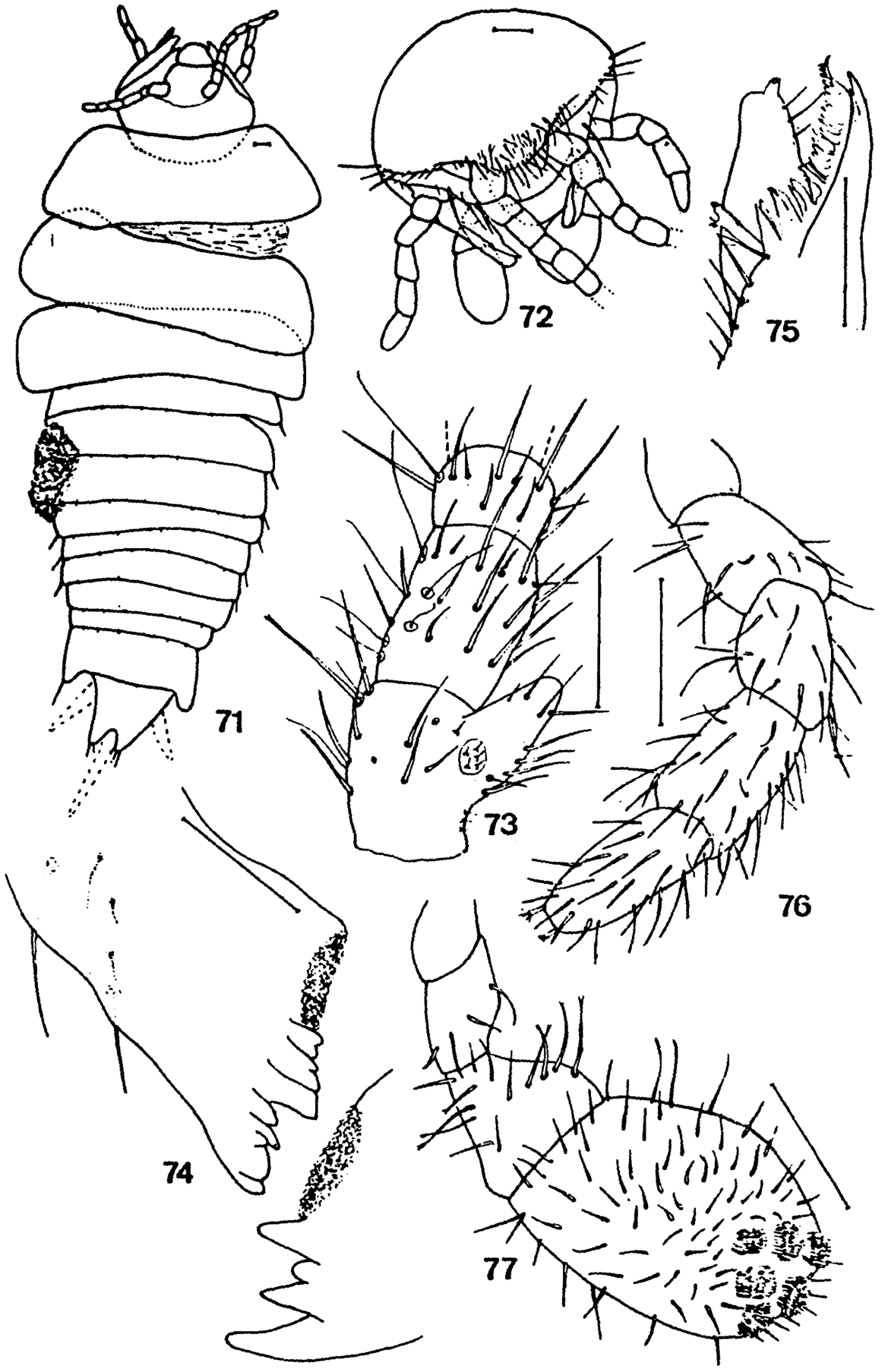


Figs. 58-64. *Pseudatelurodes celebensis* gen. n. sp. n., Fig. 58 - Laterotergite and infralateral area of the VIIth urotergite; Fig. 59 - Ibid., of the VIIIth urotergite; Fig. 60 - Posterolateral angle of the IXth urotergite; Fig. 61 - Xth urotergite; Fig. 62 - IInd urosternite; Fig. 63 - IIIrd urosternite; Fig. 64 - IVth urosternite. Scales : 0.1 mm

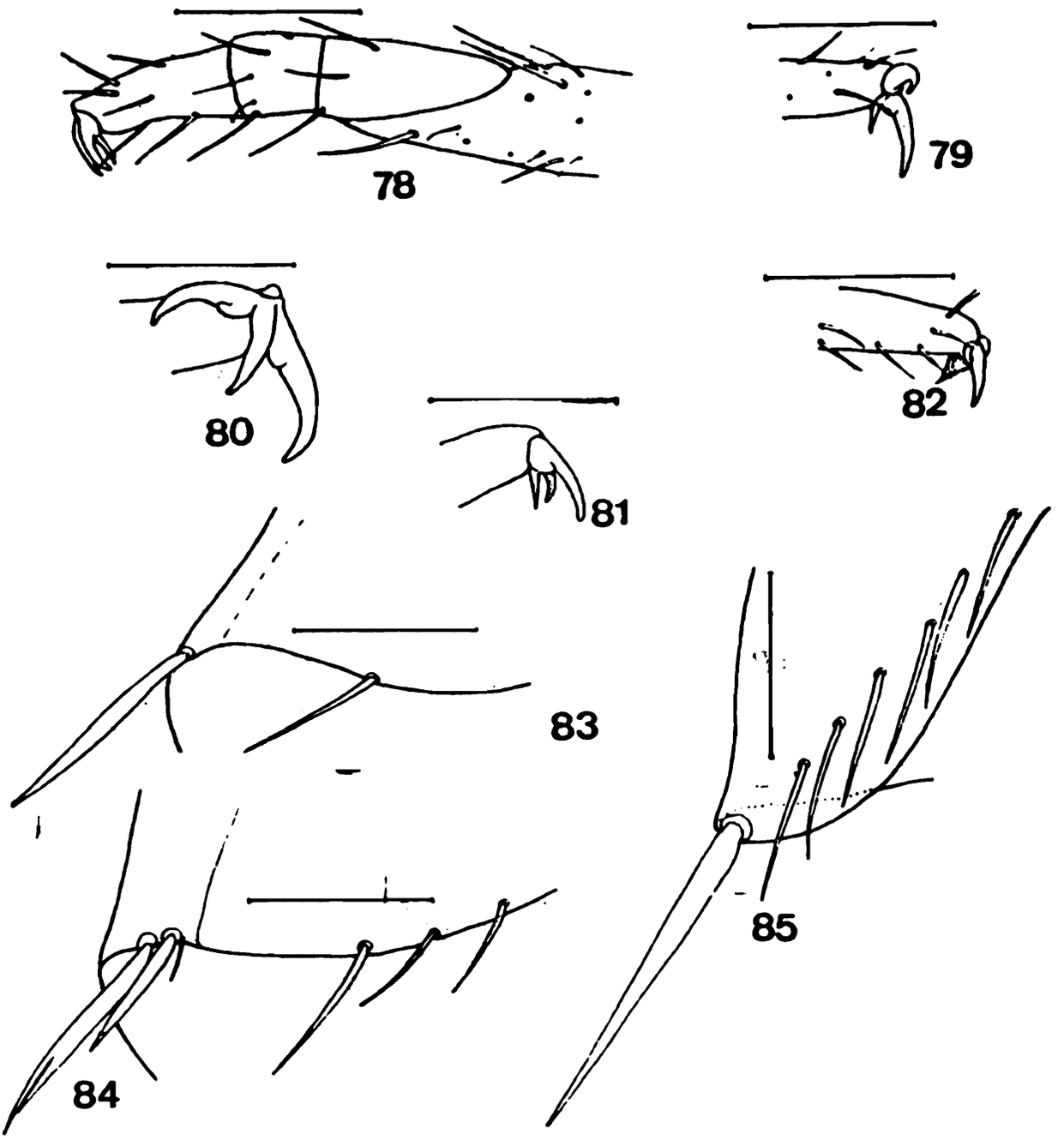
Figs. 65-68. ***Pseudatelurodes celebensis*** **gen. n. sp. n.. Fig. 65 - Vth urosternite; Fig. 66 - VIIth urosternite and subgenital plate; Fig. 67 - VIIIth coxite; Fig. 68 - IXth coxite, apical area. Scales : 0.1 mm**



Figs. 69-70. *Pseudatelurodes celebensis* gen. n. sp. n.. Fig. 69 VIIIth gonapophyses, distal articles; Fig. 70 IXth gonapophyses, distal articlles. Scales : 0.1 mm



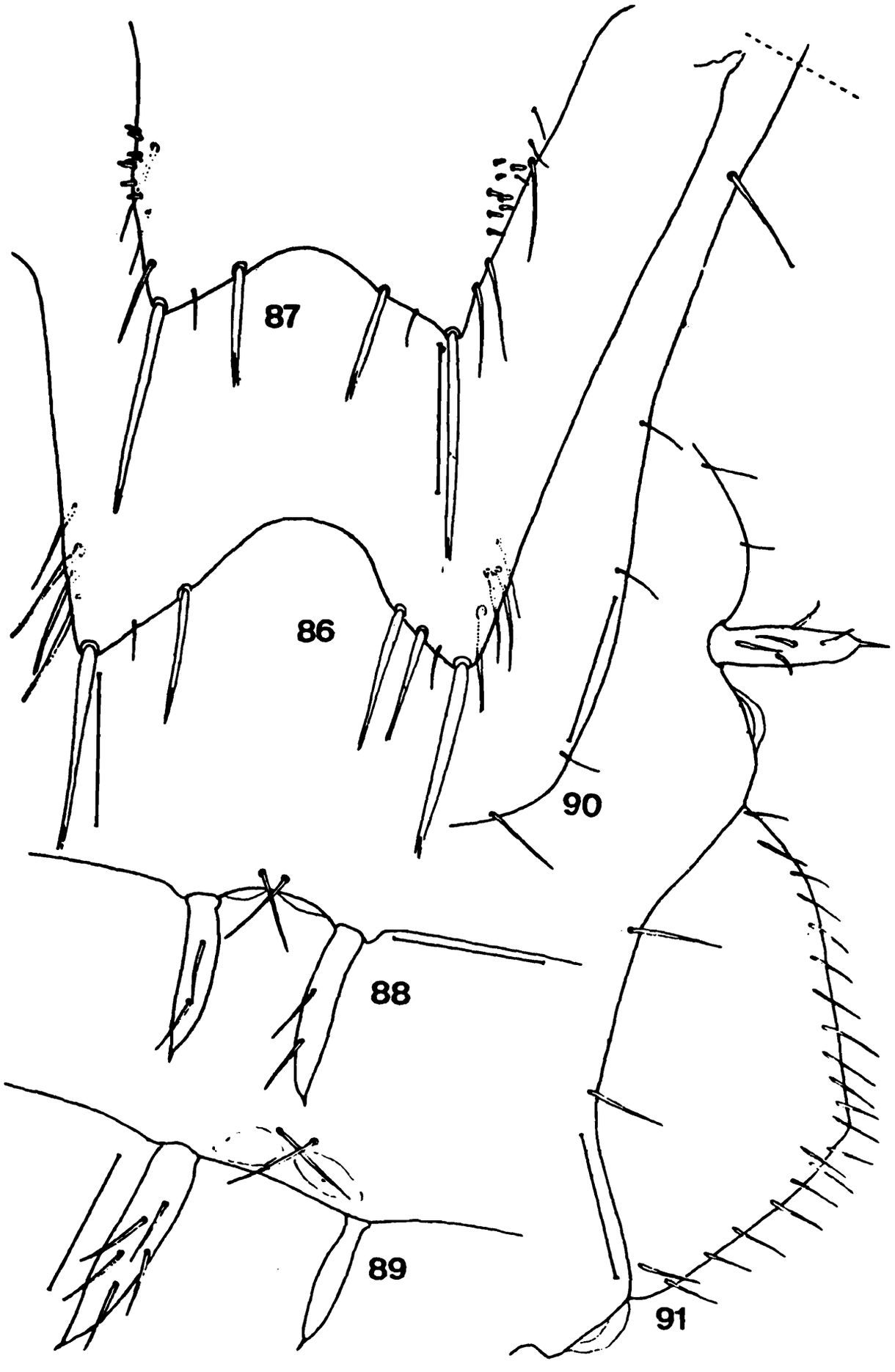
Figs. 71-77. *Bharatatelura malabarica* gen. n. sp. n.. Fig. 71 General dorsal aspect of body; Fig. 72 Anterior view of the head; Fig. 73 Male antenna, pedicellum and base of flagellum; Fig. 74 Mandibulae; Fig. 75 apical area of maxilla; Fig. 76 Maxillary palp; Fig. 77 Labial palp. Scales : 0.1 mm



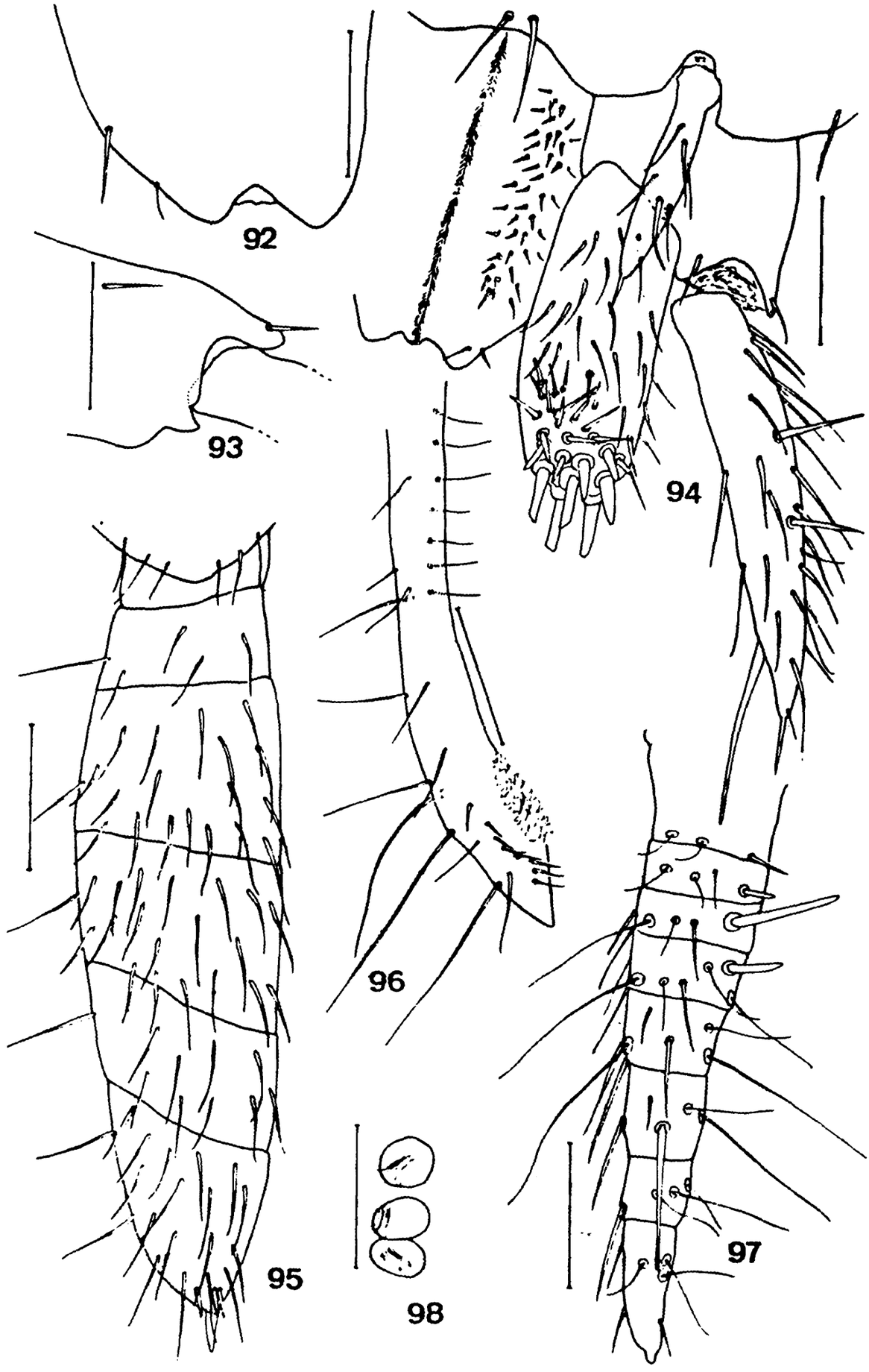
Figs. 78-79. *Bharatatelura malabarica* gen. n. sp. n. Fig. 78 - Tarsus of P I; Fig. 79 - Praetarsus of P III.

Figs. 80-81. *Proatelurina pseudolepisma* (for comparison). Fig. 80 Praetarsus of P III, specimen from Madeira island, Portugal; Fig. 81 - Ibid., specimen from Sintra, Portugal. Fig. 82. *Proatelura jacobsoni* (for comparison), praetarsus of P III, specimen from the Philippines.

Figs. 83-85. *Bharatatelura malabarica* gen. n. sp. n. Fig. 83 - Laterotergite and infralateral area of the IInd urotergite; Fig. 84 Ibid., of the IIIrd urotergite; Fig. 85 Posterolateral area of the IXth urotergite. Scales : 0.1 mm



Figs. 86-91. *Bharatatelura malabarica* gen. n. sp. n.. Fig. 86 Xth urotergite of the ♀; Fig. 87 - Ibid of the ♂; Fig. 88 IInd urosternite of the holotypus; Fig. 89 Ibid., of the allotypus; Fig. 90 IVth urosternite; Fig. 91 - VIIth urosternite of ♀ and subgenital plate. Scales : 0.1 mm



Figs. 92-98. *Bharatatelura malabarica* gen. n. sp. n.. Fig. 92 VIIIth coxite of ♀. Fig. 93 IXth coxite of ♀. Fig. 94 Hind border of VIIIth coxite, IXth coxites and styli, and genitalia of ♂. Fig. 95 VIIIth gonapophyses and border of subgenital plate; Fig. 96 IXth gonapophyses; Fig. 97 Cercus of ♂. Fig. 98 IXth gonapophyses; Fig. 97 Cercus of ♂. Fig. 98 Spermatolophids. Scales : 0.1 mm

Pseudatelurodes gen. n.

(♂ unknown)

Ateluridae : medium to small size insects (ca. 4 mm), weakly sclerotized; body limuloid, the thorax wider than long with ca. 2/3 of the length of abdomen; hypodermal pigment absent, the body and appendages whitish or yellowish.

Scales with abundant thin rays which surpass very slightly their free border, present on the head, body and coxae of the legs.

Head dorsally visible, only the proximal area covered by the anterior border of pronotum, the setae and macrochaetae restricted to the anterior area, the cephalic capsule covered by scales and not emarginated at the level of the antennae. Antennae not intact but almost certainly shorter than the thorax, without special characteristics. Mandibles apically with very strong sclerotized teeth, the molar area well developed; 2-3 very strong setae in the outer proximal area. Maxillae elongated, the lacinia with one strong and dark apical tooth and one inner hyalin thin tooth, the pectinated process hardly longer than the main outer tooth; galea more or less of the same length of the lacinia, with one only short apical cone. Maxillary palp without special feathures, provided with thin setae and with a few stronger and darker macrochaetae in the proximal articles. Labium with rounded posterolateral angles, with a few scattered setae; the labial palp without special characteristics.

Nota with long and short setae in their lateral borders only. Legs without special features, with some isolated macrochaetae; tarsus four-articulated; praetarsus with strong lateral claws, very slightly enlarged at their bases; empodium leaf-like and striated.

Urotergites completely covered by scales, the macrochaetae only in the posterolateral area and in the laterotergites. Xth urotergite strongly emarginated in the hind margin, with some thin setae in the posterolateral inner margin. Urosternites scaly, with 1+1 submedian macrochaetae and several thiner setae. Pseudovesicles in the IInd urosternite (in submedian position) and in the VIIth (in typical sublateral position). 6 pairs of abdominal stylets, from the VIth to the IXth segments. Subgenital plate large, parabolic. Ovipositor long, the gonapophyses with abundant thin setae only and clearly pseudarticulated. Posterior filaments without special charactristics.

Type-species : *Pseudatelurodes celebensis* sp.n.

Derivatio nominis : The new genus is named on account to its quite probable closeness to *Atelurodes* Silvestri, 1916.

Discussion : Only three Ateluridae genera are known to present 6 pairs of abdominal stylets, from the IVth to the IXth segment : *Dodecastyla* Paclt (PACLT, 1974) from Chile, *Mesonychographis* Silvestri (SILVESTRI, 1908) from Central Africa, and *Grassiella* Silvestri (SILVESTRI, 1912), with an amphi-atlantic distribution; none of these genera present a medial pair of pseudovesicles in the IInd urosternite and probably all of them (nothing is stated about *Dodecastyla*) show two sensorial cones in the apex of galea; furthermore, urotergal setae are present in the two former taxa and the number of abdominal vesicles is clearly different in the later.

The chaetotaxy, the shape of empodium, the occurrence of two closely located pseudovesicles in the IInd urosternite and the presence of only one short sensorial cone in the apical galea, are very similar to those shown by *Atelurodes* (SILVESTRI, 1916), a quite comparable genus that presents, however, only five pairs of abdominal stylets (IInd to the IXth segments). Only a future study of the male sex will allow, almost certainly, new distinctive characteristics between these two genera.

4. **Pseudatelurodes celebensis** sp.n.

Specimens examined : INDONESIA, Sulawesi (or Celebes) island, Bantimurung, Maros, in forest, 11/VII/1986, 1 ♀ holotypus, no. INDO-130, Reg. 4210 (CZ), col L. Deharveng.

Body length : 4.0 mm. General shape of body as in the generic description and in Fig. 48. Head, body and appendages light, yellowish, the hypodermal pigment absent. Scales very light, yellowish, golden or ivory, more or less uniform and with abundant thin rays which hardly surpass the free border of the scale. Head partially covered in its base by the anterior border of pronotum (Fig. 48 drawn after microscopical preparation); cephalic capsule covered by numerous scales, with a few scattered minute setae (mainly in the anterior area) not clearly emarginated at the level of the antennae; macrochaetae not specially abundant, only in the frontal area, clypeus and labrum. Antennae dammaged, short (maximum observed of 10 articles), devoided of special features; the two most distally preserved articles are longer than wider and composed of 3-4 sub-articles. Mandibles as in Fig. 49, clearly asymetrical, the incisive area with strong and acute sclerotized teeth, the molar area more reduced though well developed; proximal area of the outer body of mandibles with 2-3 very strong and long macrochaetae. Maxillae as in Fig. 50, the lacinia with one only developed apical sclerotized tooth followed by a further hyaline and tiny tooth; lamelated hyline process long, surpassing a little the apex of the apical tooth; galea not longer than the lacinia, with one only apical cone. Maxillary palp without special characteristics (Fig. 51), covered by thin setae and with a few stronger and darker setae in the apical area of the two proximal articles; distal article clearly longer (almost 1.5 times) and thiner than the penultimate, 5 times longer than wide. Labium and labial palp as in Fig. 52, the labium with posterolateral rounded corners and provided with a few isolated macrochaetae. Labial palp without special features, its apical article avoid, 1.5 times longer than wide and with the typical chaetotaxy.

Nota as in the generic description, with setae in the lateral margins only, their hind border almost straight. Legs without special characteristics, the scales in the coxae only; distribution of macrochaetae as in Fig. 53; tarsi four-articulated, the praetarsus as in the generic description and in Fig. 54.

Urotergites I-IX with scales only, the macrochaetae reduced to the infralateral group and to the neighbouring area of the laterotergite. Infralateral group of the Ist and IInd urotergites with two outer setae and one inner macrochaeta; outer seta the only preserved, shorter than the laterotergal setae (Fig. 55). IIIrd urotergite (Fig. 56) with four infralateral and two lateral setae, the inner macrochaeta of the infralateral group lost. IVth urotergite like the IInd, only the outer seta of the laterotergite preserved and similar to the correspondent one of the IIIrd segment.

Laterotergite and infralateral group of the Vth urotergite as in Fig. 57, similar to those of the VIth; macrochaeta short but strong, the outer seta clearly shorter and thiner; in the laterotergite, the outer seta is much shorter than the inner one. Urotergite VII with only one laterotergal seta (Fig. 58), the infralateral group with one strong macrochaeta and two thiner outer setae. Urotergite VIII as in Fig. 59, the infralateral group as in the preceeding sclerite, the laterotergite with one strong acute-pointed seta and two shorter and more delicate outer setae. IXth urotergite prolonged by an infralateral lobe, its chaetotaxy as in Fig. 60. Xth urotergite shorter than wide at base (Figs. 48 and 61), the apical notch deep; 1+1 infralateral macrochaetae (both lost) accompanied by 2+2 inner little setae (also lost); in the undersurface, 3-4 pairs of delicate paramarginal setae.

First urosternite glabrous, covered with scales. Urosternite II as in Fig. 62, with 1+1 submedian macrochaetae and 1+1 submedian pseudovesicles, each one provided with two thin setae. Urosternite III (Fig. 63) with 1+1 submedian macrochaetae, 1+1 clearly shorter (1/2 of the length of the former) sublateral macrochaetae, 1+1 infralateral setae and a pair of tiny cilia. Urosternites IV to IX provided with stylets those of the IVth the only preserved (Fig. 64) and with 1+1 submedian macrochaetae. Urosternite IV with 1+1 infralateral setae and 4+4 thin hairs between these and the insertion of the stylets. Vth urosternite (Fig. 65) similar, the infralateral setae stronger, though with only 2+2 cilia in the posterolateral border, one pair inner to the setae, the other close to the outer area of the stylet insertion. VIIth urosternite and subgenital plate as in Fig. 66; urosternite with 1+1 pseudovesicles; subgenital plate parabolic, wider than long and with several thin apical setae. VIIIth coxites well developed and provided of several marginal short setae as in Fig. 67. Coxite IX with two apical strong setae only (Fig. 68), one internal, the other external to the stylet insertion. Ovipositor ovoid, elongate, the gonapophyses VIII (Fig. 69) with 7 articles and provided of abundant thin setae and a few trichbothria, the IXth ones (Fig. 70) with 8 articles and much more scarcely setated.

Derivatio nominis : The new species is named after its geographical origin, the Celebes (or Sulawesi) island.

Bharatatelura gen.n.

Ateluridae : little insects (ca. 3 mm), weekly sclerotized; body limuloid, the thorax almost as long as wide and with ca. 2/3 of the abdominal length; hypodermal pigment absent, the body and appendages whitish or yellowish.

Scales with numerous rays that hardly surpass their free border, covering the body, head and coxae of legs.

Head dorsally exposed, free, the cephalic capsule covered only by scales, the setae restricted to the frontoclypeal and labral areas. Antennae short, not attaining the border of thorax; pedicelle of male with a distal process and a fovea. Mandibles strong, the teeth of the incisive area acute and well sclerotized, the molar area more reduced but conspicuous; external area of the body of mandibles with 2-3 very strong long setae and a few cilia. Maxillae elongate, the lacinia and the galea almost of the same length, the former with two well sclerotized apical teeth (the most distal the most developed) and with the lamellated process extending a little beyond its tip; galea with only one apical cone. Maxillary palp typical, provided with thin setae

only. Labium with posterolateral rounded corners, the labial palp without special features.

Nota covered by scales, the setae only in the lateral margins, their hind borders with a few isolated minute cilia. Legs without special characteristics, with some isolated macrochaetae; tarsus four-articulated, the praetarsus with two lateral claws with a minute basal pulvillium and an acicular empodium, much more delicate than the claws and curved in the opposite direction of these ones.

Urotergites covered by scales, their hind margin (with the exception of the IXth) with minute scattered cilia like those of the nota, the macrochaetae and big setae present only in the posterolateral angles and in the laterotergites. Xth urotergite wider than long, the apical notch much more pronounced in the female than in the male, this one provided with sensory cones in the under surface. Urosternites scaly, the first one glabrous, the IInd with 1+1 pseudovesicles very close each other, 1+1 macrochaetae in submedian position and 1+1 abdominal stylets, close to the pseudovesicles. urosternites from the IIIrd to the VIIth (VIIIth in the male), with 1+1 submedian macrochaetae and several pairs of minor setae. VIIth urosternite with 1+1 pseudovesicles in lateral (typical) position. Abdominal stylets, beside those on the IInd urosternite, in the segments VII to IX. Paramera well developed, cylindrical, apically provided with strong (probably secretory) points. Penis of the classical type, ovoid, its opening long and narrow, longitudinal. Subgenital plate wide, parabolic, with marginal setae. Ovipositor ovoid, the gonapophyses elongate and clearly articulated, with thin setae; in the apical area of the VIIIth gonapophyses a few minute spiniforms straight setae.

Cerci short, those of the male provided in the proximal articles of specialised chaetotaxy, one of the modified seta changed in a long stout dark spine. Terminal median filament damaged in the apical region, almost certainly clearly shorter than the abdomen (probably not much longer than the cerci), devoid of transformed chaetotaxy even in the male.

Spermatolophids globular, their diameter ca. 0.04 mm; heads of the spermatozoon thin and elongate, with ca. half of the diameter of the spermatolophid; aproximate number of spermatozoon per spermatolophid: 6-7.

Type-species : *Bharatatelura malabarica* sp.n.

Derivatio nominis : From Bharat, the Indian name for India, and *Atelura,* the former genus described inside the Ateluridae.

Discussion : The new genus is the only one inside the Ateluridae to present one pair of submedian stylets in the IInd; urosternite and three further pairs of stylets in the VII to IX abdominal segments. The presence of 1+1 submedian pseudovesicles in the IInd urosternite, the non-transformed terminal median filament in the male, sex that shows, however, sclerotized conules in the under surface of the Xth urotergite and specialized chaetotaxy in the inner surface of the cerci (particularly the long and stout spiniform seta), the galea with one only apical cone and the presence of stylets in the three last abdominal segments, seem to approach the new *Bharatatelura* to a group of quite interesting Oriental genera already signalized as probably monophyletic and that has been named the "*Metriotelura* group" (MENDES, 1989) : *Acanthinonychia* (PACLT, 1963), *Allomorphura* (SILVESTRI, 1916), *Allomorphuroides* (MENDES, 1989), *Assmuthia* (ESCHERICH, 1906); *Comphotrura*

(PACLT, 1963), *Heteromorphura* (PACLT, 1963) and, quite probably also (as it is known only by the female), *Trichodimeria* (PACLT, 1963). Among these genera, *Bharatatelura* gen.n. presents a lot of plesiomorphic characteristics as are the non morphologically transformed Xth urotergite of the male, the absence of exceptionally developed pulvilli or crests in the lateral claws, the normal (non-reduced) median filament in the male, the typical paramera and the absence of sexual dimorphism in what the abdominal stylets and the general body shape are concerned; furthermore, there are three pairs of abdominal stylets (excluding the submedian pair of the IInd urosternite), the maximum number known to occur in the genera of this "group" The almost typical praetarsus and the absence of drastic transformations in the genital and perigenital areas, seem to point to a primitive genus inside the "*Metriotelura* group", not very far, perhaps, from a common ancestror that could had been shared also by *Heteromorphura, Allomorphura, Allomorphuroides* and, may be, *Comphotriura* and *Platystylea.*

The new genus seems also close to *Proatelura* (SILVESTRI, 1916) and *Proatelurina* (PACLT, 1963); it is, however, easily distinguishable from both by the shape of the empodia and, in the male, by the long spine in the inner basal cerci; besides, it is also different from *Proatelura* by the presence of a pedicellar apophyses in the male (character shared with *Proatelurina*).

5. **Bharatatelura malabarica** sp.n.

Specimens examined : INDIA, State of Goa, near Forte Aguada, under stones in a nest of Formicidae *s.str.* ants, 16/VIII/1988, 1 ♂ holotypus, Reg. 4172 (CZ) col. L. Mendes; State of Haryana, Dehli, in a non cultivated green area inside the town (around Purana Qila), under stones in a nest of Myrmicidae ants, 23/VIII/1988, 1 ♀ allotypus, Reg. 4174 (CZ), col. L. Mendes; State of Maharashtra, Bombay, in the periphery of a garden under stones, in a nest of a Myrmicidae ant, 5/VIII/1988, 1 ♀ paratype, Reg. 4169 (CZ), col. L. Mendes.

Body length : 3.1 mm (♂) 3.6-3.7 mm (♀); length of thorax : 1.3 mm (♂) 1.4 mm (♀) ; width of thorax : 1.3 mm (♂) 1.4 mm (♀). General shape of body as in the generic description and in Fig. 71. Head, body and appendages, whitish, without hypodermal pigment. Alive specimens yellowish golden, the scales more or less uniform and with abundant rays hardly surpassing the free border of the scale. Head almost completely free, the macrochaetae restricted to the anterior area, as in Fig. 72. Antennae short, with 15 articles; pedicelle of male (Fig. 73) provided with an inner distal apophyses and, in its base, with a circular pit; distal articles clearly longer than wide, the praedistal divided in 2 or 3 subarticles. Mandibles as in Fig. 74, strongly asymetrical, the incisive area with numerous sclerotized teeth, the molar area well developed; in the outer margin of the body of mandibles, 2-3 very strong long setae. Maxillae as in Fig. 75, the lamelated hyalin process of the lacinia longer than the sclerotized teeth; these are two, the external one stronger; galea almost of the same length of the lacinia, with one only apical cone. Maxillary palp (Fig. 76) typical, covered only by thin setae, its distal article longer than the preceeding and 2.5 times longer than wide. Labium with rounded posterolateral corners, the labial palp as in the Fig. 77, its distal article ovoid and clearly longer than wide.

Nota as in the generic description and in Fig. 68, the setae restricted to the lateral margins; 6-8 minute and enconspicuous cilia in the hind margin of each notum; posterior borders of nota almost straight. Legs without special characteristics, the praetarsus as in the generic description and in Figs. 78 and 79 (for comparison, see Fig. 80 and 81 of the praetarsus of *Proatelurina pseudolepisma* and Fig. 82 for the praetarsus of *Proatelura jacobsoni).*

Urotergites I to IX covered by scales, the setae restricted to the infralateral group and to the laterotergites. Infralateral area of the Ist and IInd urotergites with one macrochaeta, the corresponding laterotergites also with one only (although minor) seta, as in Fig. 83. III to VIIth urotergites (Fig. 84) with 2 infralateral macrochaetae, the innermost clearly shorter (1/2 to 2/3 of the outer one); in the laterotergite, 3 setae, the inner one stronger and longer than the remaining. Infralateral area of the VIII dorsal sclerite, similar but with only 2 seate in the laterotergite, the inner one clearly stouter. Urotergite IX (Fig. 85) with the posterolateral lobe not specially (though clearly) produced, the posterolateral angle with a strong macrochaeta, the outer margin with a longitudinal row of 6 setae. urotergite X in the female (Fig. 86) much more deeply concave posteriorly than in the male (Fig. 87); in both sexes 1+1 stout posterolateral macrochaetae and (1−2) + (1−2) inner shorter and more delicate macrochaetae; in the lateral margins (3−4) + (3−4) short setae inserted only in the distal half (male) or in the distal third (female); under surface of this scelrite in the male provided with 1+1 fields in the mediolateral area, each one with less than 10 short cilyndrical dark cones.

Urosternite I glabrous. Urosternite II (Figs. 88 and 89) with 1+1 submedian pseudovesicles, 1+1 submedian macrochaetae and 1+1 submedian (external to the pseudovesicles) stylets. III urosternite with 1+1 submedian macrochaetae, 1+1 short cilia close to the macrochaetae and with 1+1 infralateral short setae. IVth urosternite (Fig. 90), similar to the V and VI , but with 2+2 short cilia in sublateral and lateral position. urosternite VII with 1+1 abdominal stylets and 1+1 lateral pseudovesicles besides the 1+1 submedian macrochaetae, its hind margin clearly (although not strongly) concave in the female (Fig. 91). Subgenital plate (Fig. 91) parabolic, much wider than long, with a fringe of marginal thin setae. Coxites VIII of female (Fig. 92) with only one or two setae in the outer margin, the IXth coxites (Fig. 93) with a much stronger stylet, provided in their inner margin of only two setae and an apical short and delicate spine. Coxites VIII and IX of male as in Fig. 94, the submedian macrochaetae of the VIIIth very close each other, the stylets of the IXth much more developed than the remaining. paramera subcilyndrical, as in Fig. 94, covered with not particularly dense thin setae, the apical transformed hairs exceptionally long and strong; penis without special characteristics, its opening longitudinal and narrow. Ovipositor elongate, ovoid, the gonapophyses VIII with 6 articles, the apical one with a few (3 to 4) very thin straight spiniform setae, shorter than the remaining, besides the typical setae (Fig. 95). IXth gonapophyses (Fig. 96) with some very long thin setae, the number of articles (and so, the pseudosegmentation), impossible to see clearly.

Terminal filament without special features, with some strong setae and a few trichobothria, similar in both sexes. Cerci provided in the male (Fig. 97) not transformed in the female—of specialized chaetotaxy; the innermost of the thin hairs is changed in a dark, spiniform seta in the second, third and fourth basal

articles; the spine of the second basal article is the less transformed, the thiner and the less elongate of all, that of the third, the stronger, the longest and the darker, attaining almost four times the length of the former.

Spermatolophids as in Fig. 98, rounded or ovoid and with ca. 0.04 mm; medium average of spermatozoon by spermatolophid : 6-7; heads of spermatozoon filiform, ca. half of the length of the spermatolophid, as in generic description.

Derivatio nominis : The new species is named *B. malabarica* as it is known only from the Western half of India, two fo the specimens were collected from the places in the Malabar coast.

6. **Allomorphuroides dicuspiditermina** Mendes, 1987

Specimens examined : MALAYSIA, Sabah area of Borneo (East Malaysia), Sepilok, Sandakan, in a termite mound, 1/XI/1979, 2 ♂♂ 3 ♀♀ (MG), leg. R. Yoshii.

The species (and the genus) have been recently described (MENDES, 1989); the studied specimens agree well with what has been noticed. The present material has been collected in the same place and in the same day than the type-material.

SUMMARY

Several samples of Ateluridae (Zygentoma) from the Oriental Region and from the Sulawesi island are studied. *Gastrotheus* (*G.*) *palpiseta, Nipponatelura shirozui* and *Atelurodes myrmicarius* are signalized for the first time in India (the former), in the Philippines (the second) and in Thailand (the later) and some notes are added to their original descriptions. *Allomorphuroides dicuspiditermina* is noticed for the second time, again to the Sabah area of Borneo. Two new species belonging to two new genera are described : *Pseudatelurodes celebensis* gen.n. sp.n. from Sulawesi and *Bharatatelura malabarica* gen.n. sp.n. from India.

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SILVESTRI, F. (1916) "Descrizione di alcuni tisanuri indo-malese" *Boll. Lab. Zool. gen. agr. Portici* **11** : 85-119.

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Rec. zool. Surv. India, 90(1-4) : 239-264, 1992

INDEX – CATALOGUE AND BIBLIOGRAPHAY OF CESTODE PARASITES FROM FRESHWATER FISHES OF INDIA

D. K. KUNDU

Zoological Survey of India, M-Block, New Alipore, Calcutta-700 053.

INTRODUCTION

Southwell (1930) published under the "*Fauna of Brisith India*" series a comprehensive account of cestode parasites of India including Burma and Ceylon. Since then there have been a number of publications on fish cestodes. In recent years there has been an avalanche of new species and genera emanating from Indian region but these are mostly in such journals which are not easily accesible to workers in this field. It was, therefore, felt that a catalogue of these publications will be useful for the information needed by the workers on systematics and taxonomy of the cestodes of fresh water fishes. With this end in view the present "Index Catalogue" has been prepared.

While compiling this catalogue it was felt that a lot of confusion has crept in with regard to the validity of many species and genera described since the publication of *Fauna of British India* Volume. It is hoped that this catalouge will induce workers to take up revisionary work in this group to clear the existing confusion.

To prepare this index catalogue and bibliography *Helminthological abstract, Index catalouge of Medical and Veterinary Zoology* and other related journals were consulted. Both species of parasites and hosts are arranged in systematic order. Current valid names of fish hosts with their synonyms and in some cases English names are included in parenthesis. The species are arranged in alphabetical order under each genus. The authorship and date of nominal subfamily has been changed according to Rules.

In spite of my efforts few reprints and journals could not be available to me. I hope the workers in this field would draw my attention to errors and ommissions, if any, so that an improved taxonomic information could be prepared for future use.

SPECIES CATALOGUE

Phylum	PLATYHELMINTHES
Class	CESTOIDAE Rudolphi, 1808
Subclass	CESTODA Carus, 1863
Order	AMPHILINIDEA Poche, 1922
Family	AMPHILINIDAE Claus, 1879
Subfamily	AMPHILININAE Poche, 1922
Genus	**Gephyrolina** Poche, 1926

1. Gephyrolina paragonopora (Woodland, 1923)

1923. *Amphilina paragonopora* Woodland, *Quart. J. Micr. Sc.*, 67 : 47-84.

Host : Mystus aor (= Aorichthys aor), Mystus seenghala (= Aorichthys seenghala), Bagarius yarrelli (= Bagarius bagarius).

Distribution : Uttar Pradesh : Allahabad (R. Ganga & Jamuna); Punjab.

Order CARYOPHYLLIDEA Van Beneden
(in Carus, 1963)

Family LYTOCESTIDAE Hunter, 1927;
Wardle and McLeod, 1952.

(= Subfamily Lytocestinae Hunter, 1927)

Genus Bovienia Fuhrmann, 1931

2. Bovienia nagpurensis Murhar, 1977

1977. *Bovienia nagpurensis* Murhar, *Proc.* 65th *Indian Sc. Congr.*, Part. III : 314-315.

Host : *Clarias batrachus*

Distribution : Maharashtra : Nagpur.

Remarks : The species is known only through abstract.

3. Bovienia serialis (Bovien, 1926) Fuhrmann, 1931

1926. *Caryophyllaeus serialis* Bovien, *Vidensk. Medd. Dansk natur. Forening.* : Kobenhaun 82 : 157-181.

1972. *Bovienia serialis* : Mackiewicz and Murhar, *J. Helminth.* 46 ; 399-405.

Host : *Clarias batrachus.*

Distribution : Maharashtra Nagpur.

Genus Crescentovitus Murhar, 1963

4. Crescentovitus biloculus Murhar, 1963

1963. *Crescentovitus biloculus* Murhar. *Parasitology*, 53 : 413-418.

Host : *Heteropneustes fossils.*

Distribution : Maharashtra : Nagpur

Genus Djombangia Bovien, 1926

5. Djombangia caballeroi Sahay and Sahay, 1977

1977. *Djombangia caballeroi* Sahay and Sahay, *Excreta Parasitologia Enmemoria Doctor Eduardo Caballero Y. Caballero* : 371-376.

1985. *Djombangia clariae* Kundu *et al. Bull. zool. Surv. India*, 7(2) : 151-154.

Host : Heteropneustes fossilis.

Distribution : Bihar : Ranchi.

Remarks : Mackiewicz (1981) suggested re-evaluation of this species as it was described from flattened material. Kundu and (1991) Hafeezullah (1986) considered it to be synonym of *D. penetrans* Bovien 1926.

6. **Djombangia indica** Satpute and Agarwal, 1974

1974. *Djombangia indica* Satpute & Agarwal, *Indian J. Exp. Biol.* 12(4) : 373-375.

Remarks : Mackiewicz (1981) suggested comparison of *D. indica* with *D. caballeroi* before assessment of the stattus of both the species. Kundu (1991) and Hafeezullah (1986) considered conspecific with *D. penetrans* Bovien, 1926 in view of the variability of the characters taken for differentiating all the above three species of genus *Djombangia.*

Genus **Introvertus** Satpute and Agarwal, 1980

7. **Introvertus raipurensis** Satpute and Agarwal, 1980

1980. *Introvertus raipurensis* Satpute & Agarwal, *Proc. Indian Acad. Parasit.* 1(2) : 17-19.

Host : *Clarias batrachus*

Distribution : Madhya Pradesh : Raipur.

Genus **Lucknowia** Gupta, 1961

8. **Lucknowia fossilis** Gupta, 1961

1961. *Lucknowia fossilis* Gupta, *Proc. Helminth, Soc. Wash.*, 28 : 38-50.

Host : *Heteropneustes fossilis.*

Distribution : Uttar Pradesh : Lucknow (R. Gomti).

Remarks : Mackiewicz (1981) pointed out that some of the specimens are partially decomposed. He also did not confirm the existence of post ovarian viteline follicles and polar filament of the egg.

Agarwal (1985) remarks that post ovarian vitelline follicles are characteristic of species of genus *lucknowia.*

9. **Lucknowia indica** Niyogi, Gupta and Agarwal, 1982

1982. *Lucknowia indica* Niyogi *et al. Proc. Indian Acad. parasit.* 3(1/2) : 17-22.

Host : *Clarias batrachus*

Distribution : Madhya Pradesh : Raipur.

Remarks : Polar filament is absent in the egg of *L. indica.*

Genus **Lytocestoides** Baylis, 1928

10. **Lytocestoides aurangabadensis** Shinde, 1970

1970. *Lytocestoides aurangabadensis* Shinde, *Marathwada Univ. J. Sci.*, 9 : 173-178.

1970. *Lytocestoides aurangabadensis minor* Shinde, *Marathwada Univ. J. Sc.*, 9 : 173-179.

1970. *Lytocestoides aurangabadensis minuta* Shinde, *Marathwada Univ. J. Sc.*, 9 : 173-178.

Host Barbus collus (= *Puntius kolus*), *Labeo calbasu.*

Distribution Maharashtra Aurangabad.

Remarks : *L. aurangabadensis* may be considered as species inquerendo. The material was examined by Mackiewicz (1981) but correct placing could not be made due to bad condition of specimen.

11. **Lytocstoides fossilis** Kanth, Sinha & Srivastava, 1984.

1984. *Lytocestoides fossilis* Kanth *et al. Indian J. Helminth.* (N.S.), 1(1/2) : 26-29.

Host : *Heteropneustes fossilis.*

Distribution : Bihar : Darbhanga.

12. **Lytocestoides lepidocephali** Kundu, 1985

1985. *Lytocestoides lepidocephali* Kundu, *Bull. zool. Surv. India,* 7(2-3) : 285-290.

Host : *Lepidocephalichthys guntea*

Distribution : West Bengal Garapota, 24-Parganas (North) dist.

Genus **Lytocestus** Cohn, 1908

13. **Lytocestus birmanicus** Lynsdale, 1956

1956. *Lytocestus birmanicus* Lynsdale. *J. Helminth;* **30** : 87-96.

1988. *Lytocestus birmanicus* : Chakravarty and Tandon, *Indian J. Helmth* (N.S.) 5(1) : 37-54.

Host Clarias batrachus.

Distribution : Northwastern region of India.

Remarks Originally described by Lynsdale (1956) from Rangoon, Burma.

14. **Lytocestus filiformis** (Woodland, 1923) Fuhrmann and Baer, 1925

1923. *Caryophyllaeus filiformis* Woodland, *Quart. J. Micr. Sc.* 67 : 435-472.

1925. *Lytocestus filiformis* : Fuhrmann and Baer *Proc. zool. Soc.* London : 79-100.

1988. *Lytocestus filiformis* : Chakravarty and Tandon, *Indian J. Helminth* (N.S.) 5(1) : 37-59.

Host Clarias batrachus.

Distribution Northeastern region of India.

Remark Woodland (1923) described this species as *Caryophyllaeus filiformis* from a marmyrid fish host, *Mormyrus cashive* of river Nile at Khartoum. Fuhrmann and Baer (1925) transferred it to the genus *Lytocestus.*

15. **Lytocestus indicus** Moghe, 1925

1925. *Caryophyllaeus indicus* Moghe, *Parasitology* 17 : 232-235.

Host : *Clarias batrachus.*

Distribution : Maharashtra : Nagpur.

16. **Lytocestus longicollis** Ramadevi, 1973

1973. *Lytocestus longicollis* Ramadevi, *J. Helminth.* 47(4) : 415-420.

Host : *Clarias batrachus.*

Distribution Andhra Pradesh Visakapatnam.

17. **Lytocestus marathwadensis** Shinde and Phad, 1986

1986. *Lytocestus marathwadensis* Shinde and Phad, *Riv. Parasitol* 47(3) : 297-298.

Host : *Clarias batrachus.*

Distribution : Maharashtra : Marathwada.

Genus **Moravekia** Sahay & Sahay, 1976

18. **Moravekia chotanagpurensis** Sahay and Sahay, 1976

1976. *Moravekia chotanagpurensis* Sahay, and Sahay, *First National convention of Indian Helminthologist,* Bhubaneswar. Abastract : 54-55.

Host : *Clarias batrachus.*

Distribution : Bihar : Chotanagpur.

Remarks : The genus and species are known from the abstract only.

Genus **Neolytocestus** Sahay and Sahay, 1976

19. **Neolytocestus vitellodiscontinutus** Sahay and Sahay, 1976

1976. *Neolytocestus vitellodiscontinutus* Sahay and Sahay, *First national convention of Indian Helminthologist,* Bhubaneswar, Abstract : 53-54.

Host : *Clarias batrachus.*

Distribution : Bihar : Chotanagpur.

Remark : The genus and species are known from the abstract only.

Family CAPINGENTIDAE Wardle and Mcleod, 1952

Genus **Adenoscolex** Fotedar, 1958

20. **Adenoscolex kashmirensis** (Mehra, 1930)

1930. *Caryophyllaeus kashmirensis* Mehra, *Proc.* 17th *Indian Sci. Congr.* Pt. 3 : 447.

Host : *Oriinus sinuatus* (= *Schizothorax sinuatus)*

Remarks : Mehra (1930) described *Caryophyllaeus kashmirenis* from *Schizothorax micropogon* in abstract form. Mackiewicz (1981) put it as sp. inq. Agarwal (1985) considered it conspecific with *Adenoscolex oreini* Fotedar, 1958 but wrongly gave priority to Fotedar's specimens. The synonymy is accepted here and *Adenoscolex kashmirensis* (Mehra, 1930) is considereed the type of the genus according to rules.

Genus **Capingentoides** Gupta, 1961

Syn. *Pseudocapigentoides* Verma, 1971

21. **Capingentoides batrachii** Gupta, 1961

1961. *Capingentoides batrachii* Gupta, *Proc. Helminth. Soc. wash.*, 28 : 38-50.

Host : *Clarias batrachus.*

Distribution : Assam : Guwahati (R. Brahmaputra).

22. Capingentoides fotedari Gupta and Parmar, 1985.

1985. *Capingentoides fotedari* Gupta and Parmar, *Indian J. Helminth.*, **37**(1) : 31-35.

Host : *Clarias batrachus* (Bloch).

Distribution : Uttar Pradesh : Lucknow.

23. Capingentoides gorakhnathai Agarwal and Singh, 1985

1985. *Capingentoides gorakhnathai* Agarwal and Singh, *Indian J. Helminth.*, (N.S.) **2**(1-2) : 81-84.

Host : *Clarias batrachus.*

Distribution : Uttar Pradesh : Gorakhpur.

24. Capingentoides singhi Verma, 1971

1971. *Capingentoides singhi* Verma, *Indian J. Helminth.*, **23**(1) : 71-80.

1971. *Pseudocapingentoides indica* Verma, *Indian J. Helminth.*, **23**(1) : 71-80.

1980. *Capingentoides heteroneusti* Gupta and Sinha, *Indian J. Helminth.* **31**(1) : 65-68.

1985. *Capingentoides singhi* : Agarwal, *Indian Rev. Life Sci.***5** : 139-161.

Host : *Heteropneustes fossilis.*

Distribution : Uttar Pradesh Lucknow.

Remarks Agarwal (1985) considered *Pseudocapingentoides* as synonym of *Capingentoides, Pseudocapingentoides indica* and *Capingentoides heteropneusti* as synonym of *Capingentoides singhi.*

25. Capingentoides moghei Pandey, 1973

1973. *Capingentoides moghei* Pandey, *Indian J. zool.*, **14**(3) : 221-226.

Host : *Channa striatus.*

Distribution : Uttar Pradesh : Ballia Dist.

Remarks : According to Agarwal (1985) report of the occurrence of *Capingentoides moghei* in *Channa striatus* is perplexing.

Genus Pseudocaryophyllaeus Gupta, 1961.

26. Pseudocaryophyllaus indica Gupta, 1961.

1961. *Pseudocaryophyllaeus indica* Gupta, *Proc. Helminth., Soc. Wash.*, **28** : 38-50.

Host : *Clarias batrachus.*

Distribution : Assam Guwahati (R. Brahmaputra).

27. Pseudoçaryophyllaeus mackiewiczi Gupta and Parmar, 1984

1984. *Pseudocaryophyllaeus mackiewiczi* Gupta and Parmar, *Indian J. Helminth.*, **34**(2) : 136-138.

Host : *Heteropneustes fossilis.*

Distribution : Uttar Pradesh Gorakhpur.

Genus Pseudolytocestus Hunter, 1929.

28. **Pseudolytocestus clariae Gupta, 1961**

1961. *Pseudolytocestus clariae* Gupta, *Proc. Helminth., Soc. Wash.*, **28** : 38-50.

Host : *Clarias batrachus*

Distribution Assam Guwahati (R. Brahmaputra).

29. **Pseudocaryophyllaeus ritai Gupta and Singh, 1983.**

1983 *Pseudocaryophyllaeus ritai* Gupta and Singh, *Indian J. Helminth.* **34**(1) : 11-14.

Host *Rita rita.*

Distribution Uttar Pradesh : Lucknow.

Order PSEUDOPHYLLIDEA Carus, 1863

Family BOTHRIOCEPHALIDAE Blanchard, 1849

Genus Bothriocephalus Rudolphi, 1808

Emended Luhe, 1899

30. **Bothriocephalus teleostei Malhotra, 1984**

1984. *Bothriocephalus teleostei* Malhotra, *Bol. Chile. Parasit.*, **37** : 6-9

Host *Barilius bendelisis, Barilius bola, Garra gotyla gotyla, Labeo dero, Labeo rohita and Schizothorax plagiostomus* (= *Schizothorax richardsonii*).

Distribution : Uttar Pradesh : Garhwal Himalayas.

Family PTYCHOBOTHRIIDAE Luhe, 1902

Genus Ptychobothrium Loennberg, 1889

31. **Ptychobothrium chelai** Shinde and Deshmukh, 1976

1976. *Ptychobothrium chelai* Shinde and Desmukh, *J. Indian Bios. Asso.*, 1(7-9) : 124-129.

Host : *Chela clupeoides* (= *Salmostoma Clupeoides*).

Distribution Maharashtra : Aurangabad.

32. **Ptychobothrium clupeodesii** Chincholikar, Shinde, Deshmukh and Jadav, 1976

1976. *Ptychobothrium clupeoidesii* Chincholikar *et al.*, *Marathwada Univ. J. Sci.*, **8** : 277-280.

Host : *Chela clupeoides* (= *Salmostoma Clupeoides*)

Distribution : Maharashtra : Aurangabad.

33. **Ptychobothrium cypseluri** Rao, 1959.

1959. *Ptychobothrium cypseluri* Rao, *J. Helminth.*, **33** : 267-272.

1976. *Ptychobothrium cypseluri* : Gupta and Arora, *Riv. Parasit.*, **36**(2/3) : 225-226.

Host *Barilius bola.*

Distribution Chandigarh : Panchkulas (R. Ghagher).

34. **Ptychobothrium khami** Shinde and Deshmukh, 1975

1975. *Ptychhobothrium kami* Shinde and Deshmukh *J. Indian Bios. Asso.,* 1(7-9) : 124-129.

Host : Nemacheilus botia.

Distribution : Maharashtra.

35. **Ptychobothrium nayarensis** Malotra, 1983

1983. *Ptycobotrium nayarensis* Malotra, *Korean, J. Parasit,* 21(2) : 205-208.

Host : Barilius bola.

Distribution : Uttar Pradesh : Pauri Garhwal, Nayar Dist. (R. East and West).

36. **Ptychobothrium puloi** Shinde and Deshmuk, 1975.

1975. *Ptychobothrium phuloi* Shinde and Deshmukh, *Jour. Indian Bio. Assn.*, 1(7-9) : 124-129.

Host : Chela phulo (= Salmostoma phulo pulo)

Distribution : Maharashtra : Aurangabad.

Genus **Senga** Dollfus, 1934

37. **Senga besnardi** Dollfus, 1934.

1934. *Senga besnardi dollfus, Bull. Soc. Zool.* France. **60** : 476.

1973. *Senga besnardi* : Ramadevi and Rao, *Rivista Parasit.* 34(4) : 281-286.

1973. *Senga besnardi* : Shinde, *Marathwada Univ. J. Sc. B. Biol. Sci.,* 11(4) : 39-40.

Host : Channa gachua (= Channa orientalis).

Distribution : Maharashtra : Aurangabad.

38. **Senga khami** Shinde and Deshmukh, 1980

1980. *Senga khami* Sinde and Deshmuk, *Indian J. Zool.,* 8(1) : 30-33.

Host : Channa marulius.

Distribution : Maharashtra : Aurangabad.

39. **Senga pycnomerus** (Woodland, 1924)

1924. *Bothriocephalus pycnomerus* Woodland, Parasitology, **16** : 441.

Host : *Channa manulius.*

Distribution : Uttar Pradesh : Allahabad.

Remarks : Dollfus (1934) placed *Pycnomerus* with the genus *Senga.*

40. **Senga punctati** Gupta and Sina, 1980

1980. *Senga punctati* Gupta and Sinha, *Indian J. Helminth.,* 32(2) : 124-128.

Host : Channa punctatus.

Distribution : Uttar Pradesh : Luckhnow.

41. Senga ophiocephalina (Tseng, 1933)

1913. *Bothriocepalus (Ancistrocepalus) polyptera* Southwell *Rec. Indian Mus.*, 9 : 79-103.

Host : *Channa striatus, Labeo roita.*

Distribution : West Bengal.

42. Senga lucknowensis Jori, 1956

1956. *Senga lucknowensis* Johhri, *Curr. Sci.* 25 : 193-195.

Host : *Mastacembelus armatus, Channa punctatus, Bagarius yarelli* (= *Bagarius bagarius*).

Distribution : Uttar Pradesh : Lucknow.

43. Senga visakhapatnamensis Ramadevi and Rao, 1973.

1973. *Senga visakhapatnamensis* Ramadevi and Rao, *Riv. parasit.* 34(4) : 281-286.

Host : Opiocepalus puncatatus (= Canna punctatus).

Distribution : Andhra Prades : Visakapatnam.

44. Senga gangesii Gairola and Malhotra, 1986

1986. *Senga gangesii* Gairola and Malhotra, *Japh. J. Parasitol.*, 35(6) : 471-474.

Host : Mystus vittatus.

Distribution : Uttar Pradesh : R. Ganges.

45. Senga vittati Gairola and Malhotra, 1986.

1986. *Senga vittati* Gairola and Malotra, *Acta Parasitol. Litu.* 22 : 92-96.

Host : Mystus vittatus.

Distribution : Uttar Pradesh : R. Ganges.

46. Senga raoi Majid and Shinde, 1984.

1984. *Senga raoi* Majid and Shinde, *Indian J. Parasitol* 8(1) : 169-172.

Host : Channa punctatus.

Distribution : Orissa : Puri.

47. Senga jagannathae Majid and Shinde, 1984

1984. *Senga jagannathae, Indian J. Parasitol,* 8(1) : 169-172.

Host : Channa punctata.

Distribution : Orissa : Puri.

48. Senga indica Gupta and Parmar, 1985

1985. *Senga indica, Indian J. Helminth,* 37(2) : 96-99.

Host : Mastacembalus armatus (Lacep).

Distribution Uttar Pradesh Lucknow (River Gomati).

Genus **Circumonchobothrium** Shinde, 1968

49. **Circumonchobothrium ophiocephali,** Schinde, 1968

1968. *Circumonchobothrium ophiocephali, Riv. Parasit.* **29** : 111-114.

Host : Ophiocephalus leucopunctatus (= Channa punctatus).

Distribution : Maharashtra Aurangabad.

50. **Circumonchobothrium aurangabadensis** Jadav & Shinde, 1976

1976. *Circumonchobothrium aurangabadensis* Jadav and shinde, *J. Indian Bios. Assn.*, **2** : 163-166.

Host : Mastacembelus armatus.

Distribution : Maharashtra Aurangabad.

51. **Circumonchobothrium khami** Shinde, 1976

1976. *Circumonchobothrium khami* Shinde, *Marathwada Univ. J. Sc.*, **16**(9) : 129-132.

Host : Ophiocephalus striatus (= Channa striatus).

Distribution Maharashtra Aurangabad.

52. **Circumonchobothrium raoii** Shinde and Jadav, 1976

1976. *Circumonchobothrium raoii* Shinde and Jadav, *Marathwada Univ. J. Sc. (Nat. Sc.)* **15**(8) : 269-272.

Host : Mastacembelus armatus.

Distribution Maharashtra : Aurangabad.

Genus **Polyonchobothrium** Diesing, 1854

53. **Polyonchobothrium armati** Malhotra, 1984

1984. *Polyonchobothrium armati* Malhotra, *Korean J. Parasitol,* **22**(2) : 238-241.

Host : Mastacembelus armatus.

Distribution Uttar Pradesh : Garhwal Hmalayas.

54. **Polyonchobotrium allabadense** Malotra, 1987

1987. *Polyonchobothrium allabadense* Gairola and Malotra, *Japn. J. Parasitl.*, **36**() : 49-5.

Host : Mystus vittatus.

Distribution Uttar Pradesh Allahabad (R. Ganges).

55. **Polyonchobotrium faizabadensis** Singh and Capoor, 1986.

1986. *Polyonchobotrium faizabadensis* Singh and Capoor, *Proc. nat. Symp. New Dimen. parasitol* Allahabad, 134-135.

Host : *Channa punctatus.*

Distribution Uttar Pradeshh : Faizabad.

Remarks Published in abstract only.

Order DIPHYLLIDEA Ben. in Carus, 1863.

Family LIGULIDAE Claus, 1868 emend. Dubinina, 1959

Subfamily LIGULINAE Claus, 1868

Genus **Ligula** Bloch, 1782

56. **Ligula intestinalis** (L., 1758)

1913. *Ligula simplicissima* Southwell, *Rec. Indian Mus.*, 9 : 79-103.

1928. *Ligula intestinalis* : Southwell, *Ann. Trop. Med and Parasitol.*, 22(4) : 419.

1936. *Ligula intestinalis* : Datta, *Rec. Indian Mus.*, 38 : 226.

Host : Labeo calbasu, Labeo rohita, Catla catla, Danio sp., *Puntius* sp., *Amblypharyngodon mola, Nemacheilus nupicola.*

Distribution : West Bengal : Berhampur.

Remarks : *Ligula simplicissima* Rudolphi, 1802 is synonimised with *Ligula intestinalis* by Dubinina (1980).

Order LECANICEPHALIDEA

Family TETRAGONOCEPHALIDAE

Genus **Guptaia** Malhotra, 1985

57. **Guptaia garhwalensis** Malhotra, 1985.

1985. *Guptaia garhwalensis* Malhotra, *Helminthologia* 20 : 45-49.

Host : Schizothorax richardsonii.

Distribution : Uttar Pradesh : Nayar of the District Pauri Garhwal (R. East and West).

Order TRYPANORHYNCHA Diesing, 1863

Family GYMNORYNCHIDAE Dollfus, 1935

Genus **Gymnorhynchus** Rudolphi, 1819

58. **Gymnorhynchus gigas** (Cuvier, 1817)

1819. *Gymnorhynchus reptans* Rudolphi, Entozoorum synopsis cui accedunt duplex et indices locupletissimi X-1811 pp. Berolini.

1930. *Gymnorhynchus gigas* : Southwell, *Fauna Brit. India,* Cestoda 1 : 152.

Host : Arius gagora (= *Tachysurus gagora*), *Clupea ilisha* (= *Hilsa ilisha*).

Distribution : West Bengal, Delta of Ganges.

Family OTOBOTHRIIDAE Dollfus, 1942

Genus **Poecilancistrum** Dollfus, 1930

59. **Poecilancistrum ilisha** (Southwell and Prasad, 1919)

Host : Chupea ilisha (= *Hilsa ilisha*).

Remarks : Larval form.

Family **PTEROBOTHRIIDAE** Printer, 1931

Genus **Pterobothrium** Diesing, 1850

60. **Pterobothrium filicolle** (Linton, 1889)

1889 *Pterobothrium filicolle* Southwell, *Rec. Indian Mus.*, 9 : 79-103.

Host : Chupea ilisha (= Hilsa ilisha).

Distribution : Bihar Monghyr, Buxar. West Bengal : Diamond Harbour.

Family **TENTACULARIIDAE** Roche, 1926

Genus **Tentacularia** Bosc, 1819

61. **Tentacularia ilisha** (Southwell and Prasad, 1918)

1918. *Rhynchobothrius ilisha* Southwell and Prasad, *Rec. Indian Mus.*, 15 : 77-88.

Host : Clupea ilisha (= Hilsa ilisha).

Distribution West Bengal.

Remarks Larval form.

Order **PROTEOCEPHALIDEA** Mola, 1928

Family **PROTEOCEPHALIDAE** La Rue, 1911

Genus **Proteocephalus** Weinland, 1858

62. **Proteocephalus ritae** Verma, 1926

1926. *Proteocepalus ritae* Verma, *Allahabad Univ. Stud.*, 2 : 353-359.

Host : Rita rita.

Distribution Uttar Pradesh Allahabad.

63. **Proteocephalus torulosus** (Batsch), 1786

1786. *Proteocephalus torulosus* Batsch, Syst. Ausz. : 298.

1979. *Proteocephalus torulosus* : Dhar and Fotedar, *Indian J. Helminth.*, 31 (2) : 111-127.

Host : Nemacheilus kashmirensis.

Distribution Kashhmir : Harwan.

64. **Proteocepalus vitellaris** (Verma, 1928)

1928. *Ichthyotaenia vitellaris* Verma, *Allahabad Univ. Stud.*, 4 : 119-176.

Host : Bagarius yarellii (= Bagarius bagarius) Mastacembelus armatus.

Distribution : Uttar Pradesh : Allahabad.

Genus **Gangesia** Woodland, 1924

Syn. *Vermania* Wardle and McLeod, 1952

65. **Gangesia bengalensis** (Southwell, 1913)

1913. *Opryocotyle bengalensis* Southwell, *Rec. Indian Mus.*, 9 : 87.

1924. *Gangesia wallago* Woodland, *Parasitology*, 16 : 441-451.

1928. *Gangesia agraensis* Verma, *Allahabad Univ. Stud.*, 4 : 119-176.

Host : Opiocepalus striatus (= *Canna striatus*) *Labeo rohhita, Wallago attu, Bagarius yarelli (= Bagarius bagarius).*

Distribution : West Bengal, Uttar Pradesh : Allahabad.

66. **Gangesia (G) indica** Gupta and Parmar, 1984

1984. *Gangesia indica* Gupta and Parmar, *Indian J. Helminth.*, 34(1) : 44-49.

Host : Wallago attu.

Distribution : Uttar Pradesh : Lucknow.

67. **Gangesia aurangabadensis** Deshmukhh and Shinde, 1986

1986. *Gangesia aurangabadensis* Deshmukh and Shinde, Second Asian Congress of Parasitology, Lucknow, (Abstract) : 173.

Host : Barbus ticto (= Puntius ticto).

Distribution : Maharashtra : Aurangabad.

68. **Gangesia (Vermaia) jammuensis** Fotedar and Dhar, 1974

1980. *Gangesia (Vermaia) jammuensis* Fotedar and Dar, *Indian J. Helminth.*, 31(2) : 111-127.

Host : Wallago attu.

Distribution : Jammu.

69. **Gangesia (Gangesia) kashmirensis** Dhar and Fotedar, 1980

1980. *Gangesia (Gangesia) kashmirensis* Dhar and Fotedar, *Indian J. Helminth.*, 31(2) : 111-127.

Host : Glyptosternum sp.

Distribution : Jammu and Kasmir : Baramullah.

70. **Gangesia (Gangesia) lucknowi** Singh, 1948

1948. *Gangesia (Gangesia) lucknowi* Singh, *Indian J. Helminth.*, 1 : 41-46.

Host : Eutropiichthys vacha.

Distribution : Uttar Pradesh : Lucknow.

71. **Gangesia macrones** Woodland, 1924

1924. *Gangesia macrones* Woodland, *Parasitology*, 16 : 441-450.

Host : Macrones seenghala (= Aorichthys seenghala).

Distribution : Uttar Pradesh Allahabad.

72. **Gangesia mehamdabadensis** Malhotra, Dixit and Capoor, 1981

1981. *Gangesia mehamdabadensis* Malhotra *et al.*, *Sci Env.*, 3(1) : 7-20.

Host : Mystus tengana..

Distribution Gujarat : Mehamdabad.

73. **Gangesia pseudotropii** Verma, 1928

1928. *Gangesia pseudotropii* Verma, *Allahabad Univ. Stud.*, 4 : 119-176.

Host : Clupisoma garua (= Silurus garua).

Distribution : Uttar Pradesh : Allahabad (R. Ganges and R. Jamuna).

74. Gangesia sanehensis Malhotra, Capoor and Shinde, 1981

1981. *Gangesia sanehensis* Malhotra *et al., Mahathhwada Univ. J Sci.*, **19**(12) : 43-52.

Host : Cirrhina mrigala, Wallago attu.

Distribution : Uttar Pradesh : Garhwal.

Genus Silurotaenia Nybelin, 1942

75. Silurotaenia nibelini Shhinde, Deshmukh and Chincholikar, 1975

1975 *Silurotaenia nibelini* Shinde, Deshmukh and Chincholikar, *Marathwada Univ. J. Sc.*, 14(7) : 355-358.

Order ANTEROPORIDEA Subhapradha, 1955

Family MONOPOROPHYLLAEIDAE Subhapradha

Genus Mastacembellophyllaeus Shinde and Chincholikar, 1977

76. Mastacembellophyllaeus nandedensis Shinde and Chincholikar, 1977

1977. *Mastacembellophyllaeus nandedensis* Shinde and Chincholikar, *Riv. Parasitol,* roma, **38**(2-3) : 171-175.

Host : Mastacembellus armatus.

Distribution : Maharashtra : Nanded.

77. Mastacembellophyllaeus psudeutropiusii Jadav and Shinde, 1982

1982. *Mastacembellophyllaeus psudeutropiusii* Jadav and Shinde, *Riv. Parasitol.*, **43**(1) 117-119.

Host : Psudeutropius taakre.

Distribution : Maharashtra : Paithon.

78. Mastacembellophyllaeus taakree Jadav and Shinde, 1977

1977. *Mastacembellophyllaeus taakree* Jadav and Shinde, *First Nat. Congr. Parasitol.*, Baroda (Abstract) : 9.

Host : Pseudeutropius taakree.

Distribution : Maharashtra : Aurangabad.

Remarks : Published in abstract only.

HOST CATALOGUE

Class PISCES

Sub Class TELEOSTOMI

Superorder CLUPEOMORPHA

Order CLUPEIFORMES

Family CLUPEIDAE

Ilisa ilisha **(Hamilton) (River shad)**	*Gymnorphynchus gigas* (Cuvier, 1817) (Larval form)
	Poecilancistrum ilisha Southwell and Prashad, 1919 (Larval form)
	Pterobothrium filicolle (Linton, 1889) Plerocercoid larva.
Superorder	**OSTARIOPHYSI**
Order	**CYPRINIFORMES**
Family	**CYPRINIDAE**
Amblypharyngodon mola (Hamilton) (Indian carpet mola)	*Ligula intestinalis* (Linnaeus, 1758) (Cestocercoid larva)
Barilius bendelisis (Hamilton)	*Bothriocephalius teleostei* Malhotra, 1984
Barilius bola (Hamilton) (Hill-trout)	*Bothriocephalus teleostei* Malhotra, 1984
	Ptychobothrium cypseluri Rao, 1959
	Ptychobothrium nayarensis Malhotra, 1983
Catla catla (Hamilton) (Catla)	*Ligula intestinalis* (Linnaeus, 1958) (Larval form)
Chela clupeoides = *Salmostoma clupeoides* (Bloch)	*Ptychobothrium chelai* Shinde and Deshmukh, 1976
Chela phulo = *Salmostoma phulo phulo* (Hamilton)	*Ptychobothrium phuloi* Shinde and Deshmukh, 1976
Cirrhina mrigala (Hamilton)	*Gangesia sanehensis* Malhotra, Capoor and Shinde, 1980
Danio acquipinnatus McClelland (Danio)	*Lagula intestinalis* (Linnaeus, 1758) (Larval form)
Garra gotyla gotyla (Gray)	*Bothriocephalus teleostei* Malhotra, 1984
Labeo calbasu (Hamilton) (Kalbasu)	*Ligula intestinalis* (Linnaeus, 1758) (Larval form)
	Lytocestoides aurangabadensis Shinde, 1970
Labeo dero (Heckel)	*Bothriocephalus teleostei* Malhotra, 1984
Labeo rohita (Hamilton)	*Bothriocephalus teleostei* Malhotra, 1984

	Gangesia bengalensis (Southwell, 1913)
	Gangesia n. sp. Dixit and Capoor, 1979.
	Ligula intestinalis (Linnaeus, 1758)
	Senga ophiocephalina TSeng, 1933
Oreinus sinuatus = *Schizothorax sinuatus* (Heckel)	*Adenoscolex oreini* Fotedar, 1958.
	= *Adenoscolex kashmirensis* (Mehra, 1930)
Barbus collus = *Puntius kolus* (Sykes)	*Lytocestoides aurangabadensis* Shinde, 1970.
Puntius sophore (Hamilton)	*Tetrarhynchus* sp. (Moghe, 1926) (Larval form)
Puntius ticto (Hamilton)	*Gangesia aurangabadensis* Deshmukh and Shinde, 1986
Rasbora daniconius (Hamilton)	*Ligula intestinalis* (Linnaeus, 1758) (Larval form)
Schizothorax micropogon Heckel	*Caryophyllaeus kashmirensis* Mehra, 1930
Schizothorax richardsonii (Gray)	*Ptychobothrium nayarensis* Malhotra, 1983
	Guptaia garhwalensis Malhotra, 1985
	Bothriocephalus teleostei Malhotra, 1984
Schizothorax plagiostomus Heckel	*Bothriocephalus teleostei* Malhotra, 1984
Order	CYPRINIFORMES
Family	COBITIDAE
Lepidocephalichthys guntea (Hamailton)	*Lytocestoides lepidocephali* Kundu, 1985
Noemacheilus rupecola (McClelland)	*Ligula intestinalis* (Linnaeus, 1758) (Larval form)
Noemacheilus botia (Hamilton)	*Ptychobothrium khami* Shinde and Deshmukh, 1976
Noemacheilus kashmirensis Hora	*Proteocephalus torulosus* (Batsch, 1786)
Order	SILURIFORMES
Family	CLARIIDAE
Clarias batrachus (Linnaeus)	*Bovienia serialis* (Bovien, 1926) Fuhrmann, 1931

Capingentoides batrachii Gupta, 1961

Capingentoides gorakhnathai Agarwal and Singh, 1985.

Djombangia clariae Kundu, Bhattacharya and Datta, 1985.

Djombangia indica Satpute and Agarwal, 1974.

Djombangia penetrans Bovien, 1926

Introvetrus raipurensis Satpute and Agarwal, 1980.

Lucknowia indica Niyogi, Gupta and Agarwal, 1982.

Lytocestus indicus (Moghe, 1925)

Lytocestus longicollis Ramadevi, 1973

Pseudocaryophyllaeus indica Gupta, 1961

Pseudolytocestus clariae, Gupta, 1961.

Order SILURIFORMES

Family HETEROPNEUSTIDAE

Hateropneustes fossilis (Bloch)

Crescentovitus biloculus Murher, 1963.

Capingentoides heteropneusti Gupta and Sinha, 1979.

Capingentoides singhi Verma, 1971.

Djombangia caballeroi Sahay and Sahay, 1978.

Lucknowia fossilis Gupta, 1961

Lytocestoides fossilis Kant, Sinha and Srivastava, 1984.

Pseudocapingentoides indica Verma, 1971.

Order SILURIFORMES

Family SILURIDAE

Wallago attu (Schneider)

Gangesia bengalensis (Southhwell, 1913).

Gangesia jammuensis Fotedar and Dhar, 1974.

Gangesia lucknowia Sinhg, 1948.

	Gangesia sanehensis Malhotra, Capoor and Shinde, 1980.
Order	SILURIFORMES
Family	SCHILBEIDAE
Clupisoma garua (Hamilton)	*Vermaia pseudotropii* Verma, 1928.
Eutropiichthys vacha (Hamilton)	*Gangesia lucknowia* Singh, 1948.
Proeutropiichthys taakree (Sykes)	*Silurotaenia nybelini* Shinde, Deshmukh and Chincholikar, 1975.
	Mastacembellophyllaeus pseudeutropiusii Jadav and Shinde, 1982.
Order	SILURIFORMES
Family	BAGRIDAE
Arius gagora = *Tachysurus gagora* (Hamilton) (Catfish)	*Gymnorhynchus gigas* (Cuvier, 1817)
Mystus aor (Hamilton) = *Aorichthys aor* (Hamilton) (Aor)	*Gephyrolina paragonopora* Woodland, 1923.
Mystus seenghala (Sykes) = *Aorichthys seenghala* (Sykes) (Giant River Catfish)	*Gephyrolina paragonopora* Woodland, 1923
	Gangesia macrones Woodland, 1924
Mystus tengara (Hamilton)	*Gangesia mehamdabadensis* Malhotra, Dixit and Capoor, 1981.
Mystus vittatus (Bloch)	*Polyonchobothrium allahabadense* Gairola and Malhotra, 1981.
	Senga gangesii Malhotra, 1986
	Senga vittati Gairola and Malhotra, 1986.
Rita rita (Hamilton) (Rita)	*Proteocephalus ritae* Verma, 1926
Order	SILURIFORMES
Family	SISORIDAE
Bagarius bagarius (Hamilton) (Bagarius)	*Proteocephalus vitellaris* Verma, 1928
Order	SILURIFORMES
Family	SISORIDAE
Bagarius yarrelli = *Bagarius bagarius* (Hamilton)	*Gephyrolina paragonopora* Woodland, 1923.
	Gangesia bengalensis (Southwell, 1913)

	Proteocephalus vitellaris (Verma, 1928)
	Senga lucknowensis Johri, 1956.
***Glyptothorax* sp.**	*Gangesia (gangesia) lucknowia* Singh, 1948.
***Glyptosternum* sp.**	*Gangesia (gangesia) kashmirensis* Dhar and Fotedar, 1979.
Order	**ATHERINIFORMES**
Family	**CYPRINODONTIDAE**
***Panchax panchax* = *Aplocheilus panchax* (Hamilton)**	*Senga sp.* Ramadevi and Rao, 1966.
Order	**PERCIFORMES**
Family	**SCIAENIDAE**
***Pama pama* (Hamilton)**	*Gymnorhynchus sp.* (Larvae)
Order	**CHANNIFORMES**
Family	**CHANNIDAE**
***Channa striatus* (Bloch)**	*Senga ophiocephalina* (Tseng, 1933)
***Channa gachua* (Hamilton)**	*Senga besnardi* Dollfus, 1934.
***Channa marulius* (Hamilton)((Giant snake head)**	*Circumonchobothrium ophiocephali* Shinde, 1968.
	Senga pycnomera (Woodland, 1924)
	Polyonchobothrium pycnomerus Tadros, 1968.
	Senga khami Shinde and Deshmukh, 1980.
***Channa punctatus* (Bloch) (Snake head)**	*Senga punctati* Gupta and Sinha, 1980.
	Senga visakhapatnamensis Ramadevi 1976.
***Channa striatus* (Bloch) (Striped snake head)**	*Senga ophiocephalina* (TSeng, 1933)
	**Capingentoides moghei* Pandey, 1975.
	Circumonchobothrium khami Shinde, 1976
	Gangesia bengalensis (Southwell, 1913)
	Ophryocotyloides monocantis Monghe

*Occurrence in *C. striatus* is perplexing.

Order MASTACEMBELIFORMES

Family MASTACEMBELIDAE

Mastacembelus armatus (Lacepede) (Spiny eel)	*Circumonchobothrium aurangabadensis* Jadav and Shinde, 1976.
	Circumonchobothrium shindei, Chincholikar, 1978.
	Circumonchobothrium raoii Shinde and Jadav, 1976.
	Mastacembellophyllaeus nandensis Shinde and Chincholikar, 1977.
	Polyonchobothrium armati Malhotra *Senga nayari* Malhotra, 1984.
Mastacembelus pancalus (Hamilton)	*Senga nayari* Malhotra, 1984.

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ESTUARINE ANIMALS : A MANUAL ON COLLECTION, PRESERVATION AND MAINTENANCE

KAZA V RAMA RAO
AND
C.A. NAGESWARA RAO

Estuarine Biological Station
Zoological Survey of India
Hillpatna, Berhampur (GM)
Orissa - 760 005, India

I. INTRODUCTION

All estuarine biologists either working at research or academic institutes should be aware of atleast the simple collection procedures of estuarine animals and their accurate identification for environmental studies. After knowing such procedures an attempt should be made to build a reference collection centre covering the local flora and fauna which will later assist in various studies connected wtih ecology, commercial exploitation, conservation and environmental assessment studies. The present manual is a tool towards such a goal which deals with the general collection, preservation and maintenance procedures of estuarine animals.

II. COLLECTION

Collection of intertidal, planktonic, nektonic and benthic animals are to be made by using suitable gear. The collection equipment recommended are very simple in design and can be obtained from manufacturers within the country (Appendix a). The main criteria for estuarine gear should be of light weight as these are to be operated in shallow waters of estuaries from indigenous craft and fibre-glass boats operated with outboard motor engine.

a. Intertidal :

This area covers varied habitats having different fauna and flora inhabiting mud flats to salt marshes and mangroove swamps. Here the collections are mainly hand picked by using blunt forceps, chisels, hammers, showels, spades, crowbars, brushes, scoopnets, wide mouth pipettes, sieves of different aperture sizes (2.5mm - 0.5mm) and also by using formaldelyde, bleaching powder etc., in pools exposed at low tide

marks. One can visit this area frequently and make representative collections. Most of the animals (sessile or motile) are either buried in the mud, sand or associated with aquatic vegetation; attached to dead wood, rocks, within empty shells, oyster beds; under stones and other substrates. A tide table chart of the area is essential for collections as the animals will be exposed only during low tide and the area should be reached well before the low tide time. If one reached after the low tide, it is impossible to make representative collection as the area will be submerged during high tide water and one has to wait till the next low tide which may take few hours and that time may not be suitable for making collections as it may be dark at that time. It is better to stay at the spot overnight to observe the tidal exposure of the coast and to collect the animals during both high and low tides for better representative collections.

b. Plankton :

Planktonic animals range from few microns to few centimeters along with bigger forms viz., medusae, jellyfishes, salps. All these organisms are collected through plankton nets made of bolting silk cloth which are towed behind a boat at low speed. The most widely used plankton net (Fig. 1) consists of a circular metal ring of 30 cm. in diameter, with a canvas collar of 10 cm. height followed by a concial net of bolting silk approximately 100 cm. height ending in a canvas cloth of 10 cm. height at the narrow end (Cod end) to which a tubular metalic bucket is clamped. The bottom of the bucket is covered and clamped with the same bolting silk cloth used for the plankton net. Three bridles are tied to the eyes provided on the metal ring which in turn are connected to a small ring or shackle which is connected to a towing rope for towing the net behind the boat at a reasonable distance (5-10 mts) to avoid the disturbances caused by the Boat. The plankton collected in the bucket after towing for a period (15-30 min.) is transferred to the container after washing the sides of the bucket and the bloting silk cloth clamped to the bucket using 10% neutral formalin for fixing and preservation. Do not use water for washing the sample after collecting plankton into the container, which will dilute the preservative thus spoiling the plankton sample in due course.

Different types (numbers) of bloting silk cloth should be used to collect different types of plankton-macro (0-4) micro (5-15) and nanoplankton (15-25).

c. Nekton :

The nektonic animals are capable of swimming against currents and include mainly decapods, squids, fishes, reptiles and mammals. Most of these animals can be collected by different types of traditional nets used by fishermen - stake nets, scoopnets, cast nets, hand nets, siene nets, Midnapore shooting nets, bag nets, drift nets, inshore drag nets, hook & line and chinese dip nets, (Figs. 2 & 3). The smaller nektonic forms like fish larvae are collected with plankton nets as they are too small to be sampled through the fishing gear.

d. Benthos :

The benthos are those animals and plants which live on the floor/underneath

and they range from subtidal to the deeper parts of the estuary. The quipment used for the collection of benthic organisms are mostly a variety of grabs and corers which are designed to penetrate the bottom and grab the sediment sample with the associated fauna and folora. The retrived sediment sample is passed through sieves of different aperture sizes (2 mm - 0.05 mm). The macrobenthos are those which are retained in the sieves of 0.5 mm while meiobenthos and microbenthos are those which pass through 0.5 mm sieves and below.

The most common grab is the Peterson grab which consists of 2 jaws which are hinged together and are held open at the time of lowering. As soon as the grab touches the bottom, the clamp is released facilitating the grab to close its jaws and while doing so it takes a bite of the floor containing a segment of sediment sample with its associated organisms. Here we recommend use of a light weight grab of less than 8 Kg weight which can be operated in shallow waters from country crafts (Fig. 4). In addition to the above Peterson grab, a modified version of Van Veen hand grab (Fig. 5) is found to be highly suitable in estuaries of shallow depths. Detailed account of the various instruments used in the collection of benthos is given by Holme & McIntyre 1971. The benthic organisms are also collected by using dredges, beam trawl and Agassiz trawl (Figs. 6-8). They are used for collection of organisms crawling on the floor but not for burrowing and others living within the sediment. A light weight dredge with a square mouth of 30 cm which can be hand hauled from a small boat is suited for the collections of smaller epibenthic organisms from a limited area. For the collection of bigger epibenthic organisms over a wide area a beam trawl or Agassiz trawl are well suited for sampling, however these are difficult to operate from a country boat. A smaller version of these trawls with a mouth width of one meter can be operated from fibre glass boats with outboard motors. The dredges and trawls should not be operated for more than 15-20 minutes as there is a chance of clogging its mouth with large sediments and making it difficult to lift them.

III. COLLECTION TREATMENT IN THE FIELD

1. Sorting :

The intertidal, planktonic, nektonic and benthic animals are to be sorted immediately after collection. The planktonic samples are to be fixed in 5-10% neutral formalin. The nekton samples are sorted out group wise (appendix - B & C), fixed and preserved in 10% neutral formalin. Bigger organisms need a slit in the belly through anal opening. Benthic organisms retrieved after sieving through a set of sieves of 2 mm down to 0.5 mm are weighed, fixed and preserved in 10% neutral formalin. For groups like sponges, coelenterates, annelids, mollusca and echinoderms special treatment of anaesthetization and fixing is needed and the details of such procedure are givne in Table I.

b. Anaesthetization :

Wherever anaesthetization is necessary, crystals of menthol, megnesium sulphate, magnesium chloride, chloral hydrate are sprinkled over the clean estuarine waters containing the animals allowing them to expand gradually (Table I).

c. Fixation :

Formalin is the best field fixative which is available commercially as 38% aqueous solution of formaldehyde gas. For dilution purposes the 38% solution is treated as 100% formalin and animals are fixed in 5-10% neutral formalin sollution generally. The 10% solution is prepared by adding 9 parts of water to 1 part of commercial formalin. (Before dilution, 1 litre of commercial formalin should be neutralized either with 20 gms of Borax or 200 gms of Hexamine).

d. Preservation :

After fixation (Killing in formalin) the liquid fixative generally becomes diluted and dirty. Further some groups are not to be preserved in formalin even for short time. Therefore, suitable preservative should be used before packing them in containers as it may not be possible to unpack the collections immediately at the laboratory (Table I).

e. Containers :

It is always preferable to use screw capped plastic tubes and wide mouth plastic bottles, jars and drums with screw caps for keeping the collected material in the field. The bigger animals — crabs, squids and certain fishes etc., should be wrapped in cheese cloth (gauze cloth) and packed in bigger screw capped, wide mouth plastic drums. The collections contained in the smaller tubes are to be packed in 1-5 litre screw capped wide mouth plastic jars with cotton padding all around.

f. Labelling :

Every sample either kept in the tubes or wrapped in cheese cloth should contain invariably an internal label printed on a tracing paper. Avoid paper labels as they become soft and disintegrate. Labels should be written with water proof black Indian Ink or with soft lead pencil (Fig. 9).

g. Documentation :

As it is not possible to write all the details on the field label, it is important to keep collection data in a field note book. The sample number given on the label should be same as mentioned in the field note book/station book so that the detailed field data can be transferred on to the permanent label in the laboratory. Data sheets are to be filled while collecting the plankton, nekton and benthos and proforma data sheets are given for guidance (Appendix - d-f).

h. Packing :

The final field packing of the collections kept in different small plastic containers are packed in steel trunks with sufficient soft padding material all around. The big plastic drums can be carried after covering with gunny bags. All these packages should contain a destination label on the outside as well as inside.

i. Photographs :

Photographic presentation of the collection spots as well as the specimens in live condition, preferably in situ and also fixed is necessary for better record of the collections and also for future publication purposes.

IV. COLLECTION TREATMENT IN THE LABORATORY

The collections brought from the field will be unpacked and transferred to suitable containers with final preservatives (Table I).

a. Sorting :

Eventhough the samples were well cleaned and preserved in the field, it needs further attention as it is not possible to have thorough cleaning of the sample in the field. As there is every chance of some specimens being damaged during transit, only the specimens in good condition should be finally preserved. After that, the collections are sorted out finally groupwise (Appendix - C). For subsorting the collection samples of lower groups a good binocular stereo microscope with wide field eyepieces and good illumination is necessary.

b. Preservation :

After subsorting, either the collections were transfered to 5-10% neutral formalin or to 75% ethyl alcohol (i.e. 4 parts of rectified spirit and one part of water). Soft bodied animals are to be transfered to 75% alcohol by passing them through 30% and 50% alcohol for few hours to avoid strinkage. The bigger animals like fishes, crustaceans are to be washed before transfering them to 75% alcohol (Table I). It is advisable to preserve bigger animals in formalin as they require large quantity of ethyal alcohol which is expensive as well as difficult to procure and maintain, while the formalin preservative is cheaper and need less attention, though it is unpleasent to work.

c. Containers :

Wide mouth glass jars and bottles of different sizes provided with plastic screw caps or glass stoppers are ideally suited for long term preservation of animal collections. While preserving the smaller specimens, it is better to use small specimen tubes (glass/plastic) which will be plugged with cotton and kept immersed in the preservative using the above mentioned glass jars/bottles with cotton padding at the bottom and top. The large specimens which cannot be kept in glass jars should be stored in plastic tanks fitted with trolly frames and tight lids.

d. Labelling (unnamed) :

After the transfer of the materials to the suitable containers, a suitable label filled with all field data written in water proof Indian Ink should be kept inside (Figs. 10-13). These labels are very important for future study of the collections as it may take even a long time to look into them.

e. Registration (unnamed register) :

The unnamed material thus collected and preserved must be registered serially in a good bound ruled ledger register using water proof Indian Ink only. The format of the unnamed register is given in the (appendix-g).

f. Documentation :

It is useful to prepare a list of collections, group wise present in the unnamed collection for a better inventory as the unnamed register will not give a ready information of all the unnamed collections of a particular group.

g. Holding of the unnamed collections : (unnamed collection room) :

A seperate collection room with shelves capacity is necessary for keeping and arranging the unsorted, sorted and registered collections group-wise. The plan of arrangement of collections should be displayed at the entrance of the collection rooms.

h. Upkeep :

The future of the collection depends upon the upkeep and maintenance i.e. routine check up, including the filling of preservative whenever necessary and dusting of the containers as it may take even years to work out the unnamed collections. It is better to evolve a routine procedure for checking the collections as the collections increase through years.

i. Photographs :

As it is not possible to photograph all the specimens in the field, efforts should be made to photograph them in the laboratory with a view to prepare line drawings at a later stage.

V IDENTIFICATION

a. Labelling (named) :

All identified material should be properly labelled on a good quality drawing paper using water proof Indian Ink. The size of the label should be proportionate to the size of the container (Figs. 14-16).

b. Registration (named) :

All the identified collections are to be entered in a bound ruled register made of good quality ledger paper. The entries of the named collections should be made with water proof Indian Ink. The format of the named registar is shown in the appendix - h.

c. Containers :

This being the final arrangement of the collection, containers of suitable size should be selected keeping in view the size of the specimen to be kept inside. There should be at least 25% extra space around the specimens in the container so that they will be kept always immersed in the preservative. The containers should be of clear glass with plastic screw caps preferably with a liner inside to reduce the evaporation of the preservative. For tube collections (smaller specimens) and tank collections (very big specimens) procedure mentioned under (IV. c) can be followed. The named collections pertaining to small/big specimens of the same species from different localities are to be kept either in big glass jar/tank without mixing their localities. The label as written in (V. a) should be inserted in the container.

d. Documentation (catalogue cards) :

For ready information of the named collections, data belonging to each species available in the collections are to be entered in the species catalogue cards (Fig. 17) and are to be kept in the index cabinets as per the suggested classified list (appendix-c).

e. Preservation :

Proper upkeep of the named collections is necessary. Regular checking of the collections and filling of the preservative should be done at intervals without fail.

f. Holding of named collections (named collection room) :

A seperate room for keeping the named collection is necessary and the room should be provided with shelves capacity so that the collections can be arranged as per the classified list (appendix - c). Special thought should be given in arranging and making them exhibited clearly as these collections itself should act as an aid to the identification for the future study of unnamed material.

The collection room should be protected from sun light and better lighting arrangement should be made so that the specimens can be seen clearly. All the identified collections should be handled (removed or replaced) by the qualified staff only.

VI. LOANS

a. Preparation of list :

All the specimens (named/unnamed) should be sent out only after filling in the proforma in quadruplicate with all details and duly checked and signed by the concerned. The proforma for sending the loan collection is given of (appendix-i).

b. Packing and Forwarding :

Proper care should be taken in selecting the packing material. They should be

either light weight and unbreakable corrugated boxes, screw caped tins or thermocole boxes so as to withstand the transit through rail/road/air. Good padding around the specimens with light cotton wool is very essential, otherwise the specimens will be pressed from all sides. Before closure of the packing, 3rd copy of the loan form duly filled should be kept inside the package. After closing the packet with a brown paper and sealing with cellotape, a despatch lable containing from and to addresses should be pasted (fig. 18). It is better to insure/register the collection parcel while sending it with in the country/abroad.

c. Despatch & Receipt :

Proper record of the specimens sent out and received should be maintained in a register for further correspondence (appendix - J & K).

VII. LITERATURE

a. References group-wise :

Literature references cards (Fig. 19) are to be maintained group-wise/species-wise/area-wise for preparation of reports, faunal lists and for other purposes. These cards should be kept in the index cabinets of 5" × 3" size for early reference. It is necessary to keep species cards and photography cards (Fig. 17, 20 & 21) also in the index cabinets of sizes 6" × 4" and 8" × 5" respectively.

b. Reference library :

A reference library covering with books, journals and reprints dealing mainly with taxonomic work (group-wise) is essential for the study of the animals so collected, preserved and maintained in the reference collection centre.

VIII. PARTIAL BIBLIOGRAPHY (PERTAINING TO COLLECTION PROCEDURES)

Ghosh, A.K. and Sengupta, T 1982. *Handbook on Insect collection, Preservation and study*. Zool. Surv. of India, Calcutta, 64 pp.

Holme, N.A. 1964. Methods of sampling the benthos. *Adv. mar. Biol.*, **2** : 171-260.

Holme, N.A. and McIntyre, A.D. 1971. *Methods for the study of marine benthos*. IBP Handbook 16, Blackwell Scientific publications. Oxford and Edinburgh, 334 pp.

Hulings C. Neil and Gray S. John. 1971. *A manual for the study of Meiofauna*. Smithsonian Contributions to Zoology, **78** : 84 pp.

Hureau, J.C. and Rice, A.L. 1983. *Guidelines for marine biological reference collections*. Unesco reports in marine science, **22** : 48 pp.

Kapur, A.P. (Ed.), 1968. *A Handbook for Zoological collections*. Zool. Surv. of India, Calcutta, 152 pp.

Lincoln, J. Roger and Gordon Sheals, J. 1979. *Invertebrate animals, collection & preservation.* British museum (Nat. Hist.), London, 149 pp.

Newell, G.C., and Newell, R.C. 1973. *Marine plankton, a practical guide.* Hutchinson Educational Ltd., London : 244 pp.

Michael, P. 1984. *Ecological methods for field and Laboratory investigations.* Tata McGraw-Hill Publishing Company Limited. New Delhi, 404 pp.

Unesco, 1968. *Zooplankton sampling.* Unesco monographs on oceanographic methodology, **2** : 174 pp.

Unesco, 1976. *Zooplankton fixation and preservation,* H.F. Steedman (Ed.) Unesco monographs on Oceanographic methodology, 4 : 350 pp.

Zoological Survey of India, 1980. *Proceedings of the workshop on techniques in Parasitology,* 148 pp.

TABLE 1. Narcotization, Fixation and Preservation of Estuarine Animals

Narcotization/ Anaesthetization	Fixative or Kill	Preservative first change	Preservative Final	REMARKS
1	2	3	4	5
BOTTOM DEPOSITS (MUDS, SANDS & OOZES ETC.,)				
None	5% neutral formalin (1 part of commercial formalin and 19 parts of sea water).	70-90% alcohol (made from rectified spirit of 90% alcohol).	90% alcohol	Use of formalin ensures the best fixation of soft parts.
MEIOFAUNA				
6% Magnesium Chloride solution for 10-15 minutes.	Bouin's fluid for soft fauna. 5% neutral formalin containing 2% glycerine for hard fauna.	70% alcohol for soft fauna 5% neutral formalin for hard fauna.	First change is final	
PLANKTON				
None	5-10% neutral formalin for 48 hours.	5-10% neutral formalin	First change is final	Large animals are to be separated from the plankton before fixation.
PROTOZOA				
None	50% alcohol or 5% neutral formalin for foraminifera and radiolarians.	70-90% alcohol 5% neutral formalin.	First change is final	
PORIFERA				
None	50% alcohol for 12 hours.	50% alcohol after 12 hours.	70% alcohol	Do not use formalin Marine sponges are kept for two hours in fresh water before drying.

COELENTERATA – HYDROZOA				
Menthol, Magnesium Sulphate, Magnesium chloride or very dilute formalin.	10-20% neutral formalin	10% neutral formalin/ 70% alcohol.	First change is final.	20% neutral formalin is used for bigger forms.
COELENTERATA – SCYPHOZOA				
Menthol, Magnesium Sulphate, Magneisum Chloride or very dilute formalin.	10-20% neutral formalin.	10% neutral formalin/ 70% alcohol	First change is final.	Larger specimens do do not need narocotization.
COELENTERATA – ANTHOZOA				
Menthol, Magnesium Sulphate or Magnesium chloride.	10-20% neutral formalin.	10% neutral formalin/ 70% alcohol.	First change is final.	Forms having calcareous skeleton should be preserved in 70% alcohol.
CTENOPHORA				
Chloral Hydrate	Chromic acid (1% 100 ml)/ Osmic acid (1% - 2 ml) mixture for 15 for 15 minutes.	Graded through 30, 40, 50, 60 & 70% alcohol.	70% alcohol.	Never use formalin solution.
PLATYHELMINTHES – TURBELLARIA				
Allow them to extend in clean water, remove excess water and Add 10% alcohol or 1% Hydroxylamine.	70-90% alcohol/5% neutral formalin for 12 hours.	70-90% alcohol	First change is final.	
PLATYHELMINTHES – TREMATODA				
Allow them to extend in 1% salt solution and transfer to a small quantity of clean solution.	10% neutral formalin/70-90% alcohol 70-90% alcohol for 12 hours.	5% neutral formalin/ 70-90% alcohol.	First change is final.	Forantomicalstudies use either Bouin's or Susa's fixatives. Bigger flukes are to be fixed on a slide under the pressure

				of cover slip. Bouin's fluid (Picric acid 75 ml, formalin 25 ml, acetic acid 5 ml) Susa'sfluid(saturated mercuric chloride. solution 80 ml, Sodium Chloride 0.5g, Trichloroacetic acid 2 g, Acetic acid 4 ml, and formalin 20 ml.
PLATYHELMINTHES – CESTODA				
Same as above	Same as above	Same as above	Same as above	The Specimens are to be stretched on a glass sheet and use small quantity of fixative over them.
NEMERTINEA				
Chloral Hydrate or Magnesium sulphate for 6-12 hours.	10% neutral formalin/ 30-50% alcohol for over night.	5% neutral formalin/ 70-90% alcohol.	First change is final.	Susa's or Bouin's fluid are good fixatives for anatomical studies.
ASCHELMINTHES – ROTIFERA				
Add drop wise 5% neutral formalin.	10% neutral formalin.	5% neutral formalin.	First change is final	
ASCHELMINTHES – GASTROTRICHA				
6%.solution of Magnesium chloride.	10% neutral formalin.	5% neutral formalin/ 70% alcohol.	First change is final	
ASCHELMINTHES – KINORHYNCHA				
Distilled water	10% neutral formalin	5% reutral formalin.	First change is final.	

ASCHELMINTHES — NEMATODA				
None	5% neutal formalin/70% hot alcohol for over night.	5% neutral formalin.	First change is final.	Parasitic nematodes are to be washed in saline water for few minutes and they shouldnotbepressed.
ASCHELMINTHES — NEMATOMORPHA				
None	5% neutral formalin for 30 minutes.	70% alcohol/5% neutral formalin.	70% alcohol.	
ACANTHOCEPHALA				
1% salt solution for few minutes.	5% neutral hot formalin/70% hot alcohol for 30 minutes.	70% alcohol.	First change is final.	
ENTOPROCTA				
Menthol or Magnesium Sulphate	Commercial formalin (undiluted)/ Bouin's fluid.	70% alcohol.	First change is final.	
BRYOZOA (POLYZOA OR ECTOPROCTA)				
Same as above	Same as above	Same as above	Same as above.	Calcified Bryozoa are to be washed in fresh water and are to be preserved in 70% alcohol only.
PHORONIDAE				
Menthol/Magnesium sulphate/ slow addition of alcohol.	10% neutral formalin for 48 hours.	5% Neutral formalin/70% alcohol.	First change is final.	
BRACHIOPODA				
Slow addition of alcohol.	90% alcohol.	70-90% alcohol.	First change is final.	A piece of stick should be kept between the valves

				before fixing for the penetration of fixative inside.
SIPUNCULA				
Slow addition of alcohol, Magnesium Chloride, Menthol.	90% alcohol or 5% neutral formalin for 12 hours.	70-90% alcohol.	First change is final.	
ECHIURA				
As above.	5% neutral formalin for 12 hours	70% alcohol.	First change is final.	
ANNELIDA/POLYCHAETA – ARCHIANNELIDA				
Slow addition of alcohol, menthol or or magnesium chloride.	10% neutral formalin 90% alcohol for 48 hours.	70% alcohol/5% neutral formalin	First change is final.	Non pelagic forms are to be preserved in alcohol only.
ANNELIDA / HIRUDINEA				
Slow addition of alcohol, chloroform or magnesium sulphate	5% neutral formalin/50% alcohol for 12 hours.	5% neutral formalin/ 70% alcohol.	First change is final.	Small forms should be straightened by pressing them between two glass slides held together by rubber bands at the time of fixation.
ARTHROPODA – CRUSTACEA (SMALLER FORMS)				
None	10% neutral formalin for 24 hours.	70-90% alcohol.	70% alcohol.	
ARTHROPODA – CRUSTACEA (LARGER FORMS)				
Chloral hydrate or 1-2% formalin to avoid limb shedding.	10% neutral formalin for 3-4 days.	70-90% alcohol.	70% alcohol.	
ARTHROPODA – XIPHOSURA				
	Inject undiluted formalin ventrally	70-90% alcohol.	70% alcohol.	The specimens can

	into the tissues and kept in 10% neutral formalin for 48 hours.			be preserved in dry condition after fixation.
ARTHROPODA – PYCNOGONIDA				
	70-90% alcohol.	70% alcohol.	First change is final.	
TARDIGRADA	5% neutral formalin/70-90% alcohol.	70% alcohol.	First Change is final.	
MOLLUSCA				
Small amounts of alcohol, magnesium sulphate, magnesium chloride, menthol chloral hydrate for 24 hours.	10% neutral formalin/70-90% alcohol. alcohol.	70-905 alcohol/ 5% neutral formalin.	First change is final.	Shelled mollusca can can also be preserved in dry condition after removing the soft parts
CHAETOGNATHA				
	5% neutral formalin/70-90% alcohol.	5% neutral formalin/ 70% alcohol	First change is final.	
ECHINODERMATA				
Magnesium sulphate or Menthol for holothurians ; immersion in fresh water for few hours for brittle and feather stars.	10% neutral formalin/70-90% alcohol.	70-90% alcohol.	First change is final.	These are uncommon in estuaries. One or two small holes are to be made in the skin around the mouth of echinoids for better penetration. of the fixative and preservative. Hard bodied echinoderms can be preserved in dry condition after fixation in formalin.

HEMICHORDATA				
Small quantity of alcohol/magnesium chloride.	10% neutral formalin for 24 hours.	5% neutral formalin/ 70-90% alcohol.	5% neutral formalin/ 70% alcohol.	
UROCHORDATA				
Magnesium sulphate or Menthol.	Commercial formalin.	5% neutral formalin/ 70-90% alcohol.	5% neutral formalin/ 70% alcohol.	
CEPHALOCHORDATA				
None	10% neutral formalin.	5% neutral formalin.	First change is final.	
FISHES				
None	10% neutral formalin for 2-3 days.	10% neutral formalin/ 70% alcohol.	10% neutral formalin/ 70% alcohol.	Make a slit in the belly for large specimens for better fixation.
AMPHIBIANS/HEPTILES/BIRDS/MAMMALS				
Use chloroform for large specimens.	10% neutral formalin for 2-3 days.	10% neutral formalin/ 70% alcohol.	10% neutral formalin/70% alcohol.	Make an incision in large specimens for better penetration of the fixative and preservative. Crocodiles, Turtles, Birds and Mammals can be skinned and preserved following taxidermic procedures.

Appendix - a

ADDRESSES OF SUPPLIERS

OCEANOGRAPHY INSTRUMENTS

The General Engineering & Scientific Works
C-4, Industrial Estate
BERHAMPUR (Gm) - 760 008 Orissa

Hydro - Bios
C/o K.L.B. Sales & Service
1E/17 Jhandewalan extension
NEW DELHI - 110 055

Krishna Plastics
Dewan Road, Ernakulam
Cochin - 682 011

SIEVES AND SOIL TESTING INSTRUMENTS

Geologist's Syndicate (Pvt) Ltd.,
137, Biplabi Rashbehari Basu Road
Calcutta - 700 001

NYLON THREAD/NETS

Garware Marine Industries Ltd.,
Raheja Centre
12th Floor
Nariman point, BOMBAY - 400 021

Biseswarlal Jagadish Prasad
Jaunlipatty
Cuttack - 753 009

BOLTING SILK

Dadia Textiles
Cotton exchange Building
Room No. 514, Kalbadevi Road
Bombay - 400 002

Shiva Scientific Company
Plot No. 329
Venkatram Nagar
Chitlapakkam
Madras - 600 014

PLASTIC CONTAINERS

Tarson Products
818, Marshall House
331, Netaji Subhas Road
Post Box No. 560
Calcutta - 700 001

Polylefins Industries Ltd.,
Post Bag No. 23
H.P.O. Akola - 444 001

Polyene General Industries Pvt. Ltd.,
11-A, Industrial Estate
Guindy
Madras - 32

Sintex Plast Containers
Plastic Division
The Bharat Vijay Mills Ltd.,
Kalol (NG) - 382 721 Gujarat

GLASS BOTTLES

Alembic Glass Industries Ltd.,
Baroda.

Appendix - b

Taxonomic list suggested for preliminary sorting

Porifera
Coelenterata
Ctenophora
Platyhelminthes
  Turbellaria
Nemertinea
Entoprocta
Ectoprocta (Bryozoa)
Phoronidae
Brachiopoda
Sipuncula
Echiura
Annelida
Crustacea
  Decapoda
  Other crustacea
Pycnogonida

Mollusca
Echinodermata
Protochordata
Fishes

Appendix - C

Taxonomic list suggested for final sorting

PROTOZOA
- Foraminifera
- Radiolaria

PORIFERA
- Calcarea
- Hexactinellida

Demospongiae

COELENTERATA
- Hydrozoa
- Scyphozoa
- Anthozoa

CTENOPHORA

PLATYHELMINTHES
- Turbellaria
- Trematoda
- Cestoda

NEMERTINEA

ASCHELMINTHES
- Rotifera
- Priapulida
- Nematoda

ENTOPROCTA

ECTOPROCTA

PHORONIDAE

BRACHIOPODA

SIPUNCULA

ECHIURA

ANNELIDA
- Polychaeta
- Oligochaeta
- Hirudiinae

CRUSTACEA
- Branchiopodia
- Ostracoda
- Copepoda
- Mystacocarida
- Branchiura
- Cirripedia
- Malacostraca
  - Leptostraca
  - Syncarida
  - Peracarida
    - Mysidacea
    - Cumacea
    - Tanaidacea
    - Isopoda
    - Amphipoda
  - Stomatopoda
  - Euphausiacea
  - Decapoda

PYCNOGONIDA

CHAETOGNATHA

MOLLUSCA
- Polyplacophora
- Aplacophora
- Gastropoda
- Scaphopoda
- Pelecypoda
- Cephalopoda

ECHINODERMATA
- Asteroidea
- Echinoidea
- Echinoidea
- Holothuroidea
- Ophiuroidea
- Crinoidea

HEMICHORDATA

UROCHORDATA

CEPHALOCHORDATA

ELASMOBRANCHII

ACTINOPTERYGII

Appendix - d

Estuarine Biological Station
Zoological Survey of India
Hillpatna, Berhampur (Gm)
Orissa, 760 005 India

Net/Bucket Zooplankton Sorting Sheet for Estuarine/Brackish and Lagoonal waters.

Code No : Sample No : Field data Sheet No :
Date of Collection : Time of coll : (Day/Night)
Collector : Analyst :
Date of Sorting : Duration of Sorting : (in hours)
Name of water body :
Location : Country : State :
District : Taluq : Village :
Sampling station Name and No :
Section (if estuary, state-Head/middle/mouth) : (if lagoon/back water, state-direction-NE/SE etc.,) :
Latitude : Longitude :
Depth (Sounding, m) : Depth of haul (m) :
Type of haul (vertical/surface) :
Duration of the haul :
Gear : Diameter : Mesh :
Volume of water filtered (m^3) :
Volume collected in ml : (displacement Vol.) Biomass mg/L (wet/dry weight) :

Abundance indicated by + against the group.

Sl. no.	Group	Total no. in sample	Total volume ml	%
1.				
2.				
3.				
4.				
5.				

Appendix - e

Estuarine Biological Station,
Zoological Survey of India,
Hillpatna, Berhampur (Gm)
Orissa 760 005 India.

Nekton Sorting Sheet for Estuarine/Brackish and lagoonal waters.

Code No : Sample No : Field data sheet No :
Date of Collection : Time of Collection (Day/Night) :
Collector : Analyst :
Date of Sorting : Duration of Sorting : (in hours)
Name of water body :
Location : Country : State :
District : Taluq : Village :

Sampling Station Name and No :
Section (if estuary, state-Head/middle/mouth) :
(if lagoon/backwater, state-direction-NE/Se etc.,) :
Latitude : Longitude :
Depth (Sounding m) : Depth of haul (m) :
Gear : Mesh :
Duration of the haul :
Biomass g/m² (wet/dry weight) :

Abundance indicated by + against the group			
Sl. No.	Group	Total no. in sample	Percent (%)
1.			
2.			
3.			
4.			
5.			

Appendix - f
Estuarine Biological Station,
Zoological Survey of India,
Hillpatna, Berhampur (Gm)
Orissa, 760 005 India.

Benthos Sorting Sheet for Estuarine/Brackish and lagoonal waters.

Code No : Sample No : Field data sheet No :
Date of Collection : Time of Collection : (Day/Night) :
Collector : Analyst :
Date of Sorting : Duration of Sorting : (in hours)
Name of water body :
Location : Country : State :
District : Taluq : Village :
Sampling station name and No :
Section (if estuary, state-Head/middle/mouth) :
(if lagoon/backwater, state-direction-NE/Se etc.,) :
Latitude : Longitude :
Depth (m) : Gear :
Area : Wet Sieve No :
Biomass g/m² (wet/dry weight) :

Abundance indicated by + against the group			
Sl. No.	Group	Total no. in sample	Percent (%)
1.			
2.			
3.			
4.			
5.			

Appendix-g

ZOOLOGICAL SURVEY OF INDIA, ESTUARINE BIOLOGICAL STATION, BERHAMPUR
REGISTER OF UNNAMED COLLECTIONS

Regn No.	Date of Regn.	Name of Survey	Particulars of specimens	No. of Exs	Locality including Habitat in detail in detail	Date of collec-tions	Host and Loca-tion if if any	Collec-tor or Donor	Field coll. No.	Date of des-patch	Date of rece-ipt	REMARKS Wet/Dry
1	2	3	4	5	6	7	8	9	10	11	12	13
127	20-3-84	Extensive Survey of Brahma-giri and near by areas, Puri Dist.	Mollusca/ Bivalvia	30 exs	Arakakuda (Village) Chilka mouth	23- 2 -84		C.A.N. Rao & Party.				

Appendix - h

ZOOLOGICAL SURVEY OF INDIA, ESTUARINE BIOLOGICAL STATION, BERHAMPUR
REGISTER OF NAMED COLLECTIONS

Regn No.	Zoological name	Locality	Name of Collector	Date of Collection	No. of examples/ Nature of Collection	Date of entry	Order & family	Det. by	REMARKS Wet/Dry
1	2	3	4	5	6	7	8	9	10
1.	*Nephthys Polybranchia* Southern	Arkakuda village, Chilka mouth lagoon	C.A.N. Rao	23.2.1984	5 examples	9.1.1986	Polychaeta Nephthy-didae	C.A.N. Rao	In pirit

Appendix - i

Forwarded to :

_____

_____

_____

_____

REGISTER FOR SENDING SPECIMENS
ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
HILLPATNA BERHAMPUR (GM)

760 005 ORISSA INDIA

Sent by
Dated
No. of Packages
Mode of despatch

LOAN GIFT EXCHANGE IDENTIFICATION AND RETURN

Sl no.	Regn. No.	NAME	LOCALITY	COLLECTOR	No. of specimens	REMARKS

☐ Received in good condition ☐ Date of Receipt ☐ Name

☐ Signature

Appendix - j

ZOOLOGICAL SURVEY OF INDIA, ESTUARINE BIOLOGICAL STATION, BERHAMPUR
CENTRAL REGISTER FOR DESPATCH OF ZOOLOGICAL MATERIAL

Serial lot No.	Date of entry in register	REFERENCE		Name and address of Sender	Particulars of material	Purpose	Disposal to sections	Initials of Person making entry.	REMARKS
		Diary No. Date	File No.						
1	2	3	4	5	6	7	8	9	10
1 to 27	18.12.84	1390/ 11.12.84	17-1-82 Tech.	Dr. Kaza V. Rama Rao Officer-in-Charge Zoological Survey of India, Hillpatna, Berhampur (Gm).	Unidentified Mollusca as per the list.	For Identification	To The Mollusca section, Z.S.I. 8, Lindsay Cal - 16.		Collections have been sent through Mr. S.S. Khora, Junior Research fellow of this station.

Appendix k

ZOOLOGICAL SURVEY OF INDIA, ESTUARINE BIOLOGICAL STATION, BERHAMPUR
CENTRAL REGISTER FOR RECEIPT OF ZOOLOGICAL MATEIAL

Serial lot No.	Date of entry in register	REFERENCE		Name and address of sender	Particulars of material	Purpose	Disposal to sections making	Intials of person entry	REMARKS
		Diary No. Date	File No.						
1	2	3	4	5	6	7	8	9	10
1 to 24	4.1.85	Moll. 534	29/84	Dr. K.V. Surya Rao Officer-in-Charge Mollusca Section Zoological Survey of India. 8. Lindsay Street, Calcutta - 700 016.	Identified mollusca Collection as per the list except lot No. 8, 14, 15.	Received after Identification.	To The O/C EBS, ZSI Berhampur.		Lot Nos. 8, 14, 15 were kept in mollusca section Z.S.I Calcutta for further study.

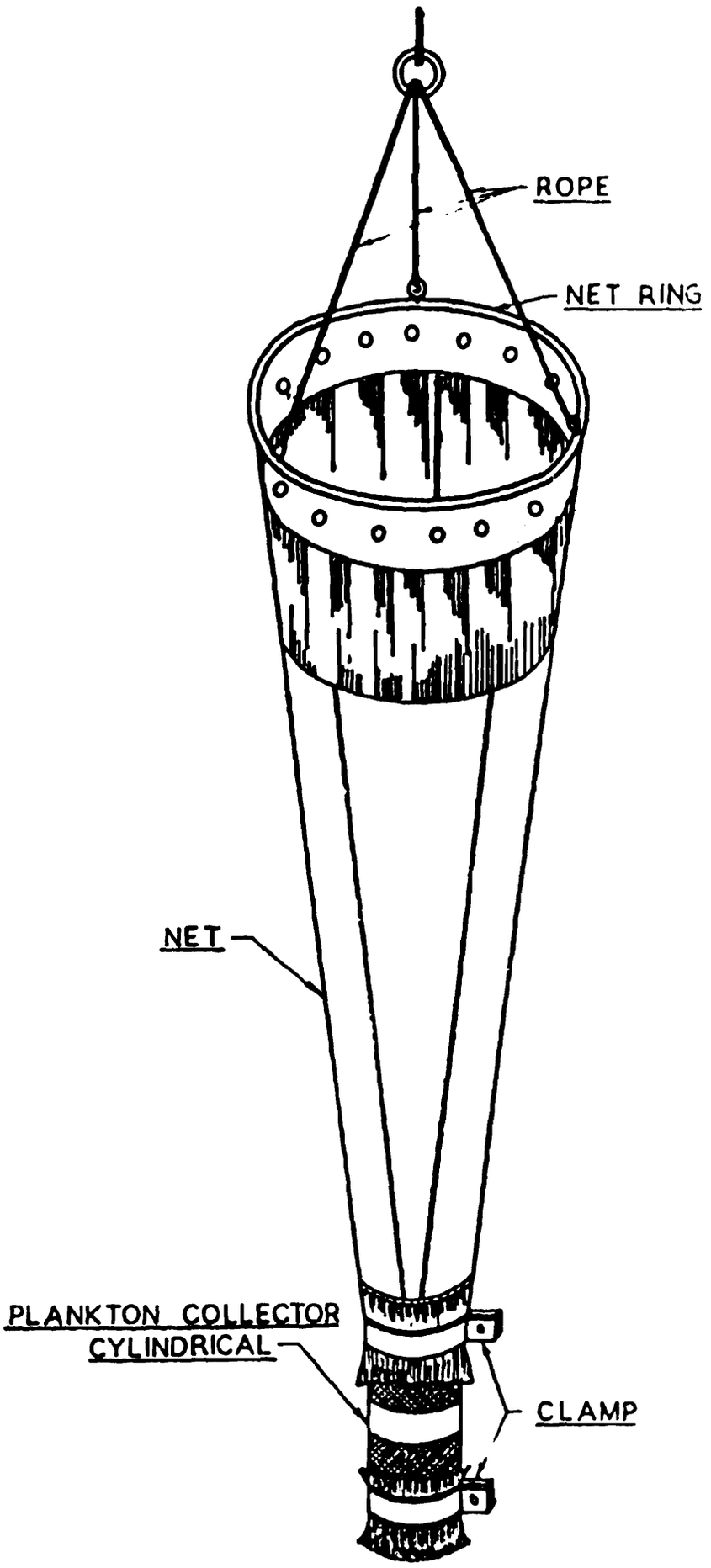


Fig. 1 Standard Plankton net

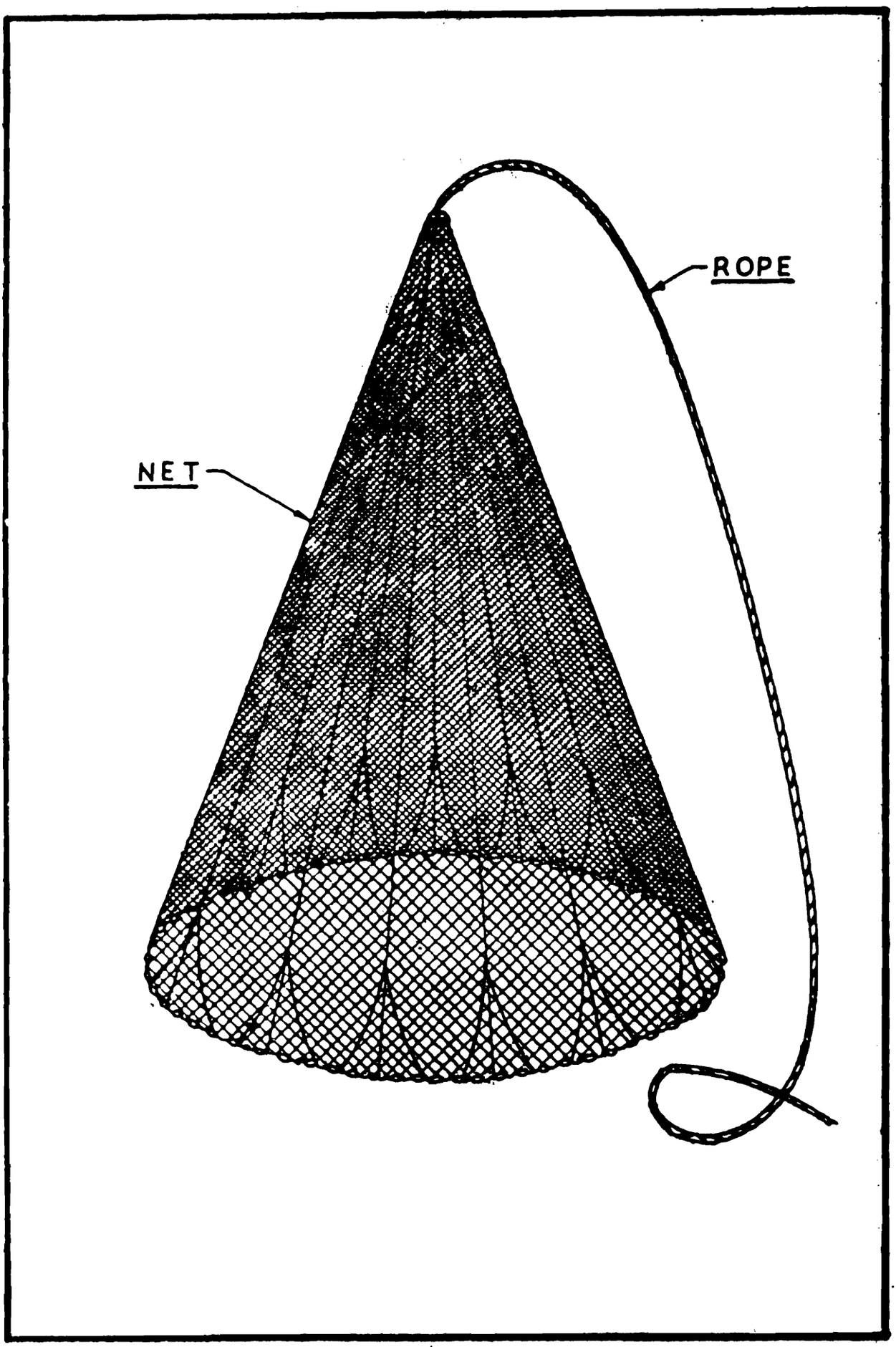


Fig. 2 Cast Net

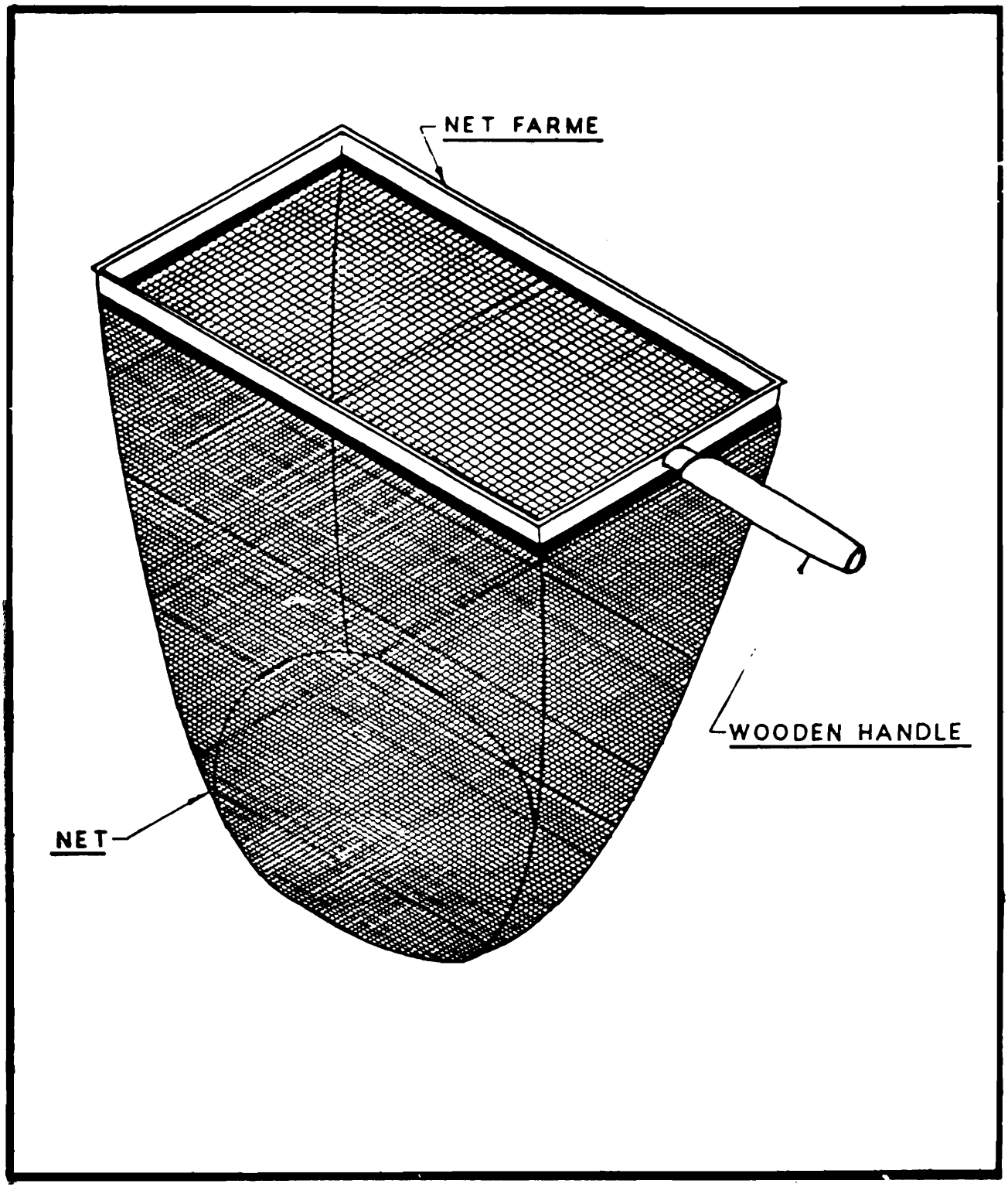


Fig. 3 Scoop net

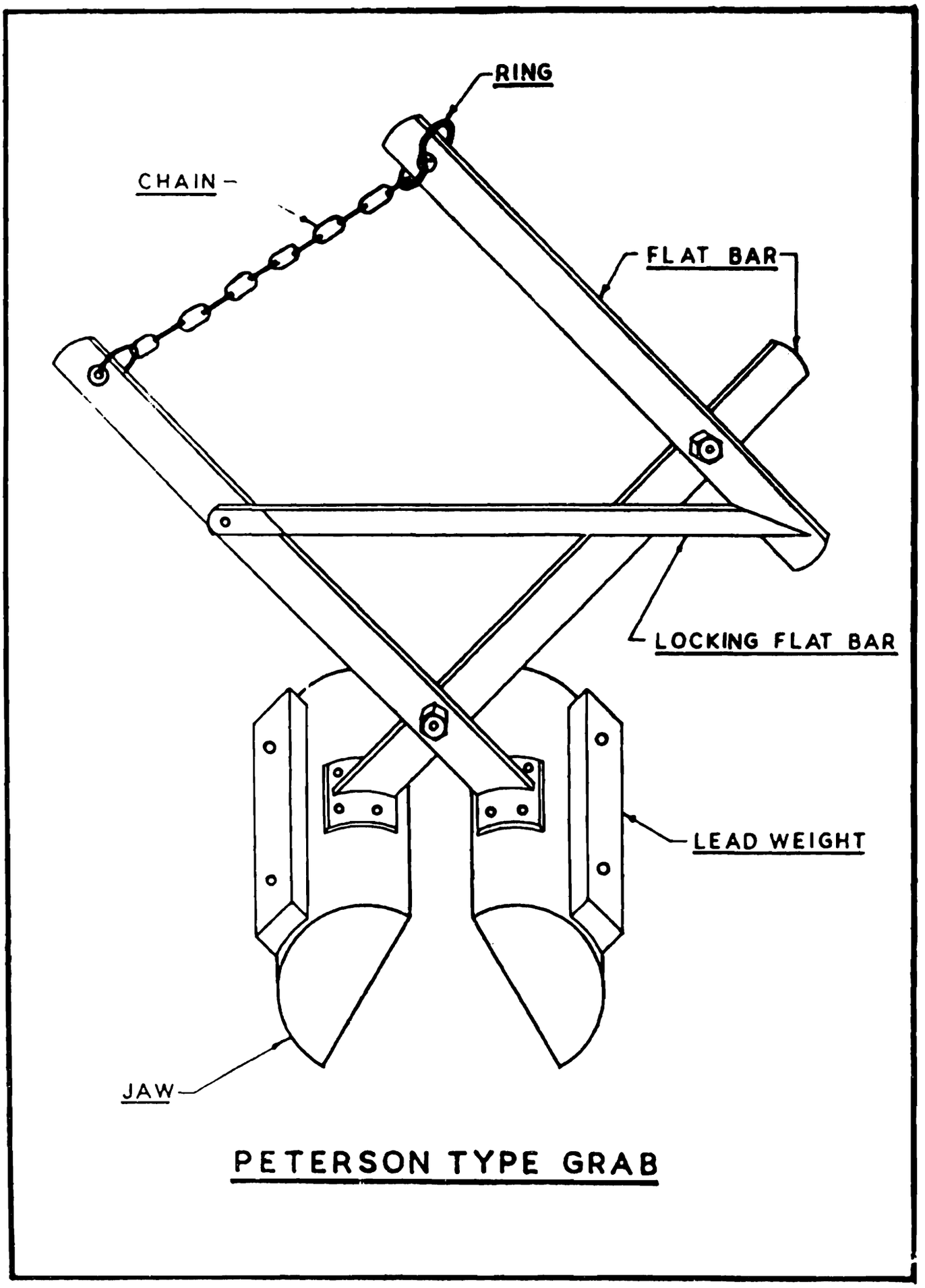


Fig. 4 Peterson grab (Modified, 8 Kg. light weight model)

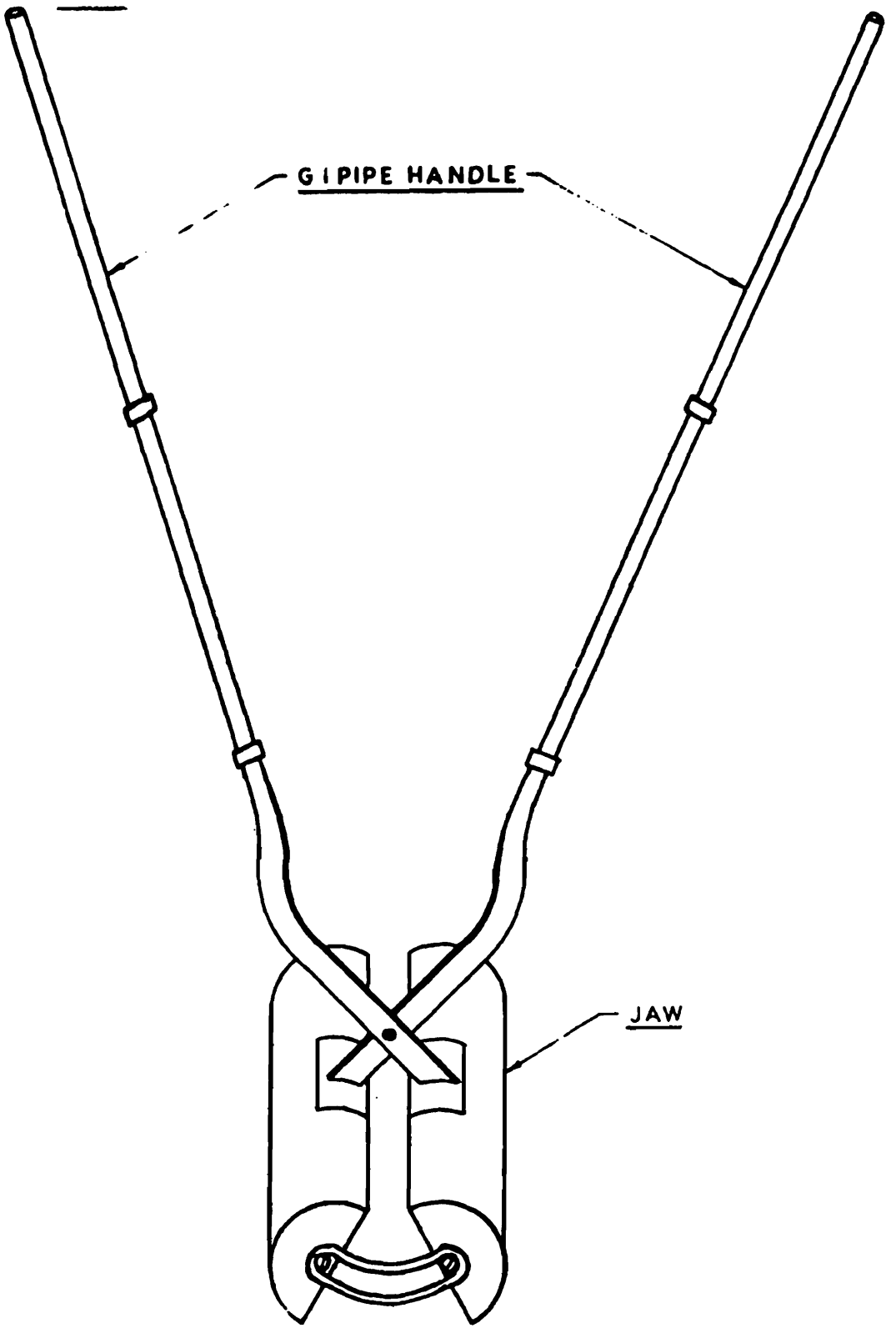


Fig. 5 Grab (Modified version of van veen hand grab model where the length of the hands can be incresed up to 10 feet)

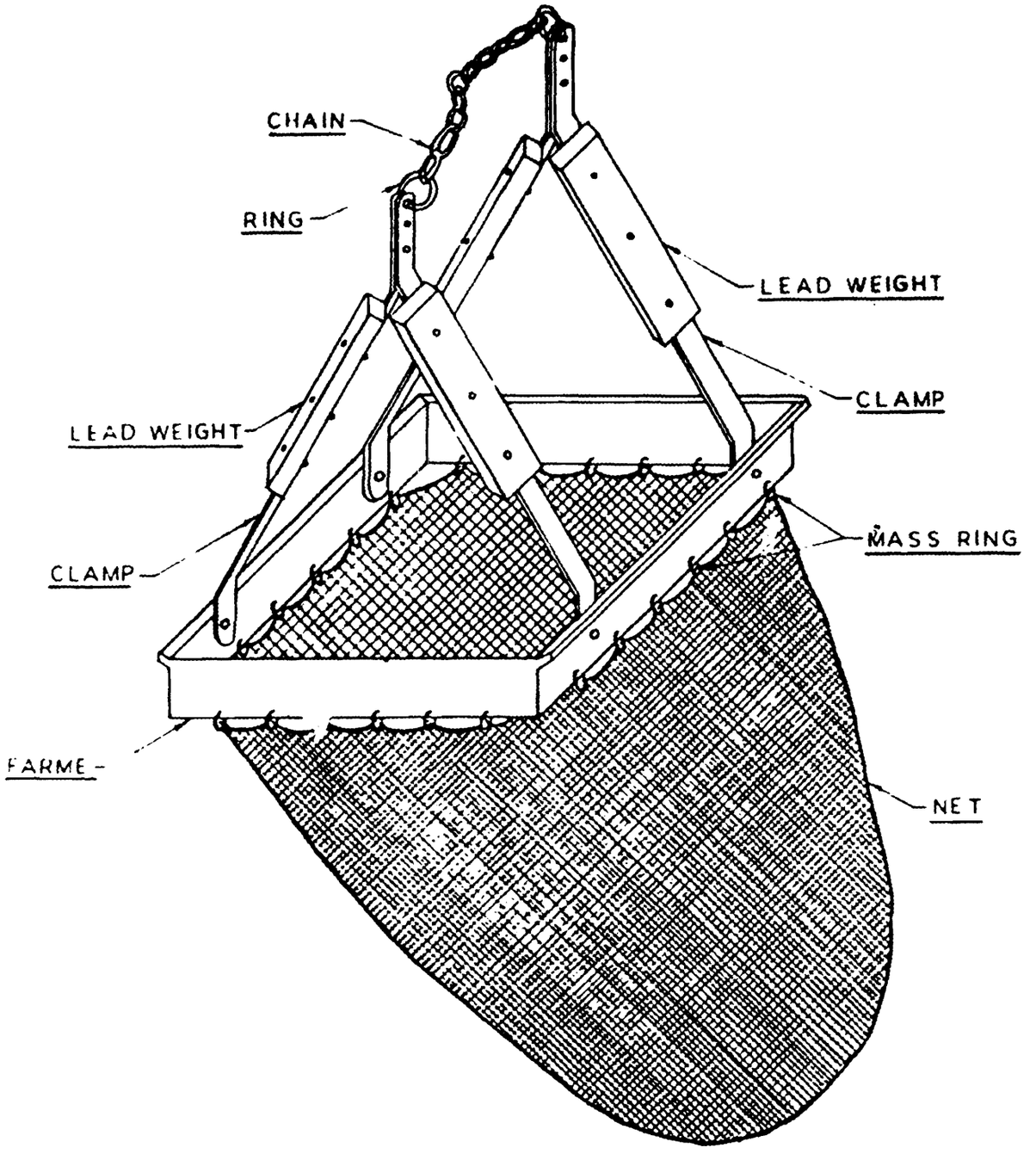


Fig. 6 Dredge (light weight model)

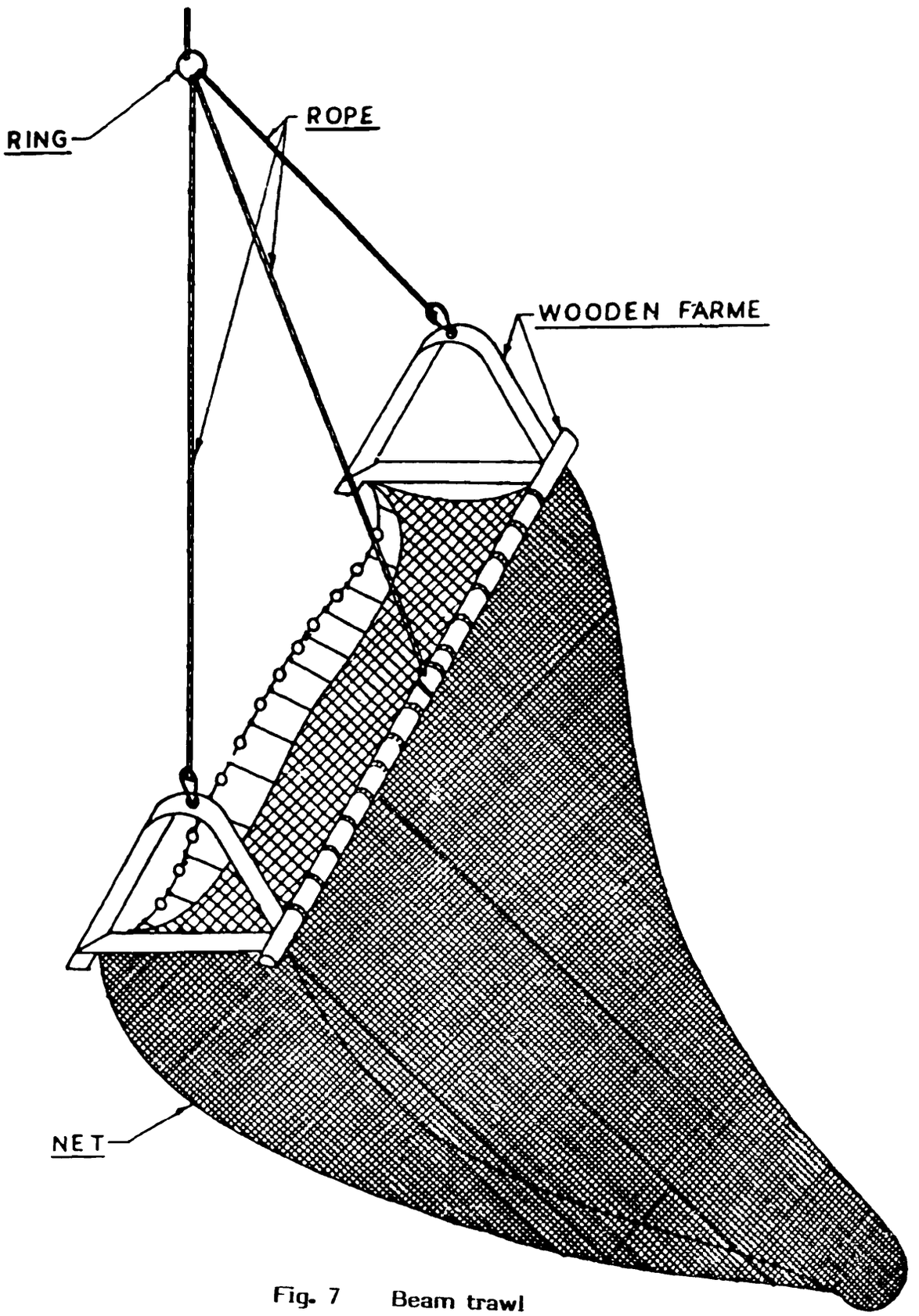


Fig. 7 Beam trawl

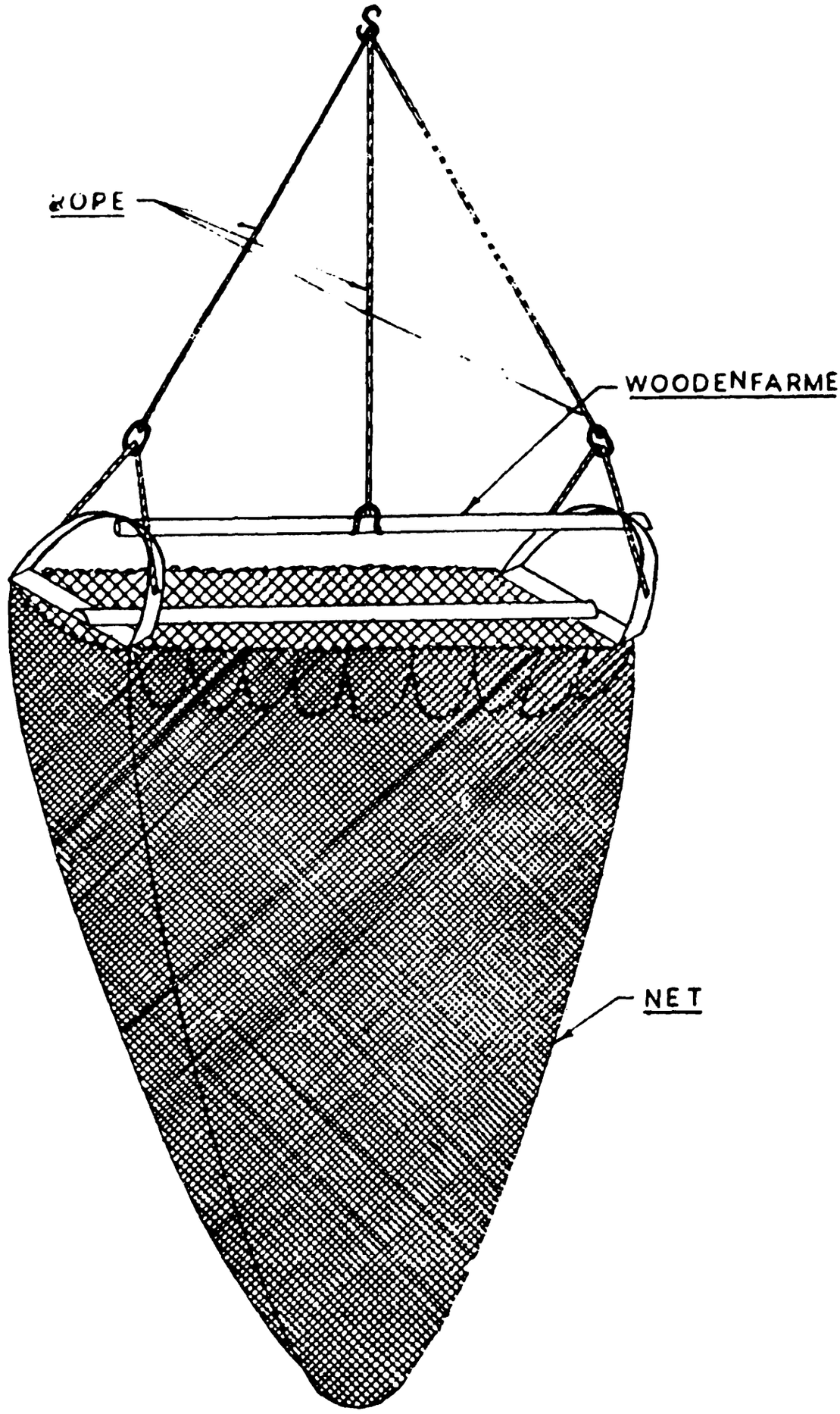


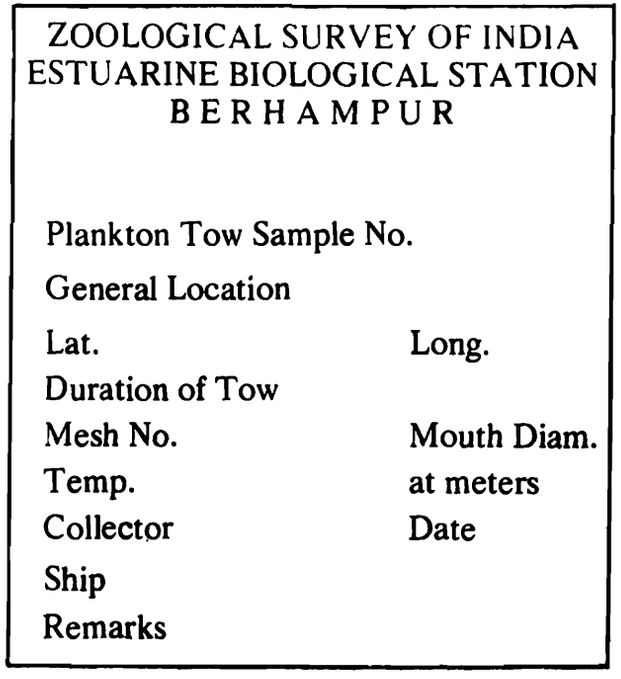
Fig. 8 Agassiz trawl

EBS/ZSI/BERHAMPUR Sample No. Locality Date	EBS/ZSI/BERHAMPUR Sample No. Locality Date
EBS/ZSI/BERHAMPUR Sample No. Locality Date	EBS/ZSI/BERHAMPUR Sample No. Locality Date

Fig. 9

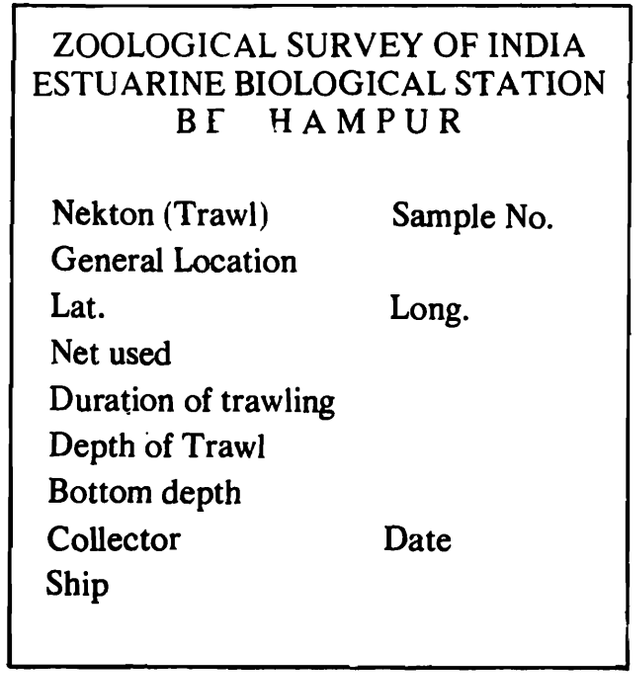
ZOOLOGICAL SURVEY OF INDIA ESTUARINE BIOLOGICAL STATION, BERHAMPUR
SURVEY, 19
LOCALITY DATE COLL.

Fig. 10


ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

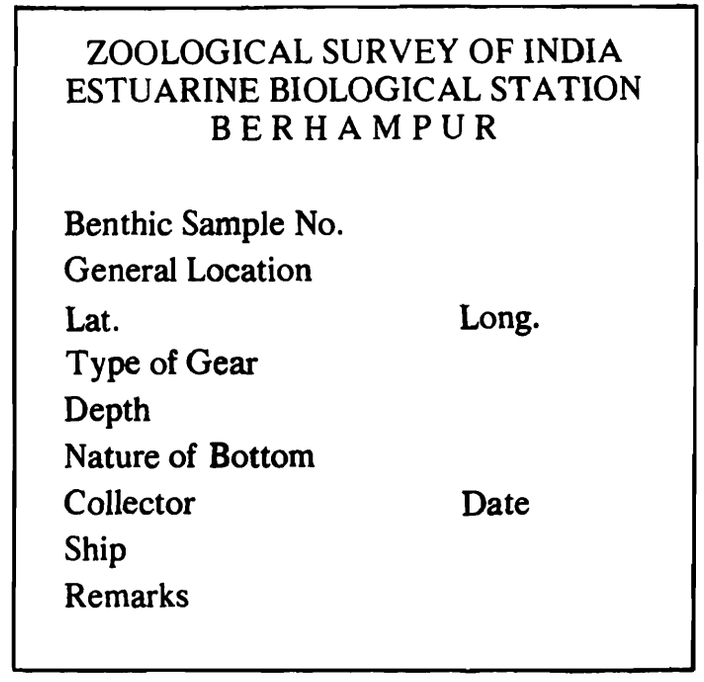
Plankton Tow Sample No.
General Location
Lat. Long.
Duration of Tow
Mesh No. Mouth Diam.
Temp. at meters
Collector Date
Ship
Remarks

Fig. 11


ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

Nekton (Trawl) Sample No.
General Location
Lat. Long.
Net used
Duration of trawling
Depth of Trawl
Bottom depth
Collector Date
Ship

Fig. 12


ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

Benthic Sample No.
General Location
Lat. Long.
Type of Gear
Depth
Nature of Bottom
Collector Date
Ship
Remarks

Fig. 13

EBS/ZSI/BERHAMPUR GENUS SPECIES LOCALITY REG. NO.	EBS/ZSI/BERHAMPUR GENUS SPECIES LOCALITY REG. NO.
EBS/ZSI/BERHAMPUR GENUS SPECIES LOCALITY REG. NO.	EBS/ZSI/BERHAMPUR GENUS SPECIES LOCALITY REG. NO.

Fig. 14

ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

Order
Family
Genus
Species
Locality
Coll. Date
Reg. No. Deg. by

Fig. 15

ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

REG. NO. GROUP
NAME
LOCALITY
DATE COLL. COLL.
DATE DET. DET.
NO. SIZE

Fig. 16

ZOOLOGICAL SURVEY OF INDIA,.
ESTUARINE BIOLOGICAL STATION,
BERHAMPUR

Phylum
Class
Order
Fam.
D : Dry/W : Wet

Genus
Species

Sl. No.	Reg. No.	Locality	Date of Coll.	Collector/ Donor	Remarks

Fig. 17

- FROM -
ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
HILL PATNA BERHAMPUR (GM)
760 005 ORISSA INDIA

Q.M.S.
R.M.S.
LATE FEE PAID
BOOK POST
UR. CERTI. POST
REGD. POST A.D.

REG. PARCEL A.D.
UR. PL. CERTI.
RECORD DELI.
REG. AIR MAIL
SURFACE MAIL
PRINTED MATTER

Fig. 18

ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION, BERHAMPUR

Fig. 19

ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION,
BERHAMPUR

Negative No. **Print**

Fig. 20
(Front Side)

Details of Photograph

Loc. **Dist.** **State**
Lat. **Long.** **Alt.** **Meters**
Date **Coll. Station No.**
Photo by
Description
Animals
Remarks

Fig. 21
(Back Side)

ZOOLOGICAL SURVEY OF INDIA
ESTUARINE BIOLOGICAL STATION
BERHAMPUR

N. No. Technical Details
Film Used Exposure Date
Exposure Film Stop Filter
Lighting Hour Camera Facing
Camera Lens

Rec. zool. surv. India, 90(1-4) : 305-306, 1992

ON A NEW RECORD OF CONCHOSTRACA (CRUSTACEA) FROM ANDHRA PRADESH

A.N.T. JOSEPH, RAMAKRISHNA AND S.G. PATIL

Freshwater Biological Station,
Zoological Survey of India,
1-1-300/B, Ashok Nagar,
Hyderabad 500 020

During the limnological survey of some water bodies of Hyderabad on 9th July 1985, specimens of Conchostraca were observed in a small puddle near Nacharam. Examination of these specimens revealed this species as *Leptestheriella maduraensis* Nayar and Nair. As there was no earlier report of Conchostraca from Andhra Pradesh, occurrence of the present species is a new record to this region.

The puddle is situated at the outskirts of Hyderabad at lat 17° 26′ N and long 78° 18′ E at 588.3 metres from the main sea level. The total area of the water body is about 5 sq. metres and depth of water varies from 5-15 cms. The bottom of the puddle is of clay and sand on rocky bottom without any vegetation and gets dried up after monsoon. The water was analysed for various physico-chemical parameters and the data provided in table-1.

Table-1. Physico-chemical characteristics of water in the puddle at Nacharam on 9.7.1985.

Water temperature	...	22° C
pH	...	7.9
Dissolved Oxygen	...	5.3 mg/1
Free Carbondioxide	...	Nil
Carbonate	...	22 mg/1
Bicarbonate	...	104 mg/1
Hardness	...	140 mg/1
Chloride	...	36 mg/1

Leptestheriella maduraensis was described by Nayar and Nair in 1968 from Narsingapatti, 10 km from Madurai in a small pool at the foot hill of the rocky mountain Yanamalai. The description given by Nayar and Nair agrees well with the present species but the length is slightly more (9.6 mm), telson narrow with 34 unequal spines and the furcal claw with 20 spines.

The authors are grateful to the Director, Zoological Survey of India, Calcutta for facilities to undertake this survey.

REFERENCE

Nayar, C.K.G. & Nair, K.K.N. 1968. On a collection of Conchostraca (Crustacea : Branchiopoda) from South India, with the description of two new species. *Hydrobiologia*, **32** : 219-224.