

Volume 97 (Part-2)

**Records of the
Zoological Survey of India**

A JOURNAL OF INDIAN ZOOLOGY

**Zoological Survey of India
1999**

Records of the Zoological Survey of India

Volume 97 (Part-2)

Edited by the Director, Zoological Survey of India



सत्यमेव जयते

**Zoological Survey of India
Calcutta
1999**

CITATION

Editor-Director. 1999. *Rec. zoo. Surv. India* Vol. 97 (Part-2), i-viii, 1-267 pp

Published —Director, ZSI, Calcutta.

Published : June, 1999

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PRICE

Indian Rs. 400.00

Foreign \$ 22.00; £ 16.00

Published at the Publication Division by the Director, Zoological Survey of India, 234/4, AJC Bose Road, 2nd MSO Building, (13th Floor), Nizam Palace, Calcutta-700 020 after laser typesetting by Calcutta Laser Graphics (P) Ltd., Calcutta-700 006 and printed at Hooghly Printing Co. Ltd., (A Govt. of India Enterprise), Calcutta-700 071.

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DR. J. R. B. ALFRED
Director
Zoological Survey of India

RECORDS OF THE ZOOLOGICAL SURVEY OF INDIA

Vol. 97 (Part-2)

1999

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**FOUR NEW SPECIES OF *CAENOCRYPTUS* THOMSON
FROM INDIA, MYANMAR AND TAIWAN**

(HYMENOPTERA : ICHNEUMONIDAE)

J. K. JONATHAN

Zoological Survey of India, Calcutta-700 053

INTRODUCTION

The genus *Caenocryptus* Thomson belongs to the tribe Ischnini of the subfamily Mesosteninae, family Ichneumonidae. It contains medium sized species with moderately stout body measuring about 7-10 mm in length. This genus has been reported from Holarctic Region. Townes (1970 : 190) reported 3 undescribed species from Mexico and one from Myanmar

This is the new record of this genus from India and Taiwan. Four new species from India (Himachal Pradesh and Jammu & Kashmir), Myanmar and Taiwan are described. Homotype female and a determined male of *Caenocryptus shikokuensis* (Uchida) from Japan was available for study. It is included here in the key and the text for comparison with the Oriental species.

SYSTEMATIC ACCOUNT

Genus *Caenocryptus* Thomson

1873. *Caenocryptus* Thomson, *Opuscula entomologica*, 5 : 494.

Type : *Cryptus rufiventris* Gravenhorst. Designated by Viereck 1914.

1952. *Habrocryptus* Uchida, *Insecta Matsumurana*, 18 : 19.

Type : *Habrocryptus shikokuensis* Uchida. Original designation. Synonymized by Townes 1970 : 189.

1954. *Pseudischnus* Walkley, *Jour. Washington Acad. Sci.*, 44 : 219.

Type : *Ischnus oregonensis* Cushman. Original designation.

Body of moderate proportions. Clypeus small, about 2.2x as wide as long, strongly convex, subpyramidal in profile, its apex convex or truncate without a median tooth or irregularity. Malarspace about 0.9x as long as basal width of mandible. Mandible of moderate length, its lower

tooth slightly shorter than upper. Apical 0.3 of female flagellum not or only slightly thickened, not flattened below, weakly tapered towards the tip. Mesoscutum mat or more or less polished, with fine and close punctures; notaulus sharp, reaching to behind center of mesoscutum. Propodeal (Fig. 1c) spiracle round or short elliptic; propodeum rather narrow or convex, its apical carina forming weak sublateral crest, often weak and rarely absent in the middle. Base of hind coxa deep, without a groove, its lower basal corner sometimes polished and hairless. Wing as shown in figure 1a, b, with hardly any variation. First tergite without a lateral tooth at the base, its spiracle near apical 0.34; dorso-lateral and ventro-lateral carinae distinct, usually complete but weak, its median dorsal carinae moderately strong, reaching to behind spiracle. Second tergite

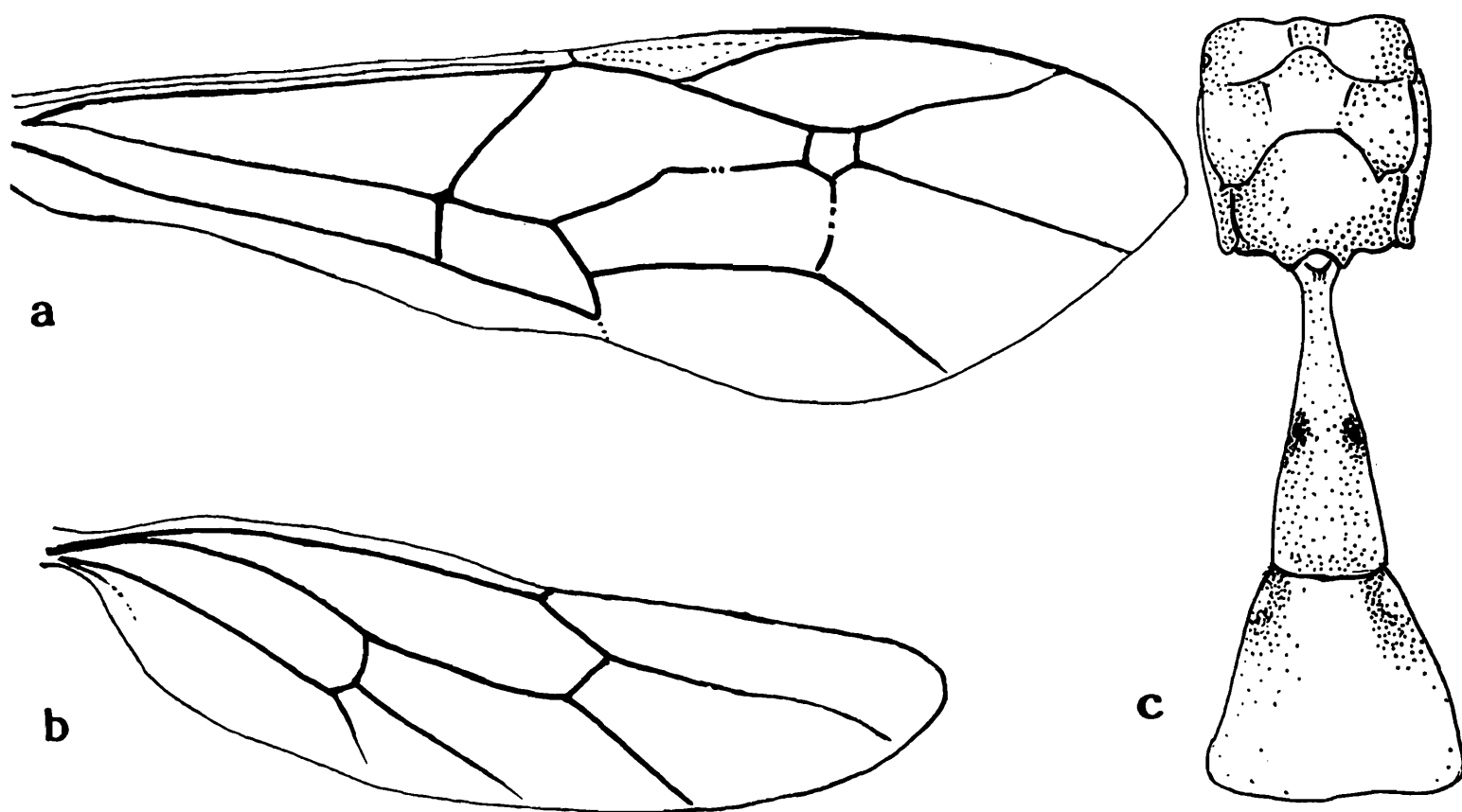


Fig. 1. *Coenocryptus* Thomson : a, b, fore and hind showing wing venation; c, dorsal view of propodeum and first tergite.

mat, with fine punctures. Ovipositor sheath about 0.6 to 1.8x as long as hind tibia. Ovipositor moderately stout, somewhat compressed its tip of moderate length to short with a distinct nodus.

Caenocryptus is rather a distinct genus easily distinguished by the absence of lateral tooth at the base of first tergite; subapical 0.6 of mediella vein weakly arched; propodeal spiracle rounded or short elliptic; clypeus without median tooth and ovipositor tip short with distinct nodus.

Host : Known host includes cocoons of sawflies and various Lepidoptera.

Key to the species of *Caenocryptus*

- 1 Antennal flagellum black and without a whitish band. Legs also black, except hind femur red. Frons strongly mat and with very minute dense and weak punctures

1. *rugosus*, sp. nov.

Antennal flagellum with a white band. Legs almost entirely black or variously marked with yellow or red. Frons mat and rugose 2
2. Body and legs almost entirely black, except antennal band and face, frons and temple along the orbit are marked. Face minutely and densely punctate. Frons with a median fine longitudinal groove. Pronotum trans-rugose. Scutellum subpolished, with minute, closely placed punctures. Mesopleurum, metapleurum and propodeum moderately strongly wrinkled**2. *shikokuensis* (Uchida)**

Body and legs not entirely black, variously marked with yellow and red 3
3. Ovipositor tip short, upper valve heavy, evenly arched between apex and nodus, not flattened. Speculum on mesopleurum with small deep and dense punctures. (Pronotum trans-rugose. Scutellum mat, minutely and densely punctate. Mesopleurum, metapleurum and propodeum rugoso-wrinkled)**3. *reticulatus*, sp. nov.**

Ovipositor tip long, both the valves equally strong, upper valve flattened at apex. Speculum on mesopleurum rugose 4
4. Pronotum largely moderately strongly transversely rugoso-striate. Mesopleurum and metapleurum strongly rugoso-wrinkled. Punctures on scutellum not dense and not running into striations. Hind tarsus with apical 0.2 of first and second to fourth segments wholly whitish.....**4. *striatus*, sp. nov.**

Pronotum strongly mat, weakly rugose in scrobes. Mesopleurum and metapleurum weakly rugose. Punctures on scutellum strong and dense, running into fine striations. Hind tarsus largely reddish-yellow **5. *burmensis*, sp. nov.**

1 *Caenocryptus rugosus*, sp. nov.

This is a distinct species having antennal flagelum black. Legs also black, except the hind femur. Frons strongly mat and with very minute dense weak punctures.

Female : Face moderately strongly granulated, except for a median oval area near antennal bases smooth and shiny. Clypeus subpolished, its basal 0.6 sparsely punctate, apical 0.4 smooth and shiny with a few scattered punctures. Malarspace granulose. Mandible ruguloso-punctate. Frons and vertex strongly mat, with minute dense weak punctures. Temple subpolished, with small close to moderately spaced punctures. Pronotum largely rugoso-wrinkled, its upper 0.25 strongly granulated, pronotal collar and lower corner subpolished and sparsely and shallowly punctate. Epomia short, but moderately strong. Mesopleurum subpolished and rugose, lower half of speculum shiny with a few coarse punctures, area anteriorly above sternaulus and mesosternum strongly granulose, dull; prepectal carina extending 0.8 the height of mesopleurum, subtegular ridge shiny, minutely punctate. Scutellum and metascutellum dull, granuloso-punctate, lateral carina of scutellum more or less confined to its base. Metapleurum mat, finely rugose, juxtacoxal carina absent. Propodeum between basal carina and apex mat, moderately strongly rugoso-wrinkled, basad of basal carina strongly granulose. First tergite strongly mat, postpetiole with a few setiferous punctures. Ovipositor sheath about 0.9x as long as hind tibia.

Black. Apical antennal segments with reddish hue. The following are yellow : face with a small median mark, orbital mark on face, frons, vertex and also temple (Fig. 2a) (this orbital mark sometimes not continuous, interrupted near malarspace and above at temple), upper margin of pronotum and collar narrowly, sometimes these are very faint and indistinct, scutellum with or without an oval mark, subtegular ridge with or without a mark. Legs in general blackish-brown to black. Fore and middle femora reddish-brown apico-basally. Hind leg (Fig. 2b) with femur red, tarsus colour variable, its apical half of second to fourth segments whitish, sometimes totally dark brown or blackish. Wings clear hyaline.

Male Essentially similar to female, except more slender and weakly sculptured, body largely subpolished. Face and clypeus minutely and densely punctate. Temple minutely and sparsely punctate. Metapleurum finely wrinkled. First to third abdominal tergites mat, with minute sparse punctures. Nervulus in fore wing slightly basad of basal vein.

Colour similar to female. The following are yellow : face and clypeus wholly, vertex and temple along the eye margin, scape of antennae in front, oval mark on scutellum, pronotal collar

and upper margin of pronotum, subtegular ridge, tegula, fore and middle coxae and their first trochanteral segment. Legs reddish or reddish-brown; hind coxa and trochanter black, femur red, tibia brown, tarsus brownish at base, rest whitish.

Length : Female, 7-10 mm. Fore wing 5.5-7.2 mm. Ovipositor sheath 2-2.5 mm. Male, 7 mm. Fore wing 5.5 mm.

Holotype Female, INDIA : HIMACHAL PRADESH Ahla, 2286 m, 14. ix.1971 A.K. Gulati, No. JD.129. *Allotype* Male, INDIA : HIMACHAL PRADESH : Dalhousi, 2132 m, 27.iv.1971, Coll. Tekchand, No. DH 11. *Paratype* 8 Females. INDIA : HIMACHAL PRADESH Ahla, 2286 m, 1 F, 3.v.1971, 1 F, 3.x. 1971, Colls. D. Ram & Sukh Dev Nos. DH 123 & J.D. 199; 3 F, 4.vii-26.x.1971, Malaise trap, collection, trap No. 1,2,3. Khadrula, 2771 m, Pabar Range, Bashahr, 1 F, 25.vi. 1950, Coll. G.D. Bhasin. JAMMU & KASHMIR : Gulmarg in Kashmir Himalaya, 2500m, 1 F, 20.vi. 1966, 1 F, 17.vi. 1966, Coll. V.K. Gupta, Colln. Nos. 203 and 197. (all in Z.S.J., Calcutta except 1 F, loc. as holotype, 3.x.1971. Sukh Dev, coll. No. JD199 in AEI, Florida).

Distribution : India : Himachal Pradesh and Jammu & Kashmir.

2. *Caenocryptus shikokuensis* (Uchida)

1936. *Habrocryptus shikokuensis* Uchida, *Insecta Matsumurana*, **11** : 8. M. F. des.Type : F, Japan : Kamegamori in Kochi (SAPPORO); Japan : Kodakasayama, Hongawa, Teragawa all in Kochi.

1952. *Habrocryptoides shikokuensis* Uchida, *Insecta Matsumurana*, **18** : 19. Syn.

1957. *Trachysphyrus shikokuensis* : Townes, *Proc. Ent. Soc. Washington*, **59** : 108.

1970. *Caenocryptus shikokuensis* : Townes, *Mem. Amer. Ent. Inst.*, **12** : 190.

This is a distinct species which differs with most of the Oriental species in its colour and sculpture. Body and legs almost entirely black, except antennal band and face, frons and temple along the orbit marked, yellow. Frons with a fine median longitudinal groove. Mesopleurum, metapleurum and propodeum moderately strongly wrinkled.

Female : Face subpolished, mat, finely and densely punctate, medially raised. Clypeus shiny, with small closely placed punctures. Malarspace granulose, 1.0x the basal width of mandible. Mandible subpolished, finely and closely punctate. Frons mat and subpolished, weakly rugose with small close setiferous punctures, with a fine median groove extending from median ocellus. Vertex mat, with very fine dense punctures. Temple subpolished, with small, closely placed punctures. Pronotum in the middle with coarse transverse rugae, above mat with fine, close and shallow punctures, pronotal collar subpolished, minutely punctate, punctures running into fine

striations, epomia short, strong. Scutellum and metascutellum subpolished with shallow punctures, its lateral carina more or less confined to its base. Mesopleurum mat, finely wrinkled, mesosternum and area above sternaulus anteriorly with fine dense punctures, prepectal carina extending about 0.8 the height of mesopleurum, speculum rugoso-punctate, subtegular ridge minutely and closely punctate. Metapleurum mat, moderately wrinkled, juxtacoxal carina not defined. Propodeum between basal carina and apex moderately strongly wrinkled, at some places appears to be reticulate, basal of basal carina mat, largely rugulose with weak setiferous punctures, apical carina transverse in the middle. First tergite mat with minute scattered punctures; second tergite mat, minutely and densely punctate; following tergites mat and subpolished. Ovipositor sheath about 0.8x as long as hind tibia; ovipositor tip as shown in figure.

Black. (Antennal flagellum broken), face and frons along the eye margin (Fig. 2, c, d), scutellum faintly in the middle, yellow. Wings clear hyaline.

Male : Essentially similar to female, except body smaller and subpolished, face minutely and densely punctate. Clypeus sparsely and shallowly punctate. Frons rugulose. Vertex and temple subpolished with minute and sparse punctures. Pronotum finely wrinkled in the middle, its upper margin and collar with fine close punctures, punctures running into wrinkles. Mesopleurum rugoso-punctate, punctures small to moderate sized. Metapleurum with moderate sized dense punctures forming reticulations. First tergite mat, postpetiole minutely and densely punctate. Following tergites mat and subpolished.

Black. Antennal flagellum reddish-brown in front. The following are yellow : scape in front, face, clypeus, mandible, malar space, temple, frons along the eye margin, pronotal collar narrowly, small dot at the top of epomia, scutellum, tegula, posterior corner of pronotum, subtegular ridge, apices of second to seventh tergites narrowly, fore and middle coxae and trochanters. Fore and middle legs yellowish-brown. Hind leg largely, second to basal half of fifth tarsal segments whitish-yellow. Wings clear hyaline with light brownish tinge.

Length Female, 10.25 mm. Fore wing 7.5 mm. Ovipositor sheath about 2.3 mm. Male, 9.5 mm. Fore wing 7.2 mm.

Material Examined 1 Female, 1 Male. JAPAN : Mt. Kamegamori, Srikoku AI, 1 F (Homotype of *Habrocryptus shikokuensis* Uchida, det. by H.K. Townes 1954), 17.vii. 1933, Coll. Y Sugihara; Kamikochi, 1 M, 25. vii, 1954, Coll. Townes family (AEI, Florida).

Distribution Japan.

3. *Caenocryptus reticulatus*, sp. nov.

This species is recognized from *Caenocryptus striatus*, sp. nov. and *Caenocryptus burmensis*, sp. nov. by having ovipositor tip short, upper valve heavy, evenly arched between apex and nodus

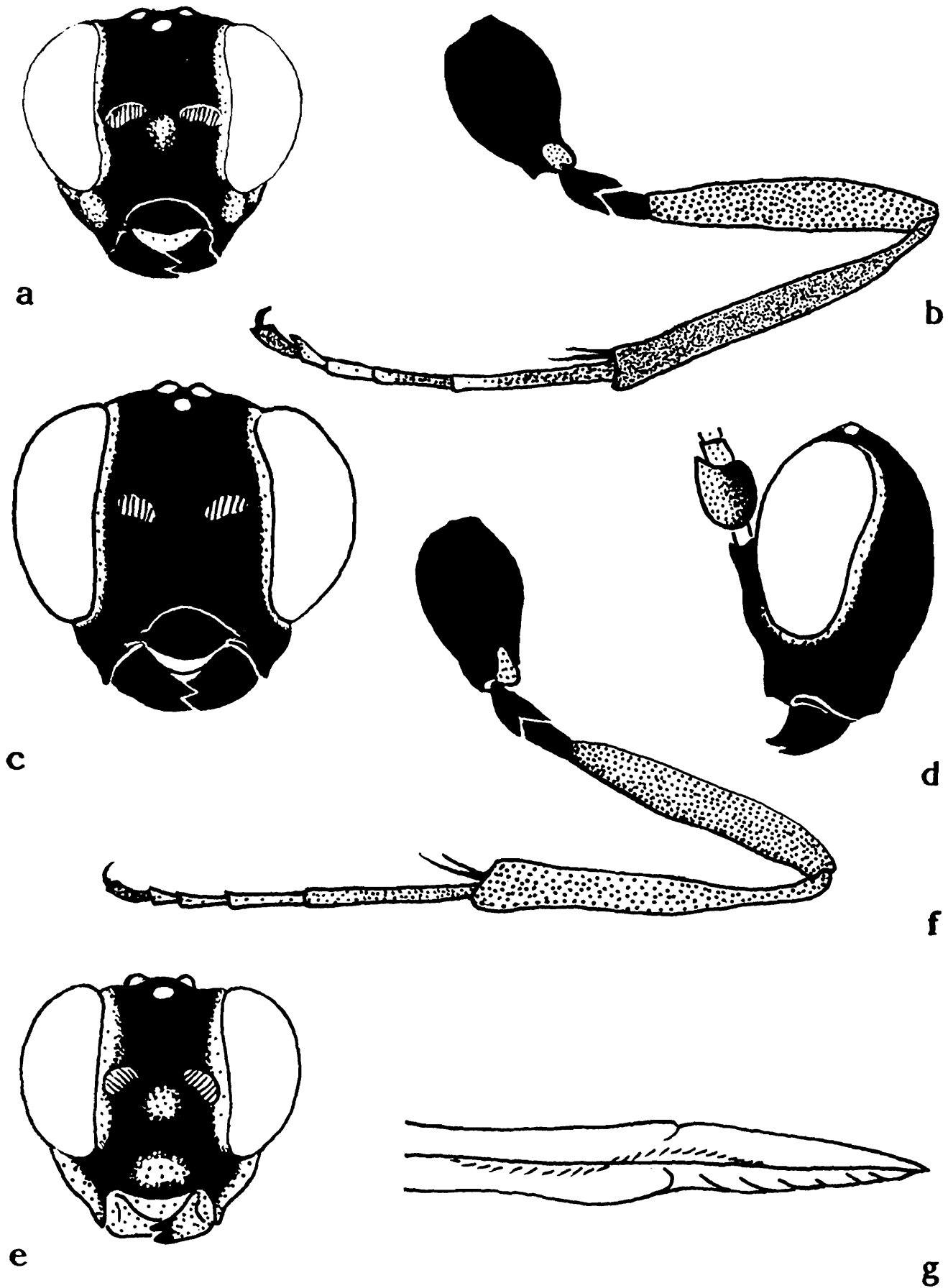


Fig. 2. *Caenocryptus rugosus* : colour pattern : a, front view of head; b, hind leg. *Caenocryptus shikokuensis* (Uchida) : colour pattern : c, d, front and side view of head. *Caenocryptus reticulatus* : colour pattern : e, front view of head; f, hind leg; g, ovipositor tip.

(Fig. 2, g) apex not flattened. Speculum and mesopleurum with deep and dense punctures.

Female : Face mat, with minute, dense punctures at sides running into fine rugosities, along the eye margins mat and dull. Clypeus subpolished, with minute, rather sparse punctures, at apex smooth and shiny. Malarspace granulose, with minute, dense punctures. Frons mat and weakly rugose. Vertex mat, minutely and closely punctate, dull. Temple mat with minute, closely placed punctures, punctures running into fine striations. Pronotum subpolished, trans-rugose, above finely striate, pronotal collar and below minutely punctate, with fine striations in between the striae, epomia moderately strong and long. Scutellum mat and subpolished, minutely and densely punctate, with fine longitudinally running striations, lateral carina extending about 0.3 its length. Metascutellum sub-polished, with closely placed small punctures. Mesopleurum subpolished, moderately strongly rugoso-wrinkled, below subtegular ridge ruguloso-punctate, subtegular ridge minutely punctate, speculum shiny with large deep punctures. Mesosternum minutely and densely puncto-rugulose, prepectal carina extending 0.9 the height of mesopleurum. Metapleurum subpolished, rugoso-wrinkled, juxtacoxal carina weakly present. Propodeum between basal carina and apex strongly rugoso-wrinkled, at some places tending to be reticulate, basal of basal carina with small sized, dense punctures, punctures forming rugosities, apical carina strong in the middle. First tergite mat, with fine, dense punctures, second to fourth tergites mat with fine dense punctures, following tergites mat and subpolished. Ovipositor sheath about 0.8x as long as hind tibia; ovipositor tip as shown in figure 2g.

Black. 6th to 9th antennal segments white above. The following are yellow : a mark on scape in front, face with a small round mark above, clypeus faintly, face and frons (Fig. 2, e) along the eye margin, malarspace, temple along the eye margin, pronotal collar and upper margin of pronotum narrowly, subtegular ridge and scutellum in the middle. Legs in general reddish-brown, except their coxae and trochanter black, and hind tarsus with second to fourth segments whitish (Fig. 2, f). Wings clear hyaline.

Male : Unknown.

Length Female, 10 mm. Fore wing 8 mm. Ovipositor sheath about 2.5 mm.

Holotype Female, INDIA : HIMACHAL PRADESH : Dalhousie 2132 m, 27.iv.1971, Coll. M.K., Kamath, No. DH 10 (Z.S.I., Calcutta).

Distribution India : Himachal Pradesh.

4. *Caenocryptus striatus*, sp. nov.

This species is close to *Caenocryptus burmensis*, sp. nov. in having ovipositor tip long, both the valves of ovipositor equally strong and upper valve flattened at the apex. Speculum and

mesopleurum rugose. It can be distinguished by having pronotum strongly transversely rugoso-striate. Meso- and metapleurum strongly rugoso-wrinkled. Punctures on scutellum neither dense nor running into striations. Hind tarsus at its apical 0.2 of first and second to fourth segments wholly, whitish.

Female : Face subpolished, moderately strongly granulated. Clypeus subpolished, mat, sparsely and shallowly punctate, its apex smooth. Malarspace granulose. Mandible shallowly punctate. Frons strongly granulose to weakly rugose, near the antennal sockets smooth and shiny. Vertex and temple mat, with fine setiferous punctures. Pronotum in the scrobe moderately strongly transversely rugoso-striate, pronotal collar and upper half of pronotum strongly granulose to weakly rugose, epomia short but strong. Scutellum and metascutellum subpolished with fine, weak and dense punctures, lateral carina of scutellum extending to its basal 0.2. Mesopleurum almost wholly moderately strongly rugose, mesosternum rugulose, subtegular ridge subpolished minutely punctate, prepectal carina extending 0.9x the height of mesopleurum. Metapleurum mat, rugose, juxtacoxal carina absent. Propodeum between basal carina and apex mat and finely rugoso-wrinkled, basad of basal carina strongly granulated, apical carina complete, transverse in the middle. First tergite mat and subpolished, with a few scattered shallow setiferous punctures. Second tergite mat with fine dense punctures, punctures towards the apex not well defined; following tergites mat and subpolished. Ovipositor sheath about 0.9x as long as hind tibia.

Black. 6th to 9th flagellar segments white above. The following are yellow : face with a T-shaped mark above (Fig. 3, a), basal half of clypeus, mandible faintly at base, orbit all along the eye margin, pronotal collar, upper margin of pronotum, scutellum with a small oval mark in the middle, subtegular ridge. First to third abdominal tergites (Fig. 3, c) more or less blackish except second and third tergites apically and following tergites wholly reddish-brown; all the coxae and trochanters dark brown to black, fore and middle femora and tibiae reddish-brown, their tarsus dark brown. Hind femur reddish, tibia blackish, tarsus with basal 0.8 of first segment and fifth segment wholly black, the rest of tarsus whitish (Fig. 3, b). Wings clear hyaline.

Male : Similar to female, except more slender and subpolished. Face subpolished, minutely and densely rugoso-punctate. Clypeus subpolished with shallow close punctures. Frons mat, densely and minutely punctate. Vertex mat, shallowly punctate. Temple shiny with shallow close punctures. Pronotum rugoso-punctate. Mesopleurum mat, weakly rugose, speculum and area below subtegular ridge rugoso-punctate. Mesosternum densely punctate. Metapleurum somewhat rugoso-punctate. Propodeum moderately strongly wrinkled, basad of basal carina granulose. First tergite mat and subpolished with scattered indistinct punctures; following tergites largely mat and dull.

Black. Antennal flagellum entirely blackish. The following are yellow : scape in front, face and clypeus wholly, mandible, except the teeth, frons along the eye margin, temple, malarspace

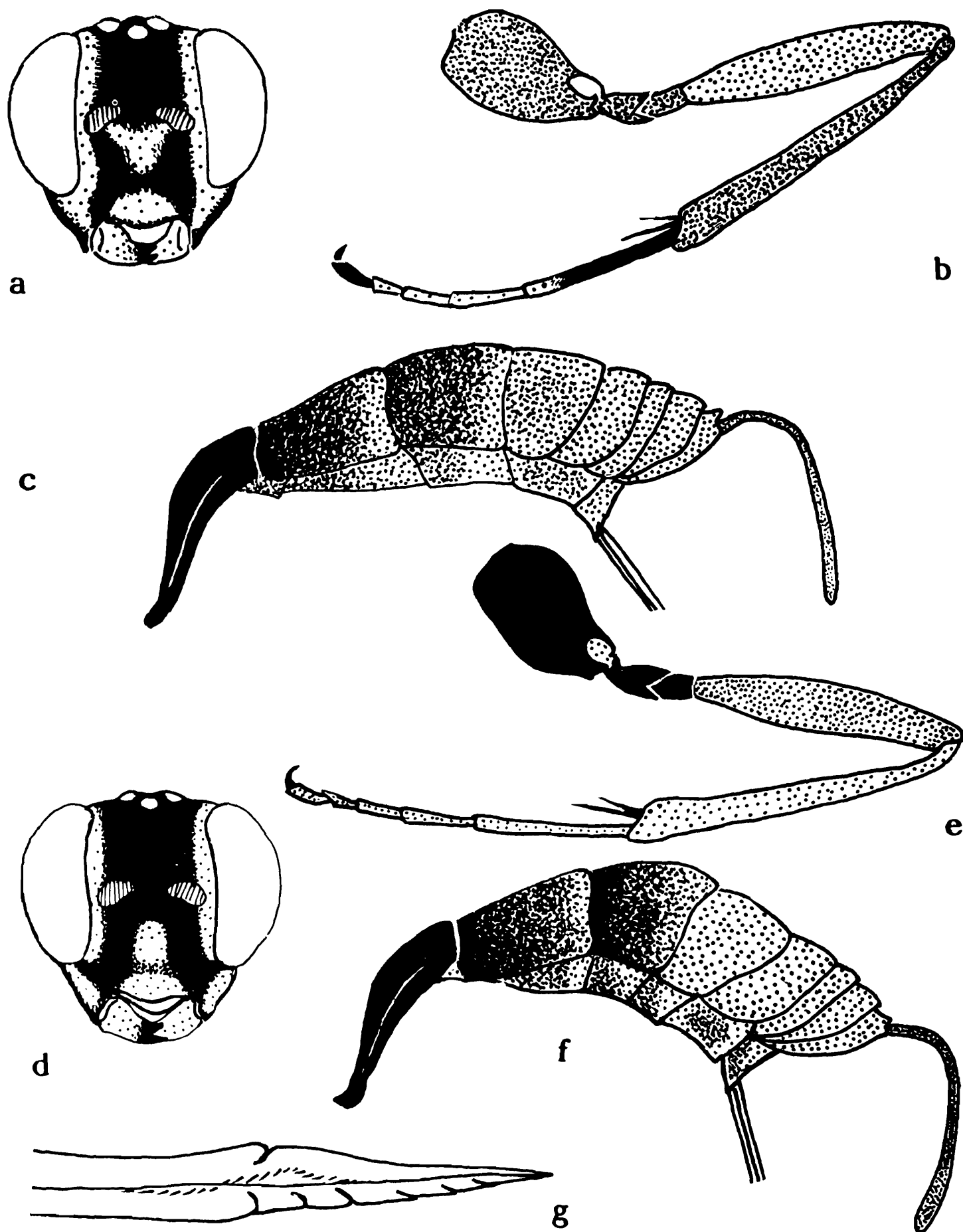


Fig. 3. *Coenocryptus striatus* : colour pattern : a, front view of head; b, hind leg; c, side view of abdomen. *Coenocryptus burmensis* : colour pattern : d, front view of head; e, hind leg; f, side view of abdomen; g, ovipositor tip.

broadly, pronotal collar, upper margin of pronotum, scutellum with a small mark, tegula, subtegular ridge, an oval mark above sternaulus, mesosternum almost wholly, fore and middle coxae and first trochanteral segment (hind legs broken). Legs in general yellowish-brown. First abdominal segment black; following segments, blackish-brown.

Length : Female, 7.2-9 mm. Fore wing 6.5-7.5 mm. Ovipositor sheath 2.25-2.8 mm. Male, 7.5 mm. Fore wing 6 mm.

Holotype Female, INDIA : HIMACHAL PRADESH : Ahla, 2286 m, near Dalhousi, 25.v.1971, Coll. J.K. Jonathan, JD5 (Z.S.I., Calcutta). *Allotype* Male, TAIWAN : Sunmoon Lake, 15.i.1969, Malaise Trap (AEI, Florida). *Paratype* 14 Females. INDIA : HIMACHAL PRADESH: Ahla, 2286 m, near Dalhousi, 6 F, 7.ii.-28. vii.1971, Colls. J.K. Jonathan, Sukh Dev, M.L. Gupta, D. Ram, M.K. Kamath and A.K. Gulati, Colln. Nos. JD27 & 30, M133, DH29, 55 & 118 (all in Z.S.I., Calcutta except 1 F, in AEI, Florida). Dalhousi, 2132 m, 2 F, 22.ix. & 2.x.1971, Colls. Girish Chandra & Tulsi Ram, Colln. Nos. JD155 & 194. Kalatop, 2438 m, 3 F, 4.v. & 22.vii. 1971, Colls. D. Ram & M.K. Kamath, Colln. Nos. DH25 & 26, M114. Khajjiar, 1828 m, 1 F, 6.v. 1971, Coll. D. Ram, No. DH32. Nichar, 2500 m, 1 F, 11.vi.1972, Coll. S. Gupta, No. 390 (Z.S.I., Calcutta). TAIWAN : Sunmoon Lake, 1 M, 1 F, 2-15.i.1969, Malaise Trap (AEI, Florida).

Distribution : India : Himachal Pradesh. Taiwan

5. *Caenocryptus burmensis*, sp. nov.

This species is distinguished from *Caenocryptus striatus*, sp. nov. by having pronotum strongly mat, mesopleurum and metapleurum weakly rugose. Punctures on scutellum strong and dense, running into striations. Hind tarsus reddish-yellow.

Female : Face moderately strongly granulated, weakly raised in the middle. Clypeus subpolished sparsely and shallowly punctate. Malarspace granulate. Mandible with minute weak punctures. Frons strongly rugose, with a median wide shallow longitudinal groove. Vertex mat with fine dense punctures. Temple subpolished, with minute closely placed punctures. Pronotum as a whole granulated, in the scrobes and above weakly rugose, upper margin strongly granulated with sparse shallow setiferous punctures. Scutellum granulated with fine dense punctures, punctures running into fine striations, its lateral carina more or less confined to its base. Metascutellum with minute dense punctures. Mesopleurum largely mat, and weakly rugose, subtegular ridge subpolished, minutely and closely punctate; prepectal carina extending more or less up to the base of subtegular ridge. Metapleurum rugoso-wrinkled, juxtacoxal carina not well defined. Propodeum between basal carina and apex moderately wrinkled, basal of basal carina

mat with minute dense punctures. First tergite mat and subpolished; second and third tergites mat, with very minute and dense punctures. Following tergites mat and subpolished. Ovipositor sheath about 0.8x as long as hind tibia. Ovipositor tip as shown in figure 3, g.

Black Apex of sixth segment to the base of tenth segment of antennal flagellum white above. The following are yellow : clypeus broadly, mandible, face sometimes faintly, malarspace, eye orbit wholly (Fig. 3, d), pronotal collar, upper margin of pronotum, scutellum with an oval mark in the center and subtegular ridge. First to third tergites black (Fig. 3, f), following tergites reddish-brown. Legs in general reddish-brown, except fore and middle coxae dark brown and usually with yellow markings. Hind coxa and trochanter largely black, its tarsus reddish-yellow (Fig. 3, e). Wings clear with yellowish tinge.

Male : Unknown.

Length Female, 11.5 mm. Fore wing 8.25 mm. Ovipositor sheath 2.25 mm.

Holotype Female, MYANMAR : Mt. Victoria, 2800 m, iv.1938, Gerd Heinrich (AEI, Florida). *Paratypes* 4 Females, same data as holotype, except 1 F, collected on v.1938 (all in AEI, Florida & 1 F in Z.S.I., Calcutta).

Distribution : Myanmar.

SUMMARY

This paper deals with four new species of *Caenocryptus* Thomson, viz., *C. rugosus*, *C. reticulatus*, *C. striatus* and *C. burmensis* from India, Myanmar and Taiwan. *C. shikokuensis* (Uchida) from Japan is also included in the key and text for comparison with the Oriental species.

Caenocryptus has been recorded from Holarctic Region. This is the first record of this genus from Oriental Region (India, Myanmar and Taiwan).

ACKNOWLEDGEMENT

This study would not have been possible without the encouragement and guidance of Prof. (Dr.) V.K. Gupta, Department of Entomology, University of Florida, U.S.A. I am thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India for providing all the necessary facilities to carry out this research work.

REFERENCES

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- Gupta, V.K. 1987. Catalogue of Indo-Australian Ichneumonidae, Part 2. *Mem. Amer. Ent. Inst.*, **41** (2) : 598-1210.

THREE NEW SPECIES OF *NIPPOCRYPTUS* UCHIDA FROM INDIA
(HYMENOPTERA ICHNEUMONIDAE)

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INTRODUCTION

The genus *Nippocryptus* Uchida belongs to the tribe Ischnini of the family Ichneumonidae. It contains medium sized species measuring 7 to 13 mm in length. This genus is known from Palaearctic and Oriental Regions. Townes (1970 : 190) referred to this genus 3 species *Ichneumon vittatorius* Jurine from Palaearctic Region and *Mesostenus misippus* Cameron and *Aglaocryptus striatifrons* Cameron from Oriental Region. On examination of the type of *A. striatifrons* Cameron, it was discovered that this species belongs to genus *Ischnus* Gravenhorst, rather than to *Nippocryptus* Uchida.

Three new species are described here from India along with a detailed description of *Mesostenus misippus* Cameron. One female specimen of *Nippocryptus suzukii* (Matsumura) (= *vittatorius* Jurine) from Japan was available for study, which is included here in the key and the text for comparison with the Oriental species.

SYSTEMATIC ACCOUNT

Genus *Nippocryptus* Uchida

1936. *Nippocryptus* Uchida, *Insecta Matsumurana*, 11 : 3. Type : *Hemiteles suzukii* Matsumura (= *vittatorius* Jurine). Original designation.

Body of moderate proportions to rather stout. Clypeus small, about 2.2x as wide as long, moderately convex with its apical 0.35 flattened or slightly concave, its apex with a median tooth, lobe, or obtuse angulation. Malarspace 0.5 to 1.1x as long as basal width of mandible; mandible with equal teeth or lower tooth slightly shorter. Mesoscutum polished or weakly mat, its punctures closely placed. Notaulus moderately strong, ending behind the center of mesoscutum. Propodeal spiracle subcircular to 2.0x as long as wide, apical carina (Fig. 1 c) with sublateral crest-like apophyses. Base of hind coxa with a short, shallow, oblique groove below its attachment. Wing venation in figure 1, a, b, the ramulus sometimes vestigial or absent. First tergite moderately stout, at base with lateral flange like teeth, its spiracles near apical 0.42; median dorsal carinae distinct in female, indistinct in male, ending between base

and middle of postpetiole, dorso-lateral carinae moderately strong to obolescent, ventro-lateral carinae distinct. Second tergite mat with small punctures, hairs short and rather dense. Ovipositor sheath 0.8 to 1.5x as long as hind tibia, ovipositor weakly compressed, its tip elongate-sagittate with a distinct nodus.

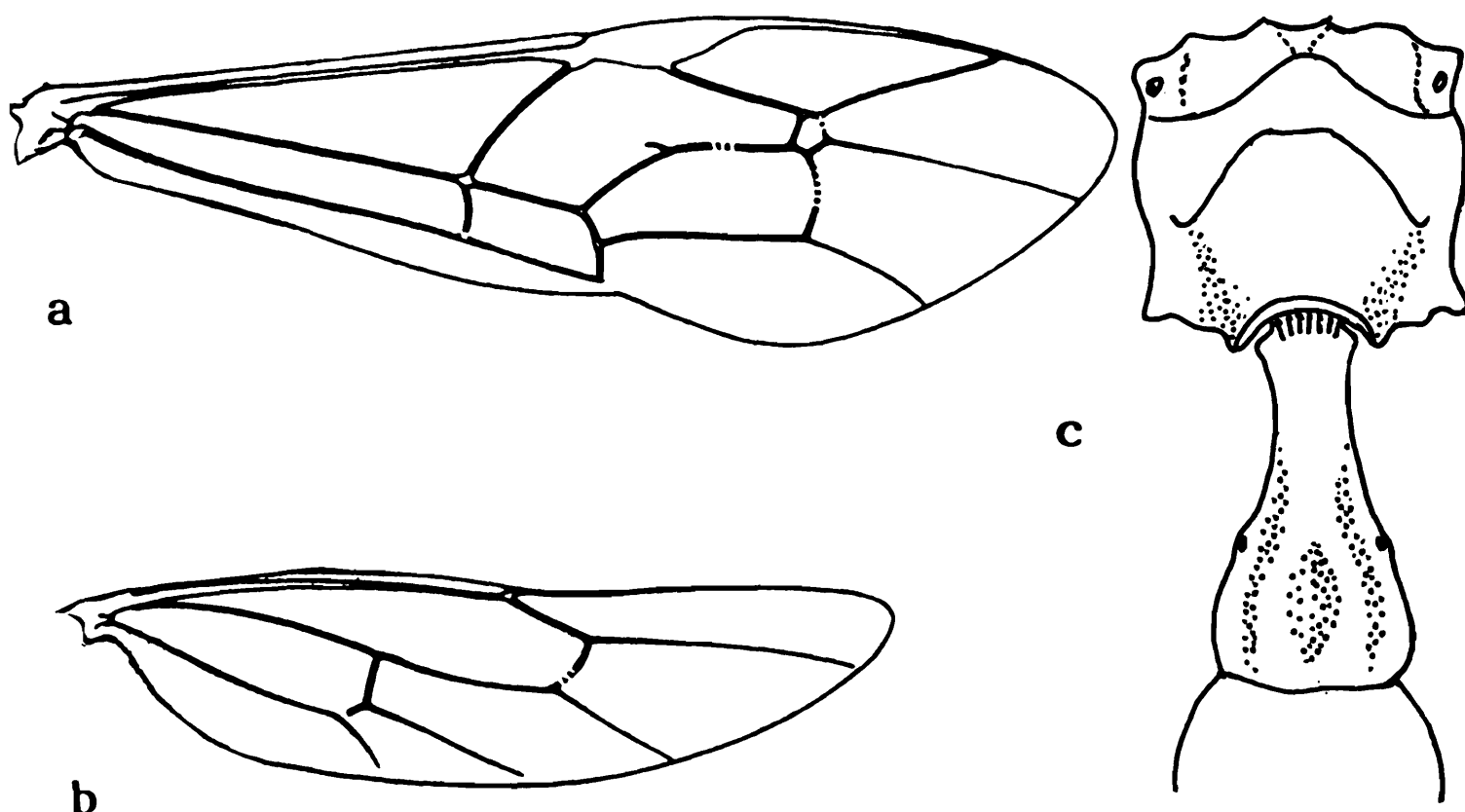


Fig. 1. *Nippocryptus* Uchida a, b, fore and hind wings showing venation; c, dorsal view of propodeum and first tergite.

Length Female 7.2-12.8 mm. Fore wing 6-9.5 mm. Ovipositor sheath 2.5-3.75 mm.

Type species *Hemiteles suzukii* Matsumura.

Nippocryptus Uchida is close to *Caenocryptus* Thomson by the absence of lateral tooth at the base of First tergite; subapical 0.6 of mediella vein weakly arched; propodeal spiracle rounded or short illiptic. However, it is easily distinguished from *Caenocryptus* by having clypeus moderately convex (not subpyramidal) in profile; ovipositor tip elongate-sagittate and apical margin of clypeus with a median short tooth, lobe, or obtuse angulation.

Key to the species of *Nippocryptus*

- 1 Body almost entirely black (except second to fourth hind tarsal segments, whitish). Fore wing with a broad dark brown transverse band.....1 *vittatorious* Jurine
- Body black and variously marked with yellow. Fore wing without a dark brown transverse band, except in *N. himalayensis*, sp. nov. with a light transverse band..2

2. Frons medially strongly rugose or wrinkled. Clypeus yellow; abdominal tergites black with narrow to moderately broad apical bands (number of bands varies). Antennal flagellum with a whitish band 3
- Frons medially strongly mat, with setiferous punctures or rugulose. Clypeus black, abdominal tergites largely black or reddish without distinct bands. Antennal flagellum with or without a band 4
3. Frons with a median longitudinal carina. Basal carina of propodeum moderately arched. Mesopleurum with an elongate mark just above sternaulus, speculum, lateral lobes of mesoscutum near the base of fore wing with small longish and median lobe with a large oval mark ; metascutellum, propodeum along apical carina, an elongate mark on metapleurum above, yellow. first tergite at base black. Hind tibia without a basal band. Ovipositor tip long 2. *missippus* (Cameron)
- Frons without a median longitudinal carina. Basal carina of propodeum acutely bent, mesopleurum, metapleurum and propodeum black. First tergite at base broadly, yellow. Hind tibia with a basal yellow band. Ovipositor tip short 3. *himalayensis*, sp. nov.
4. Propodeal spiracle oval. Speculum on mesopleurum smooth and polished. Basal carina of propodeum strongly arched in the middle. Scutellum shiny, sparsely, minutely and weakly punctate. Antennal flagellum with a whitish band. Metascutellum and scutellum yellow. Metapleurum with an oval mark at the base above. Hind tarsus reddish 4. *rufofemoratus*, sp. nov.
- Propodeal spiracle circular. Speculum on mesopleurum densely punctate. Basal carina of propodeum weakly arched in the middle. Scutellum mat minutely and densely punctate. Metascutellum and metapleurum, black. Hind tarsus largely whitish. Antennal flagellum without a band 5. *granulosus*, sp. nov.

1. *Nippocryptus vittatorius* Jurine

1807. *Ichneumon vittatorius* Jurine, *Nouvelle methode de classer les hymenopteres et les dipteres*, p. 107. F. Type : F, Europe (Geneva).
1912. *Hemiteles suzukii* Matsumura, *Thousand insects of Japan*, suppl., 4 : 131. F. des., fig. Type: F, Japan : Kyoto (Sapporo).
1936. *Nippocryptus suzukii* Uchida, *Insecta matsumurana*, 11 : 3. M, F. des. of M, figs. Japan.

This is a distinct species having body almost black, except second to fourth hind tarsal segments whitish. Fore wing with a broad dark brown transverse band (Fig. 2, a).

Female : Face largely mat, with shallow setiferous punctures, median raised area weakly rugose. Clypeus subpolished, with coarse shallow punctures, towards the apex smooth.

Mandible shallowly punctate with striations in between the punctures. Malarspace granulose, 1.0x the basal width of mandible. Frons mat, dull, weakly rugoso-punctate. Vertex mat, with setiferous punctures. Temple with small, weak and closely placed punctures. Pronotum subpolished, in the middle striato-wrinkled, its collar and upper area with small, dense punctures, punctures forming fine rugosities, epomia long and strong. Mesoscutum mat, densely punctate. Scutellum mat and subpolished with moderate sized, not so close punctures, lateral carina extending at its basal 0.3. Metascutellum smooth and shiny. Mesopleurum moderately strongly rugoso-wrinkled, its central area in front of speculum with coarse closely placed punctures, the punctures running into striations; speculum smooth and shiny except its posterior area punctate, subtegular ridge finely punctate. Mesosternum with small closely placed punctures, prepectal carina extending 0.8x the height of mesopleurum. Metapleurum finely wrinkled, along the pleural carina closely punctate. Propodeum as a whole finely rugoso-wrinkled, apical carina strong, arched, laterally forming crest-like apophyses. First tergite mat and dull, post-petiole laterally near the spiracles with small and dense punctures. Ramulus in the fore wing present. Nervulus slightly basad of basal vein, inclivous. Nervellus intercepted at its lower 0.25.

Black. 5th to 7th flagellar segments white above; temple with a narrow yellow line along the eye margin, hind tarsus with second to fourth segments whitish; fore wing clear hyaline with a broad dark brown band in the subapical region.

Male. Not available for study.

Length Female, 11.5 mm. Forewing 8 mm. Ovipositor sheath 3.75 mm.

Specimen examined : 1 Female, W. JAPAN : no other data, det. as *Nippocryptus suzukii* Matsumura by Uchida and Momoi (Gupta Colln.).

Distribution : Japan. In literature Europe.

2. *Nippocryptus misippus* (Cameron)

1904. *Mesostenus misippus* Cameron, *Trans. Ent. Soc. London*, 1904 : 114. F, des. Type : F, India : Khasi Hills, Meghalaya (formerly Assam) (Oxford).

1907. *Ischnus misippus* : Townes, Townes & Gupta, *Mem. Amer. Ent. Soc.*, 1 : 163.

1970. *Nippocryptus misippus* : Townes, *Mem. Amer. Ent. Soc.*, 12 : 191.

This species is close to *N. himalayensis*, sp. nov. in having frons medially strongly rugose or wrinkled, clypeus yellow, abdominal tergites with narrow to broad apical bands. This species is recognized by having a median longitudinal carina on frons. Mesopleurum with an elongated mark, speculum, lateral lobes of mesoscutum with longish marks and its median lobe with an oval mark, yellow. First tergite black at base and hind tibia without a basal band.

Female : Face subpolished, with small, sparse punctures, punctures at sides weak. Clypeus subpolished, sparsely and shallowly punctate. Mandible weakly striato-punctate. Malarspace

granulose, 0.75x the basal width of mandible. Frons subpolished, moderately strongly transversely rugose in the middle, near the median ocellus rugoso-punctate, at sides mat and shallowly punctate, median longitudinal carina weakly present. Vertex mat with close setiferous punctures. Temple shiny, with small closely placed punctures. Pronotum subpolished, largely trans-wrinkled, its upper margin with moderate sized deep and close punctures, punctures running into striations. Pronotal collar minutely and sparsely punctate. Scutellum with small, close and shallow punctures, lateral carina extending at its basal 0.2. Metascutellum shiny with minute scattered punctures. Mesopleurum largely rugose, speculum smooth and shiny except posteriorly punctate, mesosternum with small dense punctures, prepectal carina extending almost up to the base of subtegular ridge, subtegular ridge minutely punctate. Metapleurum moderately strongly rugoso-wrinkled, juxtacoxal carina not defined. Propodeum between basal carina and apex moderately strongly wrinkled, basad of basal carina reticulo-punctate, apical carina strongly arched, carina in the middle transverse, basal carina moderately arched (Fig. 2, e). First abdominal tergite mat, postpetiole laterally with small setiferous punctures. Ramulus absent, nervulus basad of basal vein, vertical. Nervellus intercepted at its lower 0.25. Ovipositor tip long (Fig. 2, f).

Black. Apex of 5th to 11th flagellar segments white above. The following are yellow Scape in front, face with a triangular mark above, clypeus, except at the apex, orbital mark all along the eye margin (Fig. 2, b), pronotal collar, upper margin of pronotum, an oval mark at the apex of middle lobe of mesoscutum, a small mark each on lateral lobes near to tegula, scutellum, metascutellum, subtegular ridge, speculum, an elongate transverse mark along the sternaulus, a narrow elongate mark on metapleurum above, apical carina of propodeum (Fig. 2, c), apices of all the abdominal tergites. Legs in general reddish-brown, except fore and middle coxae and trochanters yellow with black markings, their tarsi brown. Hind coxa (Fig. 2, d) black with an oval mark above and an oval mark apico-ventrally, yellow; first trochanteral segment black, tarsus white except its basal 0.4 of first segment and fifth segment wholly dark brown. Wings clear hyaline.

Male : Essentially similar to female in colour and body structure, except body slender and polished. Face densely and shallowly punctate. Frons finely rugoso-wrinkle with a few scattered punctures. Vertex mat and subpolished. Temple shiny, minutely and sparsely punctate. Pronotum striate in the middle, its upper and lower regions with moderate sized punctures. Mesopleurum rugoso-punctate in the middle, striato-punctate above. Mesosternum closely punctate, speculum smooth and shiny except for a few punctures above. Metapleurum weakly rugose. Propodeum between apical carina and apex largely rugoso-wrinkled, basad of basal carina mat with shallow close punctures, apical carina represented by knob-like apophyses. First tergite largely smooth. Ramulus present as a small stump; rest as in the female.

Black. Antennal flagellum entirely black. The following are yellow : Scape in front, face, clypeus, malarspace, mandible, except the teeth, temple, frons and vertex along the eye margin, pronotum except the middle strip, middle lobe of mesoscutum with an oval mark,

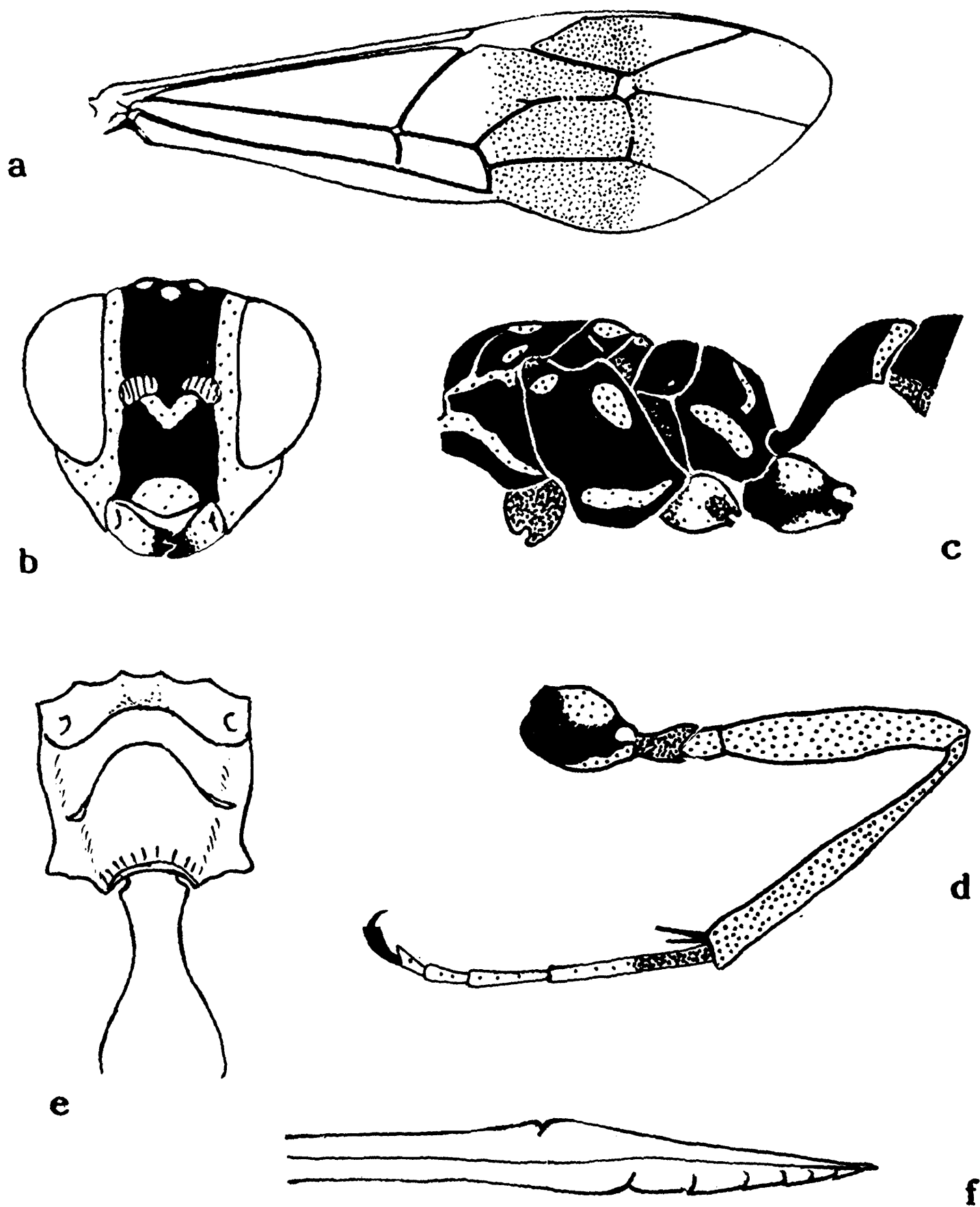


Fig. 2. *Nippocryptus vittatorius* Jurine : a, fore wing showing dark brown band. *Nippocryptus misippus* (Cameron) : colour pattern : b, front view of head; c, side view of thorax; d, hind leg; e, dorsal view of propodeum and first tergite; f, ovipositor tip.

lateral lobes with a small mark each, scutellum, metascutellum faintly, tegula, subtegular ridge, speculum, mesopleurum with a broad extensive irregular mark, metapleurum above, propodeal apophyses and median portion of apical carina, apices of all the tergites, fore and middle coxae and trochanters, yellow, their femora and tibiae yellowish-brown, tarsi dark brown. Hind coxa black with an oval mark above and below, yellow; trochanters black, femur and tibia brown, femur above and tibia at apex dark brown or blackish, tarsus white, except its first segment and claws blackish. Wings clear hyaline.

Length : Female, 10 mm. Fore wing 9 mm. Ovipositor sheath 3.5 mm. Male, 9.5 mm. Fore wing 7 mm.

Specimens examined : 5 Females, 13 Males. INDIA : MEGHALYA : (formerly Assam) : Cherrapunji, 1273 m, 1 F (homotype of *Mesostenus misippus* Cameron), 6.iv. 1966, D. T. Tikar, No. T 172; 4:F, same loc. as above, 3-7. iv. 1966, Colls. J. K. Jonathan & D. T. Tikar, Nos. J 121-125, T 127. WEST BENGAL : Darjeeling Dist. Rangiroon, 1790 m, 13 M, 25-27. v. 1966, Colls. J. K. Jonathan, M. K. Kamath, V K. Gupta, Tek Chand, Nos. J158, K118 & 196-188 (Z.S.I., Calcutta).

Distribution : India : Meghalaya (formerly part of Assam), West Bengal.

3. *Nippocryptus himalayensis*, sp. nov.

This species is close to *N. misippus* (Cameron), but can be distinguished by having first tergite broadly, yellow. Hind tibia with a basal yellow band. Frons without a median longitudinal carina and basal carina of propodeum acutely bent in the middle.

Female : Face subpolished, minutely punctate. Clypeus subpolished its basal half with small, sparse punctures. Mandible with minute sparse punctures. Malarspace granulose, 0.75x the basal width of mandible. Frons shallow, moderately strongly wrinkled in the middle at sides closely puncto-rugose; ocellar triangle with small sized punctures. Vertex mat with fine setiferous punctures. Temple subpolished, with small closely placed punctures. Pronotum largely finely wrinkled, wrinkles in the scrobe coarse, extreme upper margin rugulose, epomia moderately long and strong. Scutellum mat and subpolished, with small closely placed punctures, its lateral carina confined to its base. Metascutellum smooth and shiny. Mesopleurum subpolished, moderately strongly rugose, area below subtegular ridge, area above sternaulus in front and mesosternum with small sized moderately deep and closely placed punctures, speculum posteriorly with deep punctures, anteriorly smooth and shiny, prepectal carina extending 0.8 the height of mesopleurum. Metapleurum moderately strongly rugose, juxtacoxal carina present. Propodeum (Fig. 3, d) between basal carina and apex rugoso-wrinkled, basad of basal carina rugoso-punctate, basal carina in the middle acutely bent, apical carina evenly arched, laterally forming moderately strong apophyses. First abdominal tergite strongly mat, at base, smooth, postpetiole in the middle with sparse setiferous punctures, at sides small sized dense punctures. Ramulus in the fore wing present.

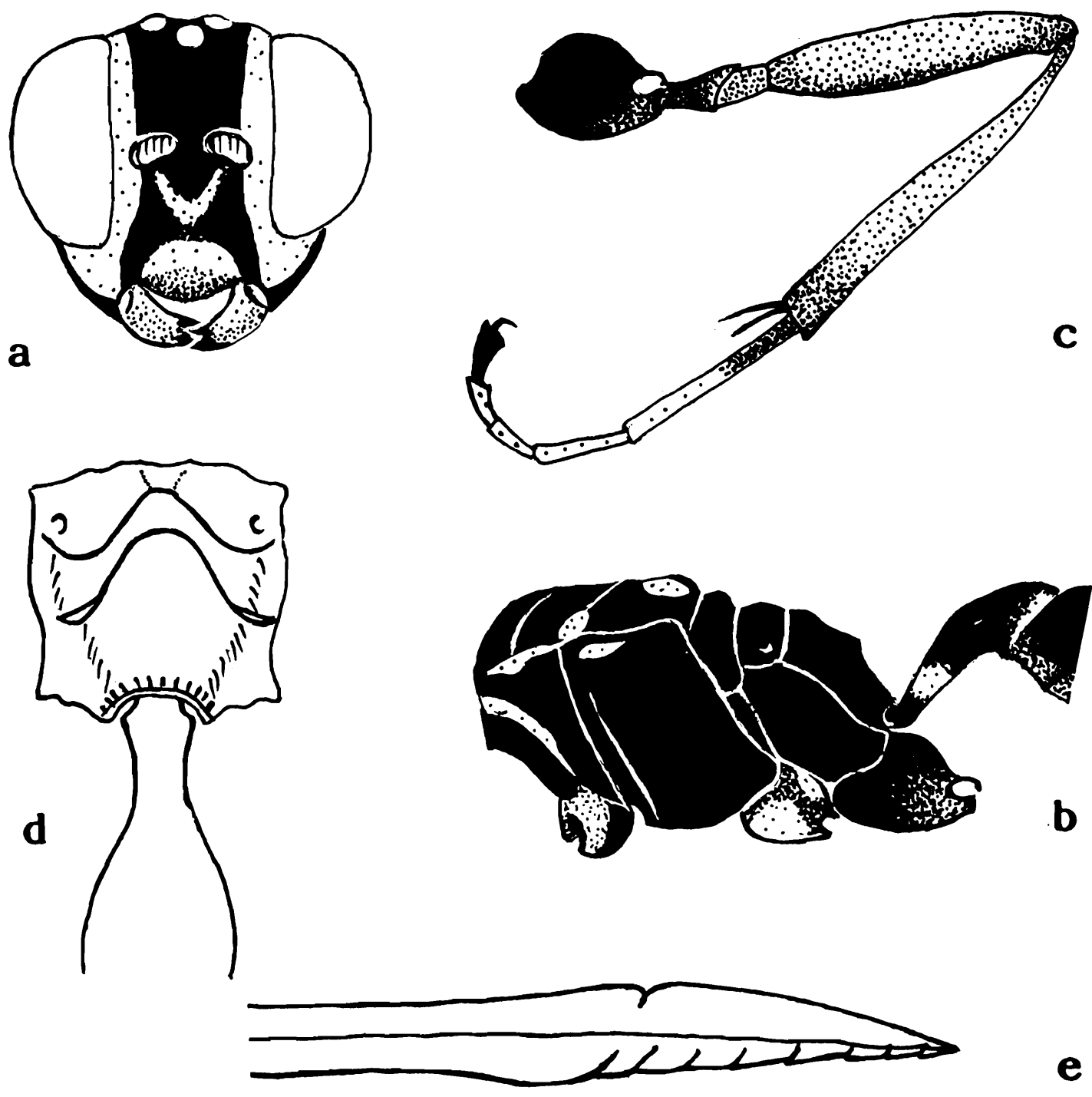


Fig. 3. *Nippocryptus himalayensis* : colour pattern : a, front view of head; b, side view of thorax; c, hind leg; d, dorsal view of propodeum and first tergite; e, ovipositor tip.

Nervulus basad of basal vein, slightly inclivous. Nervellus intercepted at its lower 0.2. Ovipositor tip as in figure 3, e.

Black. Apex of 4th to 9th flagellar segment white above. The following are yellow : Face in the middle, clypeus, orbital mark all along the eye margin (fig. 3, a), pronotal collar, upper margin of pronotum, tegula, scutellum, subtegular ridge (fig. 3, b), first tergite broadly at base and apices of first to seventh tergites narrowly (except sometimes bands on 4th-7th tergites not defined). Fore and middle coxae and trochanters yellow, with blackish markings. Hind coxa entirely black, its trochanter largely blackish-brown. All the femora reddish, tibiae reddish-brown, clouded with brown, hind tibia with a basal yellow band. Fore and middle tarsi brown to dark brown. Hind tarsus whitish, except basal 0.5 of its first segment and fifth segment wholly blackish-brown (fig. 3, c). Wings clear hyaline, except for a light brown transverse band in the middle.

Male : Body polished and slender. Face minutely and densely punctate. Clypeus with small and weak punctures, at apex smooth and shiny. Frons with moderate sized and closely placed punctures, punctures running into oblique striations, near antennal scrobes smooth and shiny; near eye margin mat, with a few weak punctures. Pronotum largely rugoso-wrinkled, punctate above, collar with sparse punctures. Scutellum and metascutellum shallowly punctate. Mesopleurum and mesosternum with moderate sized, deep and closely placed punctures, area below subtegular ridge rugoso-punctate, speculum in the middle smooth and polished. Metapleurum finely rugoso-punctate. Propodeum rugoso-wrinkled, basad of basal carina weakly punctate. First abdominal tergite smooth, postpetiole mat and shallowly punctate; rest as in female.

Black. The following are yellow : Scape, face clypeus, mandible, except the teeth, frons, vertex and temple along the eye margin, pronotal collar, upper margin of pronotum, tegula, scutellum, subtegular ridge, a mark near the base of hind wing, two lateral marks on propodeum, marks united in front by a narrow line, basal half of first tergite, apices of first to seventh tergites narrowly. Fore leg yellow except for a narrow line above on femur and tibia, and tarsus almost wholly, brown. Middle leg with coxa, trochanter and inner side of femur yellow; femur on the outer side yellowish-brown, tibia brownish-yellow with a basal yellow band. Hind leg with coxa and trochanter black, except coxa narrowly at apex and its second trochanteral segment largely yellow, femur chocolate-brown, its apical 0.4 blackish, tibia dark brown with a basal yellow band; tarsus white, except basal 0.25 of its first segment and claws blackish. Wings clear hyaline.

Length Female, 10-12.8 mm. Fore wing 8-9.5 mm. Ovipositor sheath 3.25-3.75 mm. Male, 10 mm. Fore wing 6 mm.

Holotype Female, INDIA : HIMACHAL PRADESH : Manali, 1828 m, 18. v. 1970, D. Ram, No. K214. *Allotype* Male, same data as holotype, 19. v. 1970, M. K. Kamath, No.

K216. *Paratype* 1 Female, same data as holotype, 29.v.1970, M. K. Kamath, No. K251 (Z. S. I., Calcutta).

Distribution : India : Himachal Pradesh.

4. *Nippocryptus rufofemoratus*, sp. nov.

This species is close to *N. granulosus*, sp. nov. by having body strongly mat (granulated) and abdomen largely reddish. This species can be recognised by having propodeal spiracle oval, speculum smooth, antennal flagellum with a white band, metascutellum yellow, metapleurum with an oval mark and hind tarsus and abdomen reddish.

Female : Face subpolished, strongly granulated, with fine shallow dense punctures. Clypeus shiny with moderate sized, deep and sparse punctures. Malarspace granulate, 1.0x as long as basal width of mandible. Mandible shiny, striato-punctate. Frons strongly mat and rugulose, with fine shallow punctures at sides, antennal scrobes shiny with a few trans-striations, median longitudinal groove wide and shallow without carina. Vertex mat with minute, dense, shallow punctures. Temple shiny, minutely and sparsely punctate. Scutellum shiny with minute moderately spaced punctures, lateral carina confined to its base. Metascutellum shiny, minutely punctate. Mesopleurum subpolished, with small dense coalescent punctures, appear to be rugoso-punctate, speculum smooth and polished, subtegular ridge minutely and sparsely punctate, prepectal carina extending about 0.8x the height of mesopleurum. Metapleurum strongly rugoso-wrinkled, with coarse deep punctures above, juxtacoxal carina absent. Propodeum between basal carina and apex subpolished, mat and finely wrinkled, area between the transverse carinae at sides with coarse moderately deep punctures, basal of basal carina coarsely punctate, apical carina broadly obsolete in the middle, laterally forming strong apophyses, basal carina strongly arched in the middle propodeal spiracle oval; first to third tergites granulate with fine dense setiferous punctures. Ovipositor sheath long about 1.6x as long as hind tibia.

Black. 5th to 9th flagellar segments white above. The following are yellow : Face with a mark above, orbits (fig. 4, a) all along the eye margin, pronotal collar, upper margin of pronotum, a mark at the apex of middle lobe of mesoscutum, a large oval mark on scutellum, metascutellum, subtegular ridge, a small oval mark at the basal upper corner of metapleurum. Basal 0.66 of first tergite (fig. 4, b) black, its apical 0.33 and following all the tergites deep red. Legs (fig. 4, c) in general reddish, except all the coxae and trochanters black, and coxae broadly marked with yellow. Wings clear hyaline with yellowish hue.

Male : Unknown.

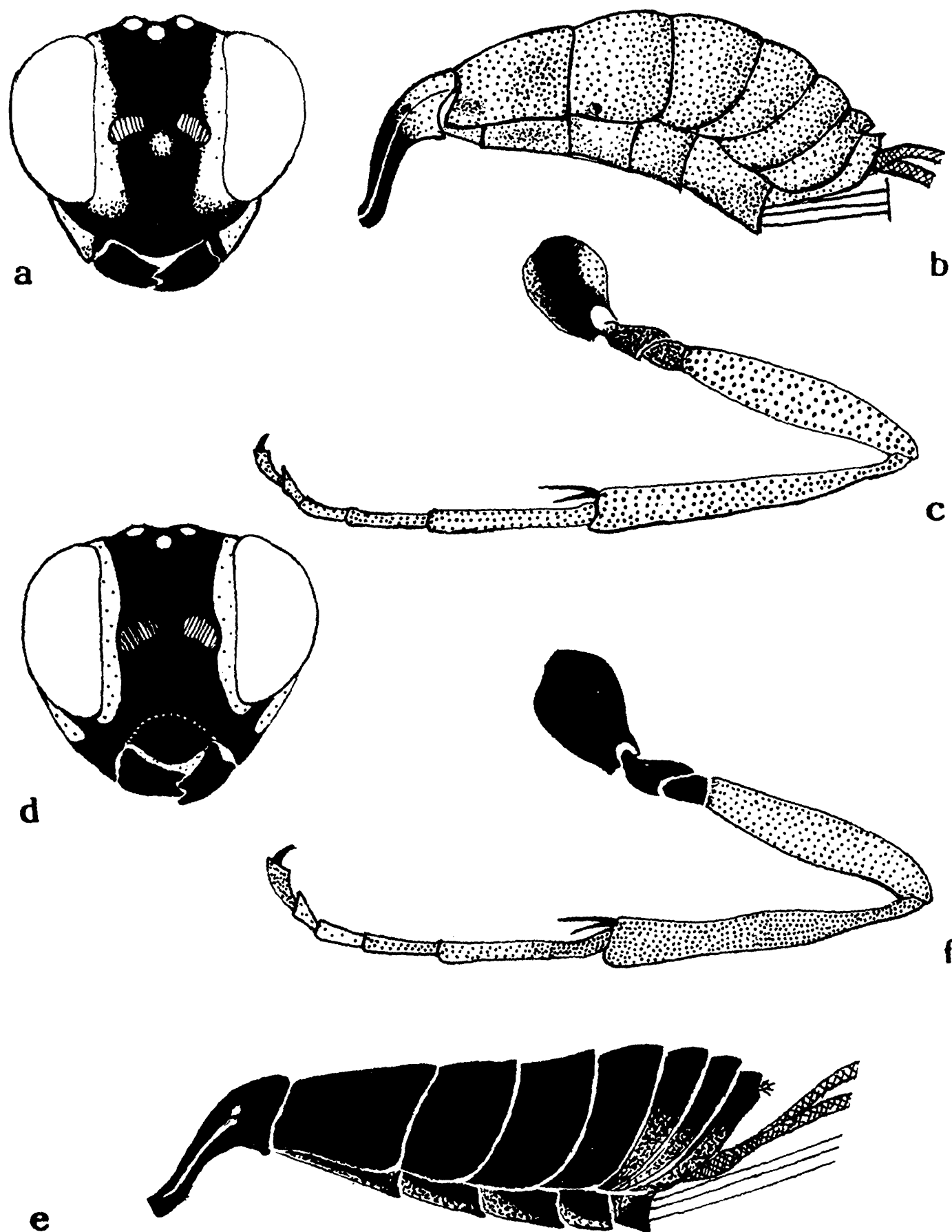


Fig. 4. *Nippocryptus rufofemoratus* : colour pattern : a, front view of head; b, side view of abdomen; c, hind leg. *Nippocryptus granulatus* : colour pattern : d, front view of head; e, side view of abdomen; f, hind leg.

Length Female 9.75 mm. Fore wing 7.2. Ovipositor sheath 3.75 mm.

Holotype Female, INDIA HIMACHAL PRADESH, Kulu, 22.ii.1967, CIBC (Z.S.I., Calcutta).

Distribution : India : Himachal Pradesh.

5. *Nippocryptus granulosus*, sp. nov.

This species is allied to *N. rufofemoratus*, sp. nov., but can be recognised by having propodeal spiracle circular, antennal flagellum without a band, hind tarsus whitish and metascutellum and metapleurum entirely, black.

Female : Body largely dull and strongly granulated. Face minutely and densely punctate, at sides granulate. Clypeus subpolished, with small sized close punctures, apical 0.2 smooth and shiny. Frons in antennal scorbes coarsely trans-striate, above strongly granulated with fine, dense, setiferous punctures, and also with fine median longitudinal carina. Vertex largely granulated, behind with dense, shallow, small punctures. Temple subpolished, with minute sparse, indistinct punctures. Mandibles rough with coarse punctures. Malarspace granulose, 0.8x the basal width of mandible. Pronotum largely rugoso-wrinkled, in the middle tending to be trans-wrinkled, above finely closely trans-rugose with weak scattered punctures in between the regulae, epomia moderately strong and long, collar finely rugose. Mesoscutum mat and subpolished, with minute close punctures. Scutellum mat with minute, close punctures, its lateral carina extending to its basal 0.33. Metascutellum with minute, weak and sparse punctures. Mesopleurum largely moderately strongly rugose, at some places finely striato-rugose, sternaulus with short ridges, below sternaulus minutely and sparsely punctate with fine transverse regulae, speculum densely punctate, prepectal carina extending almost up to the base of subtegular ridge, subtegular ridge carinated, subpolished sparsely and minutely punctate. Metapleurum moderately strongly rugose, in large specimens transversely rugose, juxtacoxal carina not well defined. Propodeum between basal carina and apex wrinkled, basal of basal carina very finely wrinkled with shallow punctures, spiracle circular, both the transverse carina strong, bent upward and straight in the middle. First to third tergites mat with fine and dense punctures, following tergites mat. Fore wing with areolet pentagonal, about 1.0x as high as the portion of second recurrent vein above bulla. Nervellus intercepted at its 0.26, ramulus in fore wing absent. Ovipositor sheath about 1.0x as long as hind tibia.

Black. Apical antennal segments with reddish-brown hue. The following are yellow or dirty yellow : Face, frons and vertex behind narrowly, temple below along the eye margin (Fig. 4, d), upper margin of pronotum narrowly, upper corner of pronotal collar (sometimes collar wholly,) a small oval mark on scutellum (sometimes mark absent), subtegular ridge. Apex of abdomen (ventrally) reddish-brown (Fig. 4, e). Legs in general reddish-brown, except all the coxae and trochanters, fore femur broadly on outer side, tibia with line a above

black; all the tibiae and fore and middle tarsi brown, hind tarsus whitish, except its first segment largely and fifth segment apically reddish-brown (Fig. 4, f). Wings clear hyaline (colour variable).

Male Unknown.

Length Female, 7.2-9.5 mm. Fore wing 6-8 mm. Ovipositor sheath 2.25-3 mm.

Holotype Female, INDIA : HIMACHAL PRADESH Manali, 1828 m, 27. v. 1970, coll. D. Ram, No. K246. *Paratypes* 9 Females. Same locality and data as holotype, 7 F, 14-28. v. 1970, Colls. M. K. Kamath, D. Ram, A. K. Gulati, Nos. K197, K216, K217, K225, K239, K245, & K249. UTTAR PRADESH Nainital, 2 F, 10-12. x 1978, V K. Gupta, No. A27 & A30 (all in Z. S. I., Calcutta & 1 F, No. 217 in AEI, Florida).

Distribution : India : Himachal Pradesh and Uttar Pradesh.

SUMMARY

This paper deals with three new species of *Nippocryptus* Uchida, viz., *N. himalayensis*, *N. rufofemoratus*, and *N. granulatus* from India. A redescription of *N. misippus* (Cameron) has been given. *N. vittatorius* (Jurine) = [*N. suzukii* (Matsumura)] from Japan is also included in the text for comparison with the Indian species.

A key to all the species has been provided.

ACKNOWLEDGEMENT

This study would not have been possible without the encouragement and guidance of Prof. (Dr.) V K. Gupta, Department of Entomology, University of Florida, U. S. A. I am thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India for providing all the necessary facilities to carry out this research work.

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ON SOME COLLECTIONS OF THYSANURA FROM EAST AND NORTH EAST INDIA

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The study of Indian fauna of Thysanura has been neglected except some stray works by Escherich (1903), Silvestri (1913, 1938, 1948), Wygodzinsky (1954) and Hazra (1980). Mendes (1990) pointed out : "The quite poorly known Indian fauna of thysanurans is for the reason that these insects are not found frequently due to their concealing habit. Special efforts are needed for their collection." The present study is based on a small collection of about 150 examples present in the National Collection of Zoological Survey of India from the eastern and North-eastern parts of India. This report however reflects only part of the knowledge that we have on this group of insects from these areas. Thus there remains ample scope for further exploration of more taxa from these regions in future. Ten species under six genera were recorded so far from the states of North-eastern India.

The present paper deals with thirteen species of Thysanura under two families and nine genera of which the genus *Silvestrella termitophila*, *Stylifera impudica* and *Ctenolepisma dubitalis* are being recorded for the first time from India. Further, *Ctenolepisma longicaudata*, not known earlier from Tripura, is being recorded for the first time from this state alongwith *Acrotelsa collaris*, *Ctenolepisma longicaudata* and *Ctenolepisma ciliata* from Bihar having no records of Thysanura so far. *Acrotelsa collaris*, *Stylifera wygodzinskyi* and *Ctenolepisma nigra* are also being recorded for the first time from the state of Orissa. *Stylifera impudica*, *Silvestrella termitophila*, *Thermobia domestica* and *Afrolepisma nigrina*, not known from West Bengal, are also being recorded for the first time in this investigation. Sikkim thysanuran fauna, known so far through one species viz., *Lepisma saccharina* (Wygodzinsky, 1954), is being enriched through records of two more species viz., *Ctenolepisma longicaudata* and *Ctenolepisma ciliata*. Two more species of Thysanura namely *Ctenolepisma ciliata* and *Ctenolepisma dubitalis* are being recorded for the first time from Manipur, earlier record being only one species, viz., *Ctenolepisma longicaudata* from the state (Wygodzinsky, 1954).

The present contribution attempts to record various species of Thysanura from the states of east and north east India and descriptions of the species have already been given by Escherich (1905), Silvestri (1913), Wygodzinsky (1972) and Hazra (1993).

SYSTEMATIC ACCOUNT

Order THYSANURA

Sub order ZYGENTOMA

Super Family LEPISMATOIDEA

Key to the families

- 1 Eyes and ocelli absent.....*Nicoletiidae*
 Eyes present 2
 2. Ocelli present, scales absent*Lepidotrichidae*
 Ocelli absent, scales present*Lepismatidae*

Family : LEPISMATIDAE

Genus *Ctenolepisma* Escherich, 1905*Ctenolepisma longicaudata* Escherich, 19051905. *Ctenolepisma longicaudata* Escherich. *Zoologica (Stuttgart)*, **43** : 83.1940. *Ctenolepisma urbana*, Slabaugh, *Ent. News.*, **51** : 95 (*sensu*, Wygodzinsky, 1972).

Material examined : 1 ♂, INDIA West Bengal, Indian Museum compound, Calcutta, 10.1.1912. Coll. Anonymous; 1 ♂, Indian Museum, Calcutta, 23.xii.1947, Coll. Anonymous; 1 ♂, 1 ♀, Darjeeling, Birch Hill, 22.viii.1978. Coll. B. K. Mondal , 5 ♂♂, 2 ♀♀, Darjeeling, 4.v.1975. Coll. B. K. Biswas; 2 ♀♀, Z.S.I., West Bengal Survey, Murshidabad, Stn. 2. (from Mango tree bark), 4.xi.1974. Coll. A. K. Hazra; 1 ♂, Indian Museum compound, Calcutta, 3.i.1972. Coll. R. L. Chowdhury; 1 ♀, Birch Hill, Darjeeling, from old papers and stored atta, 20.ix.1975. Coll. B. K. Biswas, 1 ♀ from the wall of Jabakusum House, Calcutta, 9.i.1974, Coll. P. H. Roy, 2 ♂♂, 2 ♀♀ Manipur Z.S.I. Manipur Survey, 1992, Stn.-7 Circuit House, Churachandpur, 2.iv.1992 (at night) Coll. A. K. Hazra, 10 ♀♀, Z.S.I. Manipur Survey, 1992, Churachandpur (at night). 3.iv.1992, Coll. A. K. Hazra : 1 ♀, Z.S.I. Manipur Survey, Loc. Churachandpur Circuit House, 1.iv.1992, (at night) Coll. A. K. Hazra; 3 ♀♀ (Z.S.I. Reg. No. 50/69) Bihar Z.S.I. Chotanagpur Survey, Kamarhati, 3 km. south of Chaibasa Railway Station, Stn. No. 28; Field Coll. No. 3., Coll. Rajtilak; 1 ♀ (Z.S.I. Lot No. 99/71) TRIPURA Z.S.I. Tripura Survey, loc. Teliamura, 2.ii.1971. Coll. V C. Agrawal; 1 ♀, SIKKIM : Z.S.I. Sikkim Survey, 1995, Stn. No. 12. Rabun, 16.x.1995. Coll. S. K. Mitra; 2 ♀♀ (Z.S.I. Lot No. 93/88) Z.S.I. Sikkim Survey, Tumba, Alt. 1475 m. East Sikkim, Coll. V C. Agarwal.

Distribution : INDIA : West Bengal, Uttar Pradesh, Sikkim, Bihar, Tripura, Manipur.*Remarks* : The species is recorded for the first time from the states of Tripura, Bihar and Sikkim.

Ctenolepisma ciliata (Dufour, 1831)

1831. *Lepisma ciliata* Dufour. *Ann. Sci. Nat.*, **22** : 420.

1890. *Lepisma ciliata* : Grassi et Rovelli, *Nat. Sci.*, **9** : 80.

1905. *Ctenolepisma ciliata*, Escherich, *Zoologica* (Stuttgart) **83** : 80.

Material examined : 2 ♀♀, INDIA : West Bengal, Bhatapur, Dhraka river, dist. Bankura, 20.xi.1974, Coll. A. K. Hazra. 1 ♀ (Juvenile), 1 ♀, Z.S.I. West Bengal Survey, District. Birbhum, Station-7. 10.xi.1974. Coll. A. K. Hazra; 3 ♀♀, West Bengal Survey, 1974. District Murshidabad, Hazarduari Campus, Station 2. (from mango tree bark), 4.xi.1974. Coll. A. K. Hazra, 1 ♂, Darjeeling Govt. College, District Darjeeling, 4.vii.1976, Coll. B. G. Kundu; 1 ♂, 1 ♀, Beldanga, District Murshidabad, 5.xi.1974 Coll. A. K. Hazra; 2 ♂♂, Ghatiali Hills, District Purulia Station-12, Alt. 800 ft. (from tick bark), 17.xi.1974 Coll. A. K. Hazra; 1 ♂, 1 ♀, Jabakusum House, Calcutta 26.viii.1976. Coll. D. C. Bhattacharya; 1 ♀, Kakdweep, South 24-Parganas, on the muddy road by the side of the river, 13.iii.1977. Coll. A. K. Sanyal, 2 ♂♂, Hazarduari, District Murshidabad. (from Mango tree bark) 4.xi.1974, Coll. A. K. Hazra; 1 ♀, Manipur Z.S.I. Manipur Survey 1992. Station-7, Loc. Churachandpur, Circuit House, 2.iv.1992. Coll. A. K. Hazra, 1 ♂, (Z.S.I. Lot No. 50/69) Bihar forest, 3 km. SE of chas, Bokaro Steel City, District Dhanbad. (from soil nest) Station No. 57, 20.xi.1968. Coll. Raj Tilak; 1 ♀ (Z.S.I. Lot No. 50/69) Bihar : Z.S.I., Chotanagpur Survey, Govindapur, 3 km. North West Chakulia Rly. Station, (from ant nest in a mango tree) Station No. 15. Field Coll No. 13, 29.x.1968 Coll. Raj Tilak; 1 ♂, Sikkim : Z.S.I. Sikkim Survey, 1995, Rabun. Station No. 12. 16.x.1995, Coll. S. K. Mitra; Z.S.I. Sikkim Survey, 1994. Mangan, F. C. No. 12/6 Stn.-2 (from wall of the Rest House) 2.iv.1994, Coll. P. H. Roy, 1 ♀, Chungtham, North Sikkim, Alt. 1500 m. 4.xi.1992, Coll M. S. Shishodia.

Distribution : INDIA : West Bengal, Delhi, Bihar, Sikkim, Manipur.

Remarks : This species is the first record from the states of Sikkim, Bihar and Manipur.

Ctenolepisma nigra (Oudemans, 1890)

1890. *Lepisma nigra* Oudemans In : *Weber zoolog.*, *Ergebnisse* **1** : 82.

1913. *Ctenolepisma nigra*, Silvestri, *Rec. Ind. Mus.*, **9** : 56-57.

Material examined : 1 ♀ (Z.S.I. Reg. No. 9942/18) INDIA West Bengal, Calcutta, 19.xii.1907. Coll. Mus. Collr. 5 ♂♂, 3 ♀♀, Orissa; Barkul District, Puri, (In Bunglow), ix.1912, Coll. F. H. Gravely.

Distribution : INDIA : West Bengal, Orissa.

Remarks : This species is recorded for the first time from the state of Orissa.

***Ctenolepisma dubitalis* Wygodzinsky, 1959**

1959. *Ctenolepisma dubitalis* Wygodzinsky : In Studies on the fauna of Curacao and other Caribbean Islands, **9**, No. 36 : 35.

Material examined : 1 ♀, INDIA Manipur, Z.S.I. Manipur Survey, 1992, Churachandpur, 3.iv.1992, Coll. A. K. Hazra.

Distribution : INDIA : Manipur.

Remarks : This species is recorded for the first time from India as well as from the state of Manipur.

Genus ***Acrotelsa* Escherich, 1905*****Acrotelsa collaris* (Fabricius, 1793)**

1793. *Leppisma collaris* Fabricius, *Ent. Syst.*, **2** : 64.

1913. *Acrotelsa collaris*, Silvestri, *Rec. Ind. Mus. Calcutta.*, **9** : 58.

Material examined : 1 ♂, INDIA : Orissa, Balugaon to Barkul, from the nest of stegodyphns sarisinorum Karsch, 1.viii.1914. Coll. F. H. Gravely; 2 ♀♀, (Z.S.I. Reg. No. 9939/13) West Bengal : Indian Museum, Calcutta, among old papers. 19.xi.1910. Coll. Imms; 1 ♂, (Z.S.I. Reg. No. 8050/13), Indian Museum, Calcutta, date not cited, Coll. Anonymous; 1 ♂, (Z.S.I. Reg. No. 948/13), Indian Museum, Calcutta, (from wall), 1.xi.1908. Coll. N. A. 2 ♂♂ (Z.S.I. Reg. No. Nil), Loc. Indian Museum, Calcutta, 6 ♂♂, 2 ♀♀, Indian Museum, Calcutta (in Insect room) 29.vi.1912. Coll. F. H. Gravely, 1 ♀, Orissa; Barkul, Date not cited, Coll. F. H. Gravely; 1 ♀, Bihar, Z.S.I. Chotonagpur Coalfield area Survey E.I.A. Programme, 1994. Oundings, District Bokaro, Ranchi. 11.vi.1994. Coll. A. K. Sanyal; S. Chatterjee; T. K. Pal; A. Karmakar; 2 ♂♂ (Z.S.I. Lot No. 50/69), Z.S.I. Chottanagpur Survey, Daltongunj. Stn. No. 23. T-214 27.ix.1966, Coll. Raj Tilak.

Distribution : West Bengal, Orissa, Bihar.

Remarks : This species is recorded for the first time from the states of Bihar and Orissa.

Genus ***Stylifera* Stech. 1932*****Stylifera wygodzinskyi* Hazra, 1980**

1980. *Stylifera wygodzinskyi* Hazra, *Bull. Zool. Surv. India.*, **2** (2 & 3) : 187-191.

Material examined : 6 ♂♂, 2 ♀♀, INDIA West Bengal, Cherichaforest, Suri, District Bhirbhum, under the bark of Saal tree. 2.xi.1974. Coll. A. K. Hazra; 5 ♂♂, 5 ♀♀, Bishnupur, District Bankura, Stn. 18 (Z.S.I. West Bengal Survey) from sall tree. 24.xi.1974. Coll. A. K. Hazra; 10 ♂♂, 9 ♀♀, Joypur forest, Bankura, Stn. 17, from Saal bark, 23.xi.1974. Coll.

Anonymous, 7 ♂♂, 11 ♀♀, gonpurforest, District Birbhum, Stn. 7. from bark of Saal tree 10.xi.1974. Coll. A. K. Hazra, 1 ♂, 3 ♀♀, Ghatiali Hills. Digba forest, District Purulia, Stn. 12 Teak bark, 17.xi.1974. Coll. A. K. Hazra, 15 ♂♂, 7 ♀♀ digba forest, Purulia, in Saal bark, Stn. 12 Alt. 800 ft. 17.xi.1974. Coll. A. K. Hazra, 2 ♂♂, 3 ♀♀, Beldanga, District, Murshidabad. Stn. No. 3, under the bark of mango tree. 5.xi.1974. Coll. A. K. Hazra; 1 ♂, Purulia, Matha Protected Hills Stn. 11, from streamside litter, 16.xi.1974. Coll. A. K. Hazra, 3 ♀♀, Bhatapur, side of Darakeswar river, Bankura, (from bark of mango tree), West Bengal Survey, 1974. Stn. No. 14, 20.xi.1974. Coll. A. K. Hazra; 1 ♂, Golapbag, District Murshidabad. Stn. 2 4.ii.1974. (from Mango tree bark) Coll. A. K. Hazra; 2 ♂♂, 1 ♀, Sushnia hills, Bankura, Stn. 15. Alt. 700 ft. (from bark of Segun), 21.xi.1974. Coll. A. K. Hazra; 1 ♂ Chandrapur forest, Sure, District, Birbhum (from bark of mango tree) 9.xi.1974. Coll. A. K. Hazra; 2 ♀♀ Berhampore, District. Murshidabad (under the bark of Mango tree) 3.ii.1974. Coll. A. K. Hazra, 1 ♂, Purulia West Bengal, Date not cited, Coll. Anonymous; 1 ♀, 1 ♂, (Z.S.I. Lot No. 97/72), Orissa, Z.S.I. Survey, Gopalpur, Keonjhar, 5.ii.1982. Coll. A. K. Sanyal.

Distribution : INDIA West Bengal, Orissa.

Remarks : This species is recorded for the first time from the states of Orissa.

Stylifera impudica (Escherich, 1905)

1905. *Acrotelsa impudica* Escherich, *Zoologica* (Stuttgart), **83** : 112.

1959. *Stylifera impudica*, Wygodzinsky, In : Studies on the Fauna of Curacao and other Caribbean Islands **9** : 28-49.

Material examined : 1 ♀, INDIA District. Murshidabad, Stn. 2, Z.S.I., West Bengal Survey, 4.xi.1974, Coll. A. K. Hazra.

Distribution : INDIA West Bengal.

Remarks : This speices is recorded for the first time from India.

Genus : *Thermobia* Bergroth 1890

Thermobia domestica (Packard), 1873

1873. *Lepisma domestica* Packard, *Rep. peabody Acad. Arts and Sc.*, **5** : 48.

1894. *Lepismodes furnorum*, Bergroth, *Ent. Monthly Mag.*, **5** (2) : 111.

1905. *Thermobia domestica*, Escherich, *Zoologica* (Stuttgart) **83** : 101.

Material examined : 1 ♀, (Z.S.I. Reg. No. 8048/18), label reads as 'INDIA : West Bengal, Indian Museum, Calcutta (in insect box) 22.v.1911. Coll. N.A.'

Distribution : INDIA : West Bengal, Tamil Nadu.

Remarks : This species is recorded for the first time from the state of West Bengal.

Genus : *Lepisma* Linnaeus 1758

Lepisma saccharina Linnaeus, 1758

1758. *Lepisma saccharina* Linnaeus, *Syst. Natur.*, (ed. 10) 1 : 806.

1984. *Lepisma saccharina*, Mendes, *Stuttgart Beiträge Naturk.*, A (372 : 9).

Material examined : 1 ♀, INDIA : Sikkim, (Z.S.I. Sikkim Survey 1994), Mangan (from Wall of the rest houses) F.C. No. R/6 Stn. No. 2, 2.iv.1994, Coll. P. H. Roy; 8 ♂♂, 4 ♀♀ (Z.S.I. Lot No. 93/88), Sikkim, Tumin, Alt. 1800 m. East, (from Books) 29.ix.1988. Coll. V C. Agrawal.

Distribution : INDIA Sikkim.

Genus : *Tricholepisma* Paclt., 1967

Tricholepisma gravelyi (Silvestri, 1913)

1913. *Lepisma gravelyi* Silvestri, *Rec. Ind. Mus.*, 9 : 53.

1967. *Lepisma* (*Tricholepisma*) *gravelyi*, Paclt, *Genera Insectorum*; 218 : 23.

1981. *Asterolepisma* (*Asterolepisma*) *gravelyi*, Mendes, *Rev. Zool. afr.* 95 : (1) : 200.

1988. *Tricholepisma gravelyi*, Mendes, *Boletim da Sociedade Portuguesa de Entomologia*, Supl. No. 2 : 39.

Material examined : 1 ♂, INDIA : Indian Museum Compound, Calcutta, from tree trunk with termites, date not cited, Donor : C. Paiva.

Distribution : INDIA : West Bengal (Calcutta).

Genus : *Afrolepisma* Mendes, 1981

Afrolepisma nigrina (Silvestri, 1913)

1913. *Lepisma nigrina* Silvestri, *Rec. Ind. Mus.*, 9 : 54.

1978. *Asterolepisma nigrina*, Mendes. *Proc. I. Intern. Semin. Apterygota* (Siena) : 92.

1988. *Afrolepisma nigrina*, Mendes, *Boletim do Sociedade Portuguesa de Entomologia*, Supl. No. 2 : 63.

Material examined : 1 ♀, INDIA : West Bengal, South 24-Parganas, Port Canning Stn.-1. 7.viii.1964. Coll. Anonymous.

Distribution : INDIA : West Bengal. Orissa.

Remarks : It is the first record of the speices from West Bengal.

Genus : *Silvestrella* Escherich, 1905

Silvestrella termitophila Escherich, 1905

1905. *Silvestrella termitophila* Escherich, *Das System der lepismatiden* (Stuttgart), **83** : 66.

1970. *Silvestrella termitophila*, Wygodzinsky, *Amer. Mus. Nat. Hist.*, **142** (3) : 253.

Material examined : 1 ♂, INDIA : Indian Museum Premises, Calcutta (within termite mound), 21.v.1914, coll. F. H. Gravely.

Distribution : INDIA : West Bengal.

Remarks : This genus and speices, originally described from South Africa (Escherich, 1905), is being recorded for the first time from India.

Family : NICOLETIIDAE

Genus *Atelura* Vonheyden, 1855

Atelura typhloponis Silvestri, 1913

1913. *Atelura typhloponis* Silvestri, *Rec. Ind. Mus.*, **9** : 50.

1993. *Atelura typhloponis*, Hazra, *Rec. zool. Surv. India*, Fauna West Beng., **4** : 7.

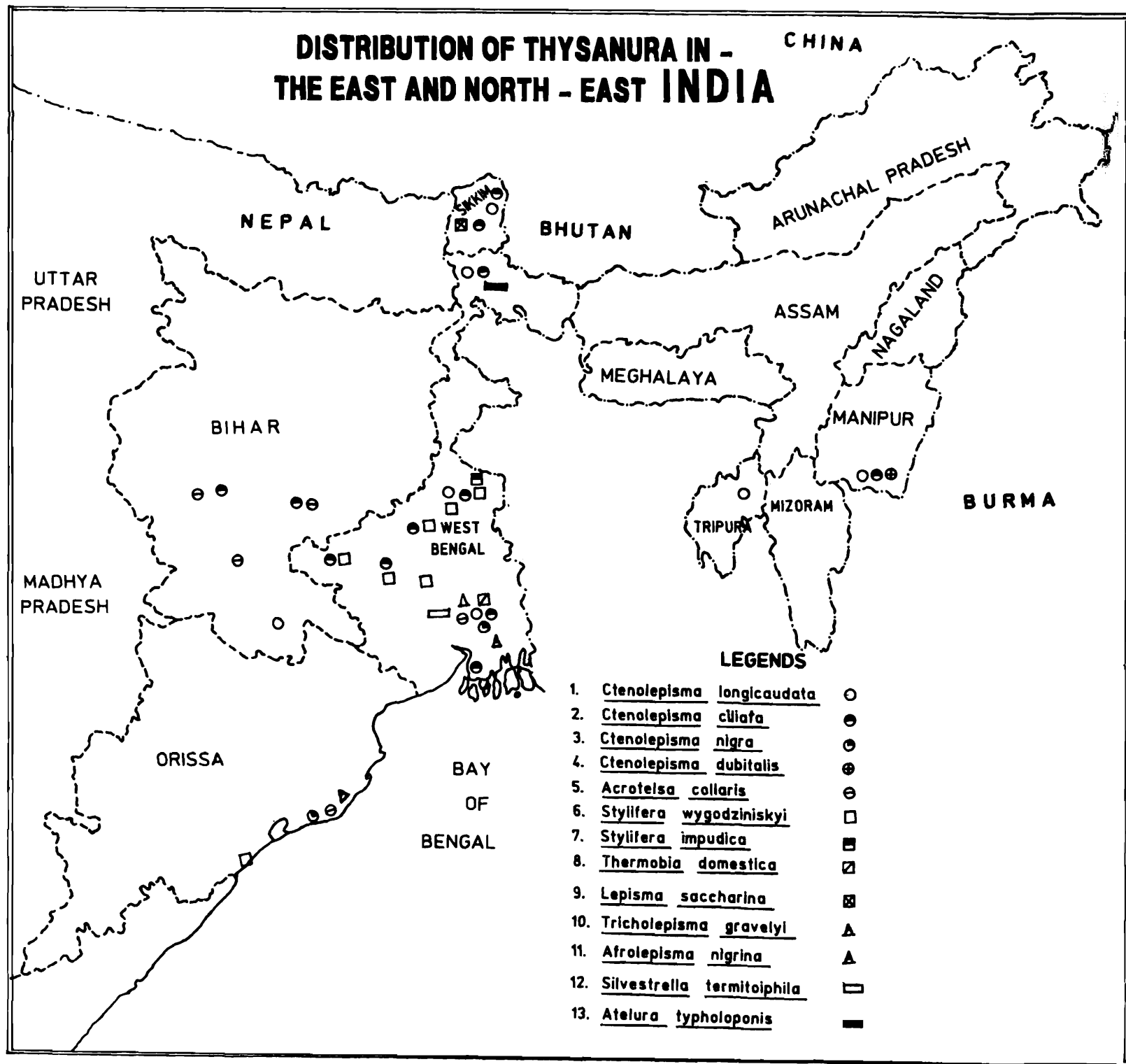
Material examined : 1 ♀ (Z.S.I. Reg. No. 8034/18), INDIA : Siliguri, Base of Himalayas, with ants under log and wood, 3-4, vi.1911, Coll. N. A. & S. W. Kemp.

Distribution : INDIA : West Bengal.

ZOOGEOGRAPHY

The knowledge of Thysanura from India is very inadequate. Uptil now we have no information about this group of insects from all the states of N.E. India. Thus no species of Thysanura so far has been reported from four states, viz., Arunachal Pradesh, Assam, Meghalaya and Nagaland. From Tripura two species were recorded recently by the authors (Hazra, Biswas and Mitra, in press).

Out of the thirteen species reported here, *Ctenolepisma longicaudata* is most widely distributed being present in West Bengal, Sikkim, Manipur, Tripura and Bihar. *Ctenolepisma ciliata* is represented in four states of N.E. India, viz., West Bengal, Bihar, Sikkim and Manipur. *Ctenolepisma dubitalis* remains restricted to Manipur only. *Ctenolepisma nigra*, since its first record by Silvestri (1913) from Calcutta, hitherto remains unrecorded from other parts of N.E. India. *Acrotelsa collaris* so far has been recorded from West Bengal,



Map-1

Table-1
Distribution of the species of Thysanura from the Eastern and North-Eastern India

Species	West Bengal	Bihar	Orissa	Sikkim	Tripura	Assam	Arunachal	Manipur	Meghalaya	Mizoram	Nagaland
	1	2	3	4	5	6	7	8	9	10	11
A. LEPISMATIDAE :											
*1. <i>Acrotelsa collaris</i>	+	+	+	—	—	—	—	—	—	—	—
*2. <i>Ctenolepisma longicaudata</i>	+	+	—	+	+	—	—	+	—	—	—
*3. <i>Ctenolepisma nigra</i>	+	—	+	—	—	—	—	—	—	—	—
*4. <i>Ctenolepisma ciliata</i>	+	+	—	+	—	—	—	+	—	—	—
**5. <i>Ctenolepisma dubitalis</i>	—	—	—	—	—	—	—	+	—	—	—
*6. <i>Stylifera wygodzinskyi</i>	+	—	+	—	—	—	—	—	—	—	—
7. <i>Lepisma saccharina</i>	—	—	—	+	—	—	—	—	—	—	—
8. <i>Tricholepisma graveleyi</i>	+	—	—	—	—	—	—	—	—	—	—
*9. <i>Afrolepisma nigrina</i>	+	—	—	—	—	—	—	—	—	—	—
*10. <i>Thermobia domestica</i>	+	—	—	—	—	—	—	—	—	—	—
**11. <i>Stylifera impudica</i>	+	—	—	—	—	—	—	—	—	—	—
**12. <i>Silvestrella termitophila</i>	+	—	—	—	—	—	—	—	—	—	—
NICOLETIDAE :											
13. <i>Atelura typhloponis</i>	+	—	—	—	—	—	—	—	—	—	—

* First record from the State

** First Record from India

Orissa and Bihar. *Lepisma saccharina*, recorded by Wygodzinsky (1954) for the first time from Sikkim, was further recorded in this investigation. *Tricholepisma graveli* described by Silvestri (1913) from Maidan, Calcutta, West Bengal is the only record of this species from eastern India. *Afrolepisma nigrina*, recorded by Silvestri (1913) for the first time from Orissa, also was found to occur in West Bengal. *Silvestrella termitophila*, originally described from South Africa (Escherich, 1905), is recorded for the first time from India (West Bengal). *Atelura typhloponis*, a myrmecophil, described by Silvestri (1913) from Siliguri, has not been recorded from any other part of India so far.

Stylifera wygodzinskyi, described for the first time from West Bengal (Hazra, 1980), is reported for the first time from Orissa. *Stylifera impudica*, known from Nearctic and Neotropical regions, recorded for the first time from India. *Thermobia domestica*, recorded by Silvestri (1913) from Lahore (Pakistan) is the first record from West Bengal. However, Mendes (1990) also recorded this species from Mandapam (South India) (Map-1).

ACKNOWLEDGEMENT

We express our sincere thanks to Dr. J.R. B. Alfred, Director, Zoological Survey of India for providing laboratory facilities.

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ON A NEW SPECIES OF APOVOSTOX HEBARD (DERMAPTERA : SPONGIPHORIDAE) FROM INDIA

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INTRODUCTION

The genus *Apovostox* Hebard, 1927 was redefined and resurrected by Srivastava (1985). According to him it is now clear that *Labia pygidiata* Dubrony, 1879 and *Irdex nitidipennis* Bormans, 1894, type species of the genera *Apovostox* and *Irdex* Burr, 1911, respectively, are not congeneric. Most of the reference, besides Bormans (1894), pertaining to *Spongiphora nitidipennis* are perhaps referable to *Chaetospania jupiter* Burr, 1900.

At present three species and one subspecies (Srivastava, 1975) are recorded from India and a new species is described here which can be separated by the following key.

KEY TO THE SPECIES (Based on males only)

- 1 (6). Parameres broad in most part, only gently narrowed near apex with tip obtuse or acute (figs. 7, 9 & 11).
- 2 (5). Pygidium laterally at middle with a single tooth; parameres with tip obtuse
- 3 (4). Pronotum slightly longer than broad, not widened posteriorly with hind margin broadly rounded, forming a sort of semicircle along with hind angles; pygidium at base declivitous, afterwards forming a rectilinear plate, widened posteriorly with hind margin truncate, laterally with a posteriorly directed small tooth at middle (fig. 5) ; forceps internally differentiated into dorsal and ventral borders but latter only with several teeth (fig. 6). ***A. agrawali*** sp. n.
- 4 (3). Pronotum about as long as broad, gently widened posteriorly with hind margin convex; pygidium strongly declivitous at base, ventrally deplanate, laterally diverging from base to a little before middle where a sharp posteriorly directed point present, afterwards converging, hind margin emarginate with angle sharply pointed; forceps internally armed ventrally and dorsally with serrations or teeth (fig. 8)
..... ***A. stella samingensis*** (Srivastava, 1975)

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- 5 (2). Pygidium laterally with a pair of teeth at about middle (fig. 10); parameres with tip acute (fig. 11) *A. chauhani* (Srivastava, 1975)
- 6 (1). Parameres narrow, comparatively broader at base, sharply narrowed apically with tip acuminate (figs. 13 & 15)
- 7 (8). Forceps with a basal lamellation above; pygidium declivitous and narrowed at base, afterwards broad and flat with hind margin faintly emarginate and dentate and angles produced into a sharp point (fig. 12) *A. serrata* (Kapoor, 1967)
- 8 (7). Forceps without a basal lamellation above; pygidium distinctly prolonged, flat, gently dilated a little before middle, lateral margin irregular, narrowed apically with tip deeply incised (fig. 14) *A. burri* (Srivastava, 1975)

Apovostox agrawali sp. n.

(figs. 1-7)

Male : General colour blackish brown; head slightly darker; mouth parts and legs yellowish brown and forceps reddish brown. Pubescent.

Head smooth, slightly longer than broad, frons and occiput weakly depressed, epicranial sutures obsolete, median suture distinct, hind margin emarginate in middle. Eyes prominent, black, distinctly longer than post-ocular area. Antennae partly damaged (on the right basal two segments and on the left 13 segments remaining) with segments long and slender; 1st comparatively stouter but narrowed at base, about as long as the distance between antennal bases; 2nd short, about as long as broad; 3rd long and cylindrical; 4th about as long as preceding but stouter; 5th onwards gradually increasing in length distally and each narrowed basally, a few apical ones thinner. Pronotum slightly longer than broad, lateral margin parallel, hind margin broadly rounded, somewhat semicircular along with hind angles, median sulcus distinct; prozona convex and well differentiated from flat metazona. Elytra and wings well developed, strongly pubescent. Legs typical of the genus; hind tarsi with 1st segment over six times longer than broad; 2nd short, about as long as broad; 3rd only slightly shorter than 1st. Abdomen gently dilated in middle, tergites weakly convex, impunctate. Penultimate sternite transverse, smooth, hind margin rounded, scarcely emarginate in middle. Ultimate tergite transverse, smooth, disc weakly depressed with longitudinal rows of pubescent and smooth areas alternating, sides parallel, posteriorly in middle with a feeble depression, above the base of forceps weakly tumid; hind margin incrassate, trisinate, oblique laterally. Pygidium at base declivitous, afterwards forming a rectilinear plate, widened posteriorly with margin sub-truncate, sides with a posteriorly directed small tooth at about middle. Genitalia with parameres three times longer than broad, almost of uniform width except near apices gently narrowed, tip obtuse; virga distinct.

Female : Unknown.

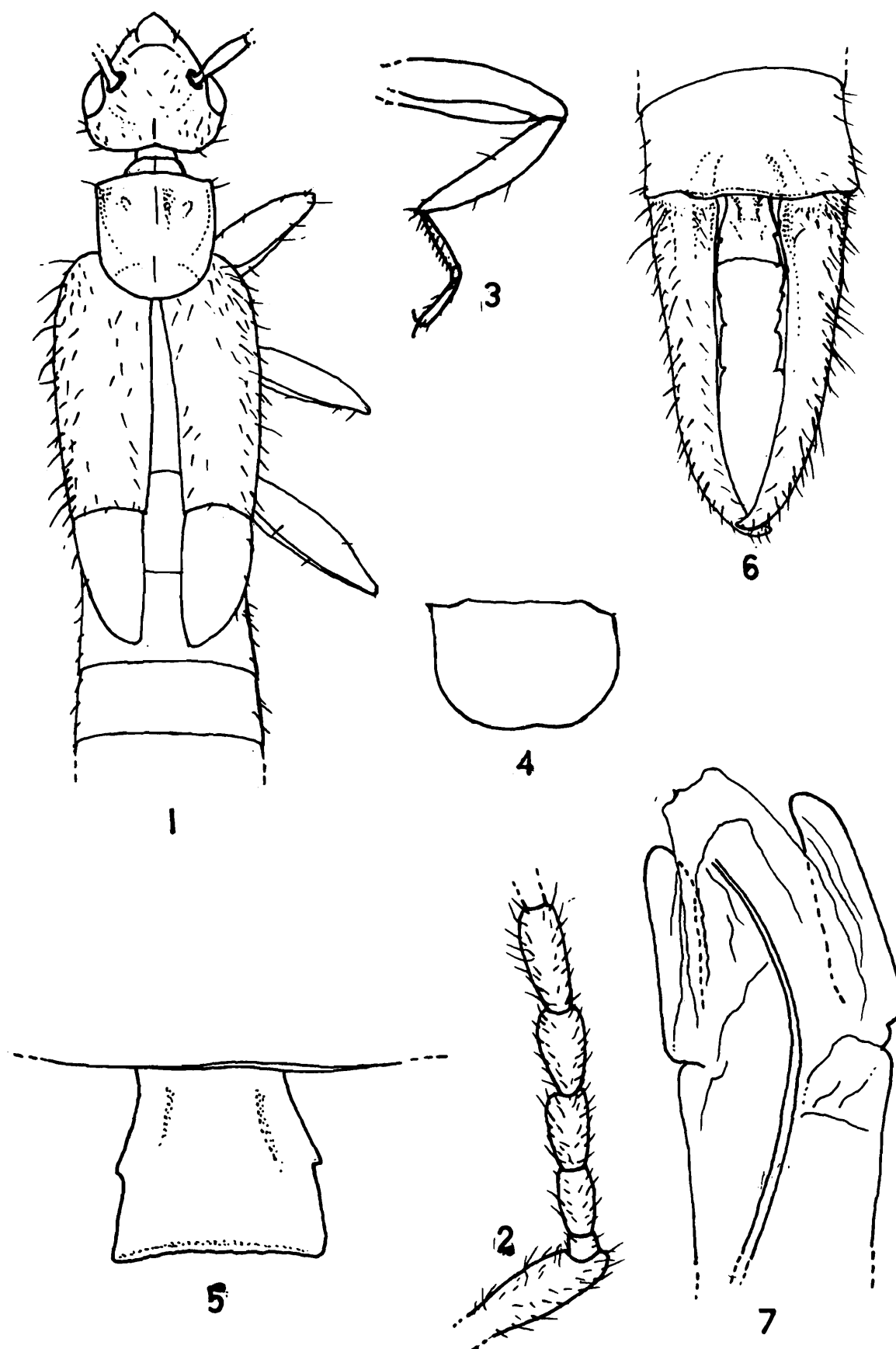


Fig. 1-7. *Apovostox agrawali* sp. n., Holotype Male, 1. Anterior portion of body; 2. A few left basal antennal segments; 3. Hind leg; 4. Penultimate sternite; 5. Pygidium enlarged; 6. Ultimate tergite and forceps; 7. Genitalia.

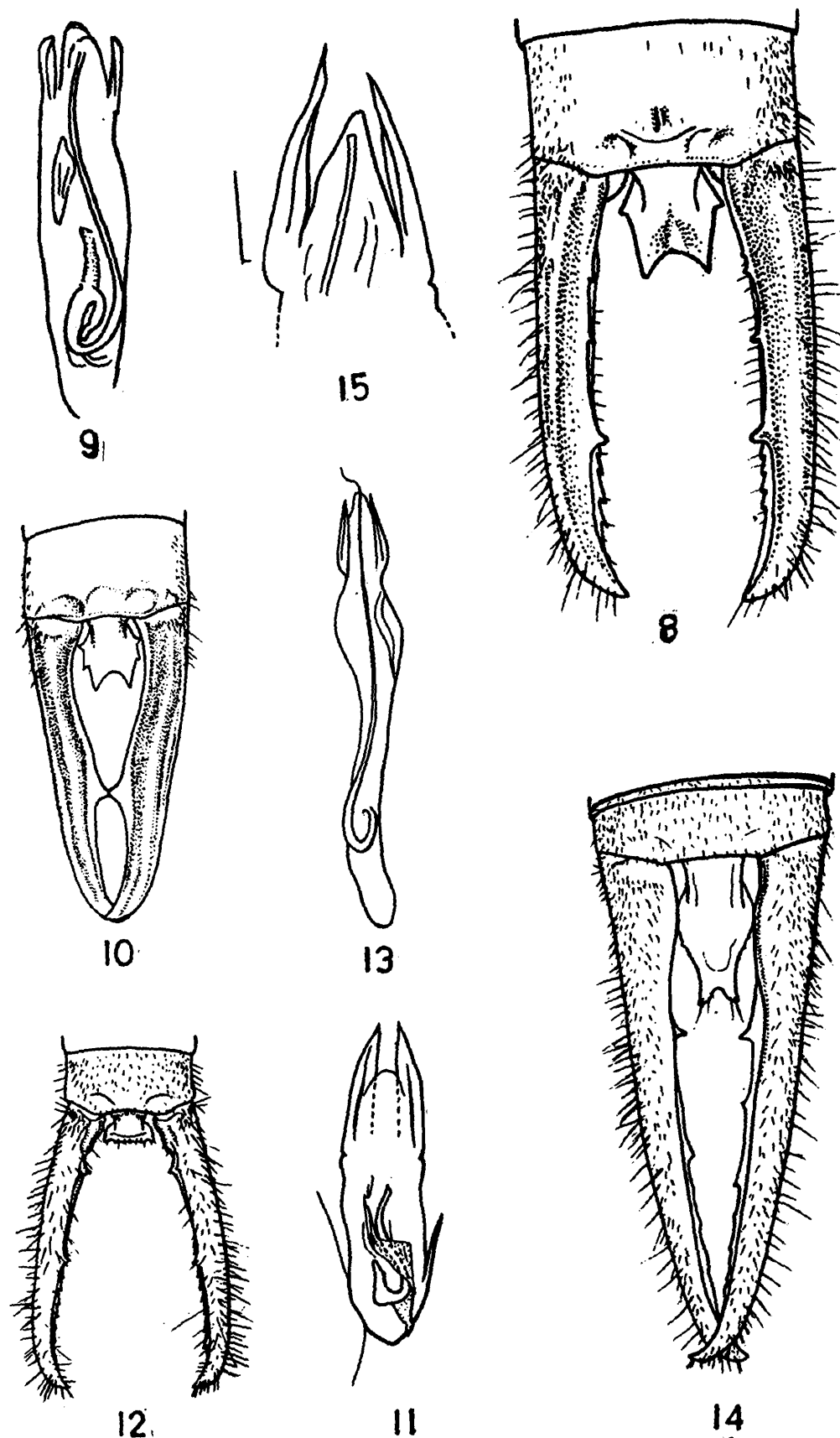


Fig. 8-15. *Apovostox stella samsingensis* (Srivastava), Holotype Male; 8. Ultimate tergite and forceps; 9. Genitalia; *Apovostox chauhani* (Srivastava), Holotype Male; 10. Ultimate tergite and forceps; 11. Genitalia; *Apovostox serrata* (Kapoor); Male; 12. Ultimate tergite and forceps; 13. Genitalia; *Apovostox burri* (Srivastava), Holotype Male; 14. Ultimate tergite and forceps and 15. Genitalia (Figs. 8-15 after Srivastava, 1975).

<i>Measurements</i> : (in mm)	Holotype
	Male
Length of body	8.1
Length of forceps	2.8
Length of pygidium	0.4

Material examined : India : Sikkim : Tumin, 1,800m, Holotype Male (genitalia mounted between two coverslips and pinned with the specimen), 26. ix. 1988 (V. C. Agrawal) — deposited in the Zoological Survey of India, Calcutta.

Remarks : The described species differs from all the known species from India by the shape of male pygidium in being narrowed at base and gradually widening posteriorly with margin subtruncate and incrassate, postero-lateral angles a little projecting, lateral margin with a minute posteriorly directed tooth at about middle.

ACKNOWLEDGEMENTS

The author is thankful to the Director, Zoological Survey of India, Calcutta for providing necessary facilities during the preparation of this paper.

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FEEDING BEHAVIOUR OF THE LARGE BANDICOOT RAT

***BANDICOTA INDICA* (Bechstein) [Rodentia : Muridae]**

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INTRODUCTION

Rodents are versatile in feeding behaviour and in the choice of food. Thus, separate studies on each individual species are necessary. However, except for the stray reports of Jerdon (1874), Blanford (1891), Sridhara and Srihari (1978,1979), Chakraborty and Chakraborty (1982) and Chakraborty (1992) practically no base line data exist on the feeding behaviour and food preference of *Bandicota indica*. A study was therefore conducted on this aspect, in nature as well as in the laboratory.

STUDY AREA

The study was conducted mainly at Sagar Island, the largest delta in the western sector of the Sundarbans and surrounded by the rivers Hugli in the northern and Western sides and river Muriganga in the eastern side. The southern part of the island faces the open sea, the Bay of Bengal. Additional studies were made at Thakurpukur and Behala areas of Western Calcutta.

METHODOLOGY

Specimens were collected by single door wire traps, measuring 40 cm x 20 cm x 12cm. Traps were set in the evening (17.00 hrs. to 19.00 hrs.) and collected in the different hours of night till morning. Observations on the feeding behaviour were made particularly during moonlit nights in nature. Some observations were also made in captivity. Stomachs of 42 adult specimens (both males and females) collected during different months of the year and preserved in 70 per cent Ethyl alcohol. Qualitative and quantitative analysis of the stomach contents (food-items) were made in the laboratory. For the qualitative analysis, reference materials were obtained according to the method of Fall *et al.* (1971). Identified and unidentified components were weighed (wet) to the nearest 0.1 gm.

Food preference, total daily intake (T.D.I.), calorie intake etc., were studied in captivity. Special types of cage as described by Chakraborty (1980) was used for the purpose. Rats were usually maintained individually in separate cages, as there was much fight and aggression when a number of them kept in a single cage. Often the dominant one did not allowed the others to feed in spite of sufficient supply of food.

To obtain the rice powder scented with male and female body odour, one kilogram of fresh powder was provided to individually caged three male and three female rats each with water *ad libitum*. After 48 hours excess of rice powder was taken out from each cage and packed separately. Detailed methodology for the laboratory study has been described under respective experiments.

FEEDING BEHAVIOUR

The large bandicoot rat usually comes out of the burrow only after dusk and returns at dawn. During the moonsoon and premonsoon months, it mainly feeds on molluscs and crabs and occasionally on fishes and prawns, even from the deep of water. After capturing the prey it takes the same to a particular feeding place which is somewhat clear space inside the bushes and may be easily identified by huge deposits of molluscan shells, scales of fish and hard parts of crabs etc. (Fig. 1). In the monsoon months it also takes the prey on the 'bandh' and sometimes bends and damages the paddy tillers of small area (800 to 1600 sq. cm.) to form a feeding platform causing considerable damage of crop. (Fig. 2).

It holds the snail with the fore paws, and the lower incisors are pushed inside the operculum, while the upper ones are pressed from outside. As a result, body whorl of the shell is either pierced or broken. Then the animal is turned a little downward and the portion of the shell adjacent to the broken region near the penultimate whorl is fragmented in the same way (Fig. 3). This process is repeated till both upper and lower incisors of the predator can be pushed inside to take out the flesh of the snail. The columellar muscle is separated from the columella by dragging. The whole body except the digestive gland is eaten. For mussels, the predator cracks the shell in the region anterior to umbo and opens it with the help of fore-paws and incisors and takes both flesh and fluid. (Fig. 4).

For the species of crabs it turns the prey up side down, places the forelimbs on the body of the prey from behind and crushes the appendages. Then it cracks the shell somewhere at the anterior region to make a hole of sufficient diameter to take out the muscle and fluid (Fig. 5).

During harvesting, the large bandicoot rat regularly visits the neighbouring paddy fields and often settles there, making fresh burrows. Consumption or damage of paddy by this species is more localised at the central part or near the 'bund' of the field. The extent of damage of the paddy during the harvesting season does not appear to be severe at Sagar Island. However, sometimes considerable damage of paddy tillers is done during monsoon.

Vegetable fields, particularly of potato are also favourite foraging ground of *B. indica*. It has been observed that in a potato field of about 800 sq. m., one to three kilogram of potato tubers were dug out by the overnight activity of the species. However, they never consumed more than 30% of a potato tuber. The damage is, therefore, much more than the actual consumption. Green leaves of different vegetables are also consumed by *B. indica*, thereby, hampering the yield. Occasionally, it makes a small opening and takes out seed and placenta of gourd. It is reported to cause heavy damage in a similar manner to the musk melon, that grows on the sandy coastal region of Sagar Island during the dry season. In addition to the different cultivated crops, it regularly visits the bushes near its habitat in search of roots, stems, leaves, fruits, etc. of different plants. Chowdhury (pers. comm.) observed *B. indica* regularly preying upon the birds roosting on the ground of Sagar and adjacent islands. At Kakdwip, adjacent to Sagar Island, Nandi (1984) found *B. indica* attacking a fresh water snake, *Enhydryis enhydryis* probably for feeding.

QUANTITATIVE AND QUALITATIVE ANALYSIS OF FOOD OBSERVATION IN NATURE

Quantitative and qualitative analysis of food in nature reveals that, the molluscs, fishes, insects, earthworms and certain plants such as grasses, *Colocasia*, *Derris* sp. etc. are usually consumed in all the seasons, and crabs and prawns usually during the monsoon and paddy and potato during the postmonsoon period (Table 1). Out of 42 stomachs examined, molluscs were found in 28, fishes in 20, insects in 21, grasses in 20, paddy in 11, *Colocasia* in 7, and potato tubers in 6. By weight (wet, species-wise) consumption of the Apple Snail, *Pila globosa*, was the highest (38%) followed by that of paddy (9%) and potato tubers (6%).

Analysis of plant material showed that consumption of seeds and fruits was highest (68%) followed by tubers and fleshy roots (26%) and leaves (5%) with almost total exclusion of aerial stems. Though a definite preference for animal food could be noticed yet, it is interesting to note that, insects which constitute some parts of the regular diet in most of the Indian rodent species (Prasad 1954, Prakash 1962, 1975, Prakash and Kumbkarni 1962, Chakraborty 1977, Sood and Dilber 1977) form only one percent by weight of its diet.

The analysis of the weight of the stomach-contents of the specimens captured in different hours (Table 2) indicates that *B. indica* starts feeding after dusk and continues throughout the night, till it retires into the burrow.

OBSERVATION IN CAPTIVITY

In captivity, experiment was made with *P. globosa*, rice, wheat, Bengal gram and green gram. *B. indica* readily accepted dry whole rice and wheat grains, but not dry whole Bengal gram

and green gram. Thus, the latter two pulses were provided in broken form. To calculate the water intake, an extra tray with equal amount of water was kept outside the cage as inside. The loss due to evaporation was noted after 24 hours and the same was adjusted during calculation. Consumption of *Pila globosa* in 24 hours was estimated by the following method.

Total weight of <i>P. globosa</i> supplied	= A gm.
Total weight of the untouched <i>P. globosa</i> after 24 hours	= B gm.
Total weight of the empty shells and operculums after 24 hours	= C gm.
Number of empty shells	= D
Average weight of the digestive gland	= 0.5 gm.
Consumption of <i>P. globosa</i> in 24 hours	= A-(B+C)-(D x 0.5) gm.

Total daily intake (T.D.I.)

Single choice : Five adult rats (3M, 2F) were acclimatized for five days providing water *ad libitum* with all the food items used in the experiment. After acclimatization, each item of food was given in sufficient quantity one by one for five days, with water *ad libitum* to all the rats. Table 3 shows the average T. D. I. per rat, calorie intake, water intake and change in the body weight with various food items. It revealed that by weight, T.D.I. with *P. globosa* was significantly higher ($p < 0.001$) than the other four food items. Among the four plant products, T.D.I. with rice was significantly higher ($P < 0.05$) than the others. Though T.D.I. with *P. globosa* was highest (95 gm) but mean calorie intake per gram of body weight per day with that food was lowest (0.141), while mean calorie intake was highest (0.194) with rice. Intake of water was significantly less ($P < 0.001$) with *P. globosa* diet than that with other four food items, due to the obvious reason of high water content (74.1%) in the flesh of *P. globosa*. There was no significant difference in the daily water intake with other four food items. Weight loss occurred with all the food items, however, it was minimum with green gram and maximum with wheat.

Double choice : Two food items were provided at a time until all possible combinations (a total of ten) had been given to five individually caged acclimatized specimens (3M, 2F) for five days each. Average daily percentage of consumption is graphed in Fig. 6 and other details provided in table 4. A simple preferential order for *P. globosa* was observed in all the four diadic trials, rice in three out of four, Bengal gram in two out of four, green gram in one out of four, while wheat was never preferred. Consumption by weight was significantly higher ($p < 0.001$) in all the four diadic trials with *P. globosa* as one of the component. By weight, consumption was minimum with wheat and green gram combination. However, calorie intake with different



Fig. 1. Feeding place of *B. indica* inside the bushes.



Fig. 2. Damage of paddy tillers by *Bandicota indica* for making the feeding platform.

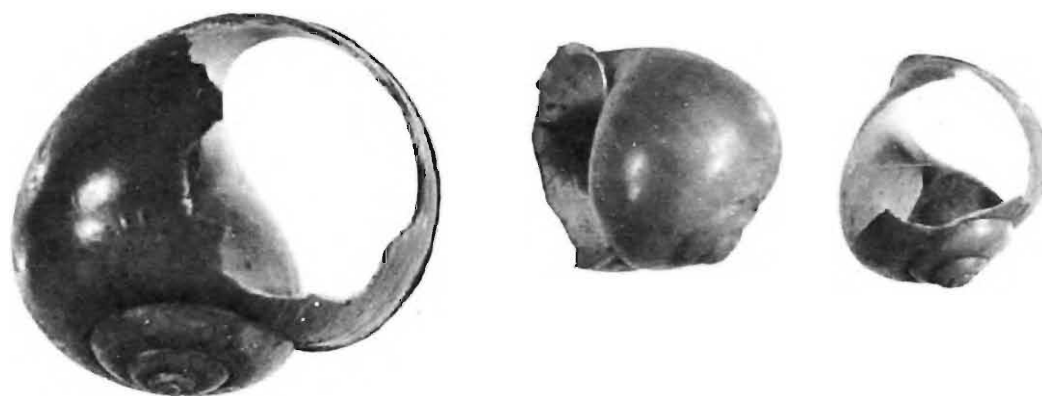


Fig. 3. Broken shells of *Pila globosa* showing the mode of feeding of *B. indica*.



Fig. 4. Broken shells of *Lamellidens marginalis* showing the mode of feeding of *B. indica*.



Fig. 5. Broken shells of a crab shwoing the mode of feeding of *B. indica*.

combination of food, varied within a small range of 0.158-0.223 per gram of body weight per day. Consumption of water was significantly less in the diadic trials having *P. globosa* as one of the item ($P < 0.001$). Weight loss occurred with all the combinations except two, viz., *P. globosa* + Bengal gram, and Rice + Bengal gram. Maximum weight was lost with wheat and green gram combination.

Multiple choice : In the first experiment a surplus of four food items, viz., *P. globosa*, rice, Bengal gram and wheat along with water *ad libitum* offered for 30 consecutive days to four individually caged acclimatized rats (2M, 2F). In the second, *P. globosa* was replaced by green gram. Average daily consumption of different food items in the first experiment by individual rat for 30 days is graphed in Fig. 7 and other details in table 5. It has been noted that though *P. globosa* was preferred throughout the experiment, yet its consumption considerably decreased in the latter days. Average total consumption by weight came to 0.153 gm. per gm. of rat per day, and that of calorie 0.288. Average daily consumption of different food items by individual rat for 30 days of the second experiment is graphed in fig. 8 and other details are summarised in table 6. Unlike the first experiment, no single food item was preferred for all the 30 days. Average consumption of food came to 0.071 gm. per gm. of rat per day and that of calorie 0.25.

Oil preference : Five specimens (3M, 2F) were offered homogeneously mixed rice powder and oil in the ratio of 90 : 10 (by weight) for five days for each test. Oils tested were coconut, ground nut, mustard and sesame. Various paired and multiple choice tests were conducted utilising the above-mentioned oils. Tests were also conducted with control (without oil) and oil diets. The paired preference tests between oil and control diet showed interesting variation (Fig. 9). There was no significant difference in the consumption of control-mustard oil diet and control-sesame oil diet. In the first two days consumption of oil diet was slightly less than control diet in both cases. However, consumption of coconut oil diet and ground nut oil diet over control diet was significantly higher. Paired preference tests (A total of six) between two different oil diets (Fig. 10) revealed that coconut and ground nut oil diets were significantly preferred over other two oil diets. Coconut and sesame oil diets were insignificantly preferred over ground nut and mustard oil diets respectively. Multiple choice tests with all the four oil diets also showed a similar trend in preference, i.e., Coconut → groundnut → sesame → mustard (Fig. 11).

Influence of body odour : Two different tests were conducted. In the first, rice powder scented by female large bandicoot rats, along with fresh rice powder were provided at a time to individually caged specimens (3M, 3F) in separate food trays for five days. In the second, same experiment was repeated with rice powder scented with males. Results were summarised in the table 7. In both the tests, consumption of scented powder rice by both the sexes was a little higher than that of the fresh powder, but the differences in the consumption were never significant.

ADDITIONAL OBSERVATIONS ON THE FEEDING BEHAVIOUR IN CAPTIVITY

During the maintenance of the large bandicoot rats in the cages, the following feeding behaviour were observed.

- i). *Bandicota indica* though nocturnal in habit, in captivity, it takes the food both during day and night, but consumption during night is much more.
- ii) A freshly collected specimen readily accepts the molluscan food and water in the cage even in presence of human beings. However, it tries to drag the food items or even food tray in the nest box in the darkest portion of the cage.
- iii) Intraspecific competition in feeding behaviour has been noted in *B. indica*. Similar habit was observed in other species by Barnett and Spencer (1951) and Chitty and Southern (1954). According to them, this carrying back habit has an incidental social value.
- iv) When same food item is simultaneously provided in two different types of food trays one familiar and other unfamiliar, consumption from the familiar tray is always higher. When the living *P. globosa* as well as only flesh of *P. globosa* supplied at a time, it takes live ones only. This, clearly illustrates neophobia in *B. indica*.
- v) Amount and nature of faecal matter of the large bandicoot rat varies according to the type of food. Normally it is blackish in colour, but with green vegetable diet it is greenish. With a diet of carrot and beet it is saturn red and carmine respectively. Faecal matter is soft and less in amount with *P. globosa* as diet, while it is much more with rice and other grains.

DISCUSSION

The study of food habit in nature as well as in captivity, revealed that *P. globosa* is the most preferred food followed by rice. Stomach-contents also revealed a wide variety of food items, both plants and animals along with a seasonality in its food habit. Almost similar result was obtained from the stomach-contents analyses of different species of rodents (Hamilton 1941, Jameson 1952, Prasad 1954, Miller 1954, Harrison 1954, Prakash 1962, 1981, Fall *et al.* 1971, Chakraborty 1977, Sood and Dilber 1977). Consumption of a wide variety of food items in nature by *B. indica* as well as by many other species of rodents is obviously to select a best possible balanced diet from the available food resources. The ability to select food on the basis of nutritional value is probably wide spread among mammals (Lepkovsky 1948) and the maintenance of a steady weight or growth rate by regulation of calorie intake is a familiar phenomenon (Soulaire 1958, Anand 1961 and Barnett 1963). However, a rodent's choice of food is not always determined by need; certain physical properties of food, such as taste, odour or colour are attractive to them irrespective of nutritional value (Barnett *op. cit.*). Hence, it appears that consumption of a wide variety of food items by *B. indica* is not only related to their nutritional value but also to their taste and odour. Seasonality in the food habit is an adaptation which *B. indica* has developed to tide over the unfavourable situation.

A = Pila globosa
 B = Rice
 C = Wheat
 D = Green gram
 E = Bengal gram

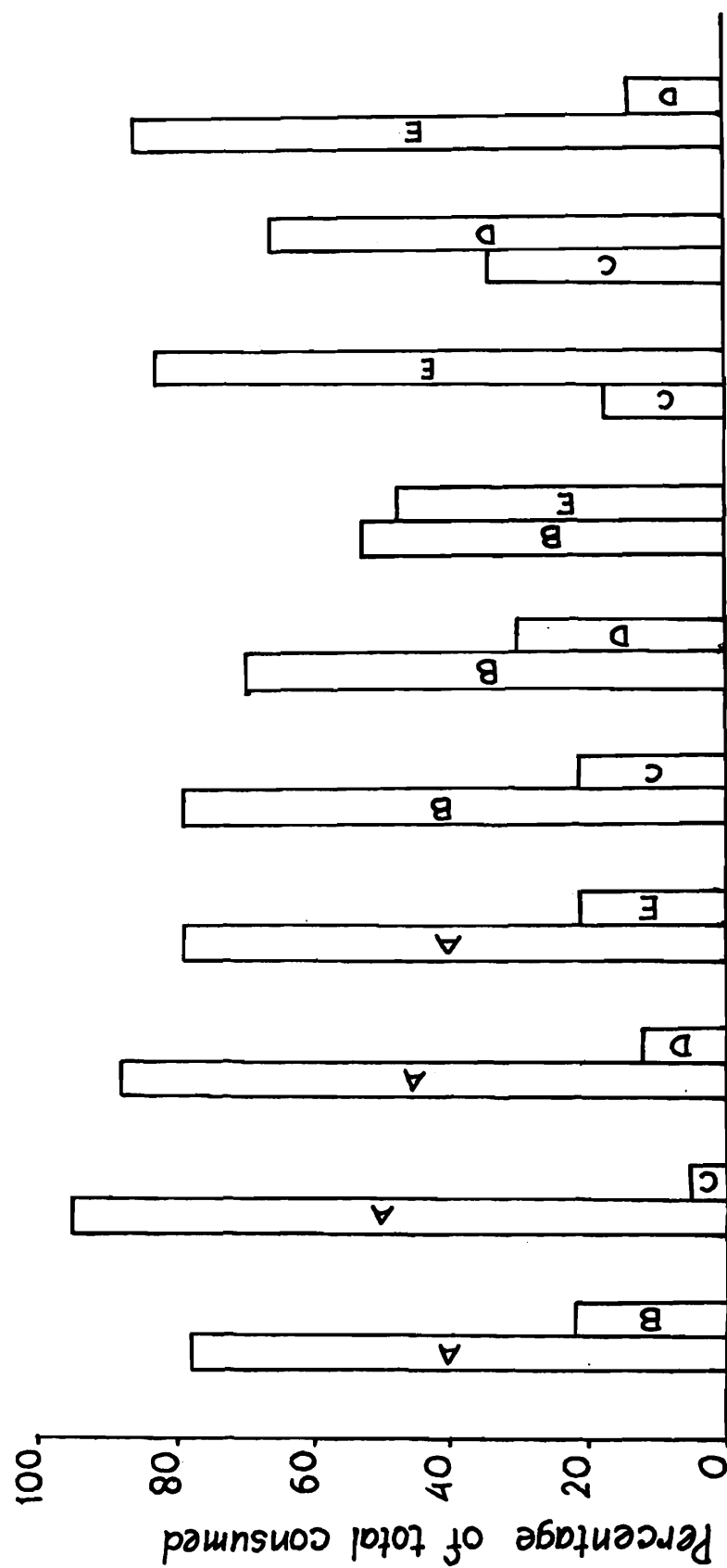


Fig. 6. Study of total daily intake in captivity with two food items provided at a time.

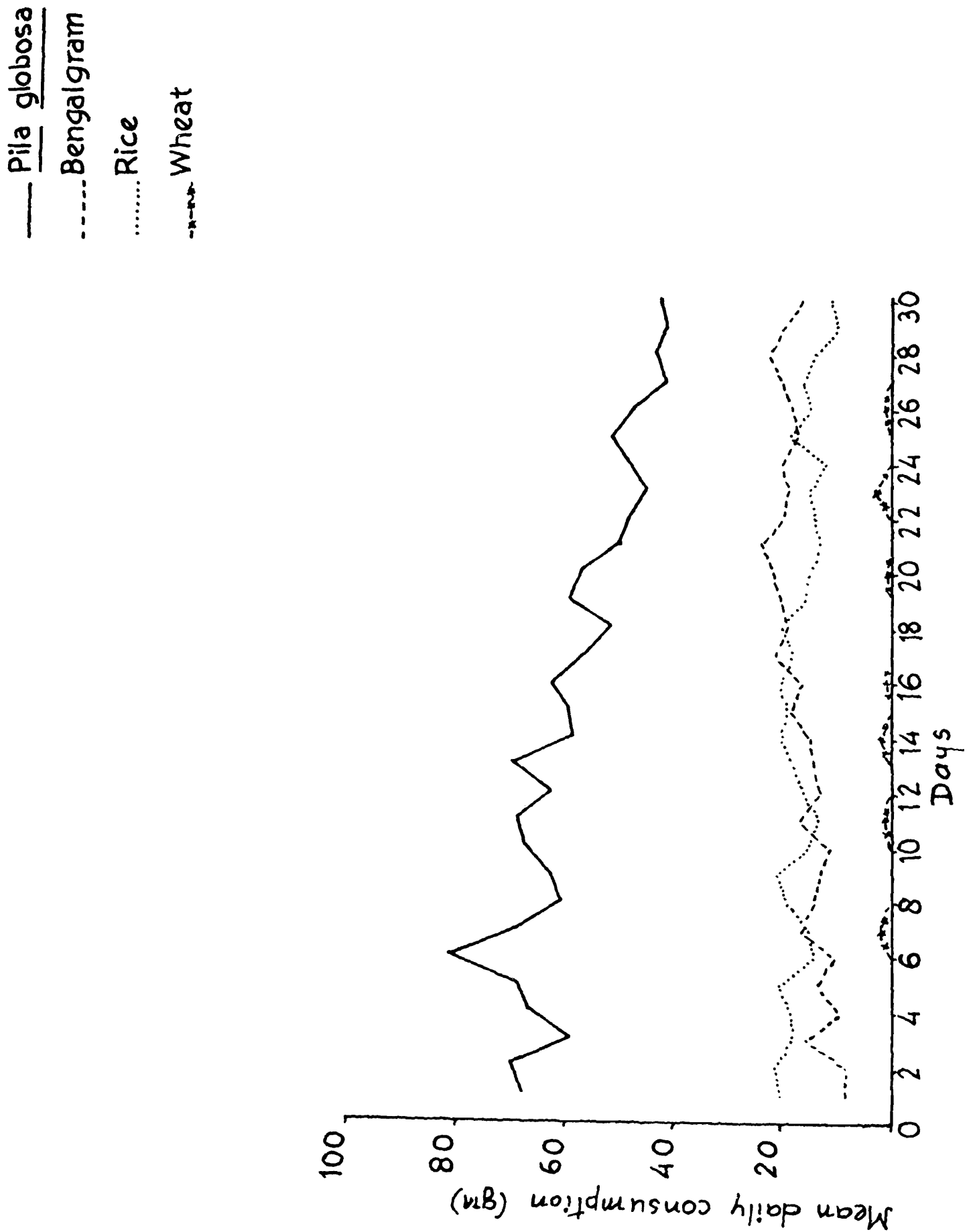


Fig. 7. Daily mean consumption of four food items when provided all at a time with *P. globosa* as one of the items

— Rice
 -x-x- Wheat
 ---- Bengal gram
 -x-x- Green gram

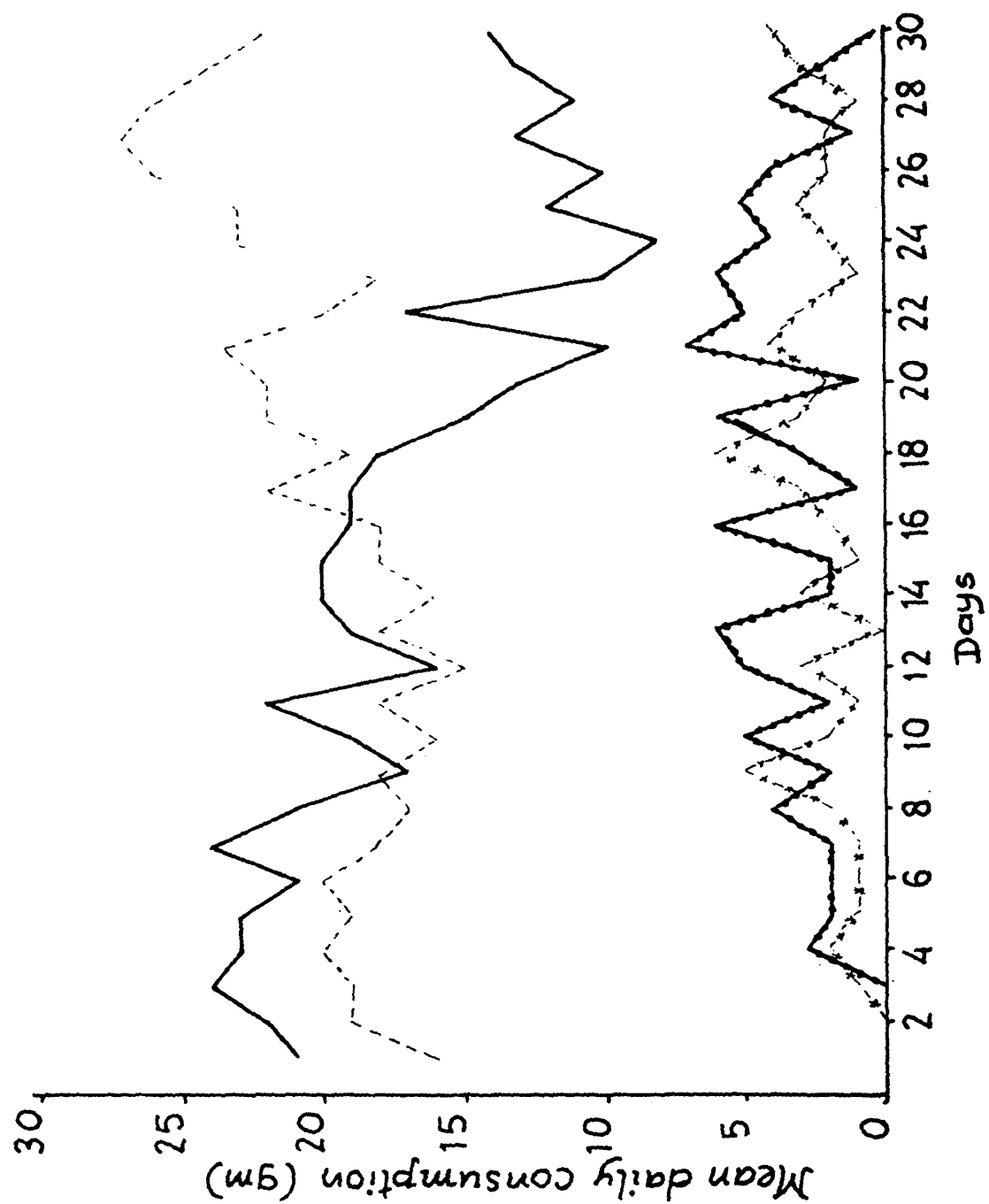


Fig. 8. Daily mean consumption of four food items when provided all at a time without *P. globosa* as one of the items.

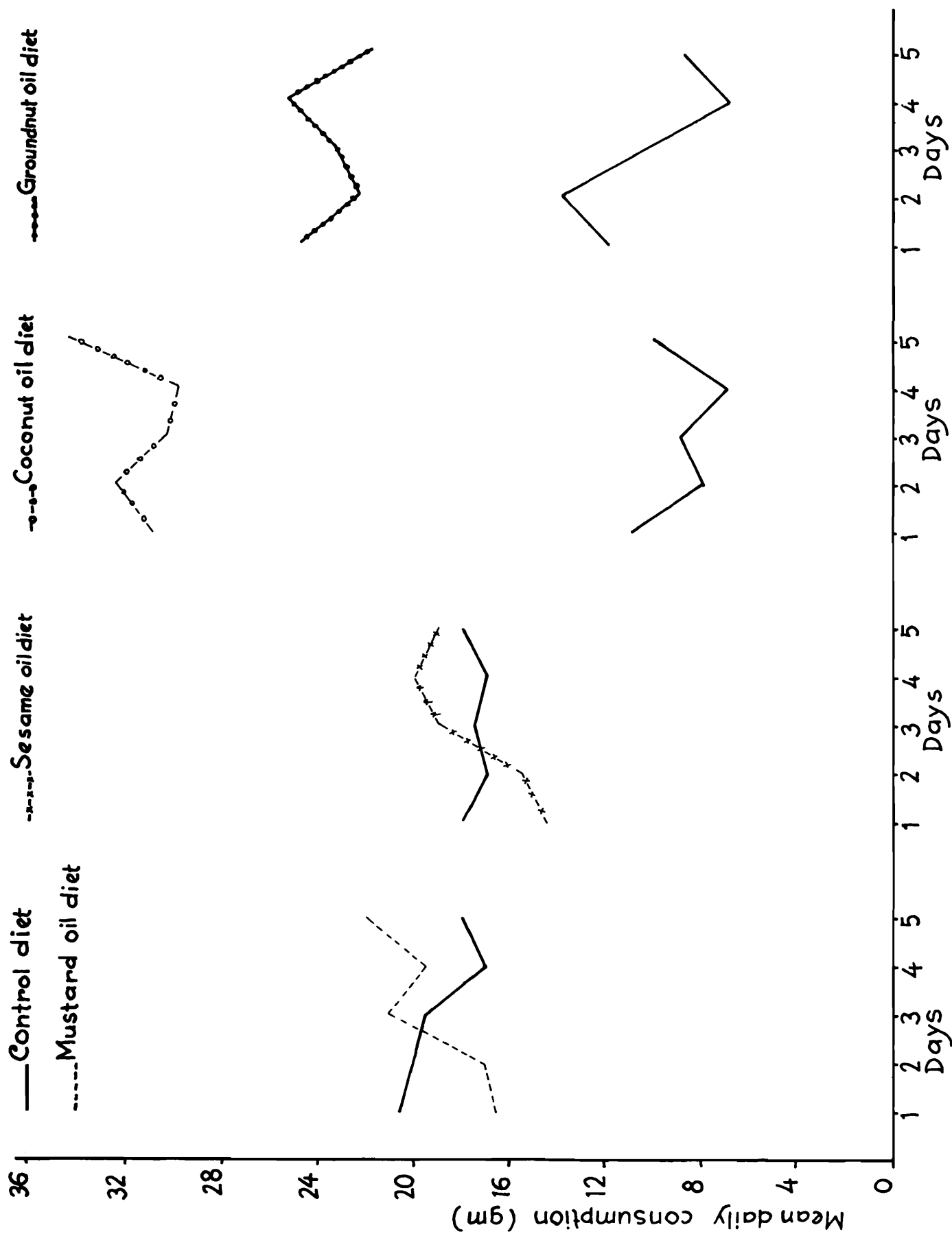


Fig. 9. Paired preference tests between various oils and control diets.

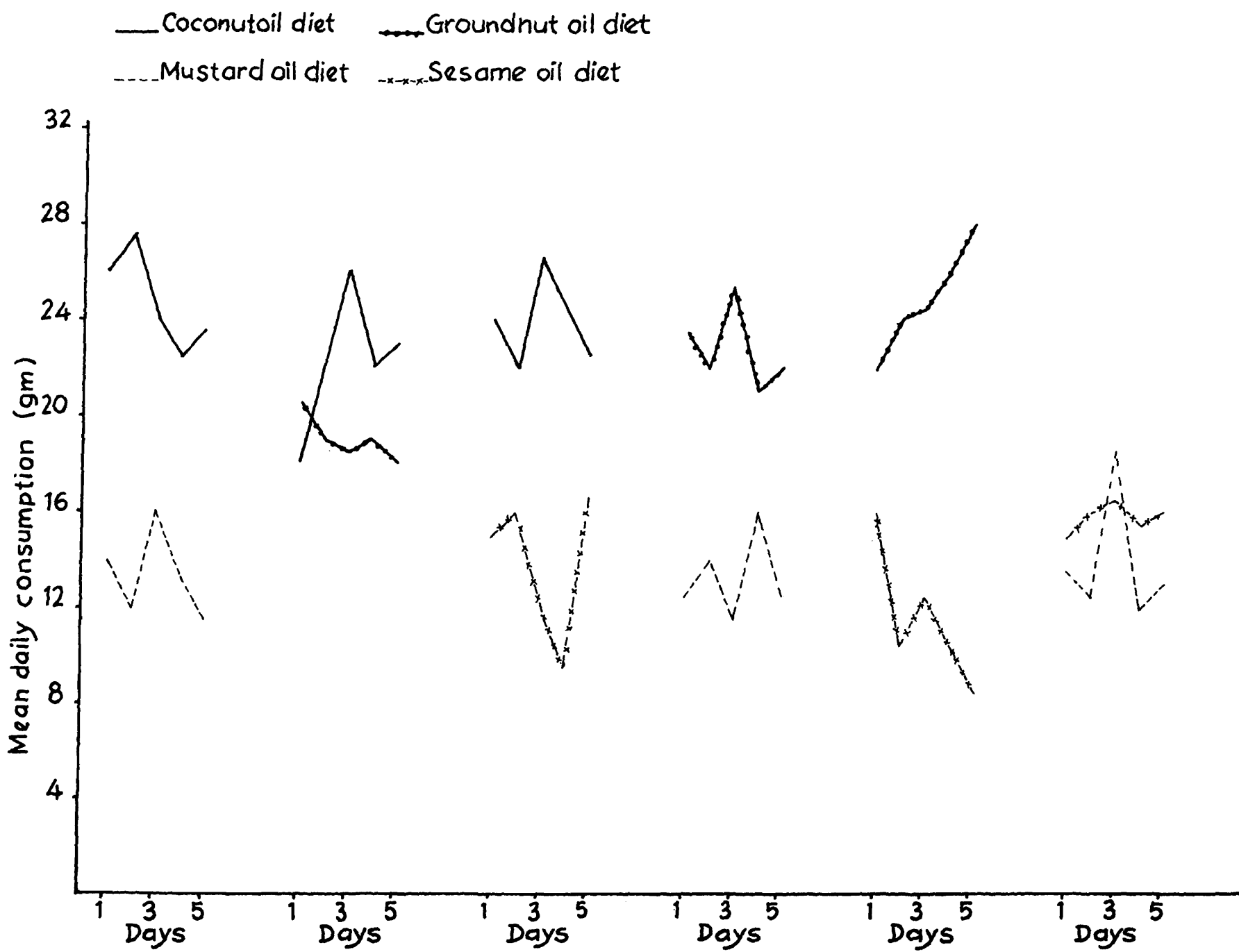


Fig. 10. Paired preference tests between two different oil diets.

- Coconut oil diet
- Groundnut oil diet
- Sesame oil diet
- Mustard oil diet

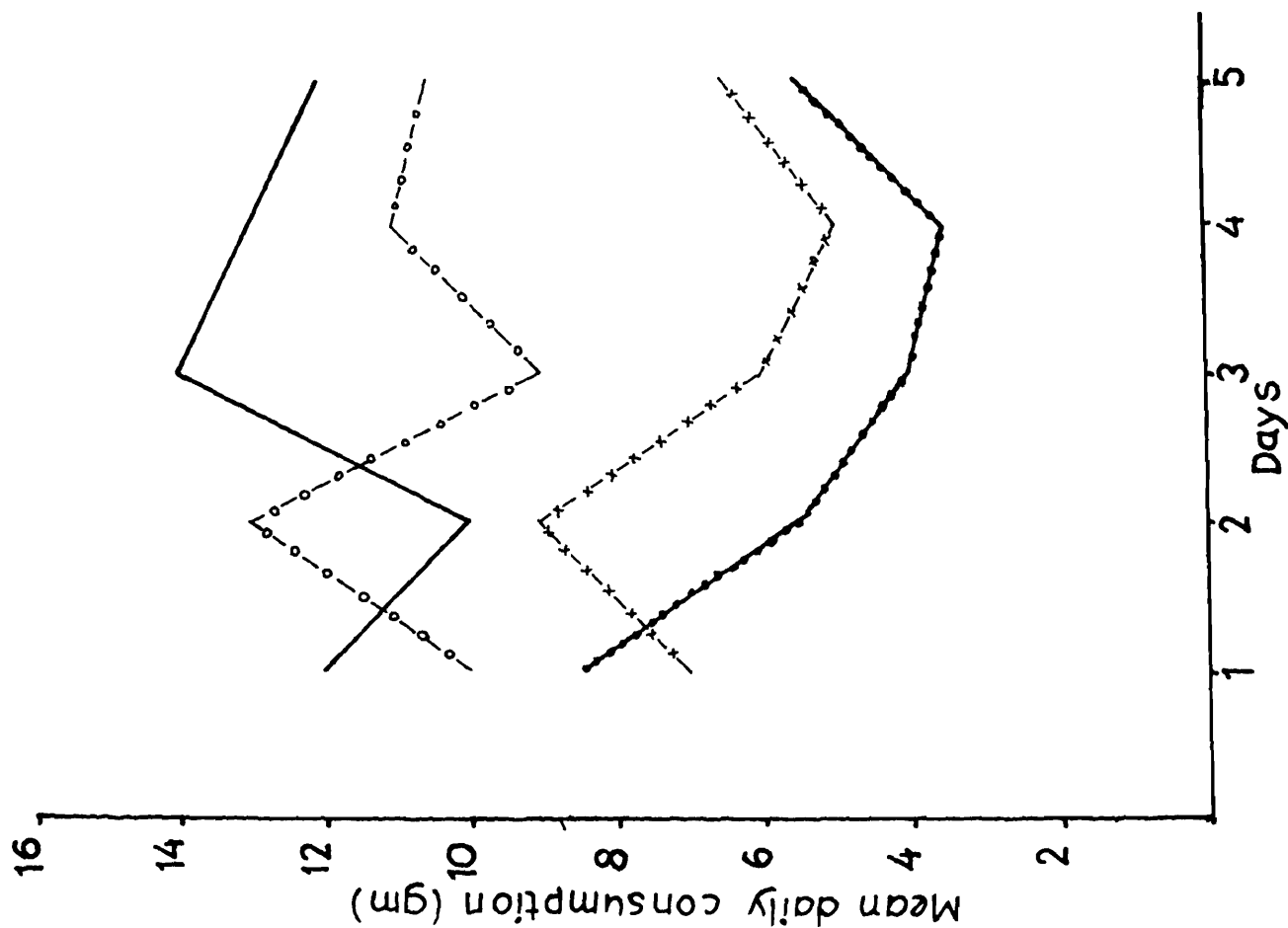


Fig. 11. Multiple choice tests with four oil diets.

The large bandicoot rat is a great predator of molluscs, crabs, fishes, birds and even some species of snakes. Large size, powerful limbs and incisors, ability to swim and run, etc., help the animal in its predaceous habit. In West Bengal, different species of molluscs and crabs are responsible for the damage of various vegetables, seedlings of paddy and wheat. A number of such pestiferous species of molluscs and crabs were found to be regularly consumed by *B. indica* at Sagar Island. Raut and Ghose (1979) also reported predation of *B. indica* on two pestiferous species of molluscs, viz., *Achatina fulica* and *Macrochlamys indica* in the gardens of Calcutta. Thus, the large bandicoot rat although responsible for certain amount of damage to paddy, vegetable, fisheries etc., yet it plays an important role in the biological control of different pestiferous species. Role of rodents in the control of various pest species, specially of insects, have also been pointed out by Prasad (1954), Prakash (1969), Sood and Dilber (1977).

In nature as well as in captivity it has been observed that even when there is sufficient supply of the most preferred food, i.e. *P. globosa*, the large bandicoot rat consumed some amount of other food items, if available. Moreover, it was found that calorie intake became less with only *P. globosa* diet, as compared with other food grains. Thus, it is obvious that when there is choice, *B. indica* selects a number of food items on the basis of nutritional value as well as palatability.

Quantity of food and calorie intake increased with the number of choice, Consumption of wide variety of food items in nature is, therefore, necessary for a steady weight and growth rate.

Mean food or calorie requirement of *B. indica* per day per gram of body weight is much less than that of the much smaller sized species of rodents, viz., *Gerbillus gleadowi*, *Millardia meltada*, *Meriones hurrianae* (Prakash *et al.* 1975), *Rattus rattus*, *Tatera indica* (Sridhara and Krishnamoorthy 1978), *Mus platythrix* (Sridhara and Srihari 1979) and *Mus musculus* (Rao and Prakash 1980). Although food consumption is generally directly related to body weight, yet it has been fairly established that the metabolic rate of the animals increases with the diminishing body size (Schmidt-Nielsen 1973) and food eaten per gram of body weight declines with increasing body weight (Barnett 1975). Therefore, the present finding is in quite agreement with the general principle of food and calorie requirements of animals.

Experiment with multiple choice illustrates the influence of habitat on the food habit of animals. All the rats of the present experiment were collected from paddy growing area and their initial preference for rice may be attributed to the familiarity of rice. Later, with the continuous supply of Bengal gram, rats became acquainted with that food and preferred over rice probably due to more nutritional value or palatability or simply for a change of taste. Medway (1978) found that in Malaysia, natural diet of *B. indica* mainly consisted of plant material including rice, tapioca, sugar cane, etc. However, at Sagar Island, *P. globosa* is the most preferred natural diet. This geographical or habitat effect on the food habit of different species of rodent have also been observed (Harrison and Woodville 1950, Barnett 1969, Chitre and Deoras 1966, Spillett 1968, Fall *et al.* 1971). In fact, rodents demonstrate a differential preference to food items depending on the availability of them in the areas of their occurrence.

Studies on oil preference with different species of rodents revealed that addition of oils has positive, negative as well as neutral role in bait acceptance. Moreover, preference for oils is not generalised but selective as in the case of *B. indica*. Addition of some particular oils proved to be effective in *Rattus rattus* (Majumder *et al.* 1969, Khan 1974), *Millardia meltada* (Jain *et al.* 1974, Chopra and Sood 1980), *Bandicota bengalensis* (Durairaj and Rao 1977) and *Golunda ellioti* (Soni *et al.* 1979). However, for *Meriones hurrianae* and *Tatera indica*, addition of vegetable oils did not significantly increase the bait consumption (Prakash *et al.* 1969). Addition of oils decreased the bait acceptance in *Mus musculus* (Rao and Prakash 1980). Reasons for preference or non preference of oils are not clearly understood. According to Barnett (1969) some preferences and some rejections are independent of nutritional value and depend on the palatability. While, Rao and Prakash (1980) opined that decline in T. D. I. with addition of oils in *M. musculus* is due to higher calorie value of the additives. Calorie and nutritional values of all the oils used in the present study are almost the same. It appears that non preference of mustard and sesame oils by *B. indica* due to the pungent smell.

Intraspecific odour increased the bait consumption to some extent but not significantly in both the sexes of *B. indica*. The role of chemical signals among rodent has been reviewed by Shunkle (1977). Intraspecific (Pheromones) and interspecific (Allomones) odours have found to increase the food consumption in a number of Indian rodents (Kumari and Prakash 1979, 1980, Rao and Prakash 1988, Idris 1982, Chopra and Sood 1983, Idris and Prakash 1983). On the contrary, repulsive or offensive action of the interspecific odours have also been reported in a number of rodent species (Subiah 1980, Krishnamoorthy 1981, 1982, Chopra and Sood 1983). However, further study is required to comment on the role of intra or interspecific odours in the bait consumption of *B. indica*.

From the above discussion it is obvious that particular care should be taken for the management of *B. indica* at Sagar Islands, so that a viable population is maintained instead of total eradication. Owing to the obvious difficulty of mixing rodenticides with *P. globosa*, the next preferred food, viz., rice is regarded as the most suitable bait base. Use of rice powder with 10% coconut or groundnut oil is suggested as bait base. However, in agreement with the suggestion of Fitzwater and Prakash (1986), use of mixed baits will be more fruitful for trapping or poison baiting.

SUMMARY

The large bandicoot rat usually feeds only after dusk till the early morning. It regularly goes to the water in search of prey and brings the prey in a particular feeding place. Analysis of stomach contents revealed diversity of food items as well as seasonality, Molluscs, fishes, insects, grasses are consumed throughout the year, crabs and prawns mainly during monsoon, while paddy and potato tuber during post monsoon. In captivity, a simple preferential order for *P. globosa* was demonstrated. Food and calorie intake increased considerably with increase in the number of

choices. Tests with oils revealed the following preference : coconut → groundnut → sesame → mustard. Consumption of food scented with intraspecific odour was higher than control food. Freshly collected specimens readily accepted water and food. It is responsible for the certain damage of paddy, vegetable, fishery, *etc.*, but at the same time plays an important role in the biological control of a number of pestiferous species.

ACKNOWLEDGEMENT

We are thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Dr. A. K. Ghosh, former Director, ZSI, for providing all the facilities and continuous encouragement. Thanks are due to Dr. R. K. Varshney, Retd. Addl. Director, ZSI, and Dr. V. C. Agrawal, Emeritus Scientist, Dr. A. K. Mukherjee, Retd. Dy. Director, ZSI for their valuable suggestions.

We are grateful to the Scientists of the Botanical Survey of India, Calcutta for helping in the identification of the plant material.

We sincerely thank Dr. I. Prakash, Insa Senior Scientist and Dr. A. Chowdhury, Dept. of Marine Science, C. U. for their valuable suggestions.

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Table 1. Frequency of occurrence and percentage of material (by weight) contained in 42 stomachs of *Bandicota indica* from Sagar Island.

Food item	Month of collection and stomach number																			
	March		April		May		June		July		August		September							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>Rana</i> sp.	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-
<i>Puntius</i> sp.	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
<i>Chela</i> sp.	-	-	-	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	-	-
Other fishes	-	-	-	+	-	-	+	-	+	-	-	-	-	+	-	+	-	-	-	+
<i>Pila globosa</i>	+	+	-	-	-	-	-	-	-	-	-	+	-	-	+	+	+	-	+	-
<i>Lamellidens marginalis</i>	-	-	-	+	-	-	-	-	-	-	-	-	+	-	+	-	-	+	-	-
Other molluscs	+	-	-	-	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	+
<i>Macrobrachium</i> sp.	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+	-	-	-
<i>Metapenaeus</i> sp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-
<i>Varuna</i> sp.	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	+	-	+	-
<i>Paratelphusa</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
<i>Belostoma</i> sp.	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-
<i>Acrotylus</i> sp.	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-
<i>Erotes</i> sp.	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-
Other insects	+	+	+	-	+	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-
<i>Pheretima</i> sp.	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+	-	-	-	-
Unidentified animals	-	+	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-
Paddy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potato	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Phaseolus</i> sp.	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>Derris</i> sp.	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	+	-	-	-	-
<i>Amaranthus</i> sp.	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
<i>Hydrolea</i> sp.	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	+
<i>Colocasia</i> sp.	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	+	-
<i>Sphenoclea</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-
Grasses	-	-	+	-	+	-	+	+	-	+	-	-	+	+	+	-	-	+	-	-
Unidentified plants	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	-	-	-	-

* Total differs from 100% due to rounding.

Contd.

October		November				December						January					February					Frequency of	*Percent
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	Occurrence	(By Weight)
-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1
-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.8
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.8
-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	12	5.5
+	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	+	12	3.8
-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	5	3
-	-	-	+	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	11	7
-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	4	0.5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.3
-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.4
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	0.1
-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.1
-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	12	0.7
-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	5	0.3
-	-	-	+	-	-	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	9	2.6
-	-	-	+	-	+	-	-	-	+	+	+	+	-	-	+	+	-	-	-	-	-	11	9
-	-	-	-	-	-	+	+	-	-	-	+	-	+	-	-	-	-	-	+	-	+	6	6
-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	+	-	4	0.4
-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0.3
+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	4	0.5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0.3
-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	+	+	-	-	-	-	+	7	5.4
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	5	0.2
+	-	+	-	+	-	+	-	-	+	-	+	-	-	-	+	+	-	+	-	-	-	20	4.3
+	+	+	+	+	+	-	-	+	+	-	-	-	-	+	-	-	-	-	+	+	+	24	11

Table 2. Average weight of the stomach contents (gm) of 42 specimens of *Bandicota indica* captured in different hours (18.00 hrs to 6.00 hrs.). Number of samples given in parenthesis.

Hours	18.00-20.00	20.00-22.00	22.00-0.0	0.0-2.00	2.00-4.00	4.00-6.00
Weight of the stomach contents	23.2(7)	42.4(9)	47.3(4)	51.1(9)	49.1(8)	57.6(5)

Table 3. Mean T.D.I. of food, calorific value, water, and changes in the body weight of *Bandicota indica* when presented five food items one at a time to five individually caged adult animals for five days study period.

Food items	Mean T.D.I (gm) of food/rat	Calories/gm	Mean Calories consumed/ rat/day	Mean water intake (c.c)/rat/day	Average body weight (gm) of experimental rats				Mean food consumption (gm)/gm of rat/day	Mean calories consumed/ gm/of rat/day
					Start	Finish	Diff.	Mean		
<i>Pila globosa</i>	*95	0.97	92.15	**7.2	652	649	-3	650.5	0.146	0.141
Rice	£36	3.48	125.28	22	649	641	-8	645	0.055	0.194
Wheat	28	3.46	96.88	23.4	641	628	-13	634.5	0.044	0.152
Green Gram	29	3.51	101.79	21	628	627	-1	627.5	0.046	0.162
Bengal Gram	32	3.65	116.16	21.3	627	624	-3	625.5	0.051	0.185

* Significantly high than other food items, $P < 0.001$

** Significantly low than with other food items, $P < 0.001$

£ Significantly high than other three plant products, $P < 0.05$

Table 4. Mean T.D.I. of food, water, calorific value and changes in the body weight of *Bandicota indica* when five food items were presented, two at a time to five individually caged adult animals for five days study period.

Food items	Mean (gm) of food	Calories/gm	Mean calories consumed/rat/day	Mean water intake (c.c.)/rat/day	Average body weight (gm) of the experimental rats			Mean food in take (gm)/gm of rat/day	Mean calories consumed/gm of rat/day
					Finish	Difference	Mean		
*1. <i>Pila glo-</i> <i>bosa Rice</i>	74 21	0.97 3.48	71.78 73.08	**12.4	574.2	646.6	-0.6	646.9	0.146 0.223
*2. <i>P. globosa</i> Wheat	88 5	0.97 3.46	85.36 17.3	**11	646.6	645.8	-0.8	646.2	0.143 0.158
*3. <i>P. globosa</i> Green Gram	79 11	0.97 3.51	76.63 38.61	**9.4	645.8	645.6	-0.2	645.7	0.139 0.178
*4. <i>P. globosa</i> Bengal Gram	74 20	0.97 3.63	71.78 72.6	**11	645.6	646	+0.4	645.8	0.145 0.223
5. Rice Wheat	30 8	3.48 3.46	104.4 27.68	25.5	646	644.8	-1.2	645.4	0.058 0.204
6. Rice Green Gram	26 11	3.48 3.51	90.48 38.61	23.5	644.8	643.8	-1.0	644.3	0.057 0.2
7. Rice Bengal Gram	21 19	3.48 3.63	73.04 68.97	26.2	643.8	644	+0.2	643.9	0.062 0.22
8. Wheat Bengal Gram	6 30	3.46 3.63	20.76 108.9	27	644	643.2	-0.8	643.6	0.055 0.201
9. Wheat Green Gram	11 21	3.46 3.51	38.06 73.71	24.3	643.2	641.8	-1.4	642.5	0.049 0.173
10. Bengal Gram Green Gram	30 5	3.63 3.51	108.9 17.55	23	641.8	641.6	-0.2	641.7	0.054 0.197

* Significantly higher than other six diadic trials, $P < 0.001$ * Significantly less than other six diadic trials, $P < 0.001$

Table 5. Average daywise consumption of *Bandicota indica* when four food items (*Pila globosa* and three food grains) were provided at a time for thirty consecutive days to four individually caged specimens.

Food items		Daywise mean consumption (gm) of each food item/rat																			
	Days—	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<i>Pila globosa</i>		68	70	59	67	69	81	69	61	63	68	69	63	70	59	60	63	57	52	60	58
Bengal Gram		8	8	15	9	13	10	16	14	13	11	16	13	14	15	18	16	21	19	20	22
Rice		20	21	18	18	20	14	15	19	21	15	13	16	18	20	19	20	18	20	16	15
Wheat		—	—	—	—	—	—	2	—	—	—	1	—	—	2	—	1	—	—	—	1
<i>Total</i>		96	99	92	94	102	105	102	94	97	94	99	92	102	96	97	100	96	91	96	96

Contd.

Table 6. Average daywise consumption of *Bandicota indica* when four food grains were provided at a time for thirty consecutive days to four individually caged specimens.

Food items		Daywise mean consumption (gm) of each food item/rat																			
	Days—	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Rice		21	22	24	23	23	21	24	21	17	19	22	16	19	20	20	19	19	18	15	15
Wheat		—	—	1	2	1	1	1	2	5	2	1	3	—	3	1	2	3	6	3	2
Bengal Gram		16	19	19	20	19	20	18	17	18	16	18	15	18	16	18	18	22	19	22	22
Green Gram		—	—	—	3	2	2	2	4	2	5	2	5	6	2	2	6	1	3	6	1
<i>Total</i>		37	41	44	48	45	44	45	44	42	42	43	39	43	41	41	45	45	46	46	40

Contd.

										Average body weight(gm)/rat				Mean consum- ption (gm)/rat/ day	Mean consum- ption (gm)/gm of rat/day	Mean calorie intake /gm of rat/day
21	22	23	24	25	26	27	28	29	30	Start	Finish	Difference	Mean			
51	49	46	49	52	48	42	44	42	43					58.4	0.098	0.095
24	20	19	20	17	18	20	23	20	16					16.2	0.027	0.098
13	14	15	12	18	15	16	14	10	11	589	592	3	590.5	16.4	0.027	0.093
—	—	3	—	—	1	—	—	—	—					0.36	0.0006	0.002
88	83	83	81	87	82	78	81	72	70					91.36	0.153	0.288

										Average body weight(gm)/rat		Mean consum- ption (gm)/rat/ day	Mean consum- ption (gm)/gm of rat/day	Mean calorie intake /gm of rat/day		
21	22	23	24	25	26	27	28	29	30	Start	Finish	Difference	Mean			
10	17	10	8	12	10	13	11	13	14				17.1	0.029	0.1	
4	3	1	2	3	4	2	1	3	4				2.1	0.003	0.01	
26	20	18	23	23	26	27	26	24	22				20.1	0.034	0.123	
7	5	6	4	5	4	1	4	2	—	581	586	5	583.5	3.0	0.005	0.017
47	45	35	37	43	42	43	42	42	40				42.3	0.0171	0.25	

Table 7. Influence of body odour on the food consumption in different sexes of *Bandicota indica*.

Type of food items provided	Mean daily intake (gm)	
	Males	Females
Test I		
A. Rice flour	19	18.5
B. Rice flour scented with females	22	20
Level of significance	Not significant	Not significant
Test II		
A. Rice flour	17	18
B. Rice flour scented with males	20	21
Level of significance	Not significant	Significant

A NEW CRYPTOSTIGMATID MITE (ACARI : ORIBATEI, APOPLOPHORIDAE) FROM DARJEELING, INDIA

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INTRODUCTION

A new species of the genus *Apoplophora* Aoki (Acari : Oribatei, Apoplophoridae), viz., *A. aokii* is described from the forest floors and tea fields in the district of Darjeeling, West Bengal, India.

The genus *Apoplophora* was erected by Aoki (1980) with *Apoplophora remota* as the type-species from Japan. But Niedbala (1984) treated *Apoplophora remota* Aoki, 1980 as a synonym of *Mesoplophora pantotrema* Berlese, 1913 while establishing the family Apoplophoridae. He (*op. cit.*) mentioned *Mesoplophora pantotrema* Berlese, 1913 as the type-species of the genus *Apoplophora* Aoki, 1980. He in the same publication also treated *Mesoplophora rostrorugosa* Hammer, 1979 as a synonym of *Mesoplophora pantotrema* Berlese, 1913. He (1993) further treated *Mesoplophora discreta* Berlese, 1913 as a synonym of *Mesoplophora pantotrema* Berlese, 1913 while reviewing oribatid mites from Berlese's collection and redescribing of species from Mesoplophoroidea. Several species under the genus *Apoplophora* are on record. Mahunka (1987) created 3 new species and transferred 2 other species of his own (1985) and also 3 other species of Hammer (1979) into this genus. Mahunka (1988) contributed one more species under this genus and in 1991 he again described 5 more new species under the genus *Apoplophora* from Malaysia. Thus 15 species are known to occur under the genus *Apoplophora*. But the species *Apoplophora rostrorugosa* (Hammer, 1979) and *A. remota* Aoki, 1980 were treated as the synonyms of *Apoplophora pantotrema* (Berlese, 1913) by Niedbala (1984) and *A. leviseta* (Hammer, 1979) were again transferred to *Mesoplophora* genus by Mahunka (1991). Thus the total number of the species stands 12 under the genus *Apoplophora* instead of 15. However, Mahunka (1991) has provided a key for the determination of species of the genus *Apoplophora* where he has given the validity of the species *Apoplophora rostrorugosa* (Hammer, 1979). Thus considering the Mahunka's view and above description, the genus *Apoplophora* contains 13 valid species till to date. All measurements are in micrometers (μm).

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Apoplophora aokii sp. nov.

(Figs. 1-3)

Female : Colour yellowish brown; length of aspis : 360-370; length of notogaster : 446-452; height of aspis : 180-210; height of notogaster : 286-290.

Aspis much longer than broad, punctate, with distinctly longitudinal striations on the middle part; all prodorsal setae erect, unilaterally barbed in the anterior half with tapering tips; rostral (*ro*) and lamellar (*le*) setae nearly equal, 130-132 long respectively; interlamellar setae (*in*) 128-132 long, procumbent; exobothridial setae (*ex*) 1 pair, 96-99 long, decumbent, situated anterior to the bothridium; bothridium (*bo*) depressed cup-like; sensillus (*ss*) filiform, nearly uniformly thick in the posterior 3/4th and gradually tapering at the anterior 1/4th distal, sparsely barbed unilaterally more than anterior half, 160-165 long, directed postero-laterally.

Notogaster punctate, with a few irregular foveolated microsculptures; notogastral setae 8 pairs, 48-152 long, unilaterally barbed in the posterior 2/3rd except setae c_3 which are quite different, much thinner and shorter than the others, glabrous, 48-50 long, setae c_1 , d_1 dorsal, c_2 , d_2 dorso-lateral and d_3 , e_1 , e_2 postero-dorsal, setae c_3 antero-lateral.

Ventral plate separable into a most densely punctate region at the anterior middle half, with 7 pairs of setae, 48-85 long, of which 6 pairs faintly barbed unilaterally at the distal half, originating around the anal plates and 1 pair smooth, in aggenital position; each anal plate thrice as long as broad, with 3 nearly equal, unilaterally ciliated anterior half setae, 55-60 long, placed equidistantly along the outer side of the anal plate; each genital plate triangular in out line, with 6 smooth setae, 20-30 long, 3 along the median margin, 2 near the posterior margin and 1 latero-posteriorly of the mid point of the plate; genital and anal apertures separated from each others by more the length of anal aperture.

Claws monodactylous, slightly curved.

Holotype : Adult F, INDIA : West Bengal : Darjeeling, Lopchu Tea Estate (from loose humus), 1200 m., 26.viii. 1989 (B. K. Mondal coll.); paratype : 1 adult F, INDIA : West Bengal : Darjeeling, Happy Valley Tea Estate (from decomposed leaves of *Camellia sinensis*), 1990 m., 24. viii. 1989 (B. K. Mondal coll.); paratype : 1 adult F, INDIA : West Bengal : Darjeeling, Darjeeling forest Div., Senchal forest range, Sonada forest block (from soil under a plant, *Machilus edulis*), 2100 m., 30. viii. 1989 (B. G. Kundu coll.); paratype : 1 adult F, INDIA : West Bengal : Darjeeling forest Div., Tonglu forest range, Palmajua forest bungalow area (from rotten leaves of *Cryptomeria japonica*), 2300 m., 2. ix. 1989 (B. K. Mondal coll.) ; deposited in the laboratory of the Department of Zoology, Ananda Chandra College, Jalpaiguri -735 101, INDIA.

The Indian species accords with *Apoplophora pantotrema* (Berlese, 1913), *A. heterotricha* Mahunka, 1987, *A. malaya* Mahunka, 1991 and *A. triseta* Mahunka, 1991 respectively. It can,

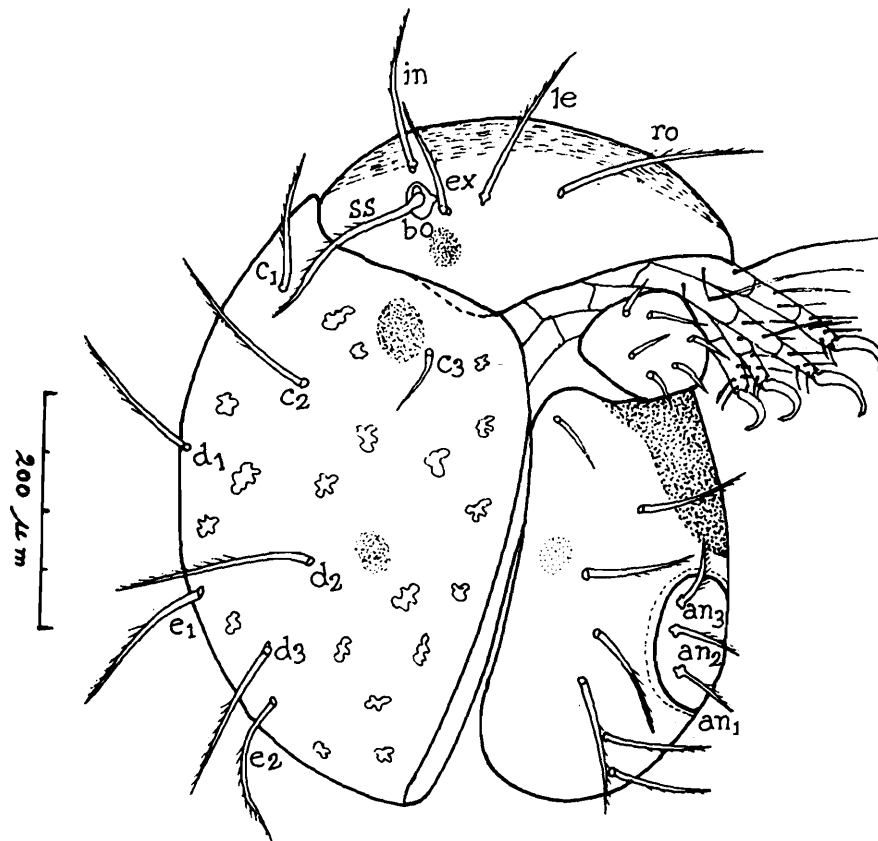


Fig. 1. *Apoplophara aokii* sp. nov. (Lateral view), *ro* = rostral seta, *le* = lamellar seta, *in* = interlamellar seta, *bo* = bothridium, *ss* = sensillus, *ex* = exobothridial seta; *c*₁, *c*₂, *c*₃, *d*₁, *d*₂, *d*₃, *e*₁, *e*₂ = notogastral setae, *an*₁, *an*₂, *an*₃ = anal setae.

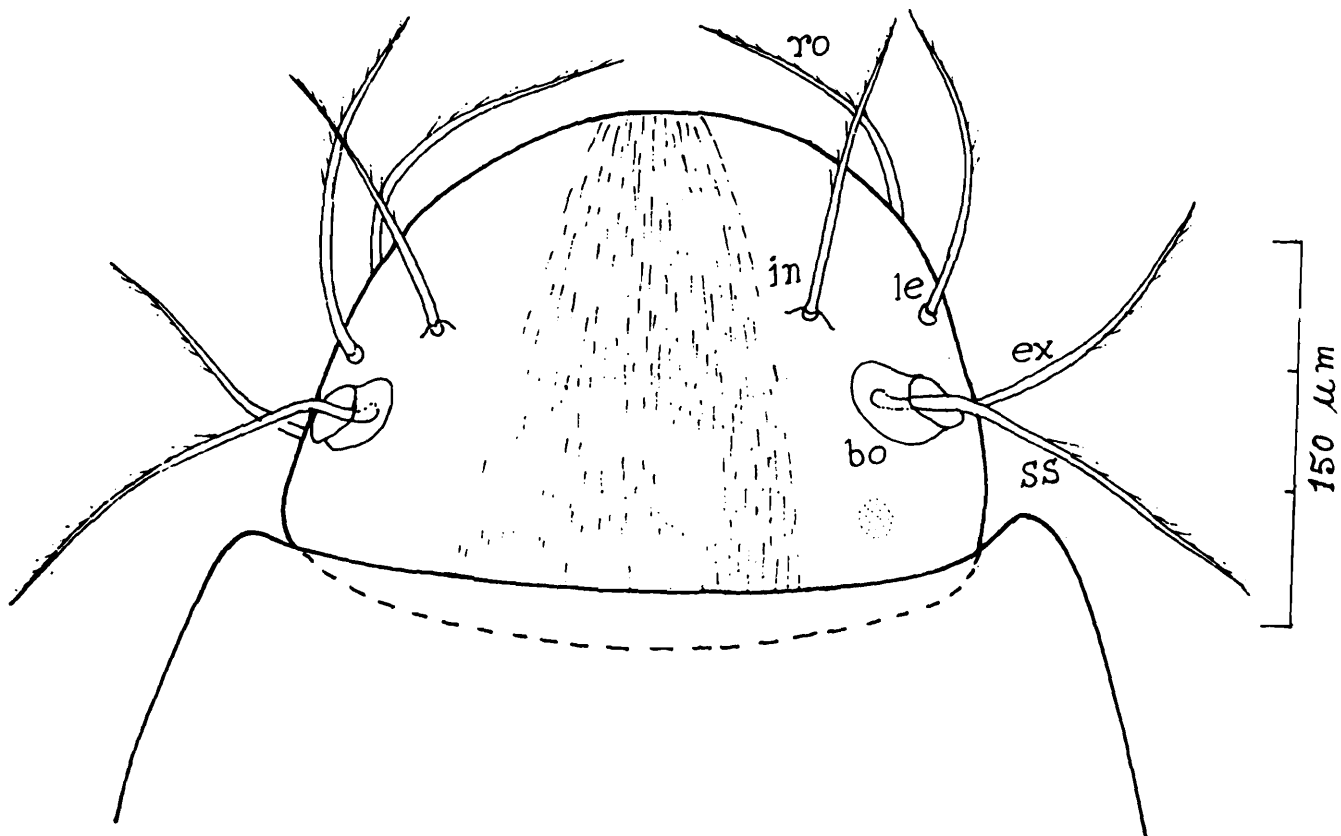


Fig. 2. *Apoplophara aokii* sp. nov. (Dorsal view of aspis), *ro* = rostral seta, *le* = lamellar seta, *in* = interlamellar seta, *bo* = bothridium, *ex* = exobothridial seta, *ss* = sensillus.

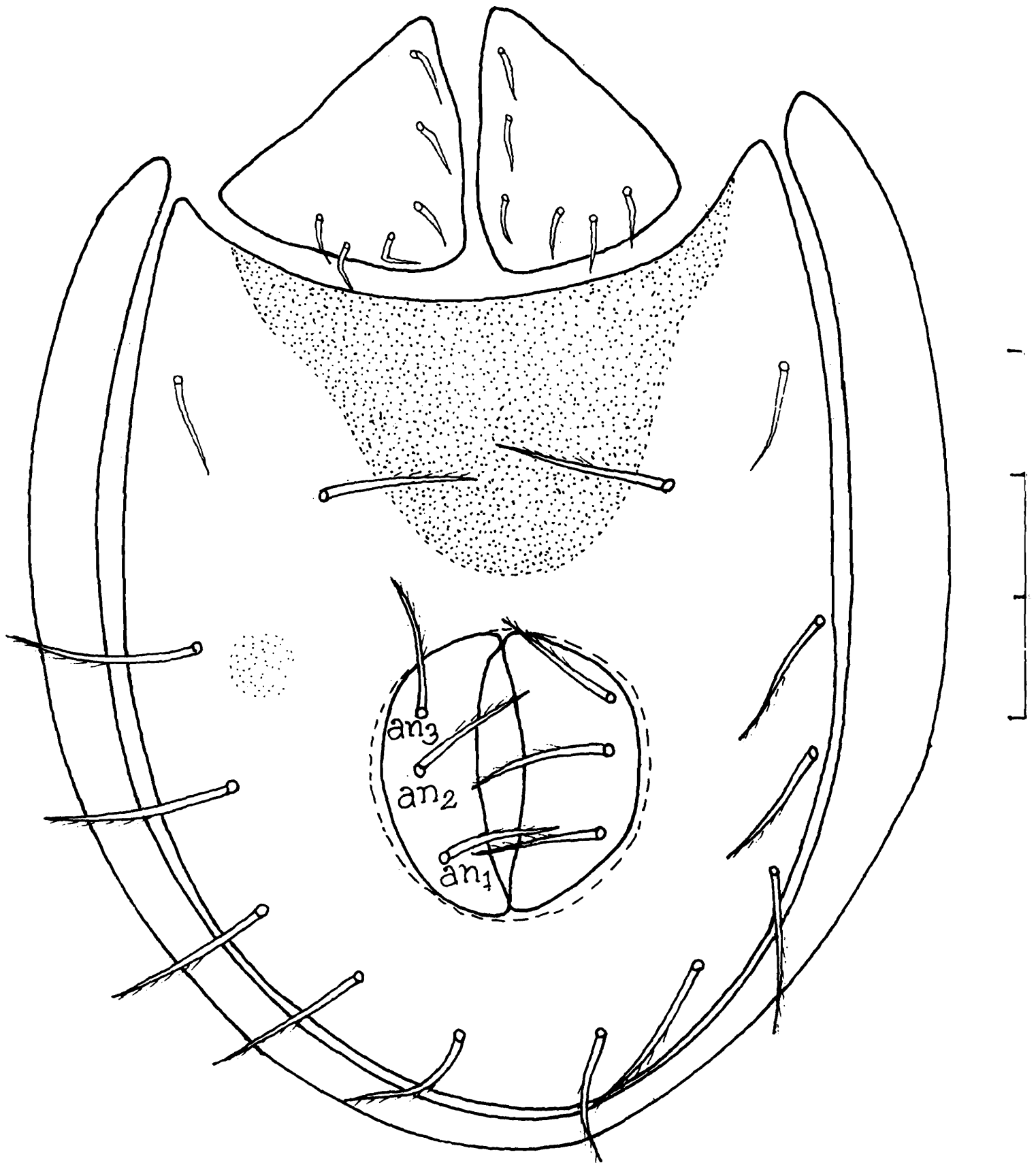


Fig. 3. *Apoplophora aokii* sp. nov. (Ano-genital region), an_1 , an_2 , an_3 = anal setae.

however, be easily distinguished from *pantotrema* by the nature of notogastral setae c_3 , presence of densely punctate region of ventral plate and number of anal setae and on the other hand from *heterotricha* by the presence of distinct striations on aspis and nature and number of ventral setae. It is further separated from *malaya* by having 3 pairs of anal setae, densely punctate region of ventral plate and 7 pairs of ventral setae of which one pair in aggenital position. However, the Indian species is the second *Apoplophora* species with 3 pairs of anal setae next to *A. trisetata*. But it is distinctly differed from *trisetata* by having larger body size, presence of distinct striations on aspis, 7 pairs of ventral setae and by the nature of notogastral setae c_3 .

SUMMARY

This paper deals with the description of a new species of soil oribatid mite (Acari), viz., *Apoplophora aokii* from forests and tea estates of Darjeeling, West Bengal, India.

ACKNOWLEDGEMENT

The first author is grateful to the University Grants Commission, New Delhi, India, for providing some financial assistance to study the oribatid mites of Darjeeling, India.

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**ON A COLLECTION OF ORIBATID FAUNA (ACARI : ORIBATEI) FROM
FOREST AND TEA SOILS IN JALPAIGURI DISTRICT, WEST BENGAL, INDIA**

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INTRODUCTION

Surveys for oribatid fauna in forest and tea soils were undertaken in Jalpaiguri district, West Bengal, India during 1996. The soil surface of most of the sites in forest and tea estate areas were covered with litter and humus. Examination of a part of the collected specimens from the soil samples reveals twenty six known species distributed over twenty five genera under sixteen families.

All the species except *Brasilobates punctata* listed here and ten genera marked with double asterisk (**) in the list are new records for India.

The specimens are deposited in the laboratory of the Department of Zoology, Ananda Chandra College, Jalpaiguri-735 101, West Bengal, India.

***Hoplophthiracarus foveolatus* Aoki, 1980**

1980. *Hoplophthiracarus foveolatus* Aoki, *Bull. Inst. Envir. Sci. Tech., Yokohama Natn. Univ.*, **6** (2) : 38.

Material examined : 3 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Banarhat Tea Estate (from soil under a tea plant, *Camellia sinensis*), 18. viii. 1996 (B. K. Mondal coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from loose litter of *Camellia sinensis*), 15. viii. 1996 (B. G. Kundu coll.).

***Hermannia setiformis* De Wet, 1993**

1993. *Hermannia setiformis* De Wet, *Navors. nas. Mus., Bloemfontein*, **9** (9) : 276.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Lataguri range, Sursuti block (from decomposed leaves of *Alstonia scholaris*), 4. viii. 1996 (B. K. Mondal coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jainti Tea Estate (from humus), 15. viii. 1996 (B. K. Mondal coll.).

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***Microtegeus globifer* Mahunka, 1985**

1985. *Microtegeus globifer* Mahunka, *Acta zool. hung.*, **31** (1-3) : 130.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Atiabari Tea Estate (from decaying leaves of *Camellia sinensis*), 12. v. 1996 (*B. K. Mondal* coll.); 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Moraghat range, North Moraghat block (from rotten leaves of *Dalbergia sissoo*), 20. viii. 1996 (*B. G. Kundu* coll.).

***Liacarus acutidens* Aoki, 1965**

1965. *Liacarus acutidens* Aoki, *Jap. J. Zool.*, **14** (3) : 1.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Lataguri range, Sursuti block (from decomposed leaves of *Ricinus communis*), 4. viii. 1996 (*B. K. Mondal* coll.).

*****Maorizetes ferox* Hammer, 1966**

1966. *Maorizetes ferox* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **15** (2) : 98.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Kalchini Tea Estate (from soil with rotten leaves of *Camellia sinensis*), 2. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from humus), 15. viii. 1996 (*B. G. Kundu* coll.).

*****Pentabodes insolitus* Balogh, 1984**

1984. *Pentabodes insolitus* Balogh, *Acta zool. hung.*, **30** (3-4) : 322.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Cooch Behar Tea Estate (from decomposed leaves of *Camellia sinensis*), 9. iv. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Dalgaon range, Dalgaon block (from loose soil with litter under *Tectona grandis*), 17. viii. 1996 (*B. G. Kundu* coll.).

*****Pseudocarabodes xenus* Mahunka, 1991**

1991. *Pseudocarabodes xenus* Mahunka, *Revue suisse Zool.*, **98** (1) : 199.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Indong Tea Estate (from litter of *Camellia sinensis*), 1. v. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Banarhat Tea Estate (from decaying leaves of *Camellia sinensis*), 18. viii. 1996 (*B. G. Kundu* coll.).

***Pseudotocepheus contractus* Grobler, 1997**

1997. *Pseudotocepheus contractus* Grobler, *Navors. nas. Mus., Bloemfontein*, **13** (1) : 7.

Material examined : 3 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Atiabari Tea Estate (from litter of *Camellia sinensis*), 12. v. 1996 (*B.K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Binaguri Tea Estate (from humus), 16. viii. 1996 (*B. G. Kundu* coll.).

*****Spinotocepheus foveolatus* Hammer, 1981**

1981. *Spinotocepheus foveolatus* Hammer, *Acarologia*, **22** (2) : 229.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Dalgaon range, Dalgaon block (from soil under *Tectona grandis*), 17. viii. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Banarhat range, Rethi block (from soil under *Eucalyptus globulus*), 19. viii. 1996 (*B. G. Kundu* coll.).

***Megalotocepheus undulatus* Hammer, 1981**

1981. *Megalotocepheus undulatus* Hammer, *Acarologia*, **22** (1) : 87.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Patkapara Tea Estate (from rotten leaves of *Camellia sinensis*), 16. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from humus), 15. viii. 1996 (*B. G. Kundu* coll.).

*****Plenotocepheus verrucosus* Grobler, 1995**

1995. *Plenotocepheus verrucosus* Grobler, *Navors. nas. Mus., Bloemfontein*, **11** (2) : 16.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Kalchini Tea Estate (from loose soil with humus, litter and rotten leaves of *Camellia sinensis*), 2. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Moraghat range, Moraghat block (from loose humus under *Terminalia arjuna*), 20. viii. 1996 (*B. G. Kundu* coll.).

*****Lophotocepheus simplex* Balogh and Balogh, 1983**

1983. *Lophotocepheus simplex* Balogh and Balogh, *Acta zool. hung.*, **29** (4) : 294.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from humus), 23. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal :

Jalpaiguri District, Jainti Tea Estate (from loose soil under *Camellia sinensis*), 15. vii. 1996 (B. K. Mondal coll.).

***Oxyoppia spiculifera* Mahunka, 1985**

1985. *Oxyoppia spiculifera* Mahunka, *Acta zool. hung.*, **31** (4) : 337.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Lataguri range, Sursuti block (from soil with litter under *Acacia auriculiformis*), 4. viii. 1996 (B. K. Mondal coll.); 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Moraghat range, North Moraghat block (from soil under *Swietenia mahagoni*), 20. viii. 1996 (B. G. Kundu coll.).

*****Interoppia mirabilis* Mahunka, 1987**

1987. *Interoppia mirabilis* Mahunka, *Revue suisse Zool.*, **94** (4) : 805.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Raja Tea Estate (from loose litter of *Camellia sinensis*), 29. iv. 1996 (B. K. Mondal coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Banarhat Tea Estate (from soil under a tea plant, *Camellia sinensis*), 18. viii. 1996 (B. G. Kundu coll.).

***Suctobelba insulana* Hammer, 1972**

1972. *Suctobelba insulana* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **19** (3) : 32.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Dalgaon range, Dalgaon block (from soil under *Melia azedarach*), 17. viii. 1996 (B. K. Mondal coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Banarhat range, Rethi block (from soil under *Tectona grandis*), 19. viii. 1996 (B. G. Kundu coll.).

*****Demisalto engelbrechti* Coetzee, 1993**

1993. *Demisalto engelbrechti* Coetzee, *Navors. nas. Mus., Bloemfontein*, **9** (5) : 143.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Ramsai range, Lower Tundu block (from soil under *Anthocephalus cadamba*), 18. viii. 1996 (B. K. Mondal coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Banarhat range, Rethi block (from decomposed leaves of *Albizia lebbeck*), 19. viii. 1996 (B.G. Kundu coll.).

***Zygoribatula gracilata* Grobler and Kok, 1993**

1993. *Zygoribatula gracilata* Grobler and Kok, *Navors. nas. Mus., Bloemfontein*, **9** (6) : 182.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Binaguri Tea Estate (from compost heap), 28. v. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Banarhat Tea Estate (from decaying leaves of *Camellia sinensis*), 18. viii. 1996 (*B. G. Kundu* coll.).

***Xylobates mollicoma* Hammer, 1973**

1973. *Xylobates mollicoma* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **20** (3) : 48.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from humus), 23. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jainti Tea Estate (from loose soil under *Camellia sinensis*), 15. viii. 1996 (*B. G. Kundu* coll.).

***Xylobates triangularis* Hammer, 1971**

1971. *Xylobates triangularis* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **16** (6) : 37.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Kalchini Tea Estate (from rotten leaves of *Camellia sinensis*), 2. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Moraghat range, Moraghat block (from loose humus under *Terminalia arjuna*), 20. viii. 1996 (*B. G. Kundu* coll.).

***Brasilobates punctata* Grobler, 1991**

1991. *Brasilobates punctata* Grobler, *Navors. nas. Mus., Bloemfontein*, **7** (5) : 75.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Birpara Tea Garden (from humus), 23. vi. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jainti Tea Estate (from loose soil under *Camellia sinensis*), 15. viii. 1996 (*B. G. Kundu* coll.).

***Parahypozetes grandis* Hammer, 1967**

1967. *Parahypozetes grandis* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **15** (4) : 11.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Lataguri range, Sursuti block (from soil with litter under *Acacia auriculiformis*), 4. viii. 1996 (*B. K. Mondal* coll.).

*****Trichoribates rausensis* Aoki, 1982**

1982. *Trichoribates rausensis* Aoki, *Bull. Inst. Envir. Sci. Tech., Yokohama Natn. Univ.*, **8** : 190.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Indong Tea Estate (from litter of *Camellia sinensis*), 1. v. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Banarhat Tea Estate (from decaying leaves of *Camellia sinensis*), 18. viii. 1996 (*B. G. Kundu* coll.).

***Galumnella nipponica* Suzuki and Aoki, 1970**

1970. *Galumnella nipponica* Suzuki and Aoki, *Annot. Zool. Japon.*, **43** (3) : 166.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Ramsai range, Lower Tundu block (from soil under *Anthocephalus cadamba*), 18. viii. 1996 (*B. K. Mondal* coll.).

***Galumna parviporosa* Balogh and Balogh, 1983**

1983. *Galumna parviporosa* Balogh and Balogh, *Acta zool. hung.*, **29** (1-3) : 102.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Dalgaon range, Dalgaon block (from soil under *Tectona grandis*), 11. viii. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest div., Banarhat range, Rethi block (from soil under *Eucalyptus globulus*), 19. viii. 1996 (*B. G. Kundu* coll.).

*****Allogalumna remota* Hammer, 1968**

1968. *Allogalumna remota* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **16** (2) : 66.

Material examined : 2 adult ♀♀, INDIA : W. Bengal : Jalpaiguri District, Binaguri Tea Estate (from compost heap), 28. v. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Lataguri range, Sursuti block (from decomposed leaves of *Ricinus communis*), 4. viii. 1996 (*B. K. Mondal* coll.).

***Pergalumna taprobanica* Balogh, 1988**

1988. *Pergalumna taprobanica* Balogh, *Acta zool. hung.*, **34** (2-3) : 189.

Material examined : 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Gairkhata Tea Estate (from compost heap), 14. vii. 1996 (*B. K. Mondal* coll.); 1 adult ♀, INDIA : W. Bengal : Jalpaiguri District, Jalpaiguri forest Div., Banarhat range, Rethi block (from decomposed leaves of *Albizia lebbeck*), 19. viii. 1996 (*B. G. Kundu* coll.).

SUMMARY

This paper deals with twenty six species of soil oribatid mites (Acari) distributed over twenty five genera under sixteen families. All the species except one (*Brasilobates punctata*) mentioned here are first time reported from India. Ten genera out of twenty five listed here are recorded for the first time from India.

ACKNOWLEDGEMENT

The first author is grateful to the University Grants Commission, New Delhi, India, for giving some financial assistance to study the oribatid fauna from forest and tea soils in the district of Jalpaiguri, West Bengal, India.

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ANNOTATED CHECK-LIST OF APHODIINAE (SCARABAEIDAE : COLEOPTERA) FROM INDIA

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INTRODUCTION

The dung beetles belonging to subfamily Aphodiinae are usually coprophagous in habit and complete their life cycle in dung deposits. Some of the species are myrmecophilous and also inhabit the mammal nests. They play an important role in decomposition of dung from soil surface and thus making the environment clean and earning the name of "Nature's Scavengers". These beetles are characterized by the nine-segmented antennae and club 3-segmented; labrum and mandibles concealed by the clypeus; posterior spiracles situated in the membrane between dorsal and ventral segments; middle coxae almost contiguous and hind tibiae with two terminal spurs and elytra completely covering the abdomen.

The Aphodiinae fauna of the World is represented by about 1,200 species. The present knowledge about the Indian Aphodiinae is due to initial efforts made by Linnaeus (1767) and Fabricius (1781, 1787, 1792, 1801) and upto nineteenth century only 32 species of Aphodiinae were described by various workers namely Dejean (1833), Fairmaire (1896, 1897), Gestro (1891), Harold (1859, 1860, 1861, 1862, 1867, 1868, 1869, 1874, 1881), Klug (1855), Lansberg (1866), Motschulsky (1863), Reiche (1863, 1869), Roth (1847), Walker (1858), Wassmann (1899), Waterhouse (1875, 1876), Westwood (1847), Wiedemann (1823) and Wiedemann & Germar (1821). Later on in the present century Arrow (1909), Balthasar (1933, 1935, 1937, 1939, 1940, 1941 (a & b), 1946, 1955, 1963, 1965, 1967, 1973), Benard (1917, 1930), Boucomont (1935), Champion & Wassmann (1923), Clouet (1901), Johnson (1978), Koshantschikov (1916), Mittal (1993), Paulian (1934, 1936 a & b), Petrovitz (1958, 1961 a & b, 1962 a & b, 1963 a & b, 1964, 1965, 1967, 1968 a & b, 1970, 1973, 1975, 1976), Pittino (1983, 1984, 1988), Pittino and Mariani (1986), Schmidt (1907, 1908, 1909, 1910, 1911, 1916, 1923), Stebnicka (1981, 1983, 1989), Tangelder and Krikken (1982), Wassmann (1902, 1911, 1918, 1923) described 101 species from India. An analysis of the fauna of Indian Aphodiinae described during the different period indicates that most of the species were described from 1901 to 1995 (Table 1) and analysis of contributions made by different

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coleopterists indicates that Petrovitz, Schmidt, Tangelder and Krikken, Balthasar, Wassmann, Harold, Pittino and Mariani and Mittal were the significant contributors, who described maximum species of Indian Aphodiinae.

Table 1 : Number of Indian species of Aphodiinae described during different periods

Sl. No	Period		Number of species described
	From	To	
1	1751	- 1800	5
2.	1801	- 1850	9
3.	1851	- 1900	18
4.	1901	- 1950	38
5.	1951	- 1995	63

CHECK LIST OF INDIAN FAUNA

Subfamily APHODIINAE Leach, 1815

Tribe APHODIINI Leach, 1815

Genus *Aphodius* Illiger, 1798

Cytoderhinus Seabra, 1909

Digonorhinus Seabra, 1909

Hemicyclorhinus Seabra, 1909

Subgenus *Acrossus* Mulsant, 1842

Aphodius (*Acrossus*) *angustiarum* Balthasar, 1967

hingstoni Petrovitz, 1976 : Tangu; Sikkim

simlaicus Petrovitz, 1970 : Simla;

Himachal Pradesh

ab. *rufipennis* Petrovitz, 1976 : Tangu; Sikkim

A. (A.) *emodus* Petrovitz, 1976 : Lachen; Sikkim

A. (A.) *opacipennis* A. Schmidt, 1910a : Sikkim

A. (A.) *ritsemai* A. Schmidt, 1909a : Sikkim

A. (A.) *ustulatus* Harold, 1862 : North-east India;
Chakratta, Kedarnath; Uttar Pradesh.

Subgenus ***Aganocrossus*** Reitter, 1895*Aphodius* (*Aganocrossus*) *amoenus* Boheman, 1857*centralis* Harold, 1868*centromaculatus* Germar, 1869ab. *fuscus* Petrovitz, 1962ab. *impugnans* A. Schmidt, 1907ab. *pallidicornis* Walker, 1858 : Chennai; Tamil NaduA. (A:) *khuntianus* Balthasar, 1940 : Khunti; Himachal Pradesh*urostigmoides* Balthasar, 1939Subgenus ***Alocoderus*** A. Schmidt, 1913*Aphodius* (*Alocoderus*) *decrepidus* Petrovitz, 1975 : India*patricius* Petrovitz, 1975A. (A.) *teyrovskyi* Balthasar, 1935 : Sikkim*milvus* Balthasar, 1955*pedongensis* Paulian, 1936a : Darjeeling; West BengalSubgenus ***Aphodius*** Illiger, 1798*Aphodius* (*S. Str.*) *elongatulus* Fabricius, 1801*chinensis* Harold, 1861*cruentus* Reiche, 1869 : Bengal*testaceus* Germar, 1813*tuberifrons* Fairmaire, 1889A. (*S. Str.*) *fasciger* Harold, 1881 : Darjeeling , West Bengalab. *infestus* A. Schmidt, 1907 : Assamab. *schenklingi* A. Schmidt, 1907 Khasis; Meghalayaab. *sexsignatus* A. Schmidt, 1907 : SikkimA. (*S. Str.*) *irregularis* Westwood, 1839 : Himalaya*basalis* Reiche, 1863 : IndiaSubgenus ***Balthasarianus*** Paulian, 1934*Aphodius* (*Balthasarianus*) *fruhstorferi* Petrovitz, 1970

Darjeeling; West Bengal

A. (*B.*) *gregori* Balthasar, 1941b : Sikkim.*abditus* Petrovitz, 1970 : Darjeeling; West BengalA. (*B.*) *nainiensis* Petrovitz, 1963a Bhimtal, Nainital; Uttar PradeshA. (*B.*) *pilosus* Harold, 1874 : India

- Subgenus ***Blackburneus*** A. Schmidt, 1913
Aphodius (*Blackburneus*) *minutissimus* A. Schmidt, 1908 :
Hulikal, Nilgiri; Tamil Nadu
A. (B.) *stebnickae* Pittino, 1988 : Nagpur; Maharashtra
- Subgenus ***Bodilus*** Mulsant and Rey, 1869
Aphodius (*Bolidus*) *liesenfeldti* Petrovitz, 1958 : Dehradun;
Kumaon; Uttar Pradesh
- Subgenus ***Emadiellus*** A. Schmidt, 1913
Aphodius (*Emadiellus*) *rufopustulatus* Wiedemann, 1823 :
Bengal
- Subgenus ***Erytodes*** A. Schmidt, 1916
Aphodius (*Erytodes*) *confirmatus* A. Schmidt, 1916 :
Chennai; Tamil Nadu
- Subgenus ***Euorodalus*** Dellacasa, 1983
Aphodius (*Euorodalus*) *himalayanus* W. Koshantschikov,
1916 : Kulu, Himachal Pradesh
- Subgenus ***Koshantschikovius*** A. Schmidt, 1913
Aphodius (*Koshantschikovius*) *andrewesi* A. Schmidt, 1908 :
Belgaum; Karnataka
A. (K.) *nagporensis* Petrovitz, 1968a :
Nagpur; Maharashtra
A. (K.) *strandi* Balthasar, 1935 : Nagpur; Maharashtra
- Subgenus ***Labarrus*** Mulsant and Rey, 1869
Aphodius (*Labarrus*) *lividus* Olivier, 1789 : Widely
distributed in India, Haryana, Uttar Pradesh,
Himachal Pradesh, Rajasthan and Andaman
(Chandra, 1992)
bilituratus Marsham, 1802
cincticulus Hope, 1846
discus Wiedemann, 1823
fimetifex Gistel, 1857
hircinus Gistel, 1857
maculicollis Montrouzier, 1860
obliteratus Mannerheim, 1833
osoletus Fabricius, 1801
sequens Walker, 1858
spilopterus Germar, 1848

- saturalis* Fabricius, 1792
saturalis Schonherr, 1833
verpertinus Ponzer, 1799
 ab. *anachoreta* Fabricius, 1801
 ab. *limbatus* Wiedemann, 1821
 ab. *limicola* Ponzer, 1798
 ssp. *matusitai* Nakane, 1961
 Subgenus ***Loboparius*** A. Schmidt, 1913
Aphodius (*Loboparius*) *immarginatus* A. Schmidt, 1907
crossulus Fairmaire, 1893
vitalisi Boucomont, 1921
 ssp. *cordieri* Boucomont, 1921
 ssp. *kumaoensis* Petrovitz, 1962a; Dehradun;
 Siwalik hills, 3000 m above; Uttar Pradesh
 ssp. *malabaricus* Petrovitz, 1962a : Mahe, Malabar;
 Kerala
minimus Reiche, 1863
 A. (L.) *nathani* Johnson, 1978 Anamalai Hill;
 Tamil Nadu
 A. (L.) *schereri* Petrovitz, 1963a : Nainital, Bhimtal; Uttar
 Pradesh
 Subgenus ***Megateloides*** Landin, 1974
Aphodius (*Megateloides*) *bostricoides* Harold, 1860 : North-
 East India
 Subgenus ***Mendidaphodius*** Reitter, 1901
Aphodius (*Mendidaphodius*) *pseudoadustus* Petrovitz, 1958
 Thar-desert; Rajasthan & Gujrat
 Subgenus ***Mesontoplatys*** Motschulsky, 1860
Aphodius (*Mesontoplatys*) *dorsalis* Klug, 1855 : India
probes Peringuey, 1901
tenuitarsis Fairmaire, 1897
 ab. *indorsalis* Endrodi, 1960
 ab. *maoensis* Endrodi, 1964
 A. (M.) *mungo* Balthasar, 1946 : Chennai, Tamil Nadu
 A. (M.) *ovatulus* Harold, 1861 : East India
ovatulus Reiche, 1861
 ab. *numerosus* A. Schmidt, 1913

- A. (M.) *scutatus* Petrovitz, 1961b : Kerala
 Subgenus *Neocalaphodius* Bordat, 1988
Aphodius (*Neocalaphodius*) *moestus* Fabricius, 1801 : India, widely distributed. Andaman (Chandra, 1992)
investigator Reiche, 1862
madagascariensis Dejean, 1833
madagascariensis Harold, 1859
mutans Walker, 1858
subvittatus Fairmaire, 1896
 ab. *connectena* Endrodi, 1960
 ab. *innotatus* Endrodi, 1960
 Subgenus *Oxyaphodius* Balthasar, 1965
Aphodius (*Oxyaphodius*) *sikkimensis* Balthasar, 1965 : Tumlong; Sikkim
 Subgenus *Paradidactylia* Balthasar, 1937
Aphodius (*Paradidactylia*) *brivioi* Petrovitz, 1961b : Machilipatnan; Kistna; Andhra Pradesh
 A. (P.) *dehradunensis* Petrovitz, 1961b : Dehradun, U. P.
 A. (P.) *haafi*, Petrovitz, 1964 : Orissa
 Subgenus *Paremadus* Nakane, 1976
Aphodius (*Paremadus*) *mahriensis* Stebnicka, 1983 : Mahri; Himachal Pradesh
 A. (P.) *schawalleri* Stebnicka, 1989 : Jammu & Kashmir
 A. (P.) *zopilae* Stebnicka, 1981 : Ladakh, Zojila, Jammu & Kashmir
 Subgenus *Phalacronothus* Motschulsky, 1859
Emadus Mulsant and Rey, 1869
Paragolius Balthasar, 1946
Aphodius (*Phalacronothus*) *avunculus* Balthasar, 1946 : Chennai; Tamil Nadu
 A. (P.) *carinulatus* Motschulsky, 1863 : India
 Subgenus *Pharaphodius* Reitter, 1892
Aphodius (*Pharaphodius*) *acutus* A. Schmidt, 1908 : South India
 A. (P.) *cornutus*, Wiedemann, 1823 : Bengal
 A. (P.) *costatulus* A. Schmidt, 1908 : Belgaum; Karnataka
dindigalensis Balthasar, 1951b : Dindigal; Tamil Nadu

- subpilosus* Petrovitz, 1965 : Vinukonda; D. Kistna
- A. (P.) *crenatus* Harold, 1862 : India; widely distributed;
Haryana, Uttar Pradesh, Himachal Pradesh,
Andaman (Chandra, 1992)
- buphalinus* Eschscholtz, 1833
- crenatus* Dejean, 1833
- pubiventris* Motschulsky, 1869
- A. (P.) *indicus* Petrovitz, 1958 : Coimbatore; Tamil Nadu
- A. (P.) *jodhpurensis* Petrovitz, 1958 : Barmer.
Thar-Desert; Rajasthan
- A.(P.) *marginellus* Fabricius, 1781 : South India
- assimilis* Megerle, 1833
- attritus* Balthasar, 1933
- lucidus* Dejean, 1862
- marginellus* Schuppel, 1833
- A. (P.) *perfidus* A. Schmidt, 1908 : Belgaum; Karnataka
- Subgenus ***Plagiogonus*** Mulsant, 1842
- Eccoaptaphodius*** Iablokov, 1964
- Oloperus*** Mulsant and Rey, 1869
- Aphodius* (*Plagiogonus*) *oberthuri* Paulian, 1936a :
Darjeeling; West Bengal
- ab. *nigrescens* Paulian, 1936a : Darjeeling;
West Bengal
- ab. *rubricatus* Paulian, 1936a : Darjeeling;
West Bengal
- A. (P.) *palea* Balthasar, 1967 : Darjeeling; West Bengal
- A. (P.) *ramamiensis* Stebnicka, 1981 : Raman, Darjeeling;
West Bengal
- Subgenus ***Pleuraphodius*** A. Schmidt, 1913
- Aphodius* (*Pleuraphodius*) *impudicus* Fabricius, 1801 : India
- A. (P.) *lewisi* Waterhouse, 1875 : South India
- Subgenus ***Teuchestes*** Mulsant, 1842
- Aphodius* (*Teuchestes*) *analisis* Fabricius, 1787 : India
- cinctipennis* Chevrolat, 1869
- ab. *niger* Landin, 1974
- ab. *sorex* Fabricius, 1792 : India
- beckeri* Mader, 1938

- Subgenus *Trichaphodius* A. Schmidt, 1913
Gilletianus Balthasar, 1933
Neoheptaolacus Paulian & Villiers, 1939
Schmidtaphodius Paulian, 1942
Trichaphodioides Paulian, 1942
- Aphodius* (*Trichaphodius*) *assamensis* Petrovitz, 1976 :
 Patkai Mt., Assam
- A. (T.) *costatulus* A. Schmidt, 1908 : Belgaum, Karnataka
subpilosus Petrovitz, 1965 : Vinukonda, Andhra Pradesh
- A. (T.) *humilis* Roth, 1851 : India
lanuginosus Perringuey, 1901
- ab. *decoloratus* Endrodi, 1957
 ab. *flavus* Endrodi, 1955
 ab. *fumosulus* Endrodi, 1957
 ab. *luctuosus* Endrodi, 1957
 ab. *nigrellus* Endrodi, 1957
 ab. *ovatus* Endrodi, 1957
 ab. *partitus* Endrodi, 1957
 ab. *punctiger* Endrodi, 1957
- ssp. *hindustanicus* Balthasar, 1935 : India
- A. (T.) *kazirangensis* Stebnicka, 1981 : Kaziranga; Assam
- A. (T.) *moorei* Paulian, 1936 : South India
- A. (T.) *reichei* Harold, 1859 : South India
binonatus Dalman, 1833
- A. (T.) *segmentaroides* A. Schmidt, 1909a : East India
- Subgenus *Trichonotulus* Bedel, 1911
Trichonotus Mulsant & Rey, 1842
- Aphodius* (*Trichonotulus*) *biseriatus* A. Schmidt, 1908 :
 India
- A. (T.) *castersi* Paulian, 1936a : Tiruchchirapalli, Tamil Nadu
echinatus Petrovitz, 1961 : Bengal
- A. (T.) *coimbatorensis* Balthasar, 1973 : Coimbatore; Tamil Nadu
- Aphodius* *campestris* Mittal, 1993 : Dehradun; U. P. ; Kurukshetra; Haryana

- A. *devabhumi* Mittal, 1993 : Badrinath; U. P.
 A. *mussooriensis* Mittal, 1993 : Mussoorie; U. P.
 A. *parvatia* Mittal, 1993 : Gorikund, Kedarnath; U. P.
 A. *rugosicapita*, Mittal, 1993 : Kalpa, H. P. ;
 Gorikund, U. P.
- Genus ***Oxyomus*** Dejean, 1833
Amidorinus W. Koshantschikov, 1912
Oxyomus Castelnau, 1840
Oxyomus Erichson, 1844
Oxyomus Eschscholtz, 1833
Oxyomus Stephens, 1839
Renaudius Balthasar, 1951
- Oxyomus* *cameratus* A. Schmidt, 1908 : Hulikal, Nilgiri;
 Tamil Nadu
- O. *nibigenus* Petrovitz, 1968 : India
 O. *simillimus* A. Schmidt, 1908 : Nilgiri Hills; Tamil
 Nadu
- Tribe CORYTHODERIINIA A. Schmidt, 1910
- Genus ***Chaetopisthes*** Westwood, 1847
- Subgenus ***Chaetopisthes*** Westwood, 1847
- Chaetopisthes* (s. str.) *fulvoides* Tangelder and Krikken : Chotanagpur,
 Nowatoli; Bihar
- C. (s. str.) *fulvus* Westwood, 1847 : Mhow, Malwa; Madhya
 Pradesh
- arrowi* Balthasar, 1941
- C. (s. str.) *latipes* Tangelder and Krikken 1982 : Faizabad;
 Uttar Pradesh
- C. (s. str.) *oberthueri* Tangelder and Krikken, 1982 : Ramnad,
 Tamil Nadu
- Subgenus ***Chaetopisthides*** Wassmann, 1918
- Chaetopisthes* (*Chaetopisthides*) *popei* Tangelder and Krikken,
 1982 : Chikkaballapuro; Karnataka
- C. (C.) *sulciger* Wassmann, 1899 : Ahmed Nagar;
 Maharashtra
- tibialis* Wassmann, 1923 : Khandesh, S. India
- Subgenus ***Miochaetopisthes*** Tangelder & Krikken 1982
- Chaetopisthes* (*Miochaetopisthes*) *cinnatus*

- Tangelder and Krikken, 1982 : Chipurupalle;
Andhra Pradesh
- Subgenus ***Neochaetopisthes*** Wassmann, 1918
- Chaetopisthes*** (*Neochaetopisthes*) *angustipes*, Tangelder and
Krikken, 1982 : Nilgiri Hills; Tamil Nadu
- C. (N.) assmuthi* Wassmann, 1911 : Khandala;
Maharashtra
- C. (N.) brevipes* Wassmann 1923 : Nowatoli, Chotanagpur,
Bihar
- C. (N.) brunneus* Wassmann, 1918 : Kirkee, Poona;
Maharashtra
- C. (N.) heimi* Wassmann, 1902 : Wallon, Ahmad Nagar,
Maharashtra
- C. (N.) longulus* Wassmann, 1923 : Kumaon, Tanakpur;
Uttar Pradesh
- C. (N.) meridionalis* Tangelder and Krikken, 1982 :
Kodaikanal; Tamil Nadu
- C. (N.) saetiger* Tangelder & Krikken, 1982 : Faizabad;
Uttar Pradesh
- C. (N.) semisulcatus* Tangelder and Krikken 1982 :
Faizabad; Uttar Pradesh
- C. (N.) septentrionalis* Tangelder and Krikken, 1982 :
Gurdaspur; Punjab
- C. (N.) simplices* Gestro, 1891 : North India
- C. (N.) ventriosus* Tangelder and Krikken, 1982 : Namkun,
Ranchi; Bihar
- Genus ***Corythoderus*** Klug, 1845
- Subgenus ***Eurycorythoderus*** Wassmann, 1918
- Corythoderus*** (*Eurycorythoderus*) *gibbiger* Wassmann, 1899 :
Sangamner, Ahmad Nagar; Maharashtra
- assmuthi* Wassmann, 1918
- fossiger*, Wassmann, 1918
- Subgenus ***Stenocorythoderus*** Wassmann, 1918
- Corythoderus*** (*Stenocorythoderus*) *braminus* Wassmann, 1918 :
Anand; Gujrat
- Genus ***Termitopisthes*** Wassmann, 1918
- Termitopisthes*** *forticulus* Tangelder and Krikken, 1982 : Kumaon,
Haldwani; Uttar Pradesh

- T. kistneri* Tangelder and Krikken, 1982 : Haldwani, Tanakpur; Uttar Pradesh
T. parallelus Wassmann, 1923 : Dehradun; Uttar Pradesh
T. schmidt Champion, 1923 : Kumaon, Tanakpur; Uttar Pradesh
T. submissus Tangelder and Krikken, 1982 Kumaon, Haldwani; Uttar Pradesh
T. wasmanni A. Schmidt, 1911 : Chotanagpur; Bihar
laticollis Wassmann, 1918 : Bangalore; Karnataka
nobilis Wassmann, 1918 Bangalore, Karnataka
 Tribe EUPARIINI A. Schmidt, 1910
 Genus *Ataenius* Harold, 1867
Auperia Chevrolat, 1864
Auperia Duval, 1856
Brancoataenius Paulian, 1979
Euparia Burmeister, 1877
Euparia Erichson, 1847
Hexalus Mulsant & Rey, 1870
Oxyomus Blanchard, 1843
Stenataenius Chalumeau, 1982
Ataenius dentatus W Koshantschikov, 1916 Andaman Islands, A & N Islands
 Genus *Dialytes* Harold, 1869
Dialytes punctatus A. Schmidt, 1911 : Andaman Islands, A & N Islands
 Genus *Odontolytes* W. Koshantschikov, 1916
Odontolytes andamanensis W Koshantschikov, 1916 : Andaman Islands, A & N Islands
 Genus *Sybacodes* Fairmaire, 1896
Sybacodes lutulentus Fairmaire, 1896 : India
 Tribe PSAMMODIINI Mulsant, 1842
 Genus *Psammodius* Fallen, 1807
Psammodius Heer, 1841
Psammodius Castelnau, 1840
Psammodius Gyllenhal, 1808
Psammodius ovatus Pittino, 1983 : Guwahati; Assam
 Tribe RHYSSEMINI Pittino and Mariani, 1986

- Genus *Platytomus* Mulsant, 1842
Platytomus indicus Balthasar, 1941 : Chennai, Tamil Nadu
P. nagporensis Pittino and Mariani, 1986 : Chota Nagpur; Bihar
P. nathani Pittino and Mariani, 1986 : Coimbatore; Tamil Nadu
- Genus *Pleurophorus* Mulsant, 1842
Pleurophorus bengalensis Pittino and Mariani, 1986 : West Bengal
P. besucheti Pittino and Mariani, 1986 : Kerala
P. schereri Pittino and Mariani, 1986 : Kaziranga; Assam
- Genus *Rhyssamodes* Reitter, 1892
Rhyssamodes indicus Pittino, 1984 : Dhanjuri; West Bengal
- Genus *Rhyssemus* Mulsant, 1842
Boucardius Petrovitz, 1967
Rhyssemus bufonis Boucomont, 1935 : Srinagar; Jammu & Kashmir
R. falcatus Petrovitz, 1961 : Tasso, Gilgit, Satil; Jammu & Kashmir
R. freyi Petrovitz, 1963 : Kaziranga; Assam
R. germanus Linnaeus, 1767 : Haryana, Uttar Pradesh; India; Widely distributed. Andamans (Chandra, 1991)
funnebris Roubal, 1912
geminatus Reitter, 1890
obsoletus Rey, 1890
puncticollis Brown, 1929
R. hamatus Petrovitz, 1963 : Rangpur; Bengal
R. inscitus Walker, 1858
crispus Reiche, 1907
insignicellis Lea, 1923
malasiacus Lansberge, 1886 : India
mussardi Petrovitz, 1975
papuanus Petrovitz, 1965
scabripennis Fauvel, 1907
sculpifrons Fairmaire, 1907

- tarsalis* Waterhouse, 1876 : North India
transversus Reiche, 1907
R. karnatakaensis Pittino, 1984 : Chikmagalur; Karnataka
R. loebli Petrovitz, 1975 : Udamapelt; Tamil Nadu
R. procerus Petrovitz, 1973 : New Delhi
R. ritsemae Clouet, 1901 : East India
costulatus Clouet, 1901
R. sinuaticollis Pittino, 1984 : Puna; Maharashtra
Genus *Trichiorhyssenus* Clouet, 1901
Trichiorhyssenus babaulti Benard, 1917 : Sarada, Ganjam; Tamil Nadu
T. expansicollis Benard, 1930 : Kodaikanal; Tamil Nadu
T. klapaleki Balthasar, 1963 : South India
T. malabricus Balthasar, 1963 : Malabar Coast; Kerala
T. setiventris Petrovitz, 1968b : Kochin; Kerala
Tribe RHYPARIINI A. Schmidt, 1910b
Genus *Rhyparus* Westwood, 1843
Antrisis Pascoe, 1866
Rhyparus De jean, 1833
Rhyparus Westwood, 1843
Rhyparus nilgirensis Arrow, 1909 : Nilgiri Hills, Tamil Nadu

SUMMARY

A check-list of 133 species of subfamily Aphodiinae so far reported from India is given citing the distribution and references.

ACKNOWLEDGEMENT

The author is grateful to the Director, Dr. J. R. B. Alfred, Zoological Survey of India, for providing the necessary facilities and to Dr. S. Biswas. Officer-in-Charge of Coleoptera Section, Z. S. I., Calcutta, for encouragement and going through the manuscript.

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**ON THE OCCURRENCE OF *THRYSSA KAMMALENSIS* (BLEEKER)
AND *THRYSSA KAMMALENSOIDES* WONGRATANA
(ENGRAULIDIDAE : PISCES) FROM INDIA**

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In this work we confirm the presence of *Thryssa kammalensis* (Bleeker, 1849) in Indian waters to set aside the view of Talwar and Jhingran (1991) that it does not occur in our area obviously following Whitehead *et al.* (1988), and to affirm the coastal marine existence of *Thryssa kammalensoides* Wongratana, 1983.

There is considerable confusion in the assignment of samples to these two Indian species of *Thryssa*. The first record of occurrence from the Orissa coast was by Day (1869) who described it as *Engraulis rhinorhynchus* Bleeker, 1852 which has been later on described by Day (1878, 1889) himself as *Engraulis kammalensis*. Additional references by Whitehead *et al.* (1988) spoke of *T. kammalensis* as "rather similar" species to *T. kammalensoides*. Further, it may be interesting to note that *T. kammalensoides* is known by two type specimens only (Whitehead *et al.* 1988). The third specimen of this species was reported by Krishnan & Mishra (1993) from Uppada of Andhra Pradesh on the east coast of India.

Both the species resemble *T. polybranchialis* Wongratana, 1983 on account of the length of maxilla and higher gillraker count but are distinguishable by less number of branched anal rays (30 to 33 Vs 35 to 39) and a minute oval first supramaxilla. Identification of *T. kammalensoides* is based on the presence of 24 to 26 gillrakers on the lower arm of the first gill arch; absence of first supramaxilla, a blunt snout less than eye diameter and 26 to 29 belly scutes. The nearest neighbour *T. kammalensis* possesses 26 to 32 gill rakers; first supramaxilla present; a longer snout and 23 to 25 belly scutes.

In order to highlight the differences, the specimens collected during a coastal survey in 1992 have been analysed and the results are presented here. The samples have been deposited with the Marine Biological Station, Zoological Survey of India, Chennai.

1. *Thryssa kammalensis* (Bleeker)

1849. *Engraulis kammalensis* Bleeker, *Verh. batav. Genoot. Kunst. Wet.*, 22 : 13 (Madura Strait near Kammal and Surabaya).
1869. *Engraulis rhinorhynchus* Bleeker : Day, *Proc. Zool. Soc. London* : 384.
1878. *Engraulis kammalensis* : Day, *Fishes of India* (4) : 626, pl.157, fig.1.
1976. *Thrissocles kammalensis* : Misra, *Fauna of India*, Pisces (2nd ed.), 2 : 135.
1988. *Thryssa kammalensis* : Whitehead *et al*, *FAO Fish. Synop.*, (125)7(2) : 433.

Material examined : 1 ex., 84 mm SL, J. T. Jothinayagam, Kashpal Muhano, 29.10.92, R. No. ZSI/MBS- 2329; 1 ex, 91 mm SL, J. T. Jothinayagam, Digha, 31.10.92, R. No. ZSI/MBS- 2173; 4 ex, 83-91 mm SL, J. T. Jothinayagam, Digha, 1.11.92, R. No. ZSI/MBS- 2259-62.

Description : Body compressed, belly with 15 or 16 plus 8, total 23 or 24 keeled scutes. Maxilla moderate, reaching just to gill opening or a little beyond, but short of pectoral fin base; first supramaxilla present, about half the size of the second. Lower gillrakers 29 to 32. Anal rays iii, 30 to 33. Snout acute, equal to eye diameter. A diffuse dark saddle on nape.

Distribution : Presently known from Penang and Islands of Indonesia.

Remarks : The present record extends the distributional boundary westward to the north eastern coast of India and reconfirms the report of Day (1869).

2. *Thryssa kammalensoides* Wongratana

1983. *Thryssa (Scutengraulis) kammalensoides* Wongratana, *Japan. J. Ichthyol.*, 29(4) : 401, fig. 20 (Godavary estuary, east coast of India).
1988. *Thryssa kammalensoides* : Whitehead *et al*, *FAO Fish. Synop.*, (125)7(2) : 434.

Material examined : 1 ex, 93 mm SL, J.T. Jothinayagam, Chandipur, 27.10.92, R. No. ZSI/MBS- 2404; 2 ex., 98-120 mm SL, M. Srinivasan, off False Point, 1.12.92, R. No. ZSI/MBS- 2680-81.

Description : Body compressed, belly with 17 or 18 plus 9 to 11, total 27 to 29 keeled scutes. Maxilla moderately short, tip pointed and reaching just to edge of gill cover; first supramaxilla absent. Lower gillrakers 24 or 25. Anal fin rays iii, 31 or 32. Snout blunt, less than eye diameter. A dark saddle on nape, extending to areas behind upper part of gill opening.

Distribution : Godavary estuary, coastal Andhrapradesh north of Godavary estuary.

Remarks : Marine, coastal, entering estuaries like other species of *Thryssa*. Distribution extended to north eastern coast of India.

ACKNOWLEDGEMENT

The authors are thankful to the Director, Zoological Survey of India, Calcutta and Officers in Charge of the Marine Biological Station and the Estuarine Biological Station for permission and facilities. Dr. A. G. K. Menon, Emeritus Scientist, Southern Regional Station had been the source of inspiration and the authors are indebted to him for comments, criticism and evaluation of the manuscript.

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ON THE COLLECTION OF ODONATA FROM ARUNACHAL PRADESH, INDIA

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INTRODUCTION

Arunachal Pradesh is situated on India's North-easternmost frontier and is almost horse-shoe shaped in area. It is considered as one of the most difficult mountainous region of the world. It lies between 27°.0-29°.30' latitude north and 91°.30'-97°.30' longitude east; bounded by Bhutan to the west, Tibet and China to the north and east, Assam to the south and Nagaland and Myanmar to the south-east and has capital at Itanagar. It covers an area of 83, 578 square kilometers. Arunachal Pradesh gets sun rays every day first on the Indian soil, and, therefore, has significantly the religious faith of the vast majority of the people based in the worship of the sun and moon, i.e., "DONYI" and "POLO" in the local dialects.

The land is mostly mountainous, with many great rivers viz., Tsangpo, Brahmaputra, Kameng, Subansiri, Siang, Lohit and Tirap etc., and large number of streams, Thus, the State is blessed with the rich, varied and colourful habitats of flora and fauna, There are green luxuriant forests right from the foot-hills to the snow-clad peaks which are the treasure houses of multitudinal biotypes remarkably coexisting in diverse environmental conditions. The monsoon starts here in April and continues upto October. The average rainfall amounts to about five metres per year.

FRASER (1933-1936) has reported several species of Odonata from Assam region but did not mention any place of Arunachal Pradesh. LAHIRI (1977, 1979, 1985 and 1987), LAHIRI & SINHA (1985, 1991), BHARGAVA (1989), MITRA (1994), PRASAD (1997) and PRASAD & VARSHNEY (1995) have listed 77 species of Odonata known from Arunachal Pradesh.

While examining the Odonata collections present in the National Collections of the Zoological Survey of India, Calcutta, the authors have come across some interesting specimens from this State. In this paper a total of 92 species of Odonata belonging to 49 genera under 11 families are reported from Arunachal Pradesh. Out of these 15 species are reported for the first time from Arunachal Pradesh.

A CONSOLIDATED LIST OF ODONATA FROM ARUNACHAL PRADESH

Order : ODONATA

Suborder : ZYGOPTERA

Superfamily : COENAGRIONOIDEA

Family : COENAGRIONIDAE

1. *Ceriagrion azureum* (Selys)
2. *Ceriagrion coromandelianum* (Fabricius)
3. *Ceriagrion fallax cerinomelas* Lieftinck
4. *Ceriagrion olivaceum* Laidlaw
5. * *Pseudagrion australasiae* Selys
6. *Pseudagrion rubriceps rubriceps* Selys
7. *Aciagrion azureum* Fraser
8. *Aciagrion olympicum* Laidlaw
9. *Aciagrion pallidum* Selys
10. *Aciagrion tillyardi* Laidlaw
11. *Enallagma parvum* Selys
12. *Ischnura aurora aurora* (Brauer)
13. *Ischnura rufostigma mildredae* Fraser
14. *Agriocnemis clauseni* Fraser
15. * *Agriocnemis lacteola* selys
16. * *Agriocnemis pieris* Laidlaw
17. *Agrocnemis pygmaea* (Rambur)
18. *Argiocnemis rubescens rubeola* Selys
19. *Onychargia atrocyana* Selys

Family : PLATYCNEMIDIDAE

20. *Calicnemia eximia* (Selys)
21. *Calicnemia Pulverulans* (Selys)
22. *Coeliccia bimaculata* Laidlaw
23. *Coeliccia pracritii* Lahiri

* Species marked with asterisk are recorded for the first time from the Arunachal Pradesh.

24. *Coelliccia renifera* (Selys)

25. *Copera vittata serapica* (Selys)

Superfamily : LESTOIDEA

Family : LESTIDAE

26. *Lestes dorothea* Fraser

27. * *Lestes praemorsus praemorsus* (Selys)

28. *Orolestes durga* Lahiri

Family : CHLOROLESTIDAE

29. *Megalestes lieftincki* Lahiri

30. *Megalestes Major* Selys

Superfamily : CALOPTERYGOIDEA

Family : CALOPTERYGIDAE

31. *Echo margarita margarita* Selys

32. *Matrona basilaris basilaris* Selys

33. *Matrona basilaris nigripecta* Selys

34. *Neurobasis chinensis chinensis* (Linn.)

35. *Vestalis gracilis gracilis* (Rambur)

Family : CHLOROCYPHIDAE

36. *Rhinocypha (Aristocypha) cuneata* Selys

37. *Rhinocypha (Aristocypha) immaculata* (Selys)

38. *Rhinocypha (Aristocypha) spuria* (Selys)

39. *Rhinocypha (Aristocypha) quadrimaculata* Selys

40. *Rhinocypha (Aristocypha) hiliaryae miaoa* Lahiri and Sinha

41. *Rhinocypha (Aristocypha) fenestralla* (Rambur)

42. * *Rhinocypha (Rhinocypha) ignipennis* Selys

43. *Libellago lineata lineata* (Burmeister)

Family : EUPHAEIDAE

- 44. *Anisopleura lastoides* Selys
- 45. *Bayadera indica* (Selys)
- 46. *Euphaea ochracea ochracea* Selys

Suborder : ANISOPTERA

Superfamily : AESHNOIDEA

Family : GOMPHIDAE

- 47. * *Anormogomphus heteropterus* Selys
- 48. *Phaenandrogomphus aureus* (Laidlaw)
- 49. *Onychogomphus bforceps* (Selys)
- 50. *Onychogomphus cacharicus* Fraser
- 51. *Onychogomphus risi* (Fraser)
- 52. *Onychogomphus schmidtii* Fraser
- 53. *Paragomphus lineatus* (Selys)
- 54. *Ictinogomphus pertinax* (Selys)
- 55. *Ictinogomphus rapax* (Rambur)

Family : AESHNIDAE

- 56. *Anax quittatus* (Burmeister)

Superfamily : CORDULEGASTEROIDEA

Family : CORDULEGASTERIDAE

- 57. *Cordulegaster brevistigma bravistigma* (Selys)

Superfamily : LIBELLULOIDEA

Family : LIBELLULIDAE

- 58. *Hylaeothemis fruhstorferi apicalis* Fraser
- 59. **Tetrathemis platyptera* Selys
- 60. **Cratilla lineata calverti* Foerster

61. **Orthetrum anceps* (Schneider)
62. *Orthetrum brunneum brunneum* (Fonscolombe)
63. *Orthetrum glaucum* (Brauer)
64. *Orthetrum japonicum internum* MacLachlan
65. **Orthetrum luzonicum* (Brauer)
66. *Orthetrum puinosum neglectum* (Rambur)
67. *Orthetrum sabina sabina* (Drury)
68. **Orthetrum taeniolatum* (Schneider)
69. **Orthetrum testaceum testaceum* (Burmeister)
70. *Orthetrum triangulare triangulare* (Selys)
71. *Lathrecista asiatica asiatica* (Fabricius)
72. **Potamarcha congener* (Rambur)
73. *Palpopleura sexmaculata sexmaculata* (Fabricius)
74. *Acisoma panorpoides panorpoides* Rambur
75. *Brachythemis contaminata* (Fabricius)
76. *Crocothemis servilia servilia* (Drury)
77. *Diplacodes trivialis* (Rambur)
78. *Indothemis limbata limbata* Selys
79. *Neurothemis fulvia* (Drury)
80. *Neurothemis intermedia intermedia* (Rambur)
81. **Neurothemis tullia tullia* (Drury)
82. *Sympetrum commixtum* (Selys)
83. *Sympetrum hypomelas* (Selys)
84. *Sympetrum orientale* (Selys)
85. *Trithemis aurora* (Burmeister)
86. *Trithemis festiva* (Rambur)
87. *Trithemis pallidinervis* (kirby)
88. *Rhyothemis variegata variegata* (Linn.)
89. *Pantala flavescens* (Fabricius)

90. *Tholymis tillarga* (Fabricius)
91. *Aethriamanta brevipennis* (Rambur)
92. *Urothemis signata signata* (Rambur)

SYSTEMATIC ACCOUNT

Order : ODONATA
Suborder : ZYGOPTERA
Superfamily : COENAGRIONOIDEA
Family : COENAGRIONIDAE
Genus : *Ceriagrion* Selys

1. *Ceriagrion azureum* (Selys)

Material examined : 1M, 1F, Namdapha, Gibbon land, 10 kms. on Miao, Vijayanagar, 10.4.81, Coll. S. Biswas.

Distribution : India (Assam, Arunachal Pradesh, Meghalaya, Mizoram and West Bengal) and Myanmar.

Remarks : Pterostigma covers less than a cell in forewings and one cell in hindwings. 14-15 postnodal nervures in forewings and 12 in hindwings.

2. *Ceriagrion coromandelianum* (Fabricius)

Material examined : 1M, Kheram village, Bordumsa, West Kameng, 8.9.1986, Coll. R. N. Bhargava.

Distribution : Throughout India, Cambodia, China, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam.

3. *Ceriagrion olivaceum* (Laidlaw)

Material examined : 1 M, 1 F, Elephant Flat, Kameng district, 23.12.1965, Coll. S. K. Bhattacharya and A. N. T. Joseph ; 1 M, Subansiri Bridge, Subansiri Division, 28.10.1966, Coll. S. K. Tandon and G. S. Arora; 2 MM, Bhalukpong, West Kameng district 28.10.1985, Coll. G.K. Srivastava; 4 MM, 2 FF, Pakhui Sanctuary, East Kameng district, 14.12.1985, Coll. R. N. Bhargava; 1M, Kalaktang, West Kameng district, 29.12.1985, Coll. R. N. Bhargava and 1 F, Khellong, West Kameng district, 7.1.1986, Coll. R. N. Bhargava.

Distribution : India (Assam, Arunachal Pradesh, Kerala, Manipur, Maharashtra, Meghalaya, Orissa, South Andaman, Uttar Pradesh and West Bengal), Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam.

Remarks : During the field trips to Pakui Sanctuary, East Kameng district in December, 1985 one of the author (M.P.) has observed that adults of this species and *Aciagrion pallidum* were very common within the long grasses all along the forest road in the sanctuary. Specimens were fluttering above the long grasses and some times they sit on the body of the party members. 11-13 postnodal nervures are present in forewings and 10-11 in hindwings.

Genus : *Pseudagrion* Selys

4. *Pseudagrion australasiae* Selys

Material examined : 1F, Hapoli, Subansiri Division, 4.5.1966, Coll. A.N.T. Joseph and 1F, Sirman Bridge, Siang, 14.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Assam, Manipur, Maghalaya and West Bengal), Australia, Indonesia, Malaysia, Myanmar and Thailand.

Remarks : It is recorded for the first time from Arunachal Pradesh.

5. *Pseudagrion rubriceps rubriceps* (Selys)

Distribution : Widely distributed throughout continental India, Indonesia, Malaysia, Myanmar, Nepal and Taiwan.

Remarks : One of the author (M.P.) while staying at Itanagar came across a male specimen of this species resting on the aquatic vegetation at the side of a permanent water body, Author was unable to collect the specimen.

Genus : *Aciagrion* Selys

6. *Aciagrion pallidum* (Selys)

Material examined : 1M, Bhalukpong, West Kameng district, 28.10.1985, Coll. G. K. Srivastava ; 1 F, Roing, Debang Valley, 8.11.1985, Coll. G. K. Srivastava, 4 MM, 5 FF, Pakhui Sanctuary, East Kameng district, 14.12.1985, Coll. R. N. Bhargava and 1M, 4 FF, Khellong, West Kameng district, 7.1.1988, Coll. R. N. Bhargava.

Distribution : India (Arunachal Pradesh, Assam (Dry Zone), Bihar, East Himalaya, Karnataka, Manipur, Maharashtra, Orissa, Tripura, Uttar Pradesh and West Bengal) Myanmar and Nepal.

Remarks : Labium, labrum, face, frons and vertex reddish brown. In specimens from Pakhui sanctuary face frons and vertex dark brown. In females abdominal segments 8th to 10th are pinkish brown. Tips of inferior anal appendages in male black. Pterostigma covers less than a cell. Nervure ab & ac present at one place in both pair of wings. Arc present at the level of second antenodal nervure. 10-11 postnodal nervures in forewings and 9-11 in hindwings.

Genus : *Enallagma* charpentier

7. *Enallagma parvum* (Selys)

Material examined : 1F, Jairampur, Tirap, 26.10.1971, Coll. G.S. Arora.

Distribution : Throughout India, Myanmar, Nepal and Sri Lanka.

Genus : *Ischnura* charpentier

8. *Ischnura aurora aurora* (Brauer)

Material examined : 1M, Tipi, West Kameng district, 11.9.1984, Coll. R. N. Bhargava; 14 MM, Dirang, West Kameng district, 17.9.1984, Coll. R. N. Bhargava, and 1M, Dedza, West Kameng district, 27.9.1984, Coll. R. N. Bhargava.

Distribution : Throughout India, Australia, China, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Newzealand, Pacific Islands, Papua, Philippines and Sri Lanka.

Genus : *Agriocnemis* Selys

9. *Agriocnemis lacteola* Selys

Material examined : 3FF, Namsai, 15.3.1969, Coll. S. K. Tandon and 2 FF, Namsai, 16.3.1969, Coll. S. K. Tandon.

Distribution : India (Assam, Bihar, Meghalaya, Orissa, Sikkim, South India, Tripura and West Bengal).

Remarks : It is recorded for the first time from Arunachal Pradesh.

10. *Agriocnemis pieris* Laidlaw

Material examined : 1M, Simi bridge Siang Division, 14.10.1966, Coll. S. K. Tandon & G. S. Arora and 1F, Jining, Siang Division, 14.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : South India, Madhya Pradesh and West Bengal.

Remarks : It is recorded for the first time from Arunachal Pradesh.

11. *Agriocnemis pygmaea* (Rambur)

Material examined : 1M, Bhalukpong, West Kameng district, 23.3.1973, Coll. S. K. Tandon; 3MM, 2FF, Tipi, West Kameng district, 10.9.1984, Coll. R. N. Bhargava ; 1M, Tipi, West Kameng district, 11.9.1984, Coll. R.N. Bhargava, 2MM, 1F, Dirang, West Kameng district, 17.9.1984, Coll. R.N. Bhargava and 2 MM, 2 FF, Dedza, West Kameng district, 27.9.1984, Coll. R.N. Bhargava.

Distribution : Throughout India, Afghanistan, Australia, Bangladesh, China, Hongkong, Indonesia, Japan, Kampuchia, Malaysia, Myanmar, New Guinea, Pacific Islands, Pakistan, Philippines, Seychelles, Singapore, Sri Lanka, Taiwan and Thailand.

Family : PLATYCENIDIDAE

Genus : *Calicnemia* Strand

12. *Calicnemia eximia* (Selys)

Material examined : 2MM, 1F, Pinjul, Kameng district, 4.5. 1966, Coll. A.N.T. Joseph; 1 M, Daparijo, Subansiri, 5.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Likhali, 6.10.1966, Coll. S. K. Tandon and G. S. Arora; 2 MM, Dalli village, Siang, 10.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 F, Simi bridge, 14.10.1966, Coll. S. K. Tandon and G. S. Arora and 1 M, Dalli, 22.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Assam, Arunachal Pradesh, Himachal Pradesh, Meghalaya, Uttar Pradesh and West Bengal), Afghanistan, Bangladesh, China, Myanmar, Nepal and Vietnam.

Genus : *Copera* Kirby

13. *Copera vittata serapica* (Selys)

Material examined : 1M, New Jining, Siang, 19.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Arunachal Pradesh, Assam, Nicobar Islands, South India and West Bengal), Indonesia, Malaysia, Myanmar and Thailand.

Super family : LESTOIDEA

Family : LESTIDAE

Genus : *Lestes* Leach

14. *Lestes praemorsus praemorsus* (Selys)

Material examined : 6 MM, Sunlouru, Subansiri, 3.3.1969, Coll. S. K. Tandon.

Distribution : India (Andaman Islands, Assam, West Bengal and Western Himalaya), Malaysia, Myanmar and Philippines.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus : *Orolestes* MacLachlan

14a. *Orolestes durga* Lahiri

Distribution : India (Arunachal Pradesh and Meghalaya)

Remarks : It is recorded for the first time from Arunachal Pradesh.

Remarks : Paratype a male Present in the National Collections, Zoological Survey of India, Calcutta from Arunachal Pradesh was examined.

Superfamily : CALOPTERYGOIDEA

Family : CALOPTERYGIDAE

Genus : *Echo* Selys

15. *Echo margarita margarita* Selys

Material examined : 2 MM, Khonsa, Khethi, Tirap, 7.11.1971, Coll. G. S. Arora.

Distribution : India (Arunachal Pradesh, Manipur and Meghalaya) and distribution in china is doubtful (Fraser, 1934).

Genus : *Matrona* Selys

16. *Matrona basilaris basilaris* Selys

Material examined : 1F, Kambang, Siang, 15.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Daparijo, Subansiri, 27.10.1966, Coll. S. K. Tandon and G. S. Arora; 2 MM, Basar, 31.10.1966, Coll. S. K. Tandon and G. S. Arora; 2MM, Dalli Village, Siang, 31.10.1966, Coll. S.K. Tandon and G. S. Arora and 1 M, Deomali forest, Namsong, Tirap, 5.11.1971, Coll. G. S. Arora.

Distribution : India (Arunachal Pradesh and Meghalaya) and Myanmar.

17. *Matrona basilaris nigripectus* Selys

Material examined : 1 M, Konsa longding Road, Tirap, 5.11.1971, Coll. G. S. Arora and 2 FF, Konsa, 7.11.1971, Coll. G. S. Arora,

Distribution : India (Meghalaya and Mizoram) and Myanmar.

Genus : *Neurobasis* Selys

18. *Neurobasis Chinensis chinensis* (Linn.)

Material examined : 1F, Pyring village, Siang, 15.10. 1966, Coll. S. K. Tandon and G. S. Arora; 2 MM, 1 F, Daparijo, Subansiri, 27.10.1966, Coll. S. K. Tandon and G. S. Arora; 3 FF, Deomali forest, Namsang Road, 28.10.1966, Coll. G. S. Arora and 1 M, Namsang, Tirap, 28. 10.1966, Coll. G. S. Arora.

Distribution : India (Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Tamil Nadu, Uttar Pradesh and West Bengal), Indonesia, Malaysia, Myanmar Nepal, Sri Lanka and Thailand.

Genus : *Vestalis* Selys

19. *Vestalis gracilis gracilis* (Rambur)

Material examined : 1 M, Tipi, West Kameng district, 6. 5. 1966, Coll. A.N.T. Joseph and 1 M, Bamo Village, Siang, 30.10.1996, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Andhra Pradesh, Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Tamil Nadu, Tripura and West Bengal), Malaysia, Myanmar, Thailand and Vietnam.

Family : CHLOROCYPHIDAE

Genus : *Rhinocypha* Rambur

Subgenus : *Aristocypha* Laidlaw

20. *Rhinocypha (Aristocypha) cuneata* Selys

Material examined : 2 MM, Pinjali, West Kameng, 4.5.1966, Coll. A. N. T. Joseph; 1 M, 1 F, Tamen, Subansiri, 6.5.1966, Coll. A. N. T. Joseph; 2 MM, Tamen, Subansiri, 18.5.1966, Coll. A. N. T. Joseph; 2 MM, Dalli village, Siang, 10.10.1966, Coll. S. K. Tandon and G. S. Arora; 3 MM, 1 F, Tipi, West Kameng, 23.10. 1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Daparijo, Subansiri, 27.10.1966, Coll. S. K. Tandon and G. S. Arora and 2 MM, 2 FF, Bamo village, Siang, 30.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Arunachal Pradesh, Assam and West Bengal) and Tibet.

21. *Rhinocypha (Aristocypha) spuria* (Selys)

Material examined : 1 M, Tipi, West Kamen district, 10.9.1984, Coll. R. N. Bhargava.

Distribution : India (Assam, Meghalaya, Mizoram, Nagaland and Uttar Pradesh) and Myanmar.

Remarks : It is recorded for the first time from Arunachal Pradesh.

22. *Rhinocypha (Aristocypha) quadrimaculata* (Selys)

Material examined : 1 M, 2FF, Nampong, Tirap, 28.10.1971, Coll. G. S. Arora and 1 M, on way to upper Subansiri district, 25.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : India (Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Orissa, Sikkim, Uttar Pradesh and West Bengal), Bangladesh, Myanmar, Nepal and Thailand.

Subgenus : *Rhinocypha* Rambur

23. *Rhinocypha (Rhinocypha) ignipennis* (Selys)

Material examined : 1 F, Tipi, West Kameng district, 6.5.1966, Coll. A.N. Joseph and 1 F, Tamen, Subansiri, 20.5.1966, Coll. A.N.T. Joseph.

Distribution : India (Meghalaya) and Myanmar.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Family : EUPHAEIDAE

Genus : *Euphaea* Selys

24. *Euphaea ochracea ochracea* (Selys)

Material examined : 2 MM, Jairampur, Tirap, 27.10.1971, Coll. G. S. Arora and 1 M, Nampong, Tirap, 28.10.1971, Coll. G. S. Arora.

Distribution : India (Arunachal Pradesh, Assam, Manipur, Meghalaya and West Bengal), Annam, Indonesia, Thailand and West Malaysia.

Suborder : ANISOPTERA

Superfamily : AESHNOIDEA

Family : GOMPHIDAE

Genus : *Anormogomphus* Selys

25. *Anormogomphus heteropterus* (Selys)

Material examined : 1 F, Jairampur, Tirap, 25.10.1971, Coll. G. S. Arora.

Distribution : India (Bihar, Himachal Pradesh, Orissa, and Uttar Pradesh) and Pakistan.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus : *Ictinogomphus* Cowley

26. *Ictinogomphus rapax* (Rambur)

Material examined : 1 M, Likhali, Siang, 14.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : India (Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Sikkim, Uttar Pradesh and West Bengal), Nepal, Malaysia, Myanmar and Sri Lanka.

27. *Ictinogomphus pertinax* (Selys)

Material examined : 1 M, Likhali, Siang, 14.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : India (Arunachal Pradesh, and West Bengal), China, Indochina, Malaysia and Myanmar.

Remarks : Discoidal cell in the right forewing made up of 4 cells, subtrigone in forewing 2 celled, anal triangle 5 celled.

Family : LIBELLULIDAE

Genus : *Tetrathemis* Brauer

28. *Tetrathemis platyptera* (Selys)

Material examined: 1 M, Sekha camp, Subansiri, 26.10.1966, Coll. S. K. Tandon and G. S. Arora and 1 M, Namsong, Deomali forest, Tirap, 10.10.1971, Coll. G. S. Arora.

Distribution : India (Karnataka, Kerala, Maharashtra, Meghalaya, Tamil Nadu, West Bengal and Western Himalaya), Indonesia, Malaysia, Myanmar and Thailand.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus : *Cratilla* Kirby

29. *Cratilla lineata calverti* Foerster

Material examined : 1 M, Chandan forest, 24.3.1973, Coll. S. K. Tandon and 1 M, Elephant Flate, 22.3. 1973, Coll. S. K. Tandon.

Distribution : India (Orissa, Uttar Pradesh, West Bengal and Western Ghats), Indonesia, Malaysia, Myanmar, Philippines, New Guinea, Sri Lanka and Thailand.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus : *Orthetrum* Newman

30. *Orthetrum anceps* (Schneider)

Material examined : 1 M , Hapoli, 15.5.1996. Coll: A.N.T; Joseph; 1 M, Pamir bridge, Subansiri, 17.5.1966, Coll. A.N.T. Joseph; 1 M , Siji, 20.10.1966, Coll. G. S. Arora; 2 MM, Likhali, Siang, 2.11.1966, Coll. G. S. Arora and 1 M, Likhali, Siang, 6.11.1966; Coll. G. S. Arora.

Distribution : India (Himachal Pradesh, Mizoram and West Bengal), Asia minor, Europe, North African Coast, Pakistan and Persia.

Remarks : It is recorded for the first time from Arunachal Pradesh.

31. *Orthetrum brunneum brunneum* (Fonscolombe)

Material examined : 1F, Kimin, 9.5.1966, Coll. A.N.T. Joseph; 2 FF, Ziro, Subansiri, 13.5.1966, Coll. A.N.T. Joseph; 2 FF, Ziro, Subansiri, 14.5.1966, Coll. A.N.T. Joseph and 4 MM, Dajoo, 10.5.1966, Coll. A.N.T. Joseph.

Distribution : India (Arunachal Pradesh, Bihar, Uttar Pradesh and Western Himalaya), Afghanistan, Iraq, North Africa, Myanmar, Pakistan, South Europe and West Asia.

32. *Orthetrum glaucum* (Brauer)

Material examined : 2 MM, Hapoli, 15.5.1966, Coll. A.N.T. Joseph; 1 M, Tamen, Subansiri, 19.5.1966, coll. A.N.T. Joseph; 1M, Tamen, 4.10.1966, Coll. A.N.T. Joseph; 1 F, Piring, 15.10.1966, Coll. S. K. Tandon and G. S. Arora; 4 MM, 2 FF, Tachidoni, Coll. S.K. Tandon and G. S. Arora; 2 MM, Dalli Camp, 22.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 F, Daparijo, 28.10.1966, Coll. S.K. Tandon and G.S. Arora; 1 M, Khonsa, Tirap, 4.11.1971, Coll. Arora; 3 MM, Khonsa, Tirap, 5.11.1971, Coll. G. S. Arora and 7 MM, Talika, Subansiri, 18.11.1974, Coll. J. M. Julka.

Distribution : Throughout India, China, Hongkong, Indonesia, Japan, Malaya Archipelago, Malaysia, Myanmar, Nepal, New Guinea, Papua, Philippines, Sri Lanka, Taiwan, Thailand and Vietnam.

33. *Orthetrum luzonicum* (Brauer)

Material examined : 2 MM, Kimin, Subansiri, 9.5.1966, Coll. A.N.T. Joseph and 1 F, Hapoli, 15.5.1966, Coll. A.N.T. Joseph.

Distribution : India (Andhra Pradesh, Assam, Himachal Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal and West Coast of India), Indonesia, Myanmar, Nepal, Philippines and Sri Lanka.

Remarks : It is recorded for the first time from Arunachal Pradesh.

34. *Orthetrum purinosum neglectum* (Rambur)

Material examined : 3 MM, Kimin, Subansiri, 9.5.1966, Coll. A.N.T. Joseph; 1 M, Dajoo, 10.5.1966, Coll. A.N.T. Joseph; 1 M, Tamen, 20.5.1966, Coll. A.N.T. Joseph; 1 M, Dalli village, 12.10.1966, Coll. S. K. Tandon and G. S. Arora; 2 FF, Tachidoni, 24.10.1966, Coll. S. K. Tandon and G. S. Arora; 2 MM, 1 F, Bela village, 27.10.1966, Coll. S. K. Tandon and G.S. Arora; 1 M, Daparijo, 28.10.1966, Coll S. K. Tandon and G. S. Arora; 1M, 1F, Daparijo, 31.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Likhali, Siang, 2.11.1966, Coll. S.K. Tandon and G.S. Arora; 1M, Deomali, Tirap, 10.11.1971, Coll. G. S. Arora and 1 M, Jairampur, Tirap, 26.10.1971, Coll. G. S. Arora.

Distribution : Throughout India, Afghanistan, Bangladesh, China, Hongkong, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Tibet and Vietnam.

35. *Orthetrum sabina sabina* (Drury)

Material examined : 5 MM, Dejoo, Subansiri, 10.5.1966, Coll. A.N.T. Joseph; 1 M, Hapoli, 15.5.1966, Coll. A.N.T. Joseph; 1 M, Baliwari, 2.10.1966, Coll. S. K. Tandon and G. S. Arora;

1 M, Bholi gaon, 2.10.1966, Coll. S. K. Tandon and G. S. Arora and 1 M, Likhali, Siang, 7.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : Throughout India, Afghanistan, Algeria, Angola, Australia, China, Cyprus, Egypt, Hongkong, Indonesia, Iran, Iraq, Laos, Malaysia, Micronesia, Myanmar, most of the African continent, New Guinea, Nepal, Papua, Philippines, Qatar, Samoa Islands, Singapore, Sri Lanka, Sudan Thailand, Tunisia, Turkey and Vietnam.

36. *Orthetrum taeniolatum* (Schneider)

Material examined : 1 M, Rupa camp, 20.12.1965, Coll. S. K. Bhattacharya and A.N.T. Joseph.

Distribution : India (Bihar, Himachal Pradesh, Madhya Pradesh, Sikkim and West Bengal), countries bordering mediterranean and Nepal.

Remarks : It is recorded for the first time from Arunachal Pradesh.

37. *Orthetrum testaceum testaceum* (Burmeister)

Material examined : 1 M, Ziro, Subansiri, 14.5.1966, Coll. A.N.T. Joseph.

Distribution : India (Assam and Orissa), Indonesia, Myanmar, Philippines and Formosa (Taiwan).

Remarks : It is recorded for the first time from Arunachal Pradesh.

38. *Orthetrum triangulare triangulare* (Selys)

Material examined : 1 M, Pamir Bridge, Subansiri, 17.10.1966, Coll. A.N.T. Joseph; 3MM, Tachidoni, 24. 10.1966, Coll. S. K. Tandon and G. S. Arora and 3 MM, Khonsa, Tirap, 4.11.1971, Coll. G. S. Arora.

Distribution : India (Arunachal Pradesh, Assam, Bihar, Haryana, Meghalaya, Mizoram, South Indian Hills, Tamil Nadu, West Bengal, and Western Himalaya), Afghanistan, China, Laos, Myanmar, Nepal, Sri Lanka, Thailand and Vietnam.

39. *Lathrecista asiatica asiatica* (Fabricius)

Material examined : 1 F, Pedding, Siang 11.10.1966, Coll. S. K. Tandon G. S. Arora.

Distribution : India (Arunachal Pradesh, Bihar, Manipur and Orissa (Mitra, 1994) Indonesia, Malaysia, New Guinea, Philippines, Sundaic Archipelago and Thailand.

40. *Potamarcha congener* (Rambur)

Material examined : 1 M, Sunpura, 3.3.1966, Coll. S. K. Tandan.

Distribution : India (Assam, Bihar, Himachal Pradesh, Kerala, Nagaland, Orissa, South Andaman Islands, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal), Australia, Bangladesh,

Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Papua, Philippines, Sri Lanka, Taiwan and Thailand.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus : *Palpopleura* Rambur

41. *Palpopleura sexmaculata sexmaculata* (Fabricius)

Material examined : 2 MM, Ziro, Subansiri, 14.5.1966, Coll. A.N.T. Joseph; 3 FF, Hapoli, Subansiri, 15.5.1966, Coll. A.N.T. Joseph; 1 M, Pamer bridge, 17.5.1966, Coll. A.N.T. Joseph; 1 M, 1 F, Bela village, 27.10.1966, Coll. S. K. Tandon and G. S. Arora; 8 MM, 4 F, Basar Village, 31.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Daparijo, 28.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Changlong, Tirap, 2.11.1971, Coll. G. S. Arora and 1M, Chandan Forest, 24.3.1973, Coll. S. K. Bhattacharya.

Distribution : Throughout India, China, Malaysia, Myanmar, Sri Lanka and Vietnam.

Genus : *Acisoma* Rambur

42. *Acisoma panorpoides panorpoides* Rambur

Material examined : 1 F, Bela Village, Subansiri, 27.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : India (Arunachal Pradesh, Assam Bihar, Chandigarh, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Orissa, Punjab, Rajasthan, South India, Uttar Pradesh and West Bengal), China, Indonesia, Japan, Malaya Archiplago, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan and Thailand.

Genus : *Diplacodes kirby*

43. *Diplacodes trivialis* (Rambur)

Material examined : 1 F, Tipi, West Kameng, 3.5.1966, Coll. A.N.T. Joseph; 1F, Likhabali, Siang, 6.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Pedding Village, 11.10.1966, Coll. S. K. Tandon and G. S. Arora and 1 M, Kimin, 4.11.1981, Coll. S.K. Gupta and M. Prasad.

Distribution : Throughout India, Australia, China, Fiji, Hongkong, Indonesia, Iraq, Japan, Laos, Malaysia, Myanmar, Nepal, New Guinea, Pacific Islands, Papua, Philippines, Ryudyus, Seychelles, Sri Lanka, Thailand and Vietnam.

Genus : *Crocothemis* Brauer

44. *Crocothemis servilia servilia* (Drury)

Material examined : 1M, 1F, Likhabali, Siang, 6.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Tipi, West Kameng, 23.10.1966, Coll. S. K. Tandon and G.S. Arora; 2MM, 1F, Bela village,

Subansiri, 27.10.1966, Coll. S.K. Tandon and G.S. Arora; 1 M. Ziro, Siang, 14.10.1966, Coll. S.K. Tandon and G.S. Arora and 1 M. Bamo village, 30.10.1966, Coll. S.K. Tandon and G.S. Arora.

Distribution : Throughout India, Bangladesh, China, Indonesia, Iran, Iraq, Japan Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan and Thailand.

Genus : *Neurothemis* Brauer

45. *Neurothemis fulvia* (Drury)

Material examined : 1 M, Daparijo. Subansiri, 28.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 F, Deomali, Tirap, 10.10. 1971, Coll. G. S. Arora and 1 M, Gara, Siang, 10.1.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : Throughout India, Australia, Bangladesh, China, Hongkong, Indonesia, Iraq, Kampuchia, Malaysia, Myanmar, Nepal, Philippines, Seychelles, Sri Lanka, Taiwan, Thailand and Vietnam.

46. *Neurothemis intermedia intermedia* (Rambur)

Material examined : 1 M, Pinjali, 21.3.1964, Coll. S. K. Bhattacharya and A.N.T. Joseph; 1 M, Chandan forest, 27.10.1965, Coll. S. K. Bhattacharya and A.N.T. Joseph; 1 F, Namsang, Tirap, 11.11.1971, Coll G. S. Arora.

Distribution : Throughout India, China and Southeast Asia.

47. *Neurothemis tullia tullia* (Drury)

Material examined : 1 M, Dapabhum Expedition, Glo-village, 11.12.1969, Coll. J. M. Julka and 1 M, Miao Reserve forest, Miao, Tirap, 1.12.1983, Coll. S. Biswas.

Distribution : India (Assam, Bihar, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, South India, Tripura, Uttar Pradesh and West Bengal), China, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand, Tibet and Vietnam.

Remarks : It is recorded for the first time from Arunachal Pradesh.

Genus *Sympetrum* Newman

48. *Sympetrum commixtum* (Selys)

Material examined : 2 MM, Near Tenga river, Tenga, West Kameng, 19.12.1965, Coll. S. K. Bhattacharya and A.N.T. Joseph; 1 F, Rupa, Kameng, 20.12.1965, Coll. S.K. Bhattacharya and A.N.T. Joseph and 1 M, Hapoli; Ziro, Lower Subansiri, 28.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : India (Arunachal Pradesh, Gujarat, North West India and West Bengal).

49. *Sympetrum hypomelas* (Selys)

Material examined : 1 M, Sessa, West Kameng, 29.10.1984, Coll. R. N. Bhargava.

Distribution : India (Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim, Uttar Pradesh, West Bengal and Western Ghats), China, Myanmar, Nepal and Tibet.

Genus : *Trithemis* Brauer

50. *Trithemis aurora* (Burmeister)

Material examined : 1 M, Likhabali, Subansiri, 6.10.1966, Coll. S. K. Tandon and G. S. Arora; 3 MM, Likhabali, Subansiri, 7.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Likhabali, Subansiri, 16.10.1966, Coll. S. K. Tandon and G. S. Arora; 3 MM, 1 F, Dali Camp, 12.10.1966, Coll. S.K. Tandon and G. S. Arora; 3 MM, Deomali, Tirap, 9.11.1971, Coll. G.S. Arora and 3 MM, 3 FF, Seji, Siang; 15.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : Throughout India, China, Hongkong, Indonesia, Japan, Kampuchia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Tibet and Vietnam.

51. *Trithemis festiva* (Rambur)

Material examined : 1 M, Pinjuli, Kameng, 24.12.1965, Coll. S. K. Bhattacharya and A.N.T. Joseph and 2 MM, Dali camp, Siang, 12.10.1966, Coll. S. K. Tandon and G. S. Arora.

Distribution : Throughout India, Afghanistan, Africa, China, Cyprus, Hongkong, Indonesia, Iraq, Kampuchia, Laos, Pakistan, Papua, Philippines, New Guinea, Singapore, Sri Lanka, Taiwan, Thailand, Turkey and Vietnam.

52. *Trithemis pallidinervis* (Kirby)

Material examined : 1 M, 1F, Seji, Siang, 15.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : Throughout India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and Tibet.

Genus : *Pantala* Hagen

53. *Pantala flavescens* (Fabricius)

Material examined : 1 F, Purha Camp, Subansiri, 12.10.1966, Coll. S. K. Tandon and G. S. Arora; 1 M, Likhabali, Siang, 17.10.1981, Coll. S. K. Gupta and M. Prasad and 1 M, Daparizo, 24.10.1981, Coll. S. K. Gupta and M. Prasad.

Distribution : Cosmopolitan.

Genus : *Rhyothemis* Hagen

54. *Rhyothemis variegata variegata* (Linn.)

Material examined : 1 M, Dejoo, Subansiri, 10.5.1966, Coll. A.N.T. Joseph.

Distribution : India (Bihar, Himachal Pradesh, Madhya Pradesh, Maharashtra, Manipur, Karnataka, Orissa, Uttar Pradesh and West Bengal), Malaysia, Myanmar, Nepal and Sri Lanka.

SUMMARY

A total of 92 species and subspecies of Odonata belonging to 49 genera under 11 families are studied from Arunachal Pradesh, of which 15 species are new records for the state.

ACKNOWLEDGEMENTS

Authors are thankful to Director, Zoological Survey of India, Calcutta for providing facilities and permission to undertake this study.

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JUMPING SPIDERS OF BANGLADESH : GENUS *MARPISSA* KOCH

(ARANEAE : SALTICIDAE)

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INTRODUCTION

'Jumping spiders' (Salticidae) of the genus *Marpissa* Koch are one of the important predators of insect pests in the garden and crop-fields. Works on this spiders in this Sub-continent is scarce. In India, Pocock (1900), Narayan (1915), Tikader (1967, '74a, b, '75, '77a, b), Tikader and Biswas (1981), Biswas and Biswas (1992) and Proszynski (1992) reported salticid spiders in different times in which very few species were under the genus *Marpissa*. In Bangladesh, Chowdhury and Pal (1984), Biswas, et. al., (1993), Okuma, et. al., (1993) and Biswas and Raychaudhuri (1997) recorded few salticids but there is no report on this genus. Kamal, et. al., (1992) reported *M. calcuttaensis* Tikader from the paddy fields in Bangladesh. Works on this spiders was done in various places of the world by different authors (Cutler, 1985; Chikuni, 1989; Locket & Millidge, 1951; Proszynski 1990; Ikeda, 1993; Yaginuma, 1986; Zabka, 1980a, b, '85, '87).

In view of the importance of spiders as biological control agents, the present paper is a part of the survey of the 'spider fauna of Barisal division', Bangladesh. It contains description of a new species *M. proszynskii* together with the taxonomic position of another species *M. bengalensis* Tikader which is a new record from the area.

Genus : *Marpissa* Koch, 1846

1846. *Marpissa* Koch, Die Arachn., 13 : 56.

1992. *Marpissa* : Biswas & Biswas, Fauna of West Bengal, Araneae, 3 : 388.

Type-species : *Marpissa muscosa* Clerck.

Distribution : AMERICA; ASIA; AUSTRALIA; EUROPE.

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1. *Marpissa bengalensis* Tikader

1974. *Marpissa bengalensis* Tikader, Proc. Indian Acad. Sci., **79** (5) : 212.

1992. *Marpissa bengalensis* : Biswas & Biswas, Fauna of West Bengal, Araneae, **3** : 391.

Material examined : 2 ♀, Kawkhali, Dist. Barisal, 18. VII. 1995, Coll. V. Biswas; 1 ♀, Mathbaria, Dist. Pirojpur, 25. IX. 1995, Coll. V. Biswas; 1 ♀, Dist. Jhalokathi, 12. X. 1995, Coll. V. Biswas; 2 ♀, Potuakhali, 15. VIII. 1995, Coll. V. Biswas.

Distribution : BANGLADESH : Barisal, Pirojpur, Potuakhali, Jhalokathi; INDIA, West Bengal.

2. *Marpissa proszynskii* sp. nov.

(Figs. 1-5)

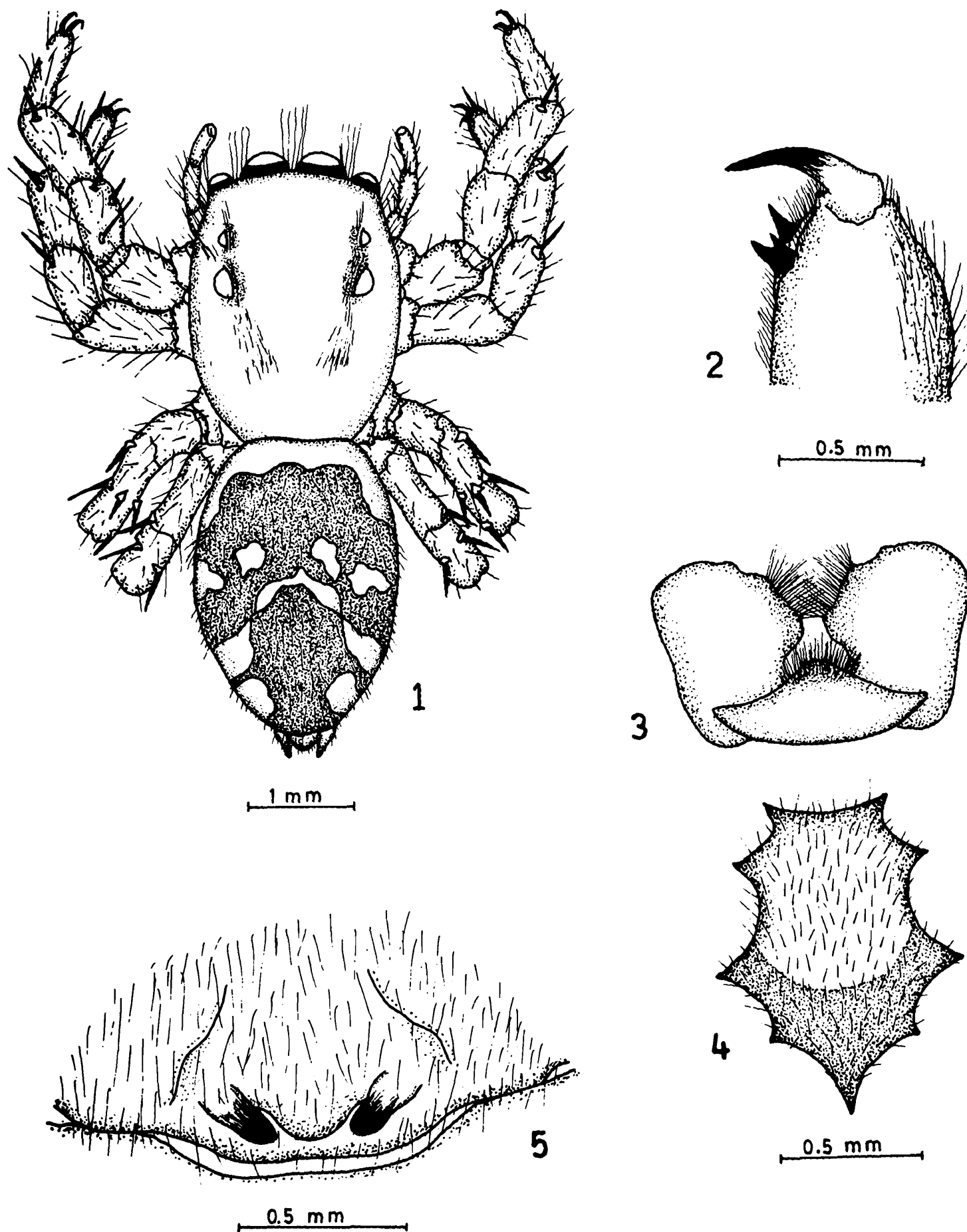
General : Cephalothorax brown, legs yellow-brown; abdomen pale-brown, with dark brown bands. Total body length 5.60 mm. Carapace 2.80 mm long, 2.00 mm wide; abdomen 3.00 mm long, 2.00 mm wide.

Cephalothorax : Longer than wide, both anterior and posteriorly narrowing, medially broad, clothed with hairs and pubescence; cephalic region raised, anterior margin slightly curved. Eyes pearly-white, dissimilar, anterior row of eyes recurved; anteromedians nearly $2\frac{1}{2}$ times larger than the anterolaterals; 2nd row of eyes minute; posterior row of eyes straight; ocular trapezium longer than wide (fig. 1). Chelicerae brown, broad, thick, with one sharp tooth on inner margin and 2 on outer margin (fig. 2). Maxillae and labium pale brown; maxillae little longer than wide, anteriorly scopulate (fig. 3); labium wider basally, bell-shaped, scopulate anteriorly (fig. 3). Sternum pale brown, wider postero-medially, posteriorly pointed (fig. 4), clothed with long, sharp hairs and few spines. Legs pale brown, slender, I and II robust, clothed with hairs and tibiae and metatarsi with strong spines (fig. 1); leg formula 1243 and the measurements (in mm) as in Table-1.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	1.5/1.5	0.9/0.9	1.0/1.0	0.9/0.9	0.6/0.6	4.9/4.9
II	1.3/1.3	0.9/0.9	1.0/1.0	0.8/0.8	0.5/0.5	4.5/4.5
III	1.3/1.3	0.8/0.8	1.0/1.0	0.7/0.7	0.5/0.5	4.3/4.3
IV	1.3/1.3	0.9/0.9	1.0/1.0	0.7/0.7	0.5/0.5	4.4/4.4

Table-1. Measurements (in mm) of different parts of legs of *Marpissa proszynskii* sp. nov.

Abdomen : Oval, anteriorly little wide, posteriorly narrowed, dorsum decorated with few black bands, clothed with hairs and pubescence (fig. 1), ventrally pale, with irregular brown spots; epigyne as in fig. 5.



Figs. 1-5 : *Marpissa proshynskii* sp. nov. 1. Dorsal view of female 2. Chelicera 3. Labium and Maxillae 4. Sternum 5. Epigynum

Male : Unknown.

Holotype : Female in spirit.

Types are at present in the Department of Zoology, Government P. C. College, Bagerhat and will be deposited to the Museum of the Department of Zoology, University of Dhaka, Dhaka-1000, Bangladesh in due course of time.

Etymology : The species is named after the famous Polish-Arachnologist professor Dr. Jerry Proszynski.

Type-locality : BANGLADESH : Pirojpur, Barisal; date 8. V 1995, Coll. V. Biswas.

Diagnosis : The present species *M. proszynskii* sp. nov. differs with *M. decorata* Tikader (Tikader, 1974) in the following characters :

1) The external appearance of the present species shows a little similarity with *M. decorata* Tikader.

2) The epigynum of the present species structurally differs with *M. decorata* and any of its Indian congeners (Tikader, 1967; Tikader & Biswas, 1981; Biswas & Biswas, 1992) and species known from elsewhere (Proszynski, 1992; Davies & Zabka, 1989; Chen & Zhang, 1989; Locket & Millidge, 1951; Ikeda, 1993 and Chikuni, 1989).

Therefore, the species is described as new to science.

SUMMARY

The jumping spiders of the genus *Marpissa* Koch of Barisal division, Bangladesh, is represented by 2 (two) species *M. bengalensis* Tikader and *M. proszynskii* sp. nov.

Studies on spiders of this area started since 1994, have revealed the existence of above two species of the genus *Marpissa* of a particular area of Bangladesh. Identity of the species were later confirmed by the Zoological Survey of India, Calcutta.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. S. C. Majumder, Scientist-SD, Sunderban Field Research Station, Zoological Survey of India, Canning, West Bengal, for the confirmation of the identity of the species. The first author is grateful to Prof. Mujibar Rahaman, Principal, Government P. C. College, Bagerhat, for providing laboratory facilities. The authors also grateful to the University Grants Commission, Bangladesh, for providing necessary funds for the study.

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**POPULATION ABUNDANCE, SEASONAL FLUCTUATION OF ANTS
(HYMENOPTERA : FORMICIDAE) IN AUTOMOBILE EXHAUST FED ROAD
SIDE SOIL OF CALCUTTA**

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INTRODUCTION

Ants are, insects of the family Formicidae, available in soil and contribute largely to the formation of the soil arthropod community. They appear in dense population groups both in rich and poor soils. Normally they tend to avoid the habitats intensively managed by man (Petal, 1976). However, many ant species do not leave man-transformed habitat, such as urbanised areas, industrial lands. Moreover they react to habitat changes by mobilising habitat-modifying reactions and altering certain parameters of their societies and populations (Petal, 1994). It is established that insects as well as arthropod fauna, exposed to the action of pollutants, respond suitably and undergo qualitative and quantitative changes to maintain their existence in a changing environment (Krzysztofak, 1991; Migula and Binkowska, 1993; Przybylski, 1979). Ants are greatly resistant to environmental pollution (Brower, 1966; De Witt and George, 1960; Petal, 1978, 1980). The ants in the soil habitat along the traffic arteries of Calcutta are expected to experience the pollution load, the automobile exhausts in particular. It may be mentioned that the automobile exhaust is at the highest in Calcutta in comparison to other big cities of India (Central Pollution Control Board, 1988—89).

The ant species encountered here are mostly common amongst the species so far reported from Calcutta (Tiwari et al., 1993).

The role of soil-ants in the soil building process and as an integrated part on the soil arthropod community is well-studied in many countries. However, no such effort has yet known from India. Therefore, the present study has been undertaken to make a comprehensive account of the ant population structure in the road side soil of Calcutta which are exhaust fed by automobile exhausts regularly. This has also been taken to study the effects of various edaphic factors and to find out the possibility of establishing an index species, which will provide a base line data for further works.

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MATERIAL AND METHOD

Two different areas of Calcutta were taken under study. (i) The eastern fringe of the city adjacent to Eastern Metropolitan Bypass, characterised by vegetal growth, some water-bodies and less automobile density. (ii) The centre of the city and is adjacent to Red Road and is characterised by vegetal cover and more automobile density on the road.

In each experimental site three plots, measuring 2mt x 5mt and horizontal to the respective roads, were selected and denoted as plot A, B and C respectively from nearer the road and away. Ten random samples of soil, each measuring about 20 cm square from 0—5 cm layer, were collected from each plot and each site at monthly intervals. The study was carried out from August, 1995 to December, 1996.

The ant samples were extracted following the standard soil extraction method of Macfadyen, 1953.

RESULT AND DISCUSSION

During the survey period altogether 24570 number of ant-samples were obtained of which 13940 were from the East Calcutta zone and 10630 were from Central Calcutta zone.

The month-wise mean number of ants obtained from each sample (20 cm x 20 cm) is shown in Table-1. A comparison of the total population between those two survey sites is shown in Fig. 1. The month-wise variations of the total population (mean number) of ants are plotted in Fig. 2. The ant species composition, percentage wise, in different plots are produced in Table 2. The percentage wise population distribution of different ant species in both the sites are shown in Fig. 3.

The total population of ants at Central Calcutta site varied in different seasons. The population exhibits two higher peaks; one in January (winter period) and the other in June (pre monsoon period), where the population mean values being 58.00 and 45.33 respectively. Two intermediary peaks were also found during October—November.

At East Calcutta similar population peaks were also observed during January and June with population means 53.33 and 48.66 respectively. A population peak of the magnitude of 67.33 was, however, observed in the month of September. The population was found to be low in the month of August and in the month of November.

The percentile distribution of collected species of Formicidae at Central Calcutta shows a composition of *Solenopsis geminata* (Fabricius) (39.04%), *Meranoplus bicolor* (Guer.) (18.60%), *Pheidole* sp. (17.50%), *Technomyrmex* sp. (9.32%) and *Prenolepis* sp. (8.18%); which were of common occurrence. Whereas *Camponotus compressus* (Fabricius) (2.65%), *Carebara* sp. (1.32%), *Tetramorium* sp. (0.85%), *Tetraponera* sp. (0.85%), *Ponera* sp. (0.66%), *Cardiocondyla* sp. (0.56%) and *Crematogaster* sp. (0.47%) were found to be poorly represented and with discrete distribution.

On the other hand, at East Calcutta the species which are mostly common had a composition of *Solenopsis geminata* (Fabricius) (41.12%), *Technomyrmex* sp. (15.32%), *Prenolepis* sp. (13.00%) and *Pheidole* sp. (10.36%). The other species such as *Dorylus* sp. (5.33%), *Camponotus compressus* (Fabricius) (3.29%), *Meranoplus bicolor* (Guer.) (2.81%), *Tetramorium* sp. (2.30%), *Crematogaster* sp. (1.88%), *Bothroponera* sp. (1.58%), *Carebara* sp. (1.51%), *Diacamma* sp. (0.56%), *Syscia* sp. (0.36%), *Anochetus* sp. (0.36%) and *Stigmatomma* sp. (0.28%) were found to be poor and discretely distributed.

Plotwise analysis of distribution of ant population exhibits a maximum concentration of 42.43% at plot A (0—1.5m) and a minimum of 25.90% at plot C (3—4.5m) at Central Calcutta site with a median concentration of 31.67% at plot B (1.5—3m) (Table 2).

Plotwise percentage composition of total ants at East Calcutta also exhibits a maximum concentration of 47.34% at plot A, however, the minimum concentration of 22.23% is found at plot B, with median concentration of 30.43% at plot C (Table 2).

Comparative study of the total ant population in both the sites exhibits a major concentration (56.74%) at East Calcutta, while it is low (43.26%) at Central Calcutta site. (Fig. 1).

The result of this study clearly shows that the total population of ants is more at East Calcutta site (56.74%) than at Central Calcutta site (43.26%). This difference is attributed due to various ecological factors which may also include variation in the concentration of automobile exhausts experienced at these sites.

The total ant population is found at its peak in both the sites during January and June, which concur with the observation of the earlier workers (Petal, 1978).

A third population peak in the month of September at East Calcutta site is somewhat abnormal and may be due to the presence of some population growth stimulating factors or due to sampling error and aggregation of the juveniles.

Plotwise distribution reveals that the soils adjacent to the roadways had more concentration of total ant population, which were found as 47.34% and 42.43% at plot A at East Calcutta and Central Calcutta sites respectively. It has also been observed that among the ant members *Solenopsis geminata* Fabricius in plot A of both the sites is maximum, which were 17.50% and 25.21% respectively. The overall contribution of this dominant species was found to be more at East Calcutta than at Central Calcutta, the concentrations being 41.12% and 39.04% respectively.

The density of vehicular movement at Central Calcutta is much more than East Calcutta. Therefore the soil in plot A at Central Calcutta is supposed to have a more concentration of lead from the automobile exhausts in comparison to the East Calcutta site. More concentration of *Solenopsis geminata* (Fabricius) in plot A of Central Calcutta is therefore suggestive to its higher tolerance of degraded environment. Existence of such tolerant species have also been found by Krzysztofiak (1991) and Petal (1978).

Table 2 : Percentage wise distribution of different species of Formicidae in different plotes at two sites under study [E C—East Calcutta : C C—Central Calcutta]

Species	Plot A		Plot B		Plot C		Total	
	EC	CC	EC	CC	EC	CC	EC	CC
<i>Solenopsis geminata</i> (F.)	17.50	25.21	11.41	6.96	12.21	6.87	41.12	39.04
<i>Technomyrmex</i> sp.	3.02	5.54	3.66		8.64	3.78	15.32	9.32
<i>Prenolepis</i> sp.	12.30	3.10	0.70	3.76	-	1.32	13.00	8.18
<i>Pheidole</i> sp.	4.61	7.62	1.79	4.79	3.96	5.09	10.36	17.50
<i>Meranoplus bicolor</i> (G.)	2.06	-	0.50	15.03	0.25	3.57	2.81	18.60
<i>Camponotus compressus</i> (F.)	-	0.11	1.51	-	1.78	2.54	3.29	2.65
<i>Dorylus</i> sp.	5.33	-	-	-	-	-	5.33	-
<i>Tetramorium</i> sp.	1.58	-	-	-	0.72	0.85	2.30	0.85
<i>Crematogaster</i> sp.	0.94	-	-	-	0.94	0.47	1.88	0.47
<i>Bothroponera</i> sp.	-	-	1.15	-	0.43	-	1.58	-
<i>Carebara</i> sp.	-	-	1.51	0.57	-	0.57	1.51	1.32
<i>Diacamma</i> sp.	-	-	-	-	0.50	-	0.50	-
<i>Syscia</i> sp.	-	-	-	-	0.36	-	0.36	-
<i>Anochetus</i> sp.	-	-	-	-	0.36	-	0.36	-
<i>Stigmatomma</i> sp.	-	-	-	-	0.28	-	0.28	-
<i>Tetraoponera</i> sp.	-	0.85	-	-	-	-	-	0.85
<i>Ponera</i> sp.	-	-	-	-	-	0.66	-	0.66
<i>Cardiocondyla</i> sp.	-	-	-	0.56	-	-	-	0.56
Total	47.34	42.43	22.23	31.67	30.43	25.90	100	100

The discrete distribution of other species suggests the cumulative effects of automobile exhausts and other ecological factors on their population structures.

It may therefore be said that automobile exhausts along with other soil factors have influences on the population structure of the soil-dwelling ants on road side soils of Calcutta.

SUMMARY

Altogether 24570 number of ant samples were collected from the road side soil of two busy roads of Calcutta at three different plots of each, denoted as A, B and C from nearer to the road and away respectively, in the period of August, 1995 to December, 1996. Population density was found higher at the site (road) of less automobile density and lower at the site (road) of more automobile density.

In both the sites population of ants showed higher peaks in January and in June.

Table 1. Monthwise mean number of ants per sample of soil in different plots at two sites under study

Plot	Aug. '95	Sep.	Oct.	Nov.	Dec.	Jan. '96	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
A	2.03	38.46	20.11	37.24	55.00	55.08	20.06	46.97	31.00	51.91	64.72	22.05	40.03	150.34	9.96	3.02	12.02
B	7.96	7.82	8.94	47.82	1.00	0.52	60.94	18.00	14.12	3.94	42.81	12.03	2.00	38.04	8.01	2.00	34.05
C	4.01	0.72	27.95	7.94	2.20	104.40	7.00	40.03	23.88	3.15	38.47	29.92	64.97	13.62	41.03	2.98	11.93
Total ($\bar{X}$)	4.66	15.66	19.00	31.00	19.33	53.33	29.33	35.00	23.00	19.66	48.66	21.33	35.66	67.33	19.66	2.66	19.33
East Calcutta																	
Plot	Aug. '95	Sep.	Oct.	Nov.	Dec. '96	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
A	6.24	13.35	18.17	32.43	5.14	89.23	14.11	16.08	19.04	23.08	24.11	9.02	34.01	14.97	62.05	49.96	20.01
B	38.91	4.93	7.87	9.84	2.00	0.86	10.95	3.94	11.94	21.00	49.86	19.94	5.01	13.07	4.97	7.98	1.96
C	31.85	8.72	12.96	14.73	0.86	83.91	7.97	7.98	4.02	9.92	62.03	3.04	19.98	13.96	49.98	25.06	30.03
Total ($\bar{X}$)	25.66	9.00	13.00	19.00	2.66	58.00	11.00	9.33	15.00	18.00	45.33	10.66	19.66	14.00	39.00	27.66	17.33
Central Calcutta																	

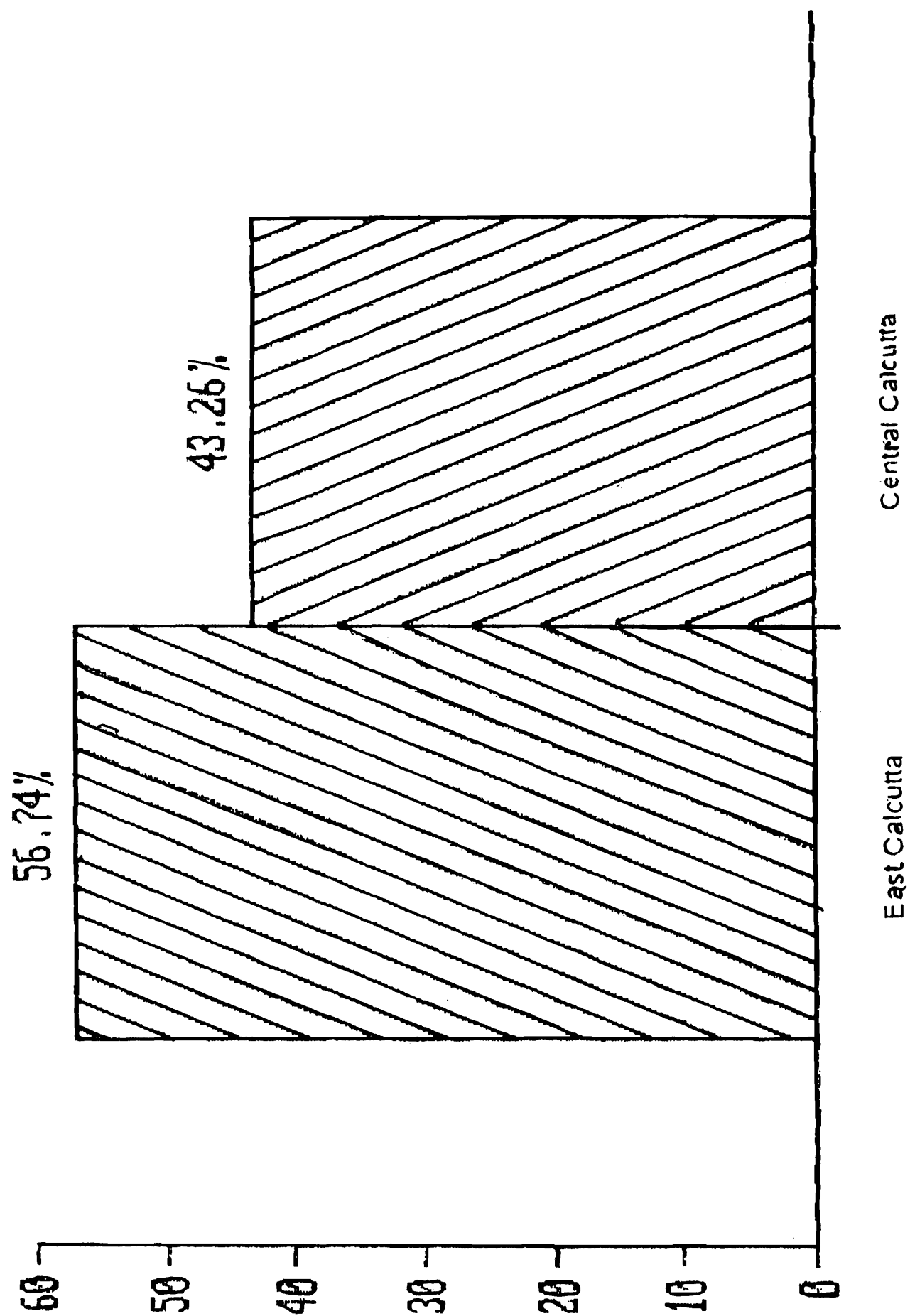


Fig. 1. Comparison of the total population of Formicidae between two sites under study.

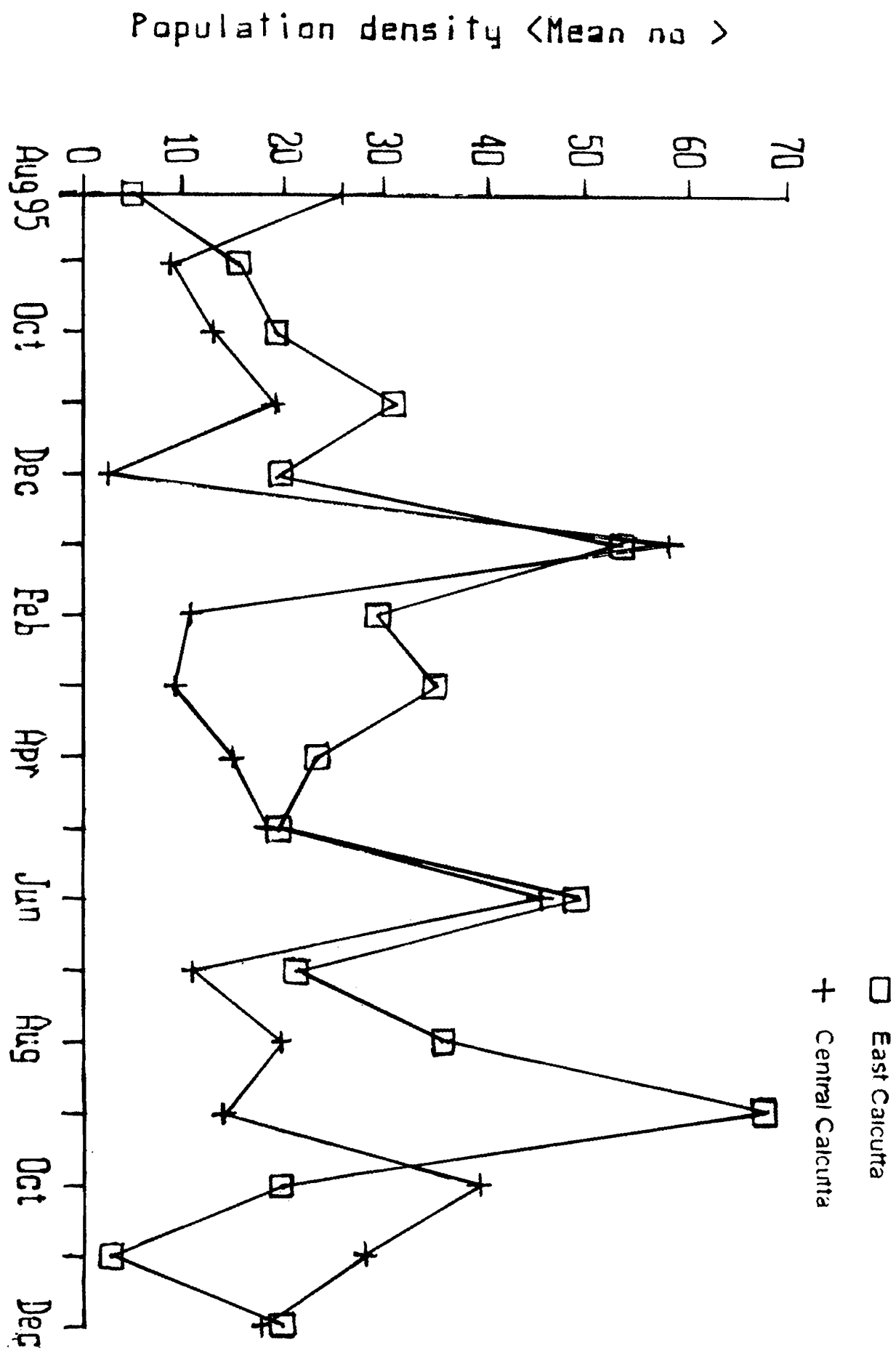


Fig. 2. Seasonal fluctuation of total population density (mean no.), per sample, of Formicidae at the two sites under study.

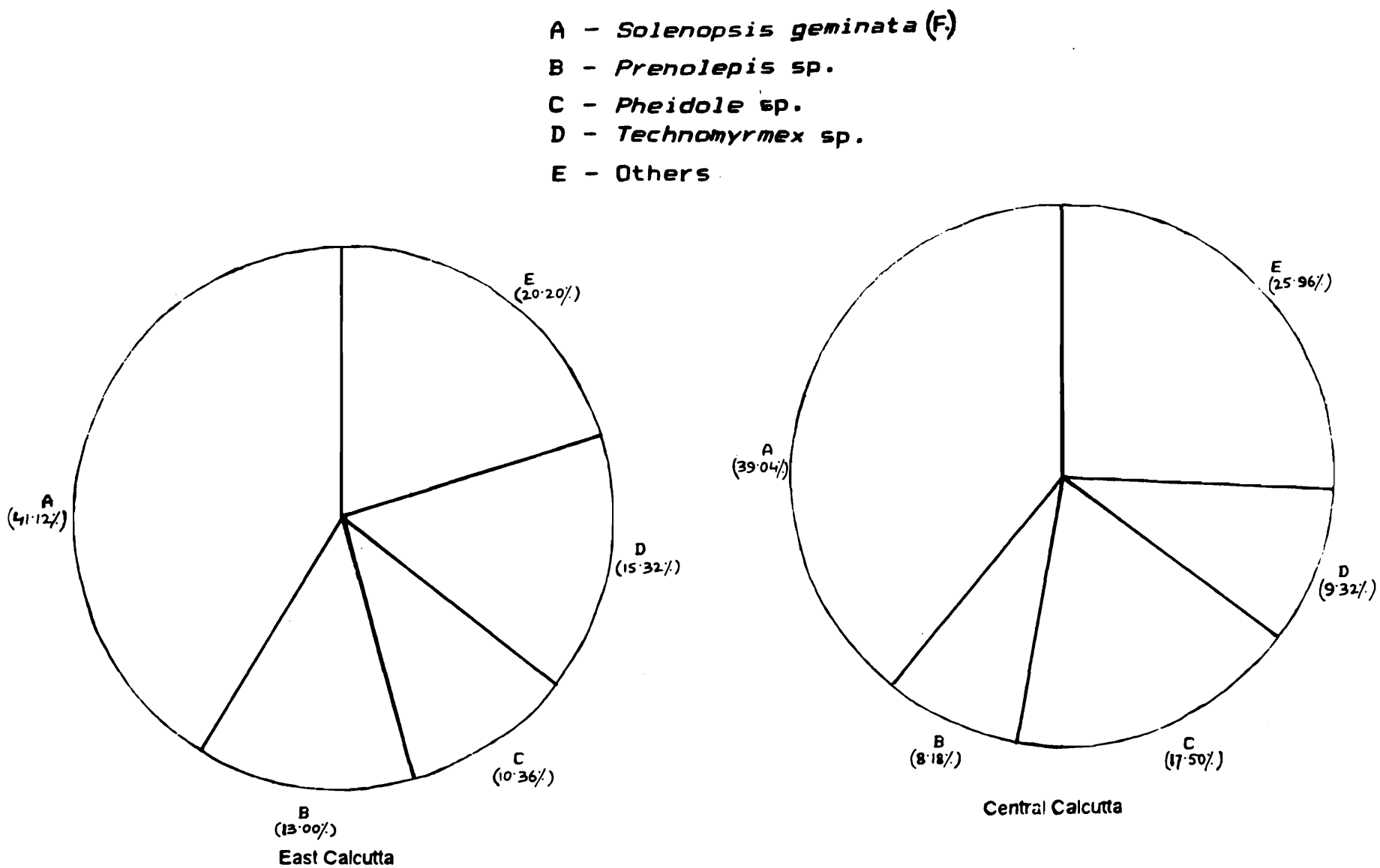


Fig. 3. Pie chart showing percentage wise population distribution of different taxa of Formicidae.

Mostly encountered species found in this population were *Solenopsis geminata* (Fabricius), *Pheidole* sp., *Technomyrmex* sp. and *Prenolepis* sp.

Among the three different plots of each site population density was found to be higher at plot A, i.e. nearer to the road, at both the sites.

It is also found that *Solenopsis geminata* (Fabricius) has the higher tolerance to degraded environment.

ACKNOWLEDGEMENT

The authors are grateful to Dr. J. R. B. Alfred, Director, Zoological Survey of India for providing necessary facilities for doing this work. The authors also express their gratitude to Dr. J. M. Petal, Polish Academy of Science, for sending valuable reprints and for his constant encouragement to do this work. The first author is very much thankful to the Officer-in-charge and staff of Hymenoptera Section, Zoological Survey of India, Calcutta

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ON A COLLECTION OF FISH FROM THE HEADWATERS OF DAMODAR RIVER

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INTRODUCTION

Fish and fisheries of Damodar River have been studied in detail only by few workers in past, that too several decades ago (Job et. al., 1952; Hora, 1955). Since then tremendous changes have been taken place in the general condition of the river because of increased mining and industrial activities in the catchment area. This has necessiated a thorough investigation of current faunal composition.

While surveying the fish fauna with the above objectives, some observations were also made as general ecology of the river, two important localities viz. Tori (Origin of the River Damodar Dist. Ranchi) and McCluskigunj (Dist. Ranchi) were selected. Survey were conducted during pre and postmonsoon seasons of three years 1995 to 1997.

DESCRIPTION OF STUDY AREA

Tori : Tori is situated at the foot hills of Khamarpat hills from where River Damodar originates. The hills are covered with dense forest and upper reaches are extremely inaccessible. Barring few small human settlements, the area around Tori is also covered with forests.

Mc Cluskigunj : The area falls under North Karanpura coal field region. This part is also covered with forests and surrounded by a chain of low hills. There are several coal mines.

RESULTS

Following is the combined list of fishes collected from both Tori and Mc Cluskigunj.

SYSTEMATIC LIST OF FISHES FROM TORI AND MC CLUSKIGUNJ

Order : CYPRINIFORMES

Family : CYPRINIDAE

Sub Family : CYPRININAE

Genus : *Cirrhinus* Cuvier

Cirrhinus reba (Hamilton-Buchanan)

Genus : *Labeo* Cuvier

Labeo boggut (Sykes)

Genus : *Osteobrama* Heckel

Osteobrama cotio cotio (Hamilton-Buchanan)

Sub Family : RASBORINAE

Genus : *Barilius* (Hamilton-Buchanan)

Barilius bendilisis (Hamilton-Buchanan)

Genus : *Danio* (Hamilton-Buchanan)

Danio aequipinnatus (Mc Clelland)

D. rerio (Hamilton-Buchanan)

Genus : *Esomus* Swainson

Esomus danricus (Hamilton-Buchanan)

Genus : *Rasbora* Bleeker

Rasbora daniconius daniconius (Hamilton-Buchanan)

Sub Family : GARRINAE

Genus : *Garra* Hamilton-Buchanan

Garra annandalei Hora

G. gotyla gotyla (Gray)

G. mullya (Sykes)

Family : BALITORIDAE

Sub Family : NEMACHILINAE

Genus : *Noemacheilus* Bleeker

Noemacheilus botia (Hamilton-Buchanan)

N. denisoni dayi Hora

N. denisoni denisoni Day

Family : COBITIDAE

Sub Family : COBITINAE

Genus : *Lepidocephalus* Bleeker.

Lepidocephalus guntea (Hamilton-Buchanan)

Order : SILURIFORMES

Family : SISORIDAE

Genus : *Glyptothorax* Blyth.*Glyptothorax telchitta telchitta* (Hamilton-Buchanan)

Order : PERCIFORMES

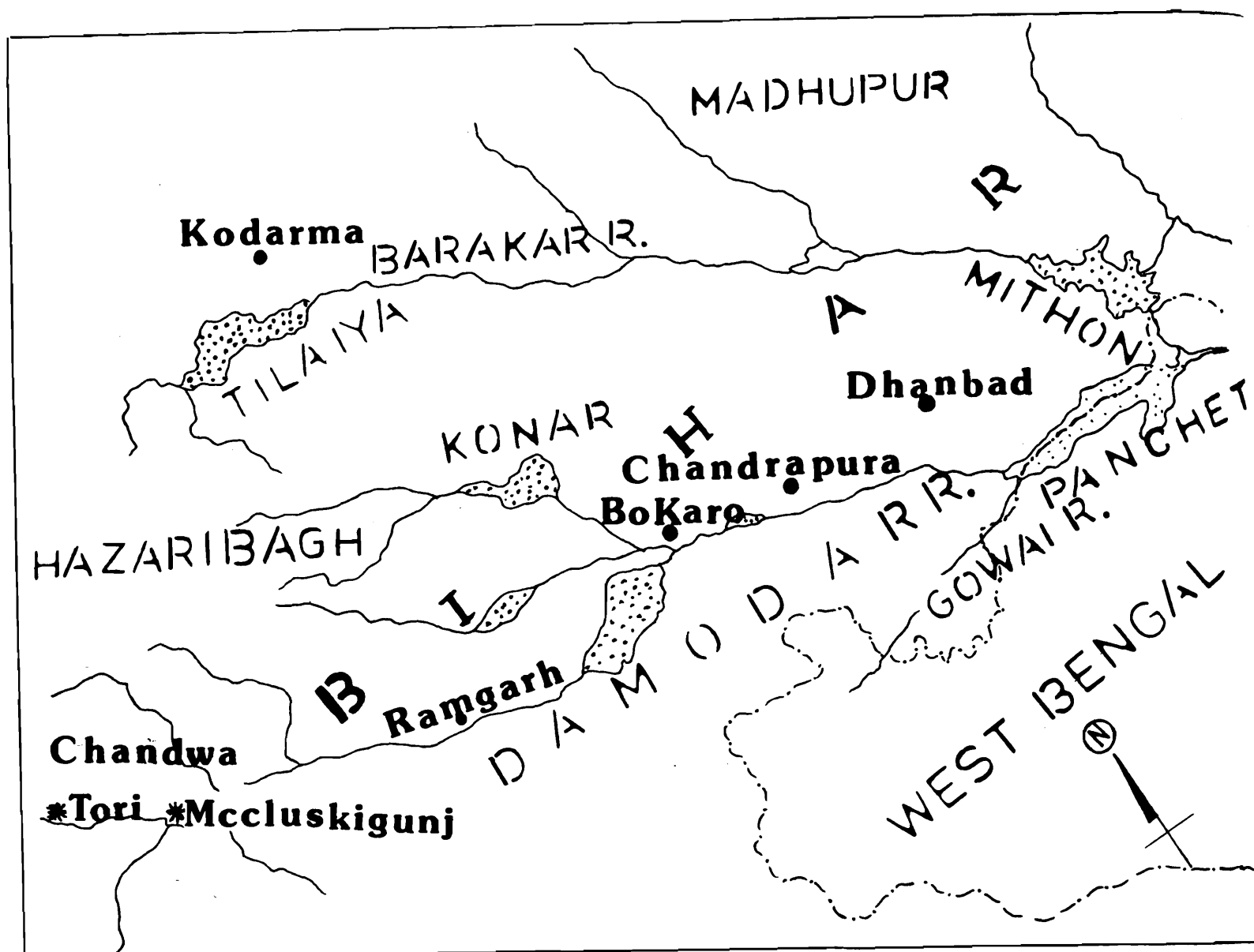
Family : MUGILIDAE

Genus : *Rhinomugil* Gill*Rhinomugil corsula* (Hamilton-Buchanan)

Family : GOBIIDAE

Genus : *Glossogobius* Gill*Glossogobius giuris giuris* (Hamilton-Buchanan)**Table 1.** Hydrobiological Parameters of Tori and Mc Cluskigunj.

	Tori		Mc cluskigunj	
	Pre monsoon	Post monsoon	Pre monsoon	Post monsoon
1. Temperature of Water	28°C	18°C	30°C	20°C
2. Temperature of Air	38°C	20°C	43°C	23°C
3. Dissolved Oxygen	4.5 mg/lit.	6.2 mg/lit.	2.3 mg/lit.	5.6 mg/lit.
4. Free Carbondioxide	0.2 mg/lit.	0.0 mg/lit.	4.0 mg/lit.	0.2 mg/lit.
5. pH Content	4.2	6.8	3.0	4.0



MAP SHOWING THE COLLECTING SITES FROM
THE HEAD WATER OF DAMODAR RIVER

Legend	
Dam.	
Collection Spot.	✱

Map Showing the Collecting Sites from the Head Water of Damodar River.

NOTES ON ECOLOGY

At Tori river bed was almost dried up during postmonsoon seasons excepting a shallow slow flowing stream. During premonsoon, water was found only in small ditches on the river beds, with total disruption of flow. Because of the absence of large human settlements and mines in these area, the water is almost free from any pollution, the physicochemical condition of water was good (Table-1). At Mc Cluskigunj a peculiar phenomenon was noticed. Local people construct a mud bridge across the river for communication. The bridge is constructed by rocks and soil with a cement pipe inserted near the bottom, for just to allow the scanty water flow. During monsoon the whole mass is washed away and settles nearby river bed.

The river around Mc Cluskigunj is considerably affected by human infiltration, particularly due to coal mining operations. During premonsoon, water temperature was very high with low dissolved oxygen (Table-1) and acidic pH (3.0) value. These factors are highly detrimental to fish fauna.

FISHERIES

Most of the above listed fishes are of no economic value except few like *Cirrhinus reba* and *Labeo boggut*. Some of the species of hill stream fish found are *Garra mullya*, *Garra gotyla gotyla*, some species of *Danio aequipinnatus* and *Danio rario*, are also found in good quantity. As the river in this area is almost devoid of commercial species, no organised fishing efforts are made and only few fishermen catch small fishes and sell in local market.

CONCLUSION

The fishes collected from Tori and Mc Cluskigunj consisted of 3 orders, 5 families 15 genera and 20 species among them, only few are of some economic value. It is quite clear that serious degradation of the river resulted either in the total elimination of some species or drastic reduction in their population unless serious measures are taken by the concerned authorities to keep the water free from pollution and built permanent concrete bridge across the river, the water will remain continuously polluted hampering drastically the fish fauna.

ACKNOWLEDGEMENT

I am thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for kindly offering me working facilities in the Fish Division and to Shri. T. K. Sen, Scientist 'SE', for suggesting me the title and for continued help and guidance while writing the paper.

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LIZARDS AND SNAKES OF FOUR CONSERVATION AREAS IN THE IDUKKI DISTRICT, KERALA STATE

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INTRODUCTION

The Idukki district which was a part of the erstwhile State of Travancore, is also a significant segment of the Western Ghats known for its faunal wealth and the famous Periyar Tiger Reserve is located in the district. Besides the Periyar Tiger Reserve, the district has four more conservation areas namely, the Idukki Wildlife sanctuary, the Chinnar Wildlife sanctuary, the Eravikulam National Park and the Thattekkad Bird sanctuary. The present report is based on the study of a collection of reptiles obtained from the conservation areas of Periyar Tiger Reserve, Idukki and Chinnar Wildlife sanctuaries and the Eravikulam National park (fig.1) which are deposited in the faunal holdings of the Western Ghats Field Research station of the Zoological Survey of India at Calicut. The collection studied contain 32 species of reptiles falling under 19 genera and 8 families (Table-I). Smith (1935, 1943) has already focussed our attention on the reptiles occurring in the Western Ghats. Some of the recent works which deal with the reptilian fauna of the Western Ghats are those of Daniel (1983), Murthy (1985, 1986) and Tikader and Sharma (1992). There has been no consolidated systematic account dealing with the reptiles of the Idukki district so far barring brief notes by Chandrasekhar (1987).

SYSTEMATIC ACCOUNT

Class : REPTILIA

Order : SQUAMATA

LIZARDS

Suborder : SAURIA

Family : GEKKONIDAE

1. *Hemidactylus maculatus* Dumeril & Bibron

1836. *Hemidactylus maculatus* (in part) Dum. & Bibr. *Erp. Gen.* iii, p. 358.

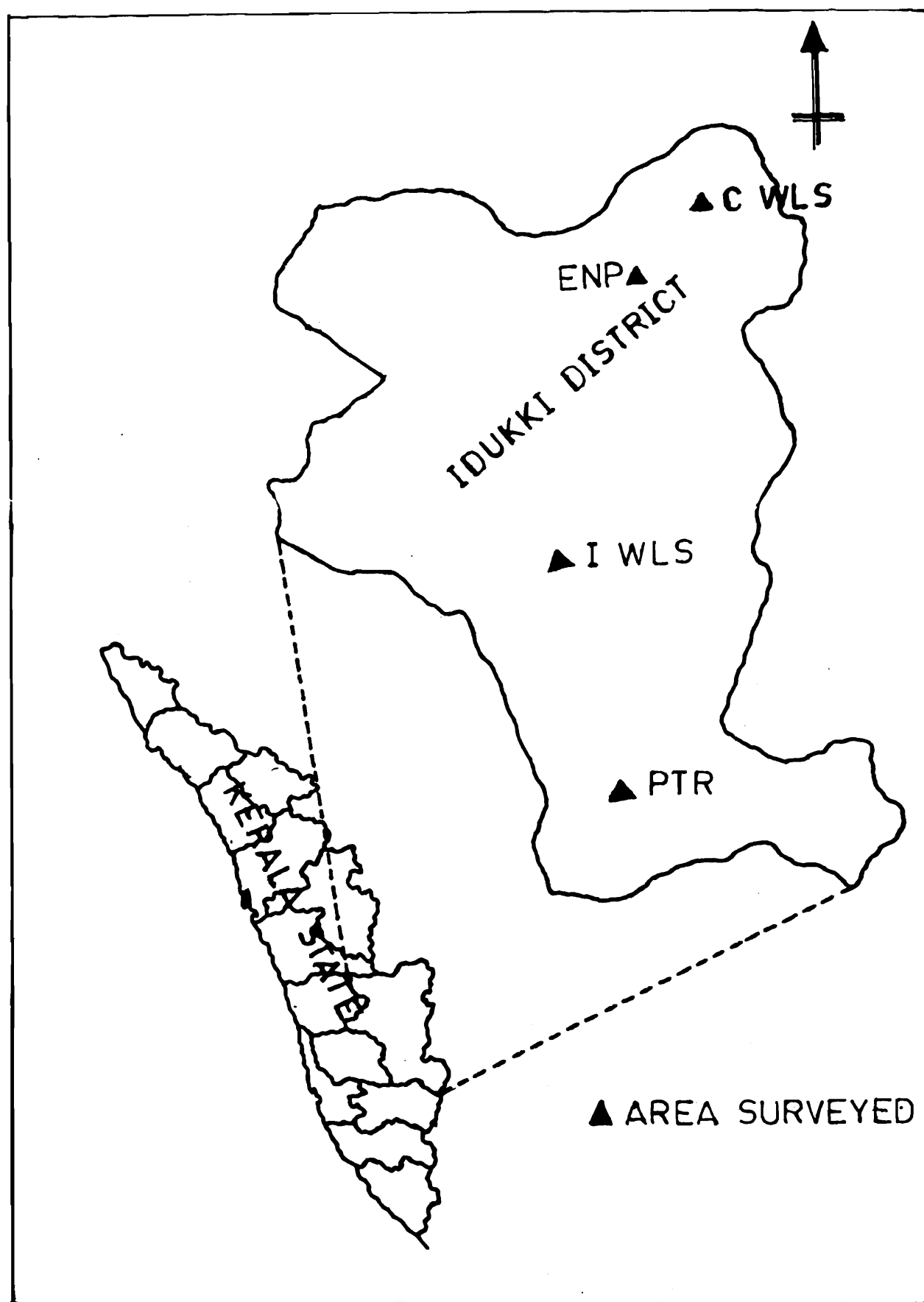


Fig. 1. Map of Idukki district showing the area surveyed. C WLS : Chinnar Wild Life sanctuary. ENP : Eravikulam National Park. I WLS : Idukki Wild life sanctuary. PTR : Periyar tiger reserve.

Material examined : 1 ex., Chinnar (Chinnar Wildlife sanctuary), 19-xi-1996, P. M. Sureshan.

Distribution : India : Gujarat, Maharashtra, Karnataka, Tamil Nadu, Kerala.

2. *Dravidogecko anamallensis* (Gunther)

1875. *Gecko anamallensis* Gunther. *Proc. Zool. Soc.*, p. 226.

Material examined : 2 exs., Rajamalai (Eravikulam National Park), 2-iv-1994 & 17-iv-1997, K. C. Gopi & E. Kunhikrishnan.

Distribution : India : Anamalai, Palni & Tirunelveli Hills (Tamil Nadu).

3. *Cnemaspis ornata* (Beddome.)

1870. *Gymnodactylus ornatus* Beddome *Madras Month. J. Med. Sci.*, i, p. 32.

Material examined : 3 exs., Churulipetty & Chambakkad (Chinnar Wildlife Sanctuary), 17-xi-1996 & 18-xi-1996, P. M. Sureshan.

Distribution : India : Tirunelveli & Anamalais (Tamil Nadu) and hills of South Kerala.

4. *Cnemaspis littoralis* (Jerdon)

1853. *Gymnodactylus littoralis* Jerdon. *J. Asiat. Soc. Bengal*, xxii, p. 469.

Material examined : 1 ex., Thannikudi (Periyar Tiger Reserve), 17-xi-1996, P. M. Sureshan.

Distribution : India : Nilambur (Kerala), Nellakota, Nilgiris (Tamil Nadu).

5. *Cnemaspis indica* (Gray)

1846. *Goniodactylus indicus* Gray. *Ann. Mag. Nat. Hist.* xviii, p. 429.

Material examined : 3 exs., Vellimala, Manakkavala & Thannikudi (Periyar Tiger Reserve), 28-vii-1995, 12-xi-1996 & 3-iii-1997, V. J. Zacharias & P. M. Sureshan.

Distribution : India : Nilgiris (Tamil Nadu), Coorg (Karnataka), Malabar coast of Kerala.

6. *Cnemaspis kandiana* (Kelaart)

1852. *Gymnodactylus kandianus* Kelaart. *Prod. Fauna Zeyl.* p. 186.

Material examined : 3 exs., Karikkavu, Mlappara & Thannikudi (Periyar Tiger Reserve), 10-xi-1996, 18-ix-1996 & 3-iii-1997, P. M. Sureshan & V. J. Zacharias.

Distribution : India : Hills of southern India & Andaman Islands., Sri Lanka., Islands west of Sumatra.

7. *Cnemaspis jerdoni* (Theobald)

1868. *Gymnodactylus jerdoni* Theobald. *Cat. Rept. Asiatic. Soc. Mus.*, p. 31.

Material examined : 2 exs., Karikkavu (Periyar Tiger Reserve), 10-xi-1996, P. M. Sureshan.

Distribution : India : Nilgiri, Anamalai, Palni & Sivagiri hills (Tamil Nadu), Sri Lanka.

Family : AGAMIDAE

8. *Psammophilus dorsalis* (Gray)

1831. *Agama dorsalis* Gray. in Griffiths. *Anim. King.* ix, p. 56

Material examined : 2 exs., Churulipetty & Chambakkad (Chinnar Wildlife Sanctuary), 17-xi-1996 & 18-xi-1996, P. M. Sureshan.

Distribution : India : Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Kerala.

9. *Salea anamallayana* (Beddome)

1878. *Lophosalea anamallayana* Beddome. *Proc. Zool. Soc.* p. 153, pl. xiv.

Material examined : 1 ex., Turner's valley (Eravikulam National Park), 5-iii-1995, C. Radhakrishnan.

Distribution : India : Anamalais, Palnis (Tamil Nadu), hills of South Kerala.

10. *Calotes versicolor* (Daudin)

1802. *Agama Versicolor* Daudin, *Hist. Nat. Rept.* iii, p. 395, pl. XLIV.

Material examined : 1 ex., Thannikudi (Periyar Tiger Reserve), 11-xi-1996, P. M. Sureshan; 1 ex., Vellayikkamali (Idukki Wildlife sanctuary), 14-xi-1996, P. M. Sureshan; 1 ex., Chambakkad (Chinnar Wildlife Sanctuary), 17-xi-1996, P. M. Sureshan.

Distribution : India : Whole of India., Sumatra to South China., Sri Lanka., Pakistan., Afghanistan.

11. *Calotes elliotti* Gunther

1864. *Calotes elliotti* Gunther. *Rept. Brit. Ind.* p. 142.

Material examined : 1 ex., Mlappara (Periyar Tiger Reserve), 18-xi-1996, P. M. Sureshan.

Distribution : India : Anamalai, Palni, Sivagiri & Tirunelveli hills (Tamil Nadu), New Amarambalam R. F & Silent Valley, Kerala.

12. *Calotes rouxi* Dumeril & Bibron

1837. *Calotes rouxii* Dum. & Bibr. *Erp. Gren.* iv. p. 407.

Material examined : 1 ex., Thannikudi (Periyar Tiger Reserve), 3-iii-1997, V. J. Zacharias.

Distribution : India : Western coastal districts from Gujarat to Kerala.

13. *Calotes calotes* (Linnaeus)

1758. *Lacerta calotes* Linnaeus. *Syst. Nat.* 10th ed., p. 207.

Material examined : 1 ex., Vellayikkamali (Idukki Wildlife sanctuary), 14-xi-1996, P. M. Sureshan.

Distribution : India : Shevroy hills (Tamil Nadu), South Kerala, Nicobar Island., Sri Lanka.

Family : SCINCIDAE

14. *Ristella guentheri* Boulenger

1887. *Ristella guentheri* Boulenger. *Cat. Liz. Brit. Mus.* iii, p. 358, pl. xxix, fig. 3.

Material examined : 1 ex., Mlappara (Periyar Tiger Reserve), 9-xi-1996, P. M. Sureshan.

Distribution : India : South Kerala.

15. *Ristella beddomii* Boulenger

1887. *Ristella beddomii* Boulenger. *Cat. Liz. Brit. Mus.* iii, p. 359 pl. xxix, fig. 4.

Material examined : 1 ex., Meenmooty (Idukki Wildlife sanctuary), 15-xi-1996, P. M. Sureshan.

Distribution : India : North Kanara district (Karnataka), Tenmalai, Parambikulam, New Amarambalam R. F. (Kerala).

16. *Mabuya macularia* (Blyth)

1853. *Eupreps macularius* Blyth. *J. Asiat. Soc. Bengal.*, xxii, p. 652.

Material examined : 2 exs., Tannikudi (Periyar Tiger Reserve), 7-xi-1996 & 3-iii-1997, P. M. Sureshan & V. J. Zacharias.

Distribution : India : Whole of India., Myanmar., Pakistan., Thailand., Vietnam., Malaysia.

17. *Mabuya bibroni* (Gray)

1838. *Tiliqua bibronii* Gray. *Ann. Mag. Nat. Hist.* ii, p. 290.

Material examined : 1 ex., Churulipetty (Chinnar wildlife Sanctuary), 17-xi-1996, P. M. Sureshan.

Distribution : India : Kerala, Tamil Nadu, Orissa., Sri Lanka.

18. *Riopa punctata* (Gmelin)

1799. *Scincus punctatus* Gmelin. *Hist. Amph.* p. 197.

Material examined : 2 exs., Churulipetty & Chambakkad (Chinnar Wildlife Sanctuary), 17-xi-1996 & 18-xi-1996 P. M. Sureshan.

Distribution : India : Almost whole of India., Sri Lanka., Man-son mountains, Tonking.

SNAKES

Suborder : SERPENTES

Family : TYPHLOPIDAE

19. *Typhlops beddomei* Boulenger

1890. *Typhlops beddomei* Boulenger. *Fauna of British India*, p. 237.

Material examined : 1 ex., Manakkavala (Periyar Tiger Reserve), 12-xi-1996, P. M. Sureshan.

Distribution : India : Hills of South India.

Family : UROPELTIDAE

20. *Uropeltis ceylanicus* Cuvier

1829. *Uropeltis ceylanicus* Cuvier. *Reg. Anim.* 2nd ed. ii, p. 76.

Material examined : 1 ex., Vellimala., Thekkadi (Periyar Tiger Reserve), 28-vii-1995, V. J. Zacharias.

Distribution : India : Goa to south Kerala and Shevroy hills of Tamil Nadu.

21. *Uropeltis ocellatus* (Beddome)

1863. *Silybura ocellata* Beddome. *Proc. Zool. Soc.* p. 225.

Material examined : 2 exs., Thekkadi (Periyar Tiger Reserve), 28-vii-1995 & 1-v-1996, V. J. Zacharias.

Distribution : India : Western Ghats, South of Goa gap.

Family : COLUBRIDAE

22. *Ahaetulla dispar* (Gunther)

1864. *Tragops dispar* Gunther. *Rept. Brit. Ind.* p. 303, pl. 23, fig. A.

Material examined : 1 ex., Bhimanada (Eravikulam National Park), 12-iv-1994, K. C. Gopi.

Distribution : India : South Western Ghats.

23. *Amphiesma beddomei* (Gunther)

1864. *Tropidonotus beddomei* Gunther. *Rept. Brit. Ind.* p. 269, pl. xxii, fig. E.

Material examined : 2 exs., Thekkadi & Mlappara (Periyar Tiger Reserve), 1-v-1996 & 9-xi-1996, V. J. Zacharias & P. M. Sureshan.

Distribution : India : Throughout the southern Western Ghats upto Pune.

24. *Amphiesma monticola* (Jerdon)

1853. *Tropidonotus monticolus* Jerdon. *Jl. Asiatic Soc. Bengal*, xxii, p. 530.

Material examined : 1 ex., Vellayikkamali (Idukki Wildlife Sanctuary), 14-xi-1996, P. M. Sureshan.

Distribution : India : Western Ghats South of Goa.

25. *Amphiesme stolata* (Linnaeus)

1758. *Coluber Stolatus* Linnaeus. *Syst. Nat.* 10th ed., p. 219.

Material examined : 2 exs., Bhimanada & Kulukkumalai (Eravikulam National Park), 12-iv-1994 & 4-iii-1995, K. C. Gopi & P. M. Sureshan.

Distribution : India : Whole of India including Andamans., Pakistan., Southern China., Indo-China., Sri Lanka.

26. *Chrysopelea ornata* (Shaw)

1802. *Coluber ornatus* Shaw. *Gen. Zool.* iii, p. 477.

Material examined : 1 ex., Thekkadi (Periyar Tiger Reserve), 1-v-1996, V. J. Zacharias.

Distribution : India : Tripura, Assam, Bihar, Bengal, Orissa, Madhya Pradesh, Western Ghats south of Goa., Sri Lanka., Whole of Indo-Chinese region extending to upper Myanmar, Southern China.

27. *Macropisthodon plumbicolor* (Cantor)

1839. *Tropidonotus plumbicolor* Cantor. *Proc. Zool. Soc.* p. 54.

Material examined : 1 ex., Rajamalai (Eravikulam National Park) 16-viii-1996, E. Kunhikrishnan.

Distribution : India : Throughout India except Ganges valley and extreme north-west., Sri Lanka.

28. *Xylophis perroteti* (Dumeril & Bibron)

1854. *Platypteryx perroteti* Dum. & Bibr. *Erp. Gren.* vii, p. 501.

Material examined : 1 ex., Near Anamudi (Eravikulam National Park), 10-viii-1996, E. Kunhikrishnan.

Distribution : India : from Wynad (Kerala) to Tirunelveli (Tamil Nadu).

Family : ELAPIDAE

29. *Calliophis nigrescens* (Gunther)

1862. *Callophis nigrescens* Gunther. *Ann. Mag. Nat. Hist.* (3) ix. p. 131.

Material examined : 2 exs., Manakkavala (Periyar Tiger Reserve), 12-xi-1996, P. M. Sureshan.

Distribution : India : Southern Western Ghats.

Family : VIPERIDAE

30. *Hypnale hypnale* (Merrem)

1820. *Cophias hypnale* Merrem. *Syst. Amph.* p. 155.

Material examined : 2 exs., Vellayikkamali (Idukki Wildlife Sanctuary), 14-xi-1996, P. M. Sureshan.

Distribution : India : Western Ghats as far north as latitude 16°, Sri Lanka.

31. *Trimeresurus gramineus* (Shaw)1802. *Coluber gramineus* Shaw. *Gen. Zool.* iii. p.420.

Material examined : 1 ex., Vellimala, Thekkadi (Periyar Tiger Reserve), 28-vii-1995, V J. Zacharias.

Distribution : India : Peninsular India South of Lat. 22°

32. *Trimeresurus macrolepis* Beddome1862. *Trimeresurus macrolepis* Beddome. *Madras Quart. J. Med. Sci.* v. p. 2, fig. 6.

Material examined : 1 ex., Umayamalai (Eravikulam National Park), 16-viii-1996, E. Kunnihikrishnan.

Distribution : India : South Western Ghats.

Table-1 : Species of Reptiles and their area of occurrence in the Idukki District.

Sl. No.	Scientific name	Area of Occurrence
<i>Family : Gekkonidae</i>		
1.	<i>Hemidactylus maculatus</i>	C WLS
2.	<i>Dravidogecko anamallensis</i>	ENP
3.	<i>Cnemaspis ornata</i>	C WLS
4.	<i>Cnemaspis littoralis</i>	PTR
5.	<i>Cnemaspis indica</i>	PTR
6.	<i>Cnemaspis kandiana</i>	PTR
7.	<i>Chemaspis jerdoni</i>	PTR
<i>Family : Agamidae</i>		
8.	<i>Psammophilus dorsalis</i>	C WLS
9.	<i>Salea anamallayana</i>	ENP
10.	<i>Calotes versicolor</i>	PTR, I WLS, C WLS
11.	<i>Calotes elliotti</i>	PTR
12.	<i>Calotes rouxi</i>	PTR

Sl. No.	Scientific name	Area of Occurrence
13.	<i>Calotes calotes</i> <i>Family : Scincidae</i>	I WLS
14.	<i>Ristella guentheri</i>	PTR
15.	<i>Ristella beddomii</i>	I WLS
16.	<i>Mabuya macularia</i>	PTR
17.	<i>Mabuya bibroni</i>	C WLS
18.	<i>Riopa punctata</i> <i>Family : Typhlopidae</i>	C WLS
19.	<i>Typhlops beddomei</i> <i>Family : Uropeltidae</i>	PTR
20.	<i>Uropeltis ceylanicus</i>	PTR
21.	<i>Uropeltis ocellatus</i> <i>Family : Colubridae</i>	PTR
22.	<i>Ahaetulla dispar</i>	ENP
23.	<i>Amphiesma beddomei</i>	PTR
24.	<i>Amphiesma monticola</i>	I WLS
25.	<i>Amphiesma stolata</i>	ENP
26.	<i>Chrysopelea ornata</i>	PTR
27.	<i>Macropisthodon plumbicolor</i>	ENP
28.	<i>Xylophis perroteti</i> <i>Family : Elapidae</i>	ENP
29.	<i>Calliophis nigrescens</i> <i>Family : Viperidae</i>	PTR
30.	<i>Hypnale hypnale</i>	I WLS
31.	<i>Trimeresurus gramineus</i>	PTR
32.	<i>Trimeresurus macrolepis</i>	ENP

PTR—Periyar Tiger Reserve; ENP—Eravikulam National Park; I WLS—Idukki Wildlife Sanctuary;
C WLS—Chinnar Wildlife Sanctuary

SUMMARY

Thirty two species of reptiles occurring in the four conservation areas of the Idukki district, Kerala State are discussed:

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Calcutta for encouragement and facilities and to the officials of the Forest Department, Govt. of Kerala for the help and co-operation rendered during the field surveys.

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**DESCRIPTIONS OF TWO NEW GALL MIDGES (DIPTERA : CECIDOMYIIDAE)
FROM NILGIRI BIOSPHERE RESERVE, KARNATAKA**

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INTRODUCTION

The Nilgiri Biosphere Reserve is spread over three States in the Indian Peninsula, namely Tamilnadu, Kerala and Karnataka. Later accounts for 1520.40 sq.kms of the total Biosphere Reserve and comprises of Bandipur Tiger Reserve and Nagarhole National Park, which lie between 12°3'30" and 12°54'17" North Latitudes and 76°7' and 76°52'4" East Longitudes; 11°45' and 12°45' NL and 76°5' and 76°25' EL respectively.

During the course of faunistic survey in Nagarhole National Park of the Biosphere Reserve, several gall midge species were encountered, of which, two turned out to be new to Science which are described here.

Subfamily : CECIDOMYIINAE

Tribe : CECIDOMIID

1. *Blastodiplosis longipennis* sp. nov. (Figs. 1-8)

Male : Body 2.00 mm long, pale brown. Eyes confluent above. Trophi normal. Palpus 4-segmented, moderately setose; first segment (10 : 7) short, $1.42 \times$ its maximum thickness; second segment (21 : 10) roughly half the length of first and a little more than twice its maximum thickness; third segment (25 : 7) longer and thinner than second; $3.57 \times$ its maximum thickness; fourth segment (43 : 5) slender, longest of all, $8.60 \times$ its maximum thickness.

Antenna : broken, longer than body, possibly with 2 + 12 binodose, tricircumfilar segments; basal enlargements globose, apical enlargements slightly constricted; basal enlargement with a whorl of regular circumfila and one whorl of long setae; apical enlargements with two whorls of regular circumfila and one whorl of long setae; circumfila shorter than apical enlargements; apical stems longer than basal ones; scape (21 : 23) cup-shaped; wider than long; pedicel (17 : 16) sub-globose; third segment (85) confluent with and shorter than fourth; basal prolongation very small; basal enlargement (19 : 15) $0 : 22$ the length of the segment and $1.26 \times$ its maximum thickness; basal stem (19 : 8) as long as basal enlargement and 2.37

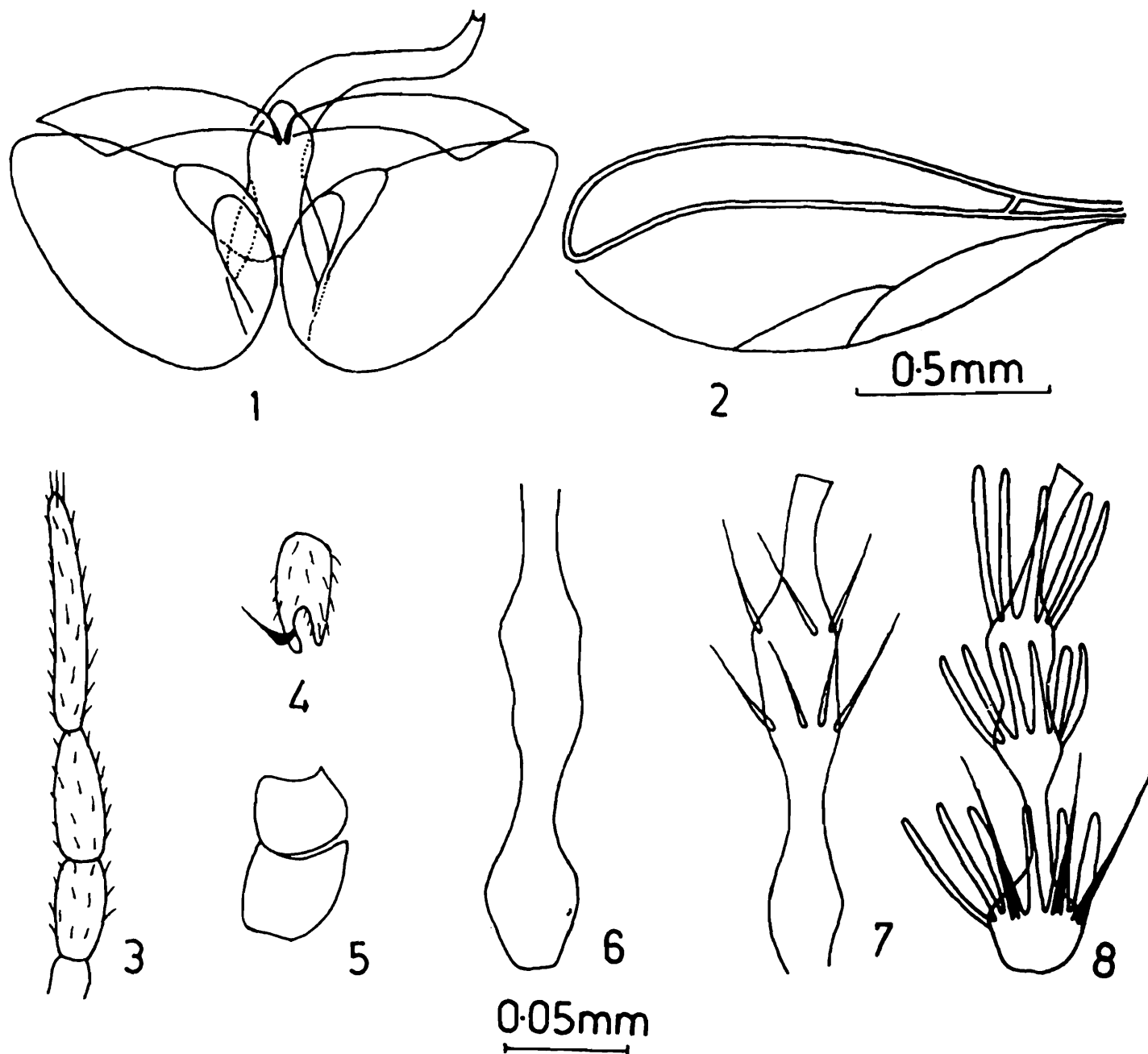


Fig. 1-8. *Blastodiplosis longipennis* sp. nov. (male) : 1. Genitalia (dorsal view); 2. Wing; 3. Palpus; 4. Claw; 5. Scape and Pedicel; 6, 7, 8. Third fourth and tenth antennal segments respectively.

× its maximum thickness; apical enlargement (26 : 15) 0.30 the length of the segment and 1.73 × its maximum thickness; apical stem (20 : 7) 0.76 the length of the apical enlargement and nearly 3.00 × its maximum thickness; fourth segment (92) longer than third, with basal enlargement (19 : 18) 0.20 the length of the segment and a little longer than wide; basal stem (19 : 8) as long as basal enlargement and 2.37 × its maximum thickness, apical enlargement (29 : 15) 0.31 the length of the segment and nearly 2.00 × its maximum thickness; apical stem (25 : 7) 0.86 the length of the apical enlargement and 3.57 × its maximum thickness, fifth, sixth and seventh segments gradually becoming shorter and thinner, eighth and ninth segments similar and longer than seventh, tenth segment shorter than ninth.

Wing : (70 : 23) hyaline, nearly 3.00 × as long as broad, vein R_1 joining costa well before the middle of the wing; vein R_s present, vein R_5 meeting costa beyond the apex of the wing; Costa interrupted at its union; vein $M_3 + 4$ absent, vein Cu forked. *Legs* : long, sparsely hairy, metatarsus (7) half the length of the terminal tarsal segment; second tarsal segment (70) 10.00 × the length of the metatarsus and shorter than the following segments combined together (79); claw evenly curved, simple on all legs; empodium shorter than the claw.

Genitalia : pale brown; sparsely setose, basal clasp segment (55 : 32) 1.71 × as long as broad, median lobe in the form of well sclerotized conspicuous setose buldge; terminal clasp segment (46 : 15) slender, evenly curved, ending in a pointed tooth; nearly 3.00 × as long as broad, dorsal plate (26 : 30) broader than long, deeply bilobed, lobes setose; subdorsal plate (35 : 15) longer than dorsal, spatulate, setose, 2.33 × as long as broad; aedeagus (64 : 11) very long, well sclerotized, dorsally recurved and 5.80 × its maximum thickness.

Female : Unknown.

Holotype : Male dissected and mounted on slide, at light, Nagarhole National Park, Karnataka, India, 15.v.1989, R. M. Sharma, coll. The type is in the collections of the Zoological Survey of India, Pune for the time being.

Grover and Bakshi (1977-78) described *B. allahabadensis* recording the genus for the first time from India. The present species closely resembles *allahabadensis*, the only known Indian species, but can easily be separated by its remarkably long, dorsally recurved aedeagus; spatulate subdorsal plate and absence of vein $M_3 + 4$.

Etymology : The specific epithet *longipennis* refers to its long aedeagus.

2. *Octodiplosis brevipalpis* sp. nov. (Figs. 9-17).

Male : Body 1.31 mm. long. Eyes confluent above. Trophi normal. Palpus : short, 2-segmented, sparsely setose; First segment (6 : 6) globose; second segment (15 : 6) 2.50 × longer than first, length 2.50 × its maximum thickness.

Antenna : longer than body, with 2 + 12 segments, flagellate segments binodose, tricicumfilar; Scape (10 : 19) cup-shaped; pedicel (12 : 16) sub-globose; third segment (51)

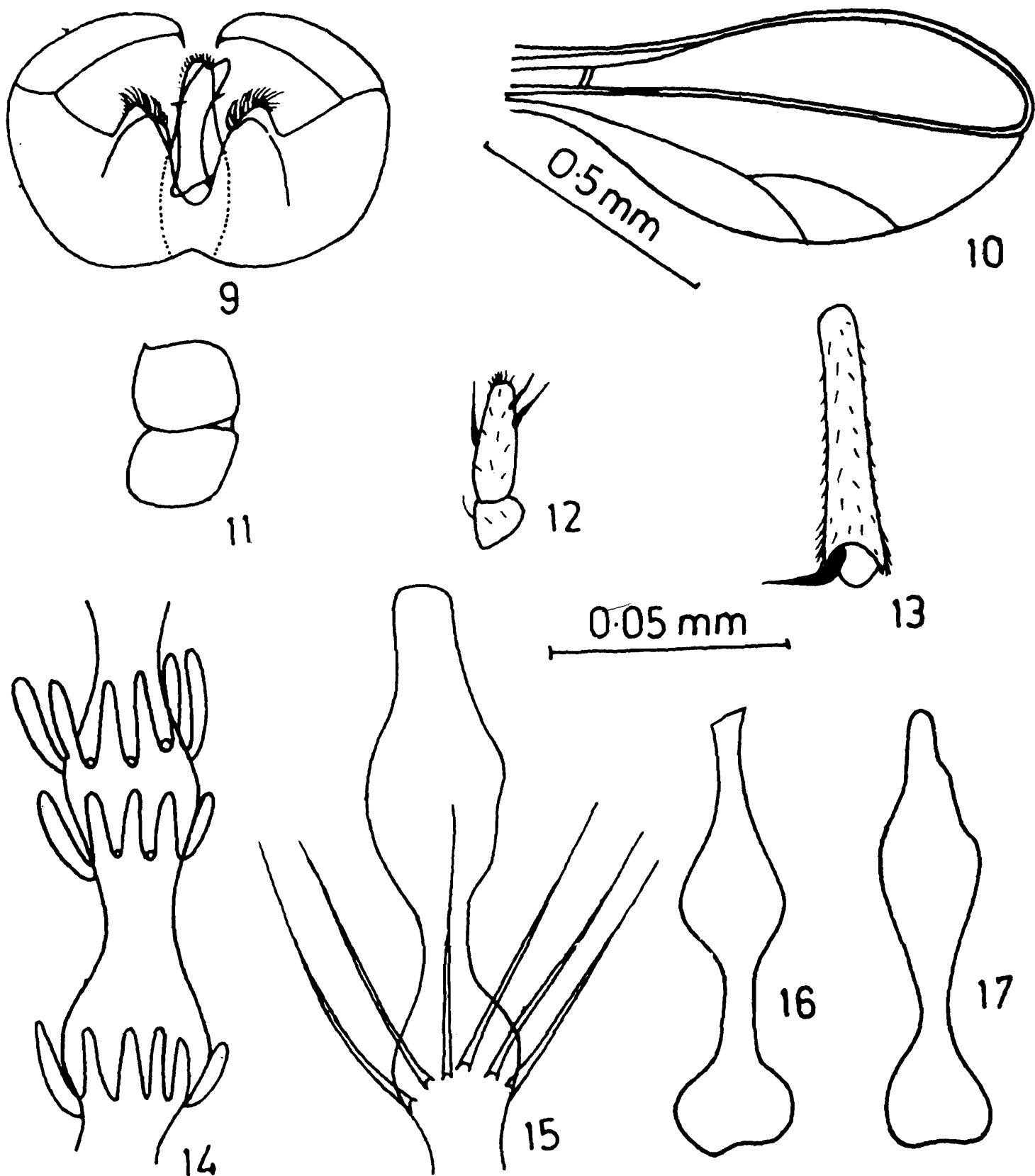


Fig. 9-17. *Octodiplosis brevipalpis* sp. nov. (Male) : 9. Genitalia (dorsal view); 10. Wing; 11. Scape and Pedicel; 12. Palpus; 13. Claw; 14. Third antennal segment; 15. Fourth antennal segment; 16. Penultimate segment; 17. Terminal segment.

confluent with and longer than fourth; basal enlargement (11 : 6) shorter than basal enlargement, slightly less than $2.00 \times$ as long as thick; apical enlargement (15 : 13) 0.25 the length of the segment and slightly longer than wide, apical stem (11 : 5) shorter than apical enlargement and a little more than $2.00 \times$ as long as thick, fourth and sixth segments similar, distal segments gradually becoming shorter, penultimate segment (42) with basal enlargement (9 : 11) 0.21 the length of the segment and wider than long; basal stem (9 : 4) as long as basal enlargement and slightly more than $2.00 \times$ as long as thick; apical enlargement (12 : 10) $1.33 \times$ longer than basal enlargement and $1.20 \times$ its maximum thickness; apical stem (10 : 3) shorter than apical enlargement and $3.33 \times$ as long as thick, terminal segment (40) shortest of all, basal enlargement (9 : 10) 0.22 the length of the segment and slightly wider than long; basal stem (8 : 2) a little shorter than basal enlargement and $4.00 \times$ as long as thick; apical enlargement (19 : 9) 0.49 the length of the segment and a little more than $2.00 \times$ as long as thick, apical stem in the form of an apical knob (5 : 2).

Wing : (42 : 17) hyaline, $2.47 \times$ as long as broad; vein R_1 joining costa a little before the basal half of the wing, vein R_s Present vein R_s reaching wing margin beyond the apex and interrupting costa at its union, vein C_u forked.

Legs : long, metatarsus (6) a little more than half the length of the terminal tarsal segment (11), second tarsal segment longest of all (38). Claw simple on all legs, bent at right angles, empodium rudimentary.

Genitalia : (45 : 28) light brown, basal clasp segment cylindrical with a large, basal obtuse lobe, $1.60 \times$ as long as broad (leaving basal lobe), basal lobe very prominent having recurved, dark brown setae at the tip; terminal clasp segment (40 : 10) slender, shorter than basal clasp segment, $4.00 \times$ as long as thick, gradually tapering towards tip, ending in a tooth; dorsal plate (30 : 30) bilobed, deeply bifid in the middle, as long as broad, subdorsal plate (50 : 16) entire, pubescent, elongate, broad basally, tapering apically, tip rounded, $3.12 \times$ as long as broad, aedeagus (50 : 18) with a pair of subapical lateral spine, as long as or longer than subdorsal plate, $2.77 \times$ as long as thick, tip rounded or notched.

Female : Unknown.

Holotype male, paratypes 3 males, dissected and mounted on slides, at light, Nagarhole National Park, Karnataka, India, 15. v. 1989, R. M. Sharma, Coll. The types are deposited in the collections of the Zoological Survey of India, Pune for the time being.

So far, the genus *Octodiplosis* Giard is represented in India by three species viz. *orientalis* (Rao), *quadrispina*, Grover and *bispina* Sharma. The present species is the most distinctive and can easily be separated from all the described species by its short 2-segmented palpus. However, it closely resembles *bispina* in having a pair of spines on aedeagus but differs by its large basal lobe of basal clasp segment.

Etymology : The specific epithet refers to a short 2 -segmented palpus.

SUMMARY

Blastodiplosis longipennis sp. nov. and *Octodiplosis brevipalpis* sp. nov. collected from Nagarhole National Park (Nilgiri Biosphere Reserve) Karnataka State, India, have been described and illustrated.

ACKNOWLEDGEMENTS

I am thankful to the Director, Zoological Survey of India, Calcutta, and the officer in-Charge of this station for permission to undertake this work and providing necessary facilities.

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BIOLOGY AND ECOLOGY OF DRAGONFLIES (INSECTA : ODONATA) WITH NOTES ON THEIR ADAPTATIONS IN DIFFERENT ECOSYSTEMS OF INDIA

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INTRODUCTION

Dragonflies constitute the primitive insect order Odonata. Their ancestors have been reported from the Carboniferous rocks; but no remarkable change in the morphology has taken place after the Jurassic.

These insects are noteworthy for their cute appearance; flight power and sharp eye-sight. These flying machines can fly backward move vertically like a helicopter or stop in turn in the midst of the most rapid progression as if they have been rammed into. This could be possible due to adjustment of the centre of gravity between the bases of the wings and leaves a sharp contrast with all other living insects.

Dragonflies have the highest development of compound eyes (Huxley 1953). It has been estimated that an eye of an adult dragonfly may contain 10,000 to 28,000 facets. The eyes occupy almost the whole of the head; other parts of the head viz. labium, labrum, clypeus, frons, occiput etc., are very small. The head is movable and can be twisted sideways 180°, backward 70° forward and downward 40°; the meso- and meta thorax are fused to form the synthorax and the legs have shifted forward to form the basket with the help of spines. These help them to capture prey while on wings and to take rest. The abdomen is relatively slender and long. The genitalia is found to be at the tip; only in case of male the copulatory organ is on the second abdominal segment. Copulation takes place usually in the air but eggs are laid in water.

Adult life (General)

Adults are terrestrial. They feed on adult insects; some times fight for food (Mitra 1994).; some of them display courtship, territories for food and breeding are also visible. Territorial fight sometimes depend on the size of insects (Mitra 1994). There are some globe trotters. They prefer to stay near water with bushes on the fringe, so that both adult and larvae get food and places for roost.

Classification : According to age life of adults can be divided into three phases...(a) Maturation or pre reproductive (b) Reproductive and (c) Post reproductive.

(a) *Pre reproductive period* : In this period the imago do all activities of a matured individual excepting the sexual life. During this phase the just emerged imago wait for some time in the emergence site and then fly away from the place and after maturation they arrive in the nearest breeding ground (Fig 2). But sometimes immature but not just emerged, dragonflies are also visible in the breeding site. This is probably to get food.

The range of the period necessary for maturation of zygopterans extend from 2 days to 30 days (Corbet 1962, Johannson 1978 & Lutz 1968); and for anisopterans from 6-45 days (Pajunen 1962, Schmidt 1964). The maturation period is usually shorter in males than in females. For instance, males of *Plathemis lydia* take 8-14 days in the case of females it is 13-24 days. In case of *Anax imperator* the males take 7-12 days and females take 13-16 days (Corbet 1962). In a few species the maturation period serves as the aestivating stage and lasts for 8-9 months (Corbet 1980). Sometimes it varies according to latitude. In *Lestes sponsa* the maturation period lasts about 20 days at all latitudes between 40° and 58°N. but lengthens progressively South of 40° N to about 100 days near the southern limit, 34° N., of species (Uéda 1978). The body colour changes at the sametime. The differences in color and other features sometimes causes confusion in identification; Fraser (1933, 1934 & 1936) contain descriptions of several immature forms of Indian dragonflies.

(b) *Reproductive period* : In this stage the mature imagos show breeding activities. This activity of adults determine the flying season (Corbet 1962). In case the breeding season is discrete the duration of the reproductive period depends upon the emergence curve and on adult longevity (Corbet 1980).

In the permanent habitats of the humid tropics the flying season is continuous; in other cases of the tropics it depends on the seasonal rain. Outside the tropical belt, the flying season is not continuous. Species of those regions can be grouped according to their flying period (Corbet 1980). According to Trottier (1971) that the species which usually maintain a resident populations in the tropical area as well as in the temperate latitude the flying season becomes shorter at higher latitudes.

On reaching the breeding ground the adult usually tend to remain there, unless driven away by storm or by aggressive behaviour of other males. The roosting sites of the mature adults ranges from less than one metre to more than 200 metres from the mating site (Hasan 1976; Parr & Parr 1974 and Uéda 1976).

Reproductive behaviour : Generally the males arrive at the breeding site earlier, both in season and day, than the females. Males of some species show courtship behaviour and establish territories also. Males then try to catch the receptive females for copulation. Reproductive behaviour of different species have been described by Bick & Hornuff (1966), Bick & Sulzback (1966), Furtado (1972, 1974 & 1975), Kumar & Prasad (1977 a), Mitra (1987), Moore (1952 a, b), Prasad & Ghosh (1982).

Selection of the breeding site : The action is often referred to as the habitat selection. It depends on the microgeographic distribution of adult and microhabitat of the larvae (Corbet 1980). A

newly formed dam, for example, is occupied first by species with wide microgeographic distribution and then by those characteristic features of later stages of ecological succession (Corbet 1980). Sometimes man made habitats are also utilised, *Bradinopyga geminata*, for instance, occur almost through out India. In plains it breeds in the stagnant pools and drains. In the western Himalaya, it breeds in rocky pools. Kumar (1973) has collected larvae of it from cemented tanks. The present author has seen to lay eggs and collected its larvae from the open container for aquarium fishes. Gambles (1986) has also reported larvae and ecdyses of *Bradinopyga strachani* and *pantala flavescens* in small rain water puddles in west Africa. During the period of October-November, 1991, the author has seen *Pantala flavescens* laying eggs in small water collected in the depressions on the metal roads of Aizwal (Mizoram). The author has also seen in the suburban of Calcutta that *Pantala flavescens* making oviposition activities over the shining surfaces of the motor car. Nevile (1960) has also reported the similar activities of the species in Ghana.

Territoriality : Some odonates are territorial in habit. Males of those species localize in an area within which he behaves in a way that evokes escape and avoidance among intruders (Corbet 1980). The dimension of the territories depend on the density of the male population in the area (Corbet 1980, Mathavan 1975, Mitra 1994). Mitra (1987) has contended that the area of the territory also depends on the area of the breeding site as well as some intrinsic factors. He (Mitra *op. cit.*) has also noted that the territory is defended both in horizontal and vertical direction.

Copulation : The male first appear in the breeding site and capture the receptive female as soon as available with the aid of their anal appendages and then remain in tandem, with or without prior evident of courtship. The pair then form the "Wheel position" and copulation takes place either at the breeding site or nearby place even on trees (Mitra 1994)

During the breeding season interspecies tandem flight is also visible. (Bick & Bick 1981; Mitra & Lahiri 1972).

Post Copulatory behaviour : After the copulation the female begins to lay eggs. In several species of Zygoptera and Anisoptera the male usually remain associated with the ovipositing female. The pair may be in tandem, continuously, intermittently and repeatedly as in *Tramea*, *Pantala*, *Hadrothemis* (Corbet 1980). In *Tholymis tillarga* the male guards the ovipositing female (Mitra 1987). Tyagi and Miller (1991) have reported similar behaviour in *Ictinogomphus rapax*. In some Zygoptera, females oviposit without the assistance of the males. This type of behaviour is usually seen in species of *Ischnura* (Bick 1972, Parr 1973, Rowe 1978). On the June 9, 1997, the author noted that after a slight dizzle at 6. 30 A.M (Sunrise at 4.50A.M) a pair of *Diplacodes trivialis* copulated on the grass field. After the copulation was over the pair detached and male and female went in the opposite directions. From the above it is presumed that sometime female may carry fertilised egg to a suitable place for laying.

Post reproductive period : In this phase the brightness of body colours disappears and becomes duller. The gonads regress. The dragonflies reduce their activities. Their wings sometimes becomes covered with thin film as a result the wing becomes blurred.

Longevity : Borror (1934), Corbet (1962, 1980), Gambles (1960) Kormondy (1959), Moore (1952), Parr and Parr (1972) have discussed about the longevity of the dragonflies. Among the populations of the same species the average longevity varies very little. Excluding the maturation period, the average longevity among the studied species of Zygoptera are one to two weeks which may be 5-8 weeks; 2-3 weeks and 3-6 weeks in case of Anisoptera (Corbet 1980). When the maturation period is added, those which neither hibernate nor aestivate after emergence, the longevity in cases of Zygoptera ranges from 7-9 weeks, while the corresponding values in Anisoptera is 8-9 weeks (Corbet 1980).

Death : Death caused by automobiles, accidents, starvations, by predators and for other reasons have been cited by Kennedy (1950), Kiauta (1965, 1971), Mitra (1974c, 1994); Moore (1951) and Ram and Prasad (1978). Mitra (1977 & 1994) cited some examples of natural deaths (death without any visible external injury).

Death may be due to clashes with automobiles; heavy rainfall and storm. Among the predators birds come first. Kennedy (1950) have made a list of birds preying on Odonata. In India House Crow, House sparrow, and Mynah act as predators. Among lizards, House geko, *Hemidactylus brookii* is also known as predator of dragonflies which come in the houses (Mitra 1974 c). Mitra (1990) and Ram and Prasad (1978) have mentioned some species of spiders which feed on dragonflies. Fishes also some times feed on larvae. In case of *Bradinopyga geminata* the cryptic coloration and habit of taking rest on tree trunks or on stone wall as well as its crepuscular habit help it to escape from the predators. Similarly in case of *Tholymis tillarga* the superficial resemblance of the wing to the hymenopterous ones and their crepuscular habit also help them to escape the predators. These features of these two species are evolutionary adaptations. On October 10, 1989, the author found that one domestic cat caught and ate completely one male *Urothemis signata signata* when the latter entered a house at Gobardanga, North 24 Parganas district of West Bengal, India. Another record of predation by mammal was made by white *et. al.* (1979) when they reported attack of *Myotis lucifugens* a bat, on *Anax junius* Dr. in America.

Migration : Like many other insects dragonflies undertake migratory flights. Fraser (1933) has listed *Pseudagrion decorum* (Rambur), *Pseudagrion microcephalum* (Rambur), *Aciagrion occidentale* Laidlaw, *Onychargia atrocyana* Selys, *Pantala flavescens* (Fabricius) and *Hemianax ephippiger* (Burmeister) as migratory dragonflies of India. *Hemianax ephippiger* appears in Calcutta during the summer. Mitra (1974 & 1994) reported migratory flights of *Pantala flavescens* in Calcutta and Sikkim in September. In North America *Anax junius* and *Pantala flavescens* occur from the tropics to North Canada (Corbet 1980). Matured forms are carried by North winds in early spring (Butler, Peterson & Corbet 1975). In this way they cross the bioclimatic zone where larvae can survive in the winter (Trottier 1966, 1967). The larvae of such spring immigrants usually emerge in late summer and probably fly southwards as immatures roost en route (Corbet 1980).

Roosting : Roosting place is important as regards breeding site is concerned. The roosting place in the afternoon or evening may be less than 1m to 200m or so from the breeding area (Corbet

1980). It includes bushes, other vegetations close to the grounds and sometimes walls of man made wells and buildings. Fraser (1944) has described aggregations of roosting *Bradinopyga geminata* in buildings in India. The present author has also noted similar behaviour of *B. geminata* in Jodhpur, Rajasthan, during March-April, 1980; Mitra (1990) has reported roosting of *Brachythemis contaminata* on the walls of wells. Gambles (1971) has recorded associations of *Lestes virgatus* returning to the same spot in consecutive nights in Nigeria. The present author has recorded mass roosting of *Aciagrion pallidum* and *Ceriagrion olivaceum* on the tall grass on the bank of river Sankosh at Jamduar (Assam valley) in December, 1973. Joseph and Lahiri (1989) and Miller (1989) reported communal roosting in *Potamarcha congener* in South India. The function of the communal roosting is not clearly known; but Miller (*op.cit*) concludes "that communal roosting in *Potamarcha congener* serves to reduce nocturnal predators, and that this enhances survival in a long-lived species which may remain in reproductive diapause throughout a long dry season" Other factors in the past may have played important roles for this behaviour. The evolutionary priority of cause and effect cannot, therefore, be determined.

Thermo-regulation : The ability of odonates to maintain a relatively constant body temperature is related to their body size as well as their behaviour (Corbet 1980). Corbet (*op. cit*) believes that perchers thermo-regulate primarily by making postural adjustments which involve both body and wings, thus varying exposures of the body to the sun. Corbet (1962) has reported the 'Obelisk' position of *Trithemis festiva* on a hot, stony stream bed at midday in Java. In this position the tip of the abdomen is directed towards sun, the wings shade the thorax., Mitra (1990) has also reported similar behaviour of *Brachythemis contaminata* and *Diplacodes trivialis* in Calcutta. Perching in the shade seems to be a means of thermo-regulation (Utzeri & Ginandrea 1989). During March-April in 1980 the present author has observed in Jodhpur of Rajasthan (Indian Desert), that a large number of *Bradinopyga geminata* specimens rest on a shaded wall during the day time and comes after the sun set. Perching in the bush or near water also help in thermo-regulation. In the period from April to May, 1990, the author has recorded in Azamgarh of eastern Uttarpradesh that *Ceriagrion coromandelianum* remains inside the bush from midmorning (10AM) to late afternoon when the ambient temperature ranges between 35°-36°C. *Pantala flavescens* and *Tholymis tillarga* perch under leaves in the hot summer days in Calcutta. Sometime the former fly 400-600 Cm above the ground in the sun although no difference of temperature from the ground level has been recorded. In the Himalaya perching in the sun help in thermo-regulation (Fig. 1)

Reaction during changes in weather conditions : Lahiri (1975) reported that during the rain *Bayadera hyalina* hangs under the wire on which they perched before the rain in Shillong. Recently a pair of *Neurothemis tullia*, (1♂ 1♀) were found to remain in the rain for continuous seven (7.8.97 to 14.8.97) days without changing the position, in Calcutta. Mitra (1996) cited the behaviour of dragonflies during the solar eclipse in 1995, with descent of temperature from 25° to 23° C and ascent of temperature up to 29° C. It was noted that with the descent of temperature the dragonflies reduced their activities, and finally stopped at 23° C; and with the rise of temperature they gradually resumed their activities.

Food and feeding activities : Adult dragonflies feed on adult odonate and nonodonate insects. Bhargava and Prasad (1980) have recorded that *Orthetrum glaucum* captures *Palpopleura sexmaculata*; Prasad and Biswas (1981) have reported that *Orthetrum sabina* captures *Acisoma panorpoides panorpoides* and feed on the species. The author has observed that *Ischnura senegalensis*, *Ceriagrion coromandelianum* and *Orthetrum sabina* feed on *Agriocnemis pygmaea*; *O. sabina* feeds on *Ceriagrion coromandelianum*. Among non-insects prey the author recorded that *Pseudagrion rubriceps* attacks aphid (*Aphis cracivora*) *Pseudagrion microcephalum* attacks the ant (*Paratrachina longicornis*), *Ceriagrion coromandelianum*, *Diplacodes trivialis* attack the ant (*Solenopsis geminata*), *Brachythemis contaminata* and *Crocothemis servilia* capture the House fly (*Musca domestica*), *Pantala flavescens* and *Tholymis tillarga* feed on mosquito, *Ischnura senegalensis* and *Crocothemis servilia* capture butterfly, *Pantala flavescens* attacks workers of termites. Mathur (1960) has also observed the similar behaviour of odonate species. Wright (1946) reported several predators and preys of adults and larvae.

Reaction towards mobile objects : Sometimes dragonflies follow mobile vertebrates and other objects like bicycle, automobiles etc. This behaviour has been reported by Acharya (1961), Corbet (1962), Corbet and Millar (1991) Mitra (1974 b & 1994), Tyagi and Miller (1991) and Worth (1961). In Africa *Brachythemis leucosticta* follows mobile objects, in Calcutta *Ictinogomphus rapax*, *Brachythemis contaminata* *Diplacodes trivialis* and *Pantala flavescens* follow men and vehicles. In Rajasthan *Trithemis aurora* follows men. In Madurai, Tamil Nadu state, India, Corbet and Miller (1991) have been successful in inducing this behaviour in some examples of *Brachythemis contaminata* of the existing populations, but have failed in case of *Diplacodes trivialis*. The author has observed that *D. trivialis* follow the object in a peculiar way. It goes ahead of the mobile object wait there, till the object reaches and again it goes ahead. Finally it returns to the original position. The causes of this behaviour is not clearly known.

Larval life

(a) **Habitat :** The larva usually occupies the aquatic habitat. However, there are certain zygoptera which develop in water that accumulates in the leaf bases; the larva of Megapodagrionidae, *Podopteryx selysi*, develop in the water contained in tree holes (Corbet 1980). The larva of New Zealand Petalurid, *Uropetala carovei*, live in damp soil. According to Fischer (1964), Tketo (1971), Willey and Ellar (1972) larvae of certain species can survive even being out of water for months. Corbet (1980) thinks that certain burrowing larvae locate themselves according to particle size of the substrate.

(b) **Food habit :** The larvae feed on aquatic animals. According to Moore (1960) dragonfly larvae feed on larvae of Mayflies, aquatic beetles bugs fish fry even earthworm which drop in water and show wriggling movement as they sink in the bottom, Corbet (1962) reports that *Aeshna umbrosa* and *Calopteryx maculata* catch larvae of *Simulium venustum*; he continues that the gut contents of *Pantala flavescens* and *Anax junius* contain chironomid larvae. Larva of *Pseudagrion salisburyense* of South Africa captures chironomid larvae and oligochaete worms.

Recently Sebastian *et. al* (1990) have tried to control the populations of *Aedes aegypti* with the aid of larvae of *Crocothemis servilia* in Mynmar (Burma). In Dum Dum Park area of West Bengal larvae of *Bradinopyga geminata* developed in the open container for aquarium fishes feed on mosquito larvae and sometimes fish fries. Food of the larvae varies according to the position of the larvae in its habitat, size of the prey, hunger etc, They detect their prey by means of their compound eyes, and mechanoreceptors. They catch their prey by the labium or by its palpi.

(c) *Predator* : Himalayan salamandar *Tylototriton verucossus* feed on larvae.

Resume of ecological records in different eco-systems of India : In India not much work has been done on the ecology of dragonflies and their adaptations in different ecosystems of the country. Following is the summary of informations available from different sources.

Calcutta (city) : Mitra (1990) has summerised ecology of adult odonata of the city on the eve of the completion of hundred years of Odonatology of Calcutta in the following ways. This can be considered as the type for the ecology of Odonata in the Ganga plain.

Habitat selection : The adults select their habitat suitable for their larvae as well as suffiecient roosting facilities which provide small insect preys to the adult near the breeding areas.

Thermo-regulation : In hot summer *Brachythemis contaminata* and *Diplacodes trivialis* remain in obelisk position in the midday. *Pantala flavescens* and *Tholymis tillarga* hang vertically under the leaves. *Bradinopyga geminata* rests in the shaded areas. Dragonflies in general reduce their activities during hot midday; and on the onset of cool season.

Activity in different seasons : In summer (March-May) *Urothemis signata*, *Diplacodes trivialis*, *Orthetrum sabina*, *Brachythemis contaminata*, *Crocothemis servilia*, *Trithemis pallidinervis*, *Neurothemis tullia tullia*, *Ceriagrion coromandelianum*, *Ischnura senegalemsis*, *Agriocnemis pygmaea* become active just after sun rise. In rainy season (June-November) the population of dragonflies become less visible due to rain. But in clear days they remain active and during the rain they hide themselves under leaves or any other shelter. In cool season (December-February) the dragonflies become active when the ambient temperature is high enough to clear the fog.

Food and cannibalism : Houseflies, mosquitos, ants, aphids, butterflies and beetles are the preys of dragonflies, *Ceriagrion coromandelianum*, *Ischnura senegalensis*, *Orthetrum sabina* feed on *Agriocnemis pygmaea*. *Orthetrum sabina* capture *Ceriagrion coromandelianum*, *Ischnura senegalensis*, *Pseudagrion microcephalum*; *Crocothemis servilia* catches *Pseudagrion rubriceps*. It is interesting to note that although dragonflies eat dragonflies but no record is available on the attack of the member of the same species for the purpose of eating

Predators : House sparrow (*Passer domesticus*), Mynah (*Acridotheres tristis*), House crow (*Corvus splendens*), House gecko (*Hemidactylus brookii*), spiders (*Plexippus paykuli* and *Crossopriza lyoni*) have been recorded as predators.

Effect of urbanisation : Several species enter houses, *Lestes platystylus*, *Pseudagrion australasiae*, *Macrogomphus montanus* and *Epophthalmia vittata* are not visible for more than fifty years in Calcutta. *Macrodiplax cora* is not visible for more than three decades.

Western Himalaya : Ecology of Odonata of western Himalaya has been recorded by Kumar and Prasad in several papers. They have been summarised as follows.

Classification according to brood per year : *Drepanosticta carmaichaeli*, *Bayadera indica*, *Anisopleura lestoides*, *A. comes* and *Macromia moorei* are univoltine, *Neurobasis chinensis* is bivoltine species *Pseudagrion rubriceps*, *Ceriagrion coromandelianum*, *Ischnura aurora*, *Agriocnemis pygmaea*, *Crocothemis servilia*, *Diplacodes trivialis* and *Orthetrum sabina* are multivoltine since more than two larval generations are visible (Kumar 1985).

Period for Life Cycle : *Orthetrum pruinosum neglectum* completes its life cycle in 155 days, *Trithemis festiva* in 109 days, *Ceriagrion coromandelianum* in 49 days to 61 days, *Anax immaculifrons* in 132 days, and *pantala flavescens* in 56 to 61 days.

Larval Habitat : Larvae of *Calicnemia miles* live in semiterrestrial condition on damp soil with thick carpet like growth of mosses and fungus which grow near waterfall on vertical hill rocks. Larvae of *Anisopleura lestoides* occur in small hill streams, which have currents, and remain concealed in crevices among small stones and pebbles in shallow water (Kumar & Prasad 1977c). Larvae of *Rhinocypha quadrimaculata* and *R. trifasciata* remain under submerged stones and pebbles in the rapid flowing hill streams with no vegetation; on the other hand larvae of *R. biforata beelsoni* remain hidden within drifted debris in the shaded forest streams (Kumar & Prasad 1977d).

Breeding : Kumar and Prasad (1977a) described breeding of *Neurobasis chinensis chinensis*, they discussed the concentration of the species during the period from March to June and from October to November.

Eastern Himalaya (Eastern Himalaya & Assam region) : The present author (Mitra 1994) reported the following events.

Breeding : *Orthetrum sabina* has been observed to breed in December at Raimona forest of Goalpara district (Western Assam).

Orthetrum pruinosum neglectum and *Pantala flavescens* have been found to show breeding activities during October-November in Mizoram.

Emergence : Emergence of *Brachythemis contaminata* was found at 10.30 hrs. at Kachugaon forest of the district Goalpara of western Assam. *Pantala flavescens* emerged at 14.30 hrs in April, 1981 at Samsingh, in the district of Darjiling, while *Neurothemis intermedia* has emerged in September, 1988 at 9.30 hrs at Tumin, Sikkim. Asahina (1958) and Svihla (1962) have reported that they have collected larvae of *Epiophlebia laidlawi* in March, April and October from different parts of Darjiling. Svihla (*op. cit*) has opined that probably June-July may be better season for collecting adults of the species.



Fig. 1. *Orthetrum pruinatum neglectum*(Rambur) basking in the sun in the midst of snow at Leh (c. 2600m.), Himachal Pradesh; at 10 A. M. in March, 1987. (Courtesy : Sri S. Chattopadhyaya, Scientist, SE.)



Fig. 2. Breeding ground of *Bradinopyga geminata* (Rambur), *Brachythemis contaminata* (Fabricius), *Tholymis tillarga* (Fabricius), *Onychargia atrocyana* Selys, *Agriocnemis pygmaea pygmaea* (Rambur), and several others, at Hazaribag National Park, Bihar.

Migration : A migratory swarm of *Pantala flavescens* has been observed on 22.9.1988 at Tumin, Sikkim.

Mass roosting : *Aciagrion pallidum* and *Ceriagrion olivaceum* have been observed to roost en masse on the tall grasses on the bank of the river Sankosh at Jamduar of the district, Goalpara, Assam, during December, 1973.

Predator : Dasgupta (1996) recorded Himalayan Salamander (*Tylotriton verrucosus*) as predator of dragonfly larvae in Darjiling Himalaya.

Feeding : Dasgupta (1988) reported larvae of *Rhinocypha cuneata* *R. bifasciata*, *Ictionogomphus rapax* as potential predators of larval *Tylotriton verrucosus* in Darjiling.

Central India : Breeding Season : Mitra (1988) has reported breeding activities of *Copera marginipes*, *Orthetrum c. cancellatum* and *Orthetrum pruinosum neglectum* in November in Madhya Pradesh.

Larval habitat : Saini and Singh (1984) reported the habitat of larvae of *Copera marginipes*, *Pseudagrion decorum*, *Ceriagrion coromandelianum*, *Ischnura aurora*, *I. senegalensis* and *Libellago lineata*.

Chhotanagpur plateau : The author has recorded following events (Mitra 1994).

Breeding activities : *Brachythemis contaminata* and *Tholymis tillarga* have been observed to show breeding activities in June at Hazaribagh (Bihar); while the breeding activities of *Crocothemis servilia* and *Orthetrum sabina* have been recorded in November at Purulia (West Bengal).

Emergence : Emergence of *Copera marginipes* and *Bradinopyga geminata* have been recorded at Hazaribagh lake at 14.15 hrs of November 1, 1974, and 18.05 hrs of October 29, 1974 respectively.

Arid zones (Rajasthan and Gujarat) :

Breeding activities : Tyagi & Miller (1991) have recorded breeding activities of *Disparoneura quadrimaculata* and *Ictionogomphus rapax* on August 31 and September 1, of 1991 respectively.

Follow of mobile objects : Tyagi & Miller (1991) have observed that *Trithemis aurora* follow mobile human beings.

Thermo-regulation : The present author has observed perching of *Bradinopyga geminata* on the shaded walls during March-April of 1980 at Jodhpur, Rajasthan. *Crocothemis servilia* fly within the bush of *Acacia* in the midday of April of 1980 at Little Rann of Cutch (Gujarat).

Predators : Sharma & Varshney (1985) have reported amphibians *Rana cyanophlyctis*, *R. tigrina*, *R. limnocharis* and the lizard *Calotes versicolor* prey on dragonflies.

Southern India (Eastern Ghats and Western Ghats) : Fraser (1924, 1931) has reported some ecological notes on dragonflies of the western Ghats; Mathavan (1975) have reported ecophysiological studies of some odonates. After this Mathavan *et. al.* (1989), A. Kumar (1990) and Miller (1990) have contributed to the study of ecology of dragonflies of the region.

Breeding activities : Mathavan *et. al.* (1989) have reported breeding activities of the following species in January, 1989 at Periyar National Park (Kerala), *Rhinocypha bisignata*, *Ischnura aurora*, *Brachythemis contaminata*, *Neurothemis tullia tullia*, *Orthetrum sabina*, *O. pruinsum neglectum*, *Pantala flavescens*, *Tholymis tillarga*, *Tramea basilaris burmeisteri* and *Trithemis aurora*. Kumar (1990) have recorded in Vedanthangal Water Bird Sanctuary in Tamil Nadu, oviposition of *Copera marginipes* in November, *Pseudagrion rubriceps* during November to January *Ceriagrion coromandelianum* *Ischnura aurora* and *Agriocnemis pygmaea* during November to April *Ictinogomphus rapax*, during October-November, *Anax, guttatus* in November, *Anax immaculifrons* during March to April, *Potamarcha congener* during November to December, *Orthetrum sabina* almost round the year. So is the case with *Orthetrum pruinsum neglectum*.

Emergence : Emergence have been recorded in *Copera marginipes* during November to February, *Pseudagrion rubriceps* during January to February, *Agriocnemis pygmaea* during January to April. *Ictinogomphus rapax* during October to November; while in *Ceriagrion coromandelianum* and *Ischnura aurora* emergence occurs almost throughout the year; *Anax guttatus* emerges in January. *A. immaculifrons* during October-November; *Potamarcha congener* emerges from April to May; *Orthetrum sabina* round the year and *Orthetrum pruinsum neglectum* from January to February in Tamil Nadu.

SUMMARY

The paper reviews biology of dragonflies in general on the basis of current informations available on the subject. In addition to the above it contains summaries of ecological records of different ecological areas Viz. Gangetic Plain, Eastern and Western Himalaya, Chhota Nagpur Plateau, Arid zones, Eastern and Western ghats including valleys of southern India.

ACKNOWLEDGEMENTS

The author is thankful to Dr. J. R. B Alfred, Director, Zoological Survey of India, Calcutta, Drs. R. K. Varshney, Addl. Director, S.K. Mitra, J.K. Jonathan both Jt. Director S. M. Prasad, Scientist-B, and Sri Kumar Chatterjee, Scientist SE (for the photograph) of the same department for facilities and encouragements. The author expresses his gratefulness to prof. B. Kiauta S.I.O. Editorial office, Holland for various helps. Finally the author appologizes for any mistake which has inadvertently escaped his notice and for which he himself is responsible.

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**NOTES ON A COLLECTION OF FISHES FROM LOHIT, TIRAP AND
CHANGLANG DISTRICTS OF ARUNACHAL PRADESH : : INDIA**

NIBEDITA SEN

Eastern Regional Station

Zoological Survey of India, Risa Colony, Shillong-793 003

INTRODUCTION

According to existing literature (Srivastava, 1966; Choudhury and Sen, 1977; Datta and Barman, 1985; Menon, 1987, 1992 and Talwar and Jhingran, 1991) altogether 54 species were so far recorded from the areas under report.

The present study is based upon 138 specimens collected by a survey party under the leadership of Shri S. J. S. Hattar, Scientist-SD, Eastern Regional Station, Zoological Survey of India, Shillong, during the year 1996. The specimens belong to 48 species of which 30 species are recorded for the first time from the area. The occurrence of *Silurus torrentis* Kobayakawa from Arunachal Pradesh, Lohit district, Tezu is of interest, since it was originally described from Thailand and Myanmar (Kobayakawa, 1989). The present record extends its distribution further westwards.

SYSTEMATIC ACCOUNT

The systematic account of 48 species under 13 families and 4 orders is recorded below. The general classification followed is after Nelson (1984) and Talwar and Jhingran (1991) except for Cobitid fishes which are after Menon (1987, 1992). New records are denoted by the symnol (*).

Phylum : CHORDATA

Grade : PISCES

Class : OSTEICHICHTHYES

Sub-Division : TELEOSTEI

Order : OSTEOGLOSSIFORMES

Family : NOTOPTERIDAE

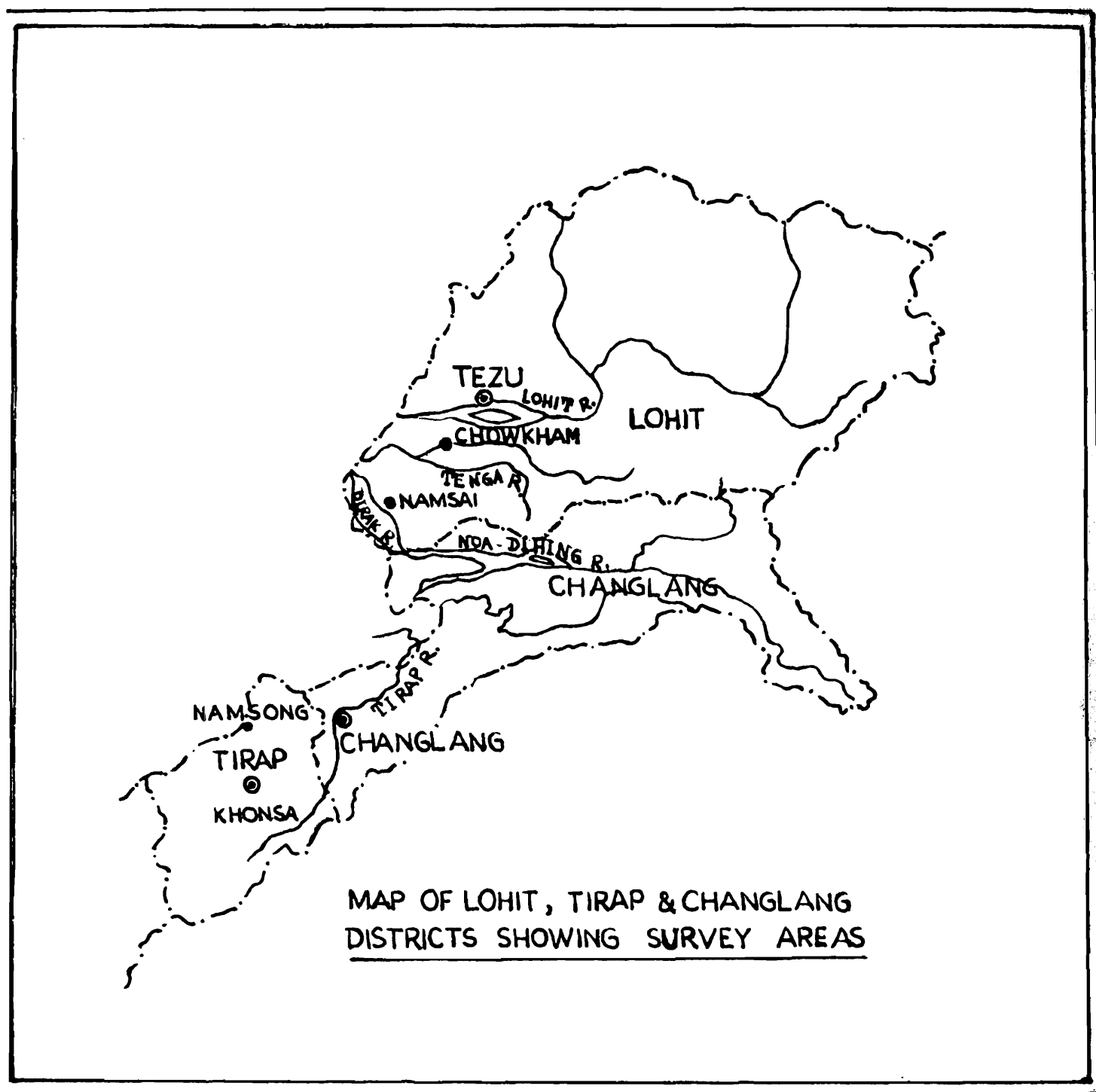


Fig. 1. Map of Lohit, Tirap & Changlang Districts showing survey areas

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

Gymnotus notopterus Pallas, 1769, *Special. Zool.*, 7 : 40, pl. 6, fig. 2 (type locality : ? Indian Ocean)

Material examined : 1 ex. (161 mm TL; Regd. No. V/F/ERS/322); Lohit district, Namsai, Dihing river; 7.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya.

Elsewhere : India; Bangladesh; Indonesia; Malaya; Myanmar; Nepal; Pakistan; Thailand.

Order : CYPRINIFORMES

Family : CYPRINIDAE

(*) 2. *Cirrhinus reba* (Hamilton-Buchanan)

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

Material examined : 1 ex. (129 mm TL; Regd. No. V/F/ERS/366); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan; Thailand.

3. *Labeo dero* (Hamilton-Buchanan)

Cyprinus dero Hamilton-Buchanan, 1822, *Fishes of Ganges* : 277, 385, pl. 22, fig. 78 (type locality : Brahmaputra river)

Material examined : 1 ex. (100 mm TL; Regd. No. V/F/ERS/361); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Arunachal Pradesh; Assam; Meghalaya.

Elsewhere : India : All along the Himalayas including Kashmir; Bangladesh; China; Myanmar; Nepal; Pakistan; Srilanka.

(*) 4. *Labeo gonius* (Hamilton-Buchanan)

Cyprinus gonius Hamilton-Buchanan, 1822, *Fishes of Ganges* : 292, 387, pl. 4, fig. 82 (type locality : freshwater rivers and ponds of Bengal)

Material examined : 1 ex. (190 mm TL; Regd. No. V/F/ERS/323); Lohit district, Namsai, Dihing river; 7.1.96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan.

(*) 5. ***Osteobrama cotio cotio*** (Hamilton-Buchanan)

Cyprinus cotio Hamilton-Buchanan, 1822, *Fishes of Ganges* : 339, 393, pl.. 39, fig. 93 (type locality : ponds and ditches of Bengal)

Material examined : 1 ex. (73 mm TL; Regd. No. V/F/ERS/365) Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya.

Elsewhere : India; Bihar, Central province, Punjab, Uttar Pradesh, West Bengal; Bangladesh; China; Myanmar; Nepal; Pakistan.

(*) 6. ***Puntius chola*** (Hamilton-Buchanan)

Cyprinus chola Hamilton-Buchanan, 1822, *Fishes of Ganges* : 312, 389 (type locality : north eastern parts of Bengal)

Material examined : 2 exs. (59 mm-61 mm TL; Regd. No. V/F/ERS/378); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya. Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan. Srilanka.

7. ***Puntius conchoni*** (Hamilton-Buchanan)

Cyprinus conchoni Hamilton-Buchanan, 1822, *Fishes of Ganges* : 317, 389 (type locality : ponds of north-east Bengal; Kosi river and Ami river)

Material examined : 2 exs. (56 mm-58 mm TL; Regd. No. V/F/ERS/343); Lohit district, Tenga river; 10.1.96. 1 ex. (65mm TL; Regd. No. V/F/ERS/364); Changlang district, Daing river; 14.1.96. 1 ex. (52 mm TL; Regd. No. V/F/ERS/325); Tirap district, Deomali; 15.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Tripura.

Elsewhere : India; Ganges, Brahmaputra, Mahanadi and Cauvery river system; Afghanistan; Bangladesh; Nepal; Pakistan.

(*) 8. ***Puntius shalynius*** Yazdani and Talukdar

Puntius shalynius Yazdani and Talukdar, 1975, *J. Bombay nat. Hist. Soc.* 72 (1) : 218 (type locality : Barapani lake near Shillong, Meghalaya)

Material examined : 2 exs. (29 mm-44 mm TL; Regd. No. V/F/ERS/385); Changlang District, Daing river; 14.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya.

Elsewhere : India : As above.

(*) 9. ***Puntius sophore*** (Hamilton-Buchanan)

Cyprinus Sophore Hamilton-Buchanan, 1822, *Fishes of Ganges* : 310, 389, pl. 19, fig. 86 (type locality : ponds and rivers in the Gangetic Province)

Material examined : 1 ex. (65 mm TL; Regd. No. V/F/ ERS/336); Lohit district, Dihing river; 9.1.96; 1 ex. (74 mmm TL; Regd. No. V/F/ERS/341); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya, Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan; Yunnan.

10. ***Puntius ticto*** (Hamilton-Buchanan)

Cyprinus ticto Hamilton-Buchanan, 1822, *Fishes of Ganges* : 314, 398, pl. 8, fig. 87 (type locality : south-eastern parts of Bengal)

Material examined : 3 exs. (48 mm-56 mm TL; Regd. No. V/ F/ ERS/ 342); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan; Srilanka; Thailand.

11. ***Tor putitora*** (Hamilton-Buchanan)

Cyprinus putitora Hamilton-Buchanan, 1822, *Fishes of Ganges* : 303, 388 (type locality : eastern parts of Bengal)

Material examined : 1 ex. (129 mm TL; Regd. No. V/F/ERS/347); Lohit district, 15 kms. from Tezu; 11.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Meghalaya.

Elsewhere : India : All along the Himalayas including Kashmir; Afghanistan; Bangladesh; Nepal; Pakistan.

(*) 12. *Chela cachi* (Hamilton-Buchanan)

Cyprinus (Chela) cachi Hamilton-Buchanan, 1822, *Fishes of Ganges* : 259, 384 (type locality : Ganges river about commencement of delta)

Material examined : 2 exs. (65 mm-66mm TL; Regd. No. V/ F/ ERS/ 339); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan.

(*) 13. *Salmostoma bacaila* (Hamilton-Buchanan)

Cyprinus bacaila Hamilton-Buchanan, 1822, *Fishes of Ganges* : 265, 384, pl. 8, fig. 76 (type locality : freshwater rivers of Gangetic provinces)

Material examined : 1 ex. (100 mm TL; Regd. No. V/ F/ ERS/367); Changlang district, Daing river; 14.1.96

Distribution within N. E. India : Assam, Manipur, Meghalaya, Tripura.

Elsewhere : Throughout India except Kerala, Karnataka and Tamilnadu; Bangladesh; Myanmar; Nepal; Pakistan.

(*) 14. *Salmostoma phulo* (Hamilton-Buchanan)

Cyprinus phulo Hamilton-Buchanan, 1822, *Fishes of Ganges* : 262, 384 (type locality : north eastern parts of Bengal)

Material examined : 1 ex. (80 mm TL; Regd. No. V/ F/ ERS/345); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India : Ganga and Brahmaputra river system; Bangladesh.

(*) 15. *Aspidoparia morar* (Hamilton-Buchanan)

Cyprinus morar Hamilton-Buchanan, 1822, *Fishes of Ganges* : 264, 384, pl. 31, fig. 75 (type locality : Yamuna river and Tista river)

Material examined : 1 ex. (109 mm TL; Regd. No. V/ F/ ERS/360); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Assam, Tripura.

Elsewhere : Northern India; Bangladesh; Myanmar; Nepal; Pakistan; Thailand.

16. *Barilius bendelisis* (Hamilton-Buchanan)

Cyprinus bendelisis Hamilton-Buchanan, 1807, *Journey in Mysore* : 3 345, pl. 32 (type locality : vedawati stream, headwaters of Krishna river near Heriuru, Mysore)

Barilius howesi Barman, 1986, *J. Bompay nat. Hist. Soc.*, 83 (1) : 171, fig. 1 (type locality: Salkapara, Jalpaiguri district, West Bengal)

Material examined : 1 ex. (28 mm TL; Regd. No. V/ F/ ERS/ 326); Tirap district, Deomali; 15.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram.

Elsewhere : India; Bangladesh; Nepal; Pakistan; Srilanka.

17. *Brachydanio rerio* (Hamilton-Buchanan)

Cyprinus rerio Hamilton-Buchanan, 1822, *Fishes of Ganges* : 323, 390, (type locality Kosi river, Uttar Pradesh)

Material examined : 2 exs. (23 mm-25 mm TL; Regd. No. V/F/ERS/327); Tirap district, Deomali; 15.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan.

18. *Danio devario* (Hamilton-Buchanan)

Cyprinus devario Hamilton-Buchanan, 1822, *Fishes of Ganges* : 341, 393, pl. 6, fig. 94 (type locality : rivers and ponds of Bengal)

Material examined : 1 ex. (78 mm TL; Regd. No. V/F/ERS/362); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Meghalaya, Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal; Pakistan.

19. *Rasbora rasbora* (Hamilton-Buchanan)

Cyprinus rasbora Hamilton-Buchanan, 1822, *Fishes of Ganges* : 329, 391, pl. 2, fig. 90 (type locality : ponds of Bengal)

Material examined : 1 ex. (78 mm TL; Regd. No. V/F/ ERS/344); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Meghalaya, Tripura.

Elsewhere : India : Gangetic provinces and Coromandal Coast, freshwaters of all the Indian States; Bangladesh; Myanmar; Pakistan; Thailand.

20. *Schizothoraichthys progastus* (Mc Clelland)

Oreinus progastus McClelland, 1839, *Asiat. Res.*, 19 : 274, 343, pl. 40, fig. 4 (type locality: Upper Assam)

Material examined : 1 ex. (145 mm TL; Regd. No. V/F/ERS/352); Lohit district, 15 kms from Tezu; 11.1.96.

Distribution within N. E. India : Upper Assam, Arunachal Pradesh.

Elsewhere : India : From the head waters of the Ganges to Arunachal Pradesh; Bhutan; Nepal; Southern Tibet.

21. *Schizothorax richardsonii* (Gray)

Cyprinus richardsonii Gray, 1832, *Illustrations of Indian Zoology*, (10) : pl. 14, fig. 2 (type locality : not known)

Material examined : 1 ex. (117 mm TL; Regd. No. V/F/ERS/351); Lohit district, 15 kms from Tezu, 11.1.96.

Distribution within N. E. India : Arunachal Pradesh

Elsewhere : India : All along the Himalaya from Jammu and Kashmir to Arunachal Pradesh; Afghanistan; Bhutan; Nepal; Pakistan.

22. *Crossocheilus latius latius* (Hamilton-Buchanan)

Cyprinus latius Hamilton-Buchanan, 1822, *Fishes of Ganges* : 345, 393 (type locality : Tista river at base of Darjeeling Himalaya)

Material examined : 5 exs (125 mm-137 mm TL; Regd. No. V/F/ERS/348); Lohit district, 15 kms from Tezu; 11.1.96. 1 ex. (88 mm TL; Regd. No. V/F/ERS/363); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya.

Elsewhere : India : drainages of Ganga, Brahmaputra, Mahanadi and Western Ghats; Bangladesh; Myanmar; Nepal; Pakistan.

(*) 23. *Garra lamta* (Hamilton-Buchanan)

Cyprinus (Garra) lamta Hamilton-Buchanan (partim), 1822, *Fishes of Ganges* : 343, 393 (type locality : Rapti river, Gorakhpur, U. P)

Material examined : 6 exs. (93 mm-101 mm TL; Regd. No. V/F/ERS/349); Lohit district, 15 kms from Tezu, 11.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya, Mizoram.

Elsewhere : India : Eastern Himalayas, Kumaon Himalayas; Abyssinia; Aden; Nepal; Pakistan; Srilanka; Syria; Tenasserim province.

24. *Garra mcClellandi* (Jerdon)

Gonorhynchus mcClellandi Jerdon, 1849, *Madras J. Lit. Sci.*, 15 : 309 (type locality : Bowany river and Manantoddy river at base of Nilgiris)

Material examined : 1 ex. (118 mm TL; Regd. No. V/F/ERS/350); Lohit district, 15 kms from Tezu, 11.1.96.

Distribution within N. E. India : Arunachal Pradesh, Meghalaya.

Elsewhere : India : Cauvery river system.

Family : PSILORHYNCHIDAE

25. *Psilorhynchus balitora* (Hamilton-Buchanan)

Cyprinus balitora Hamilton-Buchanan, 1822, *Fishes of Ganges* : 348, 394 (type locality : rivers of N. E. Bengal)

Material examined : 1 ex. (42 mm TL; Regd No. V/F/ERS/373); Lohit district, Chowkham; 12.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram.

Elsewhere : India : Northern India, West Bengal; Bangladesh; Myanmar; Nepal.

Family : HOMALOPTERIDAE

26. *Noemacheilus botia* (Hamilton-Buchanan)

Cobitis botia Hamilton-Buchanan, 1822, *Fishes of Ganges* : 350, 394 (type locality : rivers of north-east Bengal)

Material examined : 2 ex. (25 mm-28 mm TL; Regd. No. V/F/ERS/380); Lohit district, Tenga river; 9.1.96; 1 ex. (56 mm TL; Regd. No. V/F/ERS/376); Lohit district, Tenga river; 10.1.96; 1 ex. (83 mm TL; Regd No. V/F/ERS/368); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Meghalaya, Nagaland, Tripura.

Elsewhere : Throught India except Malabar coast and south of river Krishna; Bangladesh; Myanmar; Nepal; Pakistan; Srilanka.

27. *Noemacheilus cincticauda* (Blyth)

Cobitis cincticauda Blyth, 1861, *J. Asiat. Soc. Bengal*, 29 : 172 (type locality : Pegu, Burma)

Noemacheilus arunachalensis (nec Menon) Datta and Barman, 1984, *Bull. Zool. Surv. India*, 6 : 275, pl. 4 (type locality : Namdapha river, Tirap district, Arunachal Pradesh)

Material examined : 2 exs. (42 mm-46 mm TL; Regd. No. V/F/ERS/ 379); Tirap district, Namsongtham; 17.1.96.

Distribution within N. E. India : Arunachal Pradesh.

Elsewhere : Myanmar.

***28. *Noemacheilus nagaensis* (Menon)**

Noemacheilus nagaensis Menon, 1987, *Fauna of India, Pisces*, 4 : 117 (type locality : Naga hills, Nagaland)

Material examined : 1 ex. (36 mm TL; Regd. No. V/F/ERS/ 328); Tirap district, Deomali; 15.1.96.

Distribution within N. E. India : Nagaland.

Elsewhere : As above.

(*) 29. *Noemacheilus savona* (Hamilton-Buchanan)

Cobitis savona Hamilton-Buchanan, 1822, *Fishes of Ganges* : 357, 394 (type locality : Kosi river at Nathpur, Uttar Pradesh)

Material examined : 1 ex. (37 mm TL; Regd. No. V/F/ERS/372); Lohit district, Chowkham, 12. 1. 96.

Distribution within N. E. India : Assam, Meghalaya, Tripura.

Elsewhere : India : widely distributed in Eastern subhimalayan region, Uttar Pradesh; Bangladesh; Nepal.

Family : COBITIDAE**(*) 30. *Lepidocephalus annandalei* (Choudhuri)**

Lepidocephalichthys annandalei Chaudhuri, 1912, *Rec. Indian Mus.*, 7 : 442, pl. 40, figs. 3, 3a, 3b (type locality : Tista river near Jalpaiguri and Mahananda river at Siliguri)

Material examined : 2 exs. (31 mm-33 mm TL; Regd. No. V/F/ERS/383); Lohit district, Lathaw; 9.1.96.

Distribution within N. E. India : Assam, Meghalaya, Tripura.

Elsewhere : India : North Bengal.

(*) 31. *Lepidocephalus berdmorei* (Blyth)

Acanthopsis berdmorei Blyth, 1861, *J. Asiat. Soc. Bengal*, 29 : 168 (type locality : Tenasserim province, Burma)

Material examined : 1 ex. (38 mm TL; Regd. No. V/F/ERS/384); Changlang district, Daing river; 14.1.96.

Distribution within N. E. India : Manipur, Meghalaya.

Elsewhere : Myanmar.

* 32. *Lepidocephalus menoni* (Pillai and Yazdani)

Lepidocephalichthys menoni Pillai and Yazdani, 1976, *J. zool. Soc. India*, 26 (1-2) : 13, text fig. 1 (type locality : Someswari river at Baghmara, Garo hills, Meghalaya)

Lepidocephalichthys goalparensis Pillai and Yazadani, 1976, *J. zool. Soc. India*, 26 (1-2) : 15, text fig. 2 (type locality : Dudhnoi, Goalpara, Assam)

Lepidocephalichthys caudofurcatus Tilak and Hussain, *Matsya*, 3 : 60-63, figs. 1-3 (type locality : Kalapani nala, Rishikesh Dist. Dehradun; Sailani river, Beharigarh, Dist. Saharanpur and Gaugan river near Moradabad, Dist. Moradabad, U.P.)

Material examined : 5 exs. (42 mm-50 mm TL; Regd. No. V/F/ERS/356); Lohit district, Dihing river; 8. 1. 96; 3 exs. (32 mm-35 mm TL; Regd. No. V/F/ERS/382); Lohit district, Tenga river; 9. 1. 96; 3 exs. (41 mm-45 mm TL; Regd. No. V/F/ERS/329); Tirap district, Deomali; 15. 1. 96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India : Along base of Eastern Himalayas, westwards in the Gangetic riversystem as far as Dehradun and Saharanpur, Uttar Pradesh.

33. *Lepidocephalus guntea* (Hamilton-Buchanan)

Cobitis guntea Hamilton-Buchanan, 1822, *Fishes of Ganges* : 353, 394 (type locality : Bengal)

Material examined : 8 exs. (65 mm-74 mm TL; Regd. No. V/F/ERS/355); Lohit district, Dihing river; 8. 1. 96; 2 exs. (60 mm-61 mm TL; Regd. No. V/F/ERS/335); Lohit district, Dihing river; 9. 1. 96; 1 ex. (58 mm TL; Regd. No. V/F/ERS/381); Lohit district, Tenga river; 9. 1. 96; 1 ex. (62 mm TL; Regd. No. V/F/ERS/377); Lohit district, Tenga river; 10. 1. 96; 15 exs. (47 mm- 75 mm TL; Regd. No. V/F/ERS/330, 334); Tirap district, Deomali; 15. 1. 96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Tripura.

Elsewhere : Throughout India except Karnataka, Kerala, and south of Krishna; Bangladesh; Nepal; Pakistan; Thailand.

Order : SILURIFORMES

Family : BAGRIDAE

(*) 34. *Mystus bleekeri* (Day)

Bagrus keletius (nec. Valenciennes) Bleeker, 1846, *nat. Geneesk. Arch. Ned. India*, (2) 3 : 135 (type locality : Bengal)

Material examined : 1 ex. (76 mm TL; Regd. No. V/F/ERS/374); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Manipur, Meghalaya, Tripura.

Elsewhere : India : Baroda, Darjeeling, Mahanadi headwaters, Northern India, West Bengal; Bangladesh; Malaya; Myanmar; Nepal; Pakistan; Sumatra.

(*) 35. *Mystus cavasius* (Hamilton-Buchanan)

Pimelodus cavasius Hamilton-Buchanan, 1822, *Fishes of Ganges* : 203, 379, pl. 11, fig. 67 (type locality : Gangetic province)

Material examined : 1 ex. (151 mm TL; Regd. No. V/F/ERS/324); Lohit district, Dihing river; 7. 1. 96; 1 ex. (108 mm TL; Regd. No. V/F/ERS/346); Lohit district, Tenga river; 10.1.96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India; Bangladesh; Borneo; China; Java; Malaya; Myanmar; Nepal; Pakistan; Sumatra; Srilanka; Thailand.

(*) 36. *Mystus vittatus* (Bloch)

Silurus vittatus Bloch, 1797, *Ichthyol. Hist Nat.*, 11 :40, pl. 371, fig 2 (type locality : Tranquebar, Tamilnadu)

Material examined : 1 ex. (67 mm TL; Regd. No. V/F/ERS/375); Lohit district, Tenga river; 10.1. 96.

Distribution within N. E. India : Assam, Meghalaya, Tripura.

Elsewhere : India : Bangladesh; Malaya; Myanmar; Nepal; Pakistan; Srilanka; Thailand.

Family : SILURIDAE

(*) 37. *Silurus torrentis* Kobayakawa

Silurus torrentis Kobayakawa, 1989, Jap. J. Ichthyol. 36 (2) : 171, fig. 33 (type locality : Thailand and eastern Burma)

Material examined : 1 ex. (126 mm-74 mm TL; Regd. No. V/F/ERS/354); Lohit district, 15 kms from Tezu; 11. 1. 96.

Distribution within N. E. India : Recorded for the first time from India.

Elsewhere Eastern Myanmar; Thailand.

Family : SISORIDAE

(*) 38. *Gagata cenia* (Hamilton-Buchanan)

Pimelodus cenia Hamilton-Buchanan, 1822, *Fishes of Ganges* : 174, 376, pl. 31, fig. 57 (type locality : rivers of Northern Bengal)

Material examined : 2 exs. (84-90 mm TL; Regd. No. V/F/ERS/369); Changlang district, Daing river; 14. 1. 96.

Distribution within N. E. India : Assam, Manipur, Meghalaya.

Elsewhere : India : Gangetic system, Chenab in West Punjab, Orissa; Bangladesh; Myanmar; Nepal; Pakistan.

(*) 39. *Glyptothorax platypogonoides* (Bleeker)

Pimelodus platypogonoides Bleeker, 1855, *Nat. Tijdschr Ned. India*, 9 : 272 (type locality Lahat, Sumatra)

Material examined : 3 exs. (97 mm-157 mm TL; Regd. No. V/F/ERS/353); Lohit district, 15 kms from Tezu; 11. 1. 96.

Distribution within N. E. India : Manipur, Mizoram.

Elsewhere : India : As above; Myanmar; Sumatra; Thailand; West Borneo.

(*) 40. *Glyptothorax striatus* (McClelland)

Glyptosternon striatus McClelland, 1842, *Calcutta J. Nat. Hist.*, 2 : 587, pl. 6, fig. 1 (type locality : Kashya hills)

Material examined : 1 ex. (72 mm TL; Regd. No. V/F/ERS/386); Changlang district, Daing river; 14. 1. 96.

Distribution within N. E. India : Meghalaya.

Elsewhere : India : Eastern Himalayas; Sikkim.

(*) 41. *Laguvia ribeiroi* Hora

Laguvia ribeiroi Hora, 1921, *Rec. Indian Mus.*, 22 (5) : 741, pl. 29, fig. 3 (type locality : Khoila river, a tributary of Tista river at Jalpaiguri, N. Bengal)

Material examined : 1 ex. (30 mm TL; Regd. No. V/F/ERS/370); Lohit district, Chowkham; 12. 1. 96.

Distribution within N. E. India : Assam.

Elsewhere : India : Tista river system, the Vindhyas; Nepal.

Family : OLYRIDAE

(*) 42. *Olyra longicaudata* McClelland

Olyra longicaudata McClelland, 1842, *Calcutta J. Nat. Hist.*, 2 : 588, pl. 21, fig. 1 (type locality : Khasi hills, Assam) (Presently Meghalaya)

Material examined : 1 ex. (86 mm TL; Regd. No. V/F/ERS/337); Lohit district, Dihing river, 9.1.96.

Distribution within N.E. India : Assam, Meghalaya

Elsewhere : India : Eastern Himalayas; Mynamar.

Order : PERCIFORMES

Family : AMBASSIDAE

(*) 43. *Chanda nama* Hamilton-Buchanan

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

Material examined : 1 ex. (59 mm TL; Regd. No. V/F/ERS/387) : Tirap district, Namsongthang; 17.1.96. ~

Distribution within N. E. India : Assam, Manipur, Meghalaya, Tripura.

Elsewhere : India; Bangladesh; Myanmar; Nepal, Pakistan.

(*) 44. *Pseudambassis baculis* Hamilton-Buchanan

Chanda baculis Hamilton-Buchanan, 1822, *Fishes of Ganges* : 112, pl. 22, fig. 7 (type locality : N. E. Bengal)

Material examined : 4 exs. (38 mm-40mm TL; Regd. No. V/F/ERS/331); Tirap district, Deomali; 15.1.96.

Distribution Within N. E. India : Assam, Meghalaya.

Elsewhere : India : Himalaya and Indo-Gangetic plains, Bangladesh; Myanmar; Pakistan; Thailand.

Family : NANDIDAE

45. *Badis badis* (Hamilton-Buchanan)

Labrus badis Hamilton-Buchanan, 1822, *Fishes of Ganges* : 70, 368, pl. 25, fig. 23 (type locality : Gangetic Provinces)

Material examined : 3 exs. (36 mm-43 mm TL; Regd. No. V/F/ERS/359); Lohit district, Dihing river; 8. 1. 96; 1 ex. (40 mm TL; Regd. No. V/F/ERS/371); Lohit district, Chowkham; 12. 1. 96; 15 exs. (28 mm-42 mm TL; Regd. No. V/F/ERS/332); Tirap District, Deomali; 15. 1. 96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura.

Elsewhere : India : Bangladesh; Myanmar; Nepal; Pakistan.

Family : CHANNIDAE

46. *Channa orientalis* Bloch and Schneider

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

Material examined : 3 exs. (66 mm-95 mm TL; Regd. No. V/F/ERS/358); Lohit district, Dihing river; 8. 1. 96.

Distribution within N. E. India : Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Tripura.

Elsewhere : India : Afghanistan; Bangladesh; Myanmar; Nepal; Pakistan; Iran; East Indies; Srilanka.

(*) 47. *Channa punctatus* (Bloch)

Ophiocephalus punctatus Bloch, 1793, *Naturges. ausland. Fische*, 7 : 139, pl. 358 (type locality : Coromandal Coast)

Material examined : 2 exs. (61 mm-126 mm TL; Regd. No. V/F/ERS/333); Tirap district, Deomali; 15. 1. 96.

Distribution within N. E. India : Assam, Manipur, Meghalaya, Tripura.

Elsewhere : India; Afghanistan; Bangladesh; Myanmar; Nepal; Pakistan; Srilanka; Yunnan.

Family : CHAUDHURIIDAE

(*) 48. *Chaudhuria indica* (Yazdani)

Pillaia indica Yazdani, 1972, *J. Bombay nat. Hist. Soc.*, 69 (1) : 134 (type locality : near Shillong, Khasi hills, Meghalaya)

Material examined : 2 exs. (63 mm- 64 mm TL; Regd. No. V/F/ERS/357); Lohit district, Dihing river; 8. 1. 96.

Distribution within N. E. India : Assam, Meghalaya.

Elsewhere : India : As above.

SUMMARY

The present study deals with 48 species out of which 30 species reported for the first time from the region under report. *Silurus torrentis* Kobayakawa, so far known from Thailand and Myanmar is recorded for the first time from Indian region.

ACKNOWLEDGEMENT

The author is thankful to the Director, Zoological Survey of India, Calcutta, for providing necessary facilities and to Dr. G. K. Srivastava, Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong, for encouragement and necessary suggestions.

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ADDITIONAL NOTES ON FAUNA OF WEST BENGAL (AVES)

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INTRODUCTION

Majumdar *et al.*, (1992) in the State Fauna Series, 3 : Fauna of West Bengal (Aves) recorded 540 species and subspecies under 210 genera and 60 families. But subsequently it was found that nine species and subspecies, and three genera were omitted in their work.

It was felt necessary to incorporate these taxa to the Avifauna of West Bengal for a fuller record.

Taxonomic treatment has been followed after Ali & Ripley (1969-74, 78). Distribution mentioned are quoted from Ripley's Synopsis (1961).

LIST OF BIRDS REPORTED

1. **Botaurus stellaris stellaris* (Linnaeus)
2. **Cacomantis passerinus* (Vahl)
3. *Picoides darjellensis darjellensis* (Blyth)
4. *Hirundo daurica erythropygia* Sykes
5. **Pnoepyga albiventer albiventer* (Hodgson)
6. *Rhipidura albicollis albicollis* (Vieillot)
7. **Erithacus chrysaeus chrysaeus* (Hodgson)
8. **Phoenicurus caeruleocephalus* (Vigors)
9. *Nectarinia zeylonica sola* (Vieillot)
10. **Aethopyga gouldiae gouldiae* (Vigors)
11. *Aethopyga ignicauda ignicauda* (Hodgson)
12. **Callacanthus burtoni* (Gould)
13. **Carpodacus pulcherrimus pulcherrimus* (Moore)
14. **Pyrrhoptes epauletta* (Hodgson)

* Denotes addition to the list of birds of Majumdar *et al.*, (1992)

SYSTEMATIC ACCOUNT

Order : CICONIIFORMES

Family : ARDEIDAE

Genus *Botaurus* Stephens, 18191. *Botaurus stellaris stellaris* (Linnaeus)1758. *Ardea stellaris* Linnaeus, *Syst. Nat.*, ed. 10, 1 : 144 (Europe, restricted to Sweden).

1978. Ali and Ripley, Vol. 1, p. 89.

Common name : Bittern (English).*Material examined* : Medinipur district : 1 ♀, Contai, coll. J. M. Dasgupta, 31. iii. 1978.*Diagnostic characters* : Size that of the smaller Egret. Crown and nape black, extending to upper back; Crest bushy, drooping; a black line below eyes; upper back buffy brown, streaked barred and mottled with darkbrown and black; lower back, rump and tail yellowish buff profusely barred and mottled with black; chin and throat white with a prominent central buff and black line running from chin to breast; underparts yellowish buff streaked with brown and buff; sides of breast narrowly barred with brown and dark buff. Iris yellow; bill greenish yellow; legs and feet pale green. Sexes similar.*Measurements* : 1 ♀ : Wing 320; tail 115; bill 75.*Distribution* : "A migratory species found in winter in West Pakistan and India, straggling as far south and east as Bombay, Madras and Bengal." (Ripley, 1961).*Remarks* : Majumdar, *et al.*, (1992) did not list this nominate species.

Order : CUCULIFORMES

Family : CUCULIDAE

Genus *Cacomantis* S. Muller, 18432. *Cacomantis passerinus* (Vahl)1797. *Cuculus passerinus* Vahl, *Skriv. Naturhist-Selsk.*, Kjobenhavn, 4(1) : 57 (Tranquebar).

1969. Ali and Ripley, Vol. 3, p. 218.

Common name : Indian Plaintive Cuckoo (English).*Material examined* : Medinipur district : 1 ♂, Gope College compound, coll. D. K. Ghosal, 30.iii.1978.*Diagnostic characters* : Size that of the Myna but with a much longer tail. Upper plumage dark grey and brown; chin, throat and breast grey; rest of lower plumage whitish; tail blackish

with white tip and with the outer rectrices barred white; a white patch at base of primaries prominent in flight. Iris brown; bill horny brown, paler at lower mandible; legs and feet brownish yellow. Sexes similar, but hepatic variety in female not uncommon which is chestnut above crossbarred with black on back and with blackbarred white underparts, closely resembles the plumage of the Baybanded Cuckoo.

Measurements : 1 ♂ : Wing 120; tail 113; bill 23.

Distribution : Throughout the subcontinent. Absent in Andaman and Nicobar Islands.

Remarks : Majumdar, *et al.*, (1992) did not list this bird.

Order : PICIFORMES

Family : PICIDAE

Genus *Picoides* Lacepede, 1799

3. *Picoides darjellensis darjellensis* (Blyth)

1845. *Picus (Dendrocopus) darjellensis* Blyth, *J. Asiat. Soc. Beng.*, 14 (1) : 196 (Darjeeling = Darjiling, West Bengal, India, and Nepal).

1970. Ali and Ripley, Vol. 4, p. 218.

Common name : Darjeeling Pied Woodpecker (English).

Material examined : Darjeeling district : 1 ♂, 1 ♀, Selimbong, (alt. c. 2286 m), coll. R. K. Ghose, 2. xii. 1997.

Diagnostic characters : Size that of the Common Myna. Back entirely black; middle tail-feathers black, outer feathers barred with white. Hind crown crimson in male, black in female; breast and belly yellowish fulvous streaked with black; vent crimson. Iris crimson; bill plumbeous, blackish on upper mandible; legs and feet dull green.

<i>Measurements</i> :	1 ♂	1 ♀
Wing	130	126
Tail	80	76
Bill	23	22

Distribution : From West central Nepal eastward through Bhutan to northern Myanmar to northern Vietnam and Western China to Sikang and Yunnan from 1524 to 3048 m.

Remarks : Majumdar, *et al.*, (1992 : 297) listed this bird but did not examine the specimens.

Order : PASSERIFORMES

Family : HIRUNDINIDAE

Genus *Hirundo* Linnaeus, 1758

4. *Hirundo daurica erythropygia* Sykes

1832. *Hirundo erythropygia* Sykes, *Proc. Zool. Soc. London* : 83 (Dukhun = Poona = Pune, India).

1972. Ali and Ripley, Vol. 5, p. 70.

Common name : Indian striated Swallow (English).

Material examined : Darjiling district : 1 ♂, Selimbong (alt. c. 2286 m.) coll. R. K. Ghose, 23. iii. 1973.

Diagnostic characters : Size that of the House Sparrow minus the tail. Glossy steel blue-black above; fulvous white below, finely streaked with brown; a dark chestnut line over the eye; a chestnut collar round the nape; rump chestnut; tail dark brown and forked. Iris brown; bill brownish black; legs and feet black. Sexes similar.

Measurements : 1 ♂ : Wing 118; tail, central 44, outer 83, bill 9.

Distribution : "Indian plains from the Terai all over the peninsula to the Nilgiri Hills and the ranges of Kerala, and east to West Bengal up to 1524 m, in open country. In the rains may wander West to drier areas such as Rajasthan. In Winter stragglers have been taken in Ceylon." (Ripley, 1961).

Remarks : Majumdar, *et. al.*, (1992 : 307) remarked "We have observed this bird in Kochbehar and Malda district."

Family : MUSCICAPIDAE

Genus *Pnoepyga* Hodgson, 1844

5. *Pnoepyga albiventer albiventer* (Hodgson)

1837. *Tesia albiventer* Hodgson, *J. Asiat. Soc. Beng.*, 6 : 102 (Nepal, restricted by Ripley (synopsis : 357) to Ilam dist., eastern Nepal, re-restricted to Chandragiri above Thankot by Biswas, *J. Bombay nat. Hist. Soc.*, 59 : 204-5).

1971. Ali and Ripley, Vol. 6 : 156.

Common name : Scalybreasted Wren-Babbler (English).

Material examined : Darjeeling district : 1 ♀, Sandakphu, (alt. c. 3657 m), coll. R. K. Ghose, 22. vi. 1974.

Diagnostic characters : Size, smaller than the House Sparrow. A tailless, squamated little Wren-Babbler in two colour phases. *White phase* : upper plumage olive-brown with a fulvous tip on each feather; throat nearly white; lower plumage white, scalypatterned breast; flanks squamated olive-brown.

Fulvous phase : Similar to the white phase but with the whole lower plumage fulvous instead of white. Sexes similar in both phases. Iris brown; bill, upper mandible horny brown, lower brownish flesh; legs, feet and claws horny brown.

Measurements : 1 ♀ : Wing 61; tail 19; bill 13.

Distribution : “Eastern Nepal, Darjeeling, Sikkim, Bhutan, southeast Tibet, Assam, and Burma in the Chin Hills and the hills of northeast Burma, from about 610 m in winter upto 3658 m; in tropical wet evergreen, semi-evergreen, subtropical wet, and wet temperate forest” (Ripley, 1961).

Remarks : Majumdar, *et. al.*, (1992) did not list this bird.

Genus *Rhipidura* Vigors & Horsfield, 1827

6. *Rhipidura albicollis albicollis* (Vieillot)

1818. *Platyrrhynchus albicollis* Vieillot, *Nouv. Dict. d' Hist. Nat.*, 27 : 13 (Bengale).

1972. Ali and Ripley, Vol. 7, p. 213.

Common names : White throated Fantail Flycatcher (English) and Chak-dayal (Bengali).

Material examined : Darjiling district : 2 ♂ , 1 ♀ , Selimbong, (alt. c. 2286 m.), coll. R. K. Ghose, 19, 21. iii. 1975.

Diagnostic characters : Size between Sparrow and Bulbul. Entire crown, back, wing and underparts dark slaty brown with a distinct white band or semi-collar across the throat, short white supercilia, and broadly white-tipped tail. Iris brown; bill brownish black; legs and feet horny brown. Sexes similar.

<i>Measurements</i> :	2 ♂	1 ♀
Wing	79,82	75
Tail	98,105	100
Bill	13,15	14

Distribution : “From Western Nepal east along the Himalayas to Darjeeling and Sikkim, south to U. P., Bihar, and West Bengal to the vicinity of Calcutta, East Pakistan in the Sunderbans, from the lowlands to 1676 m.” (Ripley, 1961).

Remarks : Majumdar, *et. al.*, (1992, p. 356) listed this bird, based on observation data of Guntlet, 1985, at Durgapur and Damodar Valley of Bardhaman district. Specimens were not examined by them.

Genus *Erithacus* Cuvier, 18007. *Erithacus chrysaeus chrysaeus* (Hodgson)

1845. *Tarsiger chrysaeus* Hodgson, *Proc. Zool. Soc. London* : 28 (Nepal).

1973.. Ali and Ripley, Vol. 8, p. 234.

Common name : Golden Bush Robin (English).

Material examined : Darjiling district : 3 ♂, 1 ♀ and 1 young, Sandakphu, (alt. c. 3657 m.), coll. R. K. Ghose, 20, 24, 25, 26. vi. 1974.

Diagnostic characters : Size of the House Sparrow. A shy robin like bird with the whole head and upper back olive-brown; cheeks, lores and ear coverts black; supercilium, sides of back, rump, upper tail-coverts and whole lower plumage bright orange; Wings olive-brown; tail orange, central rectrices and terminal band black. Female, olive above with an indistinct yellowish olive supercilium and buff eye-ring. Entire underparts ochre-yellow.

Young, speckled brown with yellow tail. Iris brown; bill dark brown, lower mandible yellow; legs and feet pale fleshy.

<i>Measurements</i> :	3 ♂	1 ♀
Wing	65,67 (2)	62
Tail	55,56 (2)	52
Bill	15,16 (2)	14

Distribution : Throughout the Himalayas to Western China and Yunnan.

Remarks : Majumdar, *et. al.*, (1992) did not list this bird.

Genus *Phoenicurus* Forster, 18178. *Phoenicurus caeruleocephalus* (Vigors)

1831. *Phoenicura caeruleocephala* Vigors, *Proc. Zool. Soc. London* : 35. (Himalaya, restricted to Simla-Almora district, India by Ticehurst and Whistler, 1924, *Ibis*, : 471).

1973. Ali and Ripley, Vol. 8, p. 251.

Common name : Blueheaded Redstart (English).

Material examined : Darjiling district : 2 ♀, Tonglu, (alt. c 3048 m) and Sandakphu, (c 3657 m), coll. R. K. Ghose, 9,15. iii. 1975.

Diagnostic characters : Size that of the House Sparrow. Male. A black robin-like bird with bluish ashy crown and nape, a large white band on wing; abdomen and vent white. In winter the bluish and black parts get masked by pale brown fringes. Female is brown with pale eye-ring and diagnostic reddish brown rump. Iris dark brown; bill blackish brown; legs and feet black.

Measurements : 2 ♀ : Wing, 75,77; tail 56, 62; bill 15 (2).

Distribution : Breeds in Central Asian mountain range and Himalayas from NWFP east to Bhutan between 2400 and 3900 m. Winters down to the foothills.

Remarks : Majumdar *et al.*, (1992) have not listed this bird.

Family : NECTARINIIDAE

Genus *Nectarinia* Illiger, 1811

9. *Nectarinia zeylonica sola* (Vieillot)

1819. *Cinnyris sola* Vieillot, *Nouv. Dict. d'Hist. Nat.*, 31 : 512 (Pondicherry, India).

1974. Ali and Ripley, Vol. 10, p. 22.

Common names : Indian Purplerumped Sunbird (English); chongi (Bengali).

Material examined : Medinipur district : 1 ♂, 1 ♀, Digba, coll. D. K. Ghosal, 3. iv. 1978.

Diagnostic characters : Smaller than the House Sparrow. Male with lemon-yellow breast and abdomen; throat and rump metallic purple, the former provided with a deep chestnut band below the throat; crown metallic green; back deep chestnut. Female with brown back, more rufous on wing; throat and flanks greyish white; breast and centre of belly lemon-yellow. Iris orange-brown, or reddish brown; bill brownish black; legs, feet and claws black.

Measurements :	1 ♂	1 ♀
Wing	55	53
Tail	34	31
Bill	20	18

Distribution : "Peninsular India from Nasik in a line east to Jabalpur and east to East Pakistan at Dacca, south in Bombay, (sight record for Panchmahals dist., Gujarat, 1955, *J. B. N. H. S.* 52 : 787), M. P., Orissa, Andhra, Goa, Mysore, Madras and Kerala, from the plains to 457 m. [exceptionally to 914 m - 1067 m. (Nilgiris) and in Kerala (Maraiyur)]" (Ripley, 1961).

Remarks : Majumdar, *et. al.*, (1992 : 399) reported it from southern Bengal. Specimens were not examined by them.

Genus *Aethopyga* Cabanis, 1851

10. *Aethopyga gouldiae gouldiae* (Vigors)

1831. *Cinnyris gouldiae* Vigors, *Proc. Zool. Soc. London* : 44. (Himalayas restricted to Simla-Almora area, India, by Ticehurst & Whistler, 1924, *Ibis* : 471).

1974. Ali and Ripley, Vol. 10, p. 39.

Common name : Mrs. Gould's Sunbird (English).

Material examined : Darjiling district : 1 ♂ , and 1 ♀ , Tonglu (alt. 10,074 m), coll. R. K. Ghose, 8. iii. 1975.

Diagnostic characters : Smaller than the House Sparrow minus the long pointed tail. Male. Crimson above, yellow below. Forehead, crown, chin, throat, and a spot on either side of breast deep metallic purple-blue. Rump bright yellow. Upper tail-coverts and central tail metallic purple-blue. Female. Overall grey-green with a yellow band across the rump. Iris reddish brown to crimson; bill dark brown, lower mandible paler; legs and feet dark brown.

<i>Measurements</i> :	1 ♂	1 ♀
Wing	58	50
Tail	81	45
Bill	23	20

Distribution : Throughout the Himalayas, breeds between 1800 and 3600 m from Sutlej valley east to Arunachal Pradesh and thence to the higher hills of Myanmar. Winters below down to the foothills.

Remarks : Majumdar, *et. al.*, (1992) have not listed this bird.

11. *Aethopyga ignicauda ignicauda* (Hodgson)

1836. (*Cinnyris*) *Ignicauda* Hodgson, *India Review*, 1 (7) : 273 (Nepal).

1974. Ali and Ripley, Vol. 10, p. 50.

Common name : Firetailed Yellowbacked Sunbird (English).

Material examined : Darjiling district : 8 ♂ and 7 ♀ , Sandakphu, (alt. c. 3,657 m), coll. R. K. Ghose, 20, 22, 23, 24, 25, 26. vi. 1974 and 1 ♀ , Selimbong (alt. c. 2,286 m.), coll. R. K. Ghose, 24. iii. 1975.

Diagnostic characters : Size smaller than the House Sparrow minus the long pointed bright crimson tail. Male. Upperparts crimson except forehead, crown and sides of chin and throat are metallic purple; wings olive; rump bright yellow; rest of underparts yellow, breast washed with orange. Female. Olive, above; rump fringed with yellow, but no distinct rump-band; tail blackish tinged with ashy green; central feathers golden brown; blackish ashy green below; abdomen greenish yellow. Iris dark brown; bill legs and feet blackish brown.

<i>Measurements</i> :	9 ♂	7 ♀
Wing	56, 57(2), 58(2), 59(3), 60	52, 53(2), 54(2), 55(2)
Tail	99, 101, 114, 116, 119, 121, 127 missing (2)	37, 38, 39, 40(4)
Bill	12 (tip broken), 20, 21(2), 22, 23(3), 25	18(tip broken), 19, 20(3), 22(2)

Distribution : Throughout the Himalayas breeding between 3,000 and 4,000 m. from Garhwal, east through Bhutan and Arunachal Pradesh, and through the higher hills of Myanmar to Mt. Mulayit in Tenasserim. Winters below down to the foothills.

Remarks : Majumdar, *et. al.*, (1992 : 401) listed this bird but did not examine the specimens.

Family : FRINGILLIDAE

Genus *Callacanthis* Bonaparte, 1850

12. *Callacanthis burtoni* (Gould)

1838. *Carduelis Burtoni* Gould, *Proc. Zool. Soc. London* (1837) : 90. (Himalayas, restricted to Srinagar, Kashmir, India, by Baker, 1921, *J. Bombay nat. Hist. Soc.*, 27 : 729).

1974. Ali and Ripley, Vol. 10 : 145.

Common name : Redbrowed Finch (English).

Material examined : Darjiling district : 1 ♂, Sandakphu (alt. c. 3,657 m.), coll. R. K. Ghose, 16. iii. 1975.

Diagnostic characters : Larger than the House Sparrow. Male : forehead crimson; crown black; supercilium, and round eye crimson; back brown; Wings black, spotted with white; tail black, outer rectrices with white tip; chin and throat pinkish red; cheeks black, rest fulvous brown washed with pinkish red. Female : forehead, ochre-yellow; crown dark brown; supercilium and round eye ochre yellow, rest as in male; below, ochraceous brown. Iris hazel; bill dull yellow, with dark tip; legs and feet brownish flesh.

<i>Measurements</i> :	1 ♂	1 ♀
Wing	96	93
Tail	62	60
Bill	16 (tip broken)	17

Distribution : From Western Himalayas east to Sikkim through Nepal. Breeds from 2,400 m to timber line. Recorded in winter between 800 and 3000 m.

Remarks : Vaurie (1959) did not include its range in West Bengal. Ali and Ripley (1974) were of the same opinion.

Majumdar *et. el.*, (1992) have not listed this bird.

This is first record from West Bengal.

Genus *Carpodacus* Kaup, 182913. *Carpodacus pulcherrimus pulcherrimus* (Moore)

1855. *Propasser pulcherrimus* Moore, *Proc. Zool. Soc.* London : 216 (Nepal).

1974. Ali and Ripley, Vol. 10, p. 179.

Common name : Himalayan Beautiful Rosefinch (English).

Material examined : Darjiling district : 1 ♂, 1 ♀, Sandakphu (alt. c. 3,657 m), coll. R. K. Ghose, 11. iii. 1975.

Diagnostic characters : Size that of the House Sparrow. Male. Upper plumage ashy brown streaked with blackish; forehead, rump and broad supercilium rosy red; wings marked with tow faint bars; lower plumage, entirely rosy red with blackish streaks on breast and abdomen. Female, fulvous brown broadly streaked with blackish above; a faint fulvous supercilium; fulvous white, streaked with dark brown below. Iris brown; bill dark horny brown, lower mandible paler; legs and feet pale fleshy brown.

<i>Measurements</i> :	1 ♂	1 ♀
Wing	78	75
Tail	64	62
Bill	12	12

Distribution : "The Himalayas from Bashahr east through Nepal, Darjeeling, Sikkim, probably Bhutan and the southern slopes of the main range in Southeast Tibet, from 3810 to 4267 m., descending in winter as low as 2591." (Ripley, 1961).

Remarks : Majumdar, *et. al.*, (1992) did not list this bird.

Genus *Pyrrhoptes* Hodgson, 184414. *Pyrrhoptes epauletta* (Hodgson)

1836. *Pyrrhula? epauletta* Hodgson, *Asiat. Res.* 19 : 156 (Northern and Central regions, Nepal).

1974. Ali and Ripley, Vol. 10, p. 195.

Common name : Goldheaded Black Finch (English).

Material examined : Darjiling district : 1 ♂, ♀, Sandakphu, (alt. c. 3,657 m.), coll. R. K. Ghose, 27. vi. 1974.

Diagnostic characters : Size that of the House Sparrow. Male. Entire plumage black except crown and nape which are shiny golden orange; secondaries marked with a diagnostic white line; abdomen orange-buff. In female crown grey tinged with yellow; rest of plumage chestnut-brown, paler on underparts. White line in wing as in male. Iris brown; bill horny brown, legs and feet brown.

<i>Measurements :</i>	1 ♂	1 ♀
Wing	78	76
Tail	62	59
Bill	14	12

Distribution : The Himalayas from Simla east through Bhutan and Arunachal Pradesh to northern Myanmar and Western China in Yunnan and Sikang. Breeds between 2800 and 3900 m, and descending down in winters between 1400 and 3600 m.

Remarks : Majumder, *et. al.* (1992) did not list this bird.

SUMMARY

Additional comprehensive information on the birds of West Bengal has been furnished based on collections present in the Zoological Survey of India, Calcutta. The list comprises 14 species and subspecies belonging to 13 genera, 7 families and 4 orders.

ACKNOWLEDGEMENT

We are thankful to the Director, Zoological Survey of India, for facilities to carry out the present work. We are also thankful to Dr. R. K. Varshney, Additional Director, Zoological Survey of India, for constant encouragement. We are also indebted to Shri S. S. Saha, Bird Section, for critically going through the manuscript and suggesting improvements.

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ON THE MEDIAEVAL ANIMAL REMAINS COLLECTED FROM BORAL, CALCUTTA, WEST BENGAL

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INTRODUCTION

During February, 1986 a pond locally known as Tripura Sundari Dighi at Boral (c 22° 29'54" N, 88°35' 20"E) near Calcutta, West Bengal (see Loc. map) was dug for renovation. Dr. Shibaprasad Banerjee, a resident of that locality informed the Director, Zoological Survey of India that a number of prehistoric animal remains were unearthed while digging the said pond. So, the Palaeozoology Division under the leadership of Shri S. Banerjee surveyed and collected the animal remains from the site.

The Dighi had old ruins of "British Nil Kuthi" on the northern side, an old temple of Baro Thakur Panchanandatala on the western side, a great Banyan tree on the eastern side and the present locality on the southern side. All the remains were found from an area of 400,000 sq. meter.

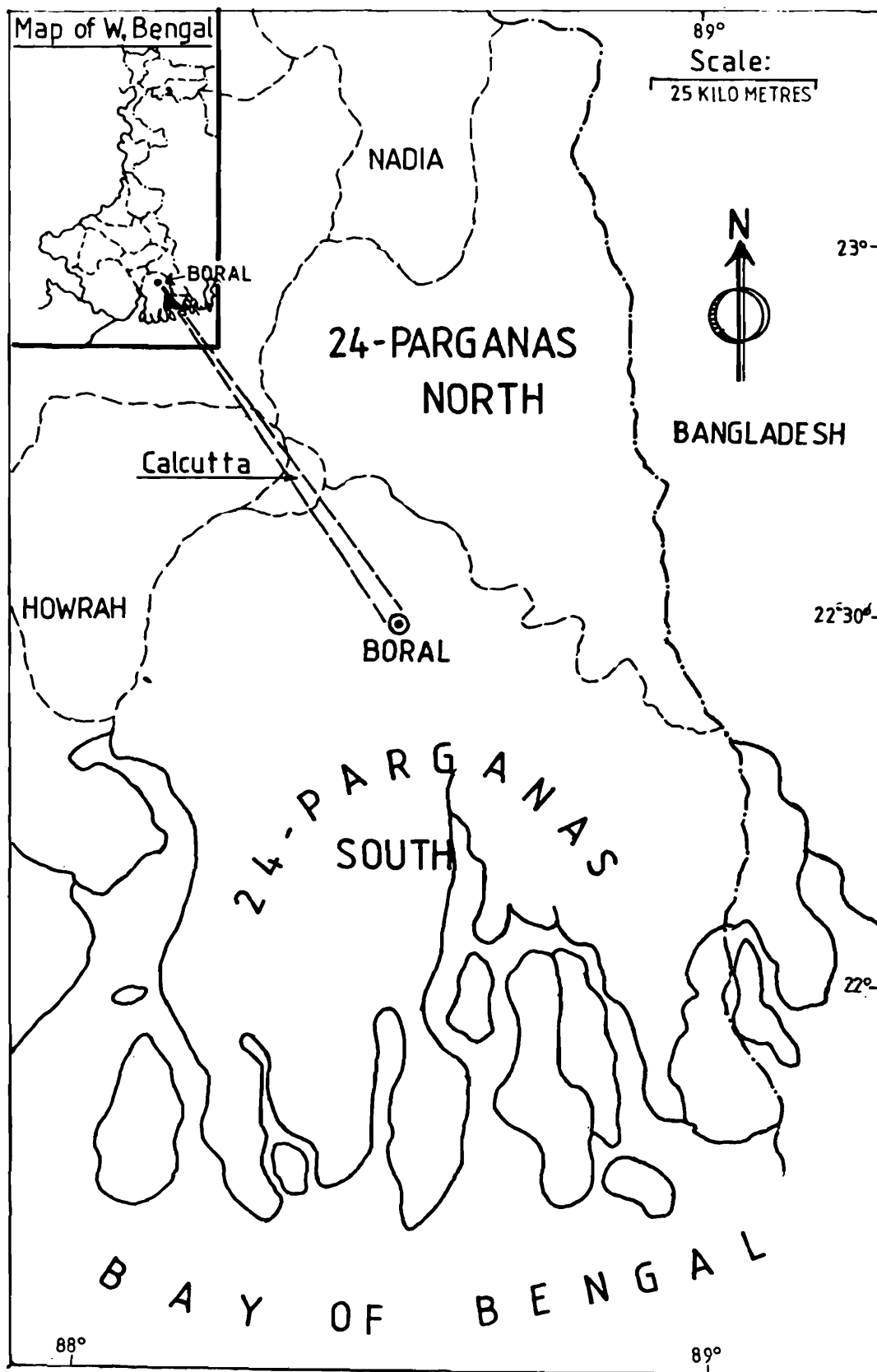
Besides animal remains, many terracota figurines such as a female sunga head, elephant head, folk dog, stamp for decoration and numerous black and red ware potteries, ivory casket, etc. were found. Based on the study of archaeological material, the Archaeology Department is of the opinion that the cultural sequence of Boral ranges from 1st century B. C. to late Mediaeval upto 14-15 century A. D.

The animal remains reveal the existence of the following species :

Trionyx gangeticus Cuvier; *Chitra indica* Gray; *Crocodylus porosus* Schneider; *Canis aureus* Linnaeus; *Elephas maximus* Linnaeus; *Cervus duvauceli* Cuvier; *Sus scrofa cristatus* Wagner; *Bos namadicus* Falconer; *Bos gaurus* H. Smith; *Bubalus bubalis* (Linnaeus), (both wild and domesticated) and *Bos indicus* Linnaeus.

Total number of animal remains is 83. The predominant bone remains are those of Zebu or domestic humped cattle (*Bos indicus* Linnaeus) which is about 45% of the total collection, and of *Bubalus bubalis* (Linnaeus) which is about 26%. Interestingly in the collection, the remains of wild animals are more in number than the domesticated varieties in contrast to other sites where the remains of the domesticated animals outnumber those of wild.

MAP OF WEST BENGAL SHOWING THE LOCATION OF BORAL



Map of West Bengal showing the locality of Boral

The systematic account of the species present in the collection is given below :

<i>Systematic Account of Species</i>	<i>No. of bones</i>
Class : REPTILIA	
Order : CHELONIA	
Family : TRIONYCHIDAE	
<i>Trionyx gangeticus</i> Cuvier	2
<i>Chitra indica</i> Gray	5
Order : CROCODILIA	
Family : CROCODYLIDAE	
<i>Crocodylus porosus</i> Schneider	1
Class : MAMMALIA	
Order : CARNIVORA	
Family : CANIDAE	
<i>Canis aureus</i> Linnaeus	7
Order : PROBOSCIDEA	
Family : ELEPHANTIDAE	
<i>Elephas maximus</i> Linnaeus	2
Order : ARTIODACTYLA	
Family : CERVIDAE	
<i>Cervus duvauceli</i> Cuvier	1
Family : SUIDAE	
<i>Sus scrofa cristatus</i> Wagner	1
Family : BOVIDAE	
<i>Bos namadicus</i> Falconer	2
<i>Bos gaurus</i> H. Smith	2
<i>Bos indicus</i> Linnaeus	38
<i>Bubalus bubalis</i> (Linnaeus) Wild	6
<i>Bubalus bubalis</i> (Linnaeus)	16

THE ANIMAL SPECIES

Trionyx gangeticus Cuvier (The Ganges soft-shelled turtle) :

Fragment of hypoplastron and a femur (pl. -1. fig.-b).

Chitra indica Gray (The River turtle) :

Fragment of carapace, epiplastron, hypoplastron, scapula and a humerus (pl.-1. fig. -a).

Crocodylus porosus Schneider (The Marsh Crocodile) :

Only a broken skull was found in this collection (pl.-1, fig.-c & d). Presence of this species testifies that the area was rather marshy and was connected with river.

Canis aureus Linnaeus (The Jackal) :

A very good representative collection of this species was found from Boral. This consists of a skull, 1st molar, right humerus, left and right femur, left tibia and left pelvis (pl.-1, fig.-e& f).

Elephas maximus Linnaeus (The Elephant) :

Detached plates of molar tooth (pl.-2, fig. -e). The origin of *Elephas maximus* is not yet been ascertained with certainty. Badam (1984) opined that *Elephas hysudricus* or *Elephas namadicus* of Indian Pleistocene is the probable ancestor of *Elephas maximus*.

Cervus duvauceli Cuvier (The Swamp Deer) :

This species of deer is represented in the collection by an antler (pl.-2, fig.-f).

The distribution of this species is north of the Ganges from Kumaon (U. P.) to Assam and Madhya Pradesh. However, the antler from Boral testifies its one time existence in the swampy areas of southern West Bengal which was the periphery of extended Sundarbans a few centuries ago.

Sus scrofa cristatus Wagner (The Pig) :

Only a single specimen of lower jaw of the species was found in this collection (pl. -2, fig. -d).

Sus scrofa cristatus is common throughout Peninsular India and a subspecies of *Sus scrofa*, the wild boar of the Lower Pleistocene which is still extant in the Indian jungle. It is assumed that all the domesticated Indian pigs owe their ancestry to this Wild species.

However, archaeozoologists are of the opinion that the pig constituted one of the most important animals in the development of culture in the Prehistoric period of the Old World (Nath, 1961).

***Bos namadicus* Falconer (The Extinct Cattle) :**

Upper right 1st and 2nd molar teeth of this species were found (pl. -2, fig. -c).

Bos namadicus is an extinct species of the family Bovidae. This species was reported from India as early as Middle to Late Pleistocene of Narmada Alluvium, Older Alluvium of Penganga and Yamuna and the Billa Surgam Cave of Kurnool (Badam 1979).

Recently one of the authors (S. Banerjee) reported *Bos namadicus* from Mochpal (Early Historic), Bharatpur (Chalcolithic) and Susunia (Late quaternary) all in West Bengal (Banerjee 1976, 1981; Banerjee and Saha 1976).

***Bos gaurus* H. Smith (The Indian Bison):**

Bos gaurus is represented in this collection by a fragmentary left femur and a 3rd phalanx (pl. -3, fig. b & d). The Gaur is a distant and wild relative of the present day cattle and is found in the forests throughout India.

***Bos indicus* Linnaeus (The Humped Cattle) :**

The bulk remains of bone fragments are those of *Bos indicus*. Out of 83 fragments of animal remains collected from Boral, 38 specimens are of *Bos indicus* (pl.-2, fig. -a & b).

Comparatively a large collection of *Bos indicus* from Boral indicates that the human inhabitants of this site maintained a large herd of cattle for milk as well as for agriculture.

Table-1. Comparative measurements (in mm.) of Right humerus, Left metacarpal, and Left astragalus of *Bubalus panihatensis* (Banerjee and Saha in press), *Bubalus maruvatoorensis* (Ghosh, et al :1972) *Bubalus bubalis* (Linnaeus) (domesticated) and *Bubalus bubalis* (Linnaeus) (Wild).

	<i>B. Panihatiensis</i>	<i>B. maruva- toorensis</i>	<i>B. bubalis</i> (domesticated)	<i>B. Bubalis</i> (wild)
	Sub-recent Panihati West Bengal	L. Pleistocene Maruvatoor Tamil Nadu	Recent Calcutta	Mediaeval Boral West Bengal

Right humerus

Maximum length	362		310	356
Proximal end length	130 +	-	121	131
Proximal end width	78 +			116
Distal end length	120 +	106	98	104

	<i>B. Panihatiensis</i>	<i>B. maruva- toorensis</i>	<i>B. bubalis</i> (domesticated)	<i>B. Bubalis</i> (wild)
	Sub-recent Panihati West Bengal	L. Pleistocene Maruvatoor Tamil Nadu	Recent Calcutta	Mediaeval Boral West Bengal
Distal end width	69	54.5	80	89
Head length	164		70	85
Head width	72		69	80
Medial-shaft				
Transverse length	74	-	60	63
<i>Left metacarpal :</i>				
Maximum length	245		195	235
Proximal end length	90		65	79
Proximal end width	54		39	44
Distal end length	98	-	70	86
Distal end width	50	-	36	40
Lateral length	61		36	52
Transverse length	35		26	
<i>Left astragalus</i>				
Maximum length	100		76	84
Maximum width	65		46	48

***Bubalus bubalis* (Linnaeus) (The Indian Wild Buffalo) :**

The collection of wild buffalo consists of right humerus, right radius left metacarpal, atlas, cervical vertebrae and left astragalus (pl. -3 & 4, fig. -3a, c, e, f, & 4a & d).

The bones of this species are larger than those of the domestic variety but smaller than those of *B. panihatiensis* (See Table 1). However, the ridges for the attachment of muscles of the present collection are more prominent.

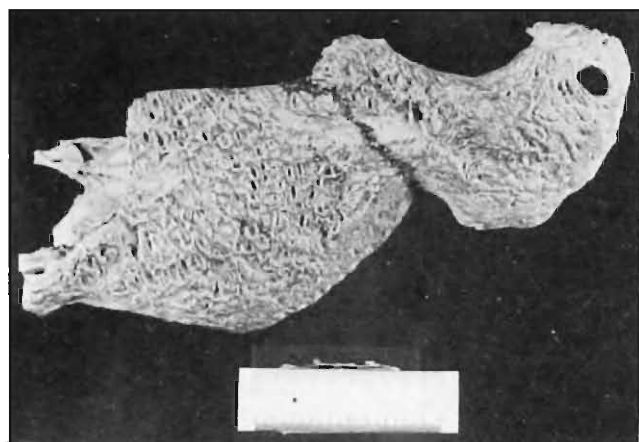
Generally it is difficult to differentiate between the bones of the wild and domestic buffalo due to lack of comparative material as stated by Clason (1977). The general consensus of opinion is that the Indian Wild Buffalo is the direct lineal descendant of the gigantic *Bubalus palaeindicus* Falconer of Siwalik Hills which gave rise to present day domestic buffaloes in India (Nath 1961). Badam (1984) also agrees with this view but he emphasises that very little is known about the process of its domestication, although it was domesticated within the subcontinent. However,



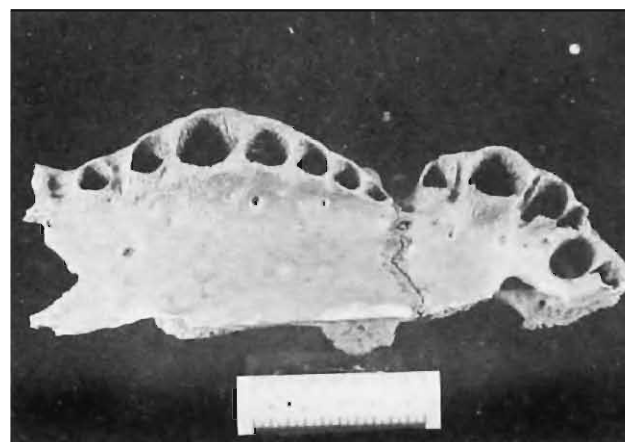
a



b



c



d



e



f

Plate-1 : (a-f)

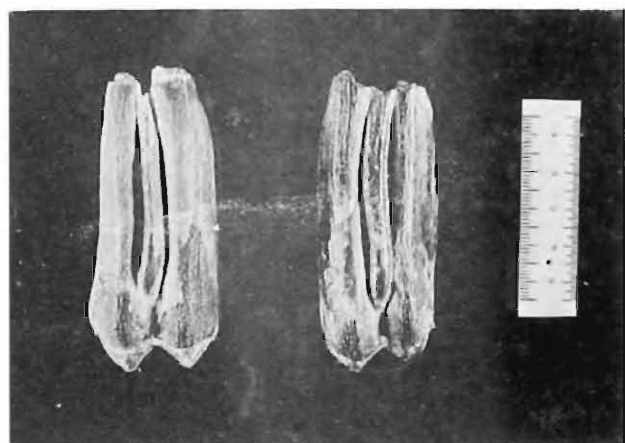
(a) Left humerus of *Chitra indica* Gray; (b) Fragment of Epiplastron of *Trionyx gangeticus* Cuvier; (c) Fragment of skull (right side) of *Crocodylus porosus* Schneider-Dorsal view; (d) -Ventral view; (e) Skull (slightly broken) of *Canis aureus* Linnaeus -v; (f) Dorsal view.



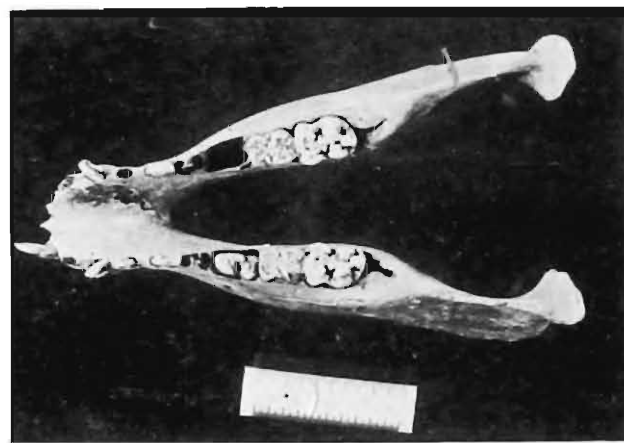
a



b



c



d



e



f

Plate-2 : (a-f)

(a) Right metatarsal of *Bos indicus* Linnaeus; (b) Right radius with ulna of *Bos indicus* Linnaeus; (c) Upper right 1st and 2nd molar of *Bos namadicus* Falconer-Labial view ; (d) Lower jaw of *Sus scrofa cristatus* Wagner; (e) Detached plates of molar tooth of *Elephas maximus* Linnaeus; (f) Fragment of antler to *Cervus duvauceli* Cuvier.



a



b



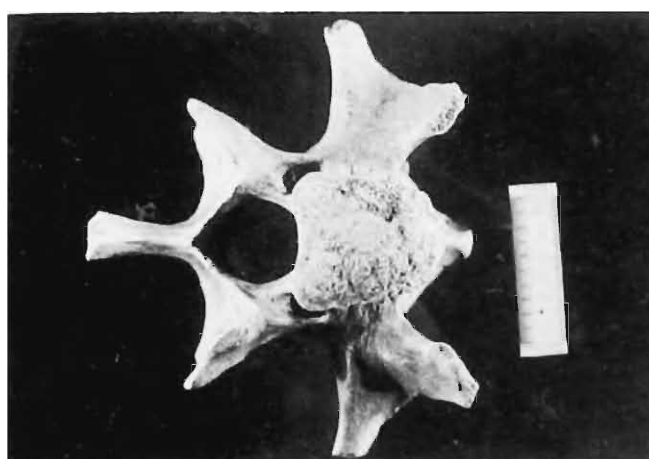
c



d



e



f

Plate-3 : (a-f)

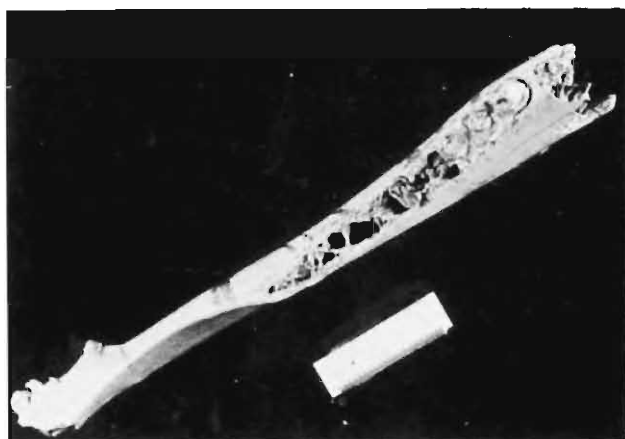
(a) Right radius of *Bubalus bubalis* Linnaeus; (b) Proximal end of left femur of *Bos gaurus* H. Smith;
 (c) Left metacarpal of *Bubalus bubalis* (Linnaeus) (wild); (d) Third phalanx of *Bos gaurus* H. Smith;
 (e) Left tibia of *Bubalus bubalis* (Linnaeus) (wild); (f) Cervical vertebra of *Bubalus bubalis* (Linnaeus)
 (Wild).



a



b



c



d



e



f

Plate-4 : (a-f)

(a) Atlas vertebra of *Bubalus bubalis* (Linnaeus) (Wild); (b) Atlas vertebra of *Bubalus bubalis* (Linnaeus) (Domesticated); (c) Left mandible with 3rd molar of *Bubalus bubalis* (Linnaeus) (Domesticated); (d) Right humerus of *Bubalis bubalis* (Linnaeus) (Wild); (e) Left metacarpal of *Bubalus bubalis* (Linnaeus) Domesticated; (f) Right tibia of *Bubalus bubalis* (Linnaeus) (Domesticated).

Ghosh (1985) stated that buffaloes were domesticated in India during early agricultural period (2000-3000 B. C).

Occurrence of both wild and domestic buffaloes together was also reported by Nath (1963) from the historical levels of Nagarjunakonda.

***Bubalus bubalis* (Linnaeus) (The domestic Buffalo) :**

Sixteen skeletal fragments of domestic *Bubalus bubalis* are present in this collection (p1. -4, fig. -b, c, e, & f).

The above mentioned fauna reported from Boral also have been unearthed from different sites in India, which has been presented in a tabular form (See Table -2).

DISCUSSION

Boral is situated 20 km south of Calcutta. It was quite a famous place in ancient days and had its own cultural importance. It is said that a King of the Sen dynasty known as Sujagya Sen had built the original temple of Tripura Sundari near the dighi (pond) about 700 years ago. The old ruined temple has been replaced by a new one and the deity in it is regularly worshipped.

The archaeological antiquities collected from this pond indicate that the civilization in this locality was as old as 1st Century B. C.

The remains of *Cervus duvauceli*, *Elephas maximus*, *Bos gaurus*, *Bos namadicus* and *Bubalus bubalis* (wild) testify their one time existence in the forests of Sundarbans.

The remains of domestic buffalo and cattle amply prove that there was a civilization and the human inhabitants used to maintain herds of buffalo and cattle for milk and agriculture

The most interesting finding of Zoological interest is the remains of *Bos namadicus* Falconer from Boral. Recently *Bos namadicus* has been reported from Susunia, in Bankura District (Banerjee & Saha 1976) which is about 20,000 years old and from Mochpal, Barasat, North 24-parganas District (Banerjee 1976) which is about 2000 years old. The third report is from Bharatpur, Burdwan District (Banerjee 1981). Ghosh (1977) described a subspecies of this species from Chandraketugarh, North 24-Parganas District in West Bengal. All these reports suggest that this species had a fairly wide distribution in West Bengal at least 20,000 years ago upto recent times.

SUMMARY

Altogether 12 species belonging to both wild and domestic species of animals have been reported from Boral, a Mediaeval site in West Bengal. The occurrence of these animal remains testify that pastoralism was mainstay of the economy of the local people augmented by hunting

Table-2 : Showing the occurrence of different species reported upon from Boral, along with other prehistoric sites in India

CULTURE	LOCALITY	DATE	<i>Trionyx gangeticus</i>	<i>Chitra indica</i>	<i>Crocodylus porosus</i>	<i>Canis aureus</i>	<i>Elephas maximus</i>	<i>Cervus duvauceli</i>	<i>Sus scrofa cristatus</i>	<i>Bos namadicus</i>	<i>Bos gaurus</i>	<i>Bubalus bubalis (wild)</i>	<i>Bubalus bubalis</i>	<i>Bos indicus</i>
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MEDIAEVAL	BORAL	200 BC-1100 AD	+	+	+	+	+	+	+	+	+	+	+	+
EARLY HISTORIC	MOCHPAL	200 BC-200 AD	+							+				
	KETU GARH	200 BC-200 AD								+				
IRON AGE	ARIKAMEDU	20-50 AD							+					+
	SARNATH	1200 AD					+		+				+	+
	NAGARJUNA-KONDA	200 BC-1200 AD					+		+	-			+	+
	JAUGADA	400 BC-300 AD	+						+				+	+
	HASTINAPUR	800-300 BC	+				+	+	+				+	+
	UJJAIN	500BC	-	-	-	-	+	-	+		-		+	+
	BHARATPUR	200 BC-1000 AD	-	-	-	-	-	-	+	-		-	+	+

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CHALCOLITHIC	NASIK	1300-1000BC	+	-	-	-	-		+				+	+
	NEVASA	1300BC	-	+	-	-	-	+	+				+	+
	INAMGAON	1600-700BC		-	-	-	+		+	-	-		+	+
	NAGDA	1600-1200BC	+	+	+	-	+	+	+	-	-		+	+
	NAVDATOLL	1600-1400BC	-	-		-	+		+	-	-		+	+
	DAIMABAD	2000-1000 BC	-	-	-	-				-			+	+
	KAYATHA	2000-1300 BC					+		+	-	-		+	+
	SOMNATH	2200-1200 BC	-		-	-			+	-		-	+	+
	AHAR	2200-1300 BC			-			-	+	-	-		+	+
	BHARATPUR	1000 BC	+		-	-		+	+	+	-		+	+
HARAPPAN	RANGPUR	2000-800 BC	-					+	+	-			+	+
	RUPAR	2000-800 BC	+				+	-	+	-	-		+	+
	SURKOTADO	2100-1700 BC		-					-	-	-	-		+
	LOTHAL	2300-1800 BC			-	+	+		+	-			+	+
	KALIBANGAN	2300-1900 BC					+	+		-	+		+	+
NEOLITHIC	BRAHMAGIRI	500BC-200 AD							+				+	+
	NAGARJUNA-KONDA	2500-1500 BC						+	+				+	+
	SANGANKAL	1600-1500 BC												+

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	HALLUR	1700-1000 BC									-			+
	MASKI	1800-1000 BC										-	+	+
	PALYAMPALLI	1700-1400 BC												+
	TIKKAIKOTA	1800-1500 BC												+
	T. NARSIPUR	1800-1500 BC												+
	PIKLIHAL	2200 BC					+						+	+
	UTNUR	2400-2000 BC							+					+
	KODEKAL	2500 BC											+	+
MESOLITHIC	ADAMGARH	5500-900 BC							+				+	+
	LANGHNAJ	2000 BC							+				+	+
	BAGOR	4500-3300 BC							+				+	+

and agriculture. Authors are also in the opinion that *Bos namadicus* had a fairly wide distribution in West Bengal.

ACKNOWLEDGEMENTS

Authors are thankful to the Director, Zoological Survey of India for the facilities provided for this research work. They are also grateful to Dr. Shiboprasad Banerjee, Agriculture-Scientist, who has not only taken much initiative to inform about the excavation but also helped us in collecting the material and rendered valuable informations. Thanks are also due to Dr. V C. Agrawal, Scientist -SE for critically going through the manuscript, to Shri M. Ghosh, Assistant Zoologist, for technical help rendered for the preparation of this paper and to Photography and Artist Sections of Z. S. I. for co-operation.

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ON A COLLECTION OF FISH FROM CANNANORE-MANGALORE SECTOR OF THE WEST COAST OF INDIA

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INTRODUCTION

A Faunastic Survey was undertaken in January-February, 1989 by one of us (M. S.) to the coastal areas between Cannanore and Mangalore (Fig. 1) in pursuance of the Annual Programme "Coastal and Marine Ecosystems of the coasts of India" of the Marine Biological Station, Zoological Survey of India, Madras and this paper is based on the fish fauna collected during the survey. Fishes collected between Kakinada and Gopalpur coast pertaining to this programme was already published (Krishnan and Mishra, 1993). The ultimate aim of these surveys is to have a comprehensive account of the fauna of the coasts of India. After Day (1865), there has not been much taxonomic information added to our knowledge of the fish fauna of the Malabar coast. It is, therefore, believed that this paper will be of great use to the students of ichthyotaxonomy of the area.

The arrangement of families in this account is after Nelson (1984) and the genera and species are arranged in alphabetical order. The type locality of the species are given in parentheses after the first citation. All the examined samples are registered and deposited with the Marine Biological Station, Zoological Survey of India, Madras.

SYSTEMATIC ACCOUNT

Class : CHONDRICHTHYES

Order : CARCHARHINIFORMES

Family : CARCHARHINIDAE

1. *Rhizoprionodon acutus* (Ruppell)

1837. *Carcharias acutus* Ruppell, *Neue Wirbel. Fauna Abyss., Fische Rothen Meeres*, (11) : 65, pl. 18, fig. 4 (Djedda, Red Sea).

1984. *Rhizoprionodon acutus* : Compagno, *FAO Fish. Synop.*, (125) 4(2) : 525.

Material examined : 1, 222 mm, Kasaragod, 31.01.89, ZSI/MBS-1878.

Distribution : Indo-west Pacific; West coast of Africa.

2. *Scoliodon laticaudatus* Muller & Henle

1838. *Scoliodon laticaudatus* Muller & Henle, *Syst. Besch. Plagiost.*, (1) : 27 (Aus Indien).

Material examined: 1, 245 mm, Kotikulam, 30.01.89, ZSI/MBS-2001; 1, 265 mm, Kasaragod, 31.01.89, ZSI/MBS-1877; 1, 117 mm, Cannanore, 01.02.89, ZSI/MBS-2012.

Distribution : Tanzania; Persian Gulf to Indonesia, north to Japan.

Family : SPHYRNIDAE

3. *Sphyrna lewini* (Griffith & Smith)

1834. *Zygaena lewini* Griffith & Smith, in Cuvier, Griffith & Smith, *Anim. Kingd.*, 10 : 640, pl. 50 (South coast of New Holland, Australia).

1984. *Sphyrna lewini* : Compagno, *FAO Fish. Synop.*, (125) 4(2) : 545.

Material examined : 1, 290 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1800.

Distribution : Circumglobal in coastal temperate and tropical seas.

Class : OSTEICHTHYES

Order : ANGUILLIFORMES

Family : CONGRIDAE

4. *Uroconger lepturus* (Richardson)

1845. *Congrus lepturus* Richardson, *Zool. Voy. Sulphur* : 106, pl. 56, figs. 1-6 (Canton, China).

1986. *Uroconger lepturus* : Castle, in Smith & Heemstra, *Smith's Sea Fishes* : 165, fig. 40.12.

Material examined : 5, 290-340 mm TL, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1901; 4, 200-310 mm TL, off Mangalore, 27.01.89, ZSI/MBS-1902 ; 1, 300 mm TL, Someshwar, 28.01.89, ZSI/MBS-1766.

Distribution : Indo-Pacific.

Family : MURAENESOCIDAE

5. *Muraenesox cinereus* (Forsskal)

1775. *Muraena tata cinerea* Forsskal, *Descript. animal.* : 22 (Red Sea).

1991. *Muraenesox cinereus* : Talwar & Jhingran, *Inland Fishes of India*, 1 : 92.

Material examined : 1, 580 mm TL, Cannanore, 01.02.89, ZSI/MBS-2000.

Distribution : Eastern Mediterranean, Red Sea, through India to Indonesia, north to Japan, south to northern Australia.

Order : CLUPEIFORMES

Family : CLUPEIDAE

Subfamily : DUSSUMIERINAE

6. *Dussumieria acuta* Valenciennes

1847. *Dussumieria acuta* Valenciennes, *Hist. nat. poiss.*, 20 : 467 (Bombay, Coromandel).

Material examined : 1, 115 mm, Puthiyangadi, 02.02.89, ZSI/ MBS-1899.

Distribution : Gulf of Aden, to India, Indonesia, the Philippines.

Remarks : This sample is slightly slender (21% of SL) than the normal range (22 to 29% of SL) cited by Whitehead (1985). This is assigned to the taxon based on the presence of a number of striae on the posterior part of scales.

Subfamily : CLUPEINAE

7. *Escualosa thoracata* (Valenciennes)

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

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

Material examined : 7, 57-62 mm, Kotikulam, 30. 01. 89, ZSI/MBS-2005.

Distribution : Coast of Pakistan, eastward to Indonesia, the Philippines to Papua New Guinea, Australia.

8. *Sardinella albella* (Valenciennes)

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

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

Material examined : 1, 78 mm, Kotikulam, 30.01.89, ZSI/MBS-2004.

Distribution : Indo-West Pacific.

9. *Sardinella gibbosa* (Bleeker)

1849. *Clupea gibbosa* Bleeker, *J. Ind. Arch.*, 3 : 72 (Macassar).

1985. *Sardinella gibbosa* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 100.

Material examined : 5, 113-123 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1898.

Distribution : Indo-west Pacific.

10. *Sardinella longiceps* Valenciennes

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

Material examined : 2, 90 & 140 mm, off Mangalore, 27.01.89, ZSI/MBS-1895 ; 8, 82-139 mm, Kotikulam, 30.01.89, ZSI/MBS-2003 ; 1, 81 mm, Kasaragod, 31.01.89, ZSI/MBS-1908 ; 2, 94 & 99 mm, Cannanore, 01.02.89, ZSI/MBS-1894.

Distribution : Gulf of Aden, Gulf of Oman, to southern coasts of India, Andamans.

Subfamily : DOROSOMATINAE

11. *Anodontosoma chacunda* (Hamilton)

1822. *Clupanodon chacunda* Hamilton, *Fishes of Ganges* : 246 (Ganges estuaries).

1985. *Anodontosoma chacunda* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 252.

Material examined : 1, 115 mm, Kasaragod, 31.01.89, ZSI/MBS-1886; 1, 114 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1887.

Distribution : Persian Gulf to Indonesia, the Philippines, Viet Nam, to northern Australia, Caroline Islands, New Caledonia.

12. *Nematalosa nasus* (Bloch)

1795. *Clupea nasus* Bloch, *Naturges. ausland. Fische*, 9 : 116, pl. 429, fig. 1 (Malabar).

1985. *Nematalosa nasus* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 248.

Material examined : 2, 55 & 79 mm, Kasaragod, 31.01.89, ZSI-MBS-1903 ; 1, 62 mm, Cannanore, 01.02.89, ZSI/MBS-1913.

Distribution : Persian Gulf to Andaman Sea, Gulf of Thailand, South China Sea, the Philippines, north to southern Japan.

Family : PRISTIGASTERDAE

13. *Ilisha melastoma* (Schneider)

1801. *Clupea melastoma* Schneider, *Syst Ichthyol. Bloch* : 427 (Coromandel).

1985. *Ilisha melastoma* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 272.

Material examined : 1, 104 mm, off Mangalore, 27.01.89, ZSI/MBS-1925.

Distribution : South-west coast of India to Calcutta in northeast coast; Java Sea, South China Sea, East China Sea.

14. *Ilisha striatula* Wongratana

1983. *Ilisha striatula* Wongratana, *Jap. J. Ichthyol.*, 29 (4) : 396, fig. 13 (Karachi, Porto Novo, Madras, Tuticorin).

Material examined : 2, 105 & 115 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1926 ; 1, 116 mm, Someshwar, 28.01.89, ZSI/MBS-1774 ; 1, 106 mm, Kasaragod, 31.01.89, ZSI/MBS-2021.

Distribution : Coasts of India and Pakistan.

15. *Opisthopterus tardoore* (Cuvier)

1829. *Pristigaster tardoore* Cuvier, *Regne animal*. (2nd ed.), 2 : 381 (Vizagapatnam).

1985. *Opisthopterus tardoore* : Whitehead, *FAO Fish. Synop.*, (125) 7(1) : 294.

Material examined : 1, 146 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/ MBS-1896 ; 1, 120 mm, off Mangalore, 27.01.89, ZSI/MBS-1897 ; 1, 132 mm, Kotikulam, 30.01.89, ZSI/ MBS-2002; 2, 47 & 118 mm, Cannanore, 01.02.89, ZSI/MBS-1993.

Distribution : Gulf of Oman to south-east coast of India, coasts of Myanmar, Singapore and Java Sea.

Family : ENGRAULIDIDAE

16. *Stolephorus indicus* (van Hasselt)

1823. *Engraulis indica* van Hasselt, *Algemeene Konst-en Letterbode*, 1(23) : 329 (Java).

1988. *Stolephorus indicus* : Whitehead *et al.*, *FAO Fish. Synop.*, (125) 7(2) : 412.

Material examined : 1, 115 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1900.

Distribution : Indo-West Pacific.

17. *Stolephorus insularis* Hardenberg

1933. *Stolephorus insularis* Hardenberg, *Natuurk. Tijdschr. Ned-Indie*, 93(2) : 260 (Java, Lingga, Bawean, Kangean, Moluccas).

Material examined : 1, 60 mm, Cannanore, 01.02.89, ZSI/MBS-1914.

Distribution : Gulf of Aden to Andaman Sea, Gulf of Thailand, Java Sea, Hong Kong, Fujian, Taiwan.

18. *Stolephorus Waitei* Jordan & Seale

1926. *Stolephorus waitei* Jordan & Seale, *Bull. Mus. comp. Zool. Harvard*, 67(11) : 380 (Queensland).

Material examined : 3, 72-85 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1922 ; 4, 73-78 mm, off Mangalore, 27.01.89, ZSI/MBS-1923 ; 1, 76 mm, Someshwar, 28.01.89, ZSI/MBS-1783 ; 2, 75 & 76 mm, Cannanore, 01.02.89, ZSI/MBS-1921 ; 5, 61-73 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1924.

Distribution : South-west and east coast of India, through Java Sea, to Papua New Guinea, Queensland in Australia.

19. *Thryssa dayi* Wongratana

1983. *Thryssa (Scutengraulis) dayi* Wongratana, *Jap. J. Ichthyol.*, 29(4) : 404, fig. 24 (Bomnay, Karachi).

1988. *Thryssa dayi* : Whitehead *et al.*, *FAO Fish. Synop.*, (125) 7(2) : 428.

Material examined : 3, 111-142 mm, Cannanore, 01.02.89, ZSI/MBS-1892.

Distribution : West coast of India and Pakistan.

20. *Thryssa mystax* (Schneider)

1801. *Clupea mystax* Schneider, *Syst. Ichthyol. Bloch* : 426, pl. 83 (Malabar).

1988. *Thryssa mystax* : Whitehead *et al.*, *FAO Fish. Synop.*, (125) 7(2) : 348.

Material examined : 2, 120 & 145 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1891 ; 1, 116 mm, Someshwar, 28.01.89, ZSI/MBS-1784 ; 1, 78 mm, Kotikulam, 30.01.89, ZSI/MBS-2006 ; 2, 112 & 129 mm, Kasaragod, 31.01.89, ZSI/MBS-1889 ; 7, 112-133 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1890.

Distribution : Coasts of India, Myanmar, Pinang, Indonesia.

21. *Thryssa polybranchialis* Wongratana

1983. *Thryssa (Scutengraulis) polybranchialis* Wongratana, *Jap. J. Ichthyol.*, 29(4) : 402, fig. 21 (Canara, Cochin, Porto Novo, Waltair).

1988. *Thryssa polybranchialis* : Whitehead *et al.*, *FAO Fish. Synop.*, (125) 7(2) : 439.

Material examined : 3, 90-117 mm, Cannanore, 01.02.89, ZSI/MBS-1893.

Distribution : Coasts of India.

22. *Thryssa setirostris* (Broussonet)

1782. *Clupea setirostris* Broussonet, *Ichthyol.* : unpagged, pl. 2 (Tana Island, New Herbrides).

1988. *Thryssa setirostris* : Whitehead *et al.*, *FAO Fish. Synop.*, (125) 7(2) : 443.

Material examined : 1, 117 mm, Kasaragod, 31.01.89, ZSI/MBS-1888.

Distribution : Indo-west Pacific.

Family : CHIROCENTRIDAE

23. *Chirocentrus nudus* Swainson

1839. *Chirocentrus nudus* Swainson, *Nat. Hist. anim.*, 2 : 294 (Vizagapatnam).

Material examined : 1, 278 mm, off Mangalore, 27.01.89, ZSI/MBS-1955.

Distribution : Indo-West Pacific.

Order : SILURIFORMES

Family : ARIIDAE

24. *Arius dussumieri* Valenciennes

1840. *Arius dussumieri* Valenciennes, *Hist. nat. poiss.*, 15 : 84 (Malabar).

Material examined : 1, 75 mm, Cannanore, 01.02.89, ZSI/MBS-1917.

Distribution : Pakistan, India, Sri Lanka, Bangladesh, Myanmar.

25. *Arius maculatus* (Thunberg)

1792. *Silurus maculatus* Thunberg, *Kongl. Vetensk. Akad. Nya. Handl.*, 13 : 31 pl. 1, fig 2 (Japan).

1982. *Arius maculatus* : Jayaram, *Rec. zool. Surv. India, Occ. Pap.*, (37) : 23, fig. 5A, 17.

Material examined : 3, 41-99 mm, Kasaragod, 31.01.89, ZSI/MBS-1792; 1, 121 mm, Cannanore, 01.02.89, ZSI/MBS-1991.

Distribution : Pakistan, India to Indonesia, Thailand, China.

26. *Arius sona* (Mamilton)

1822. *Pimelodus sona* Hamilton, *Fishes of Ganges* : 172, 376 (estuaries of Bengal).

1982. *Arius sona* : Jayaram, *Rec. zool. Surv. India, Occ. Pap.*, (37) : 28, figs. 9, 21.

Material examined : 2, 71 & 100 mm, off Mangalore, 27.01.89, ZSI/MBS-1791

Distribution : Pakistan, India to Indonesia, Polynesia.

27. *Arius thalassinus* (Ruppell)

1837. *Bagrus thalassinus* Ruppell, *Neue Wirbel. Fauna Abyss., Fische Rothen Meeres*, 11 : 75, pl. 20, fig. 2 (Massaua, Red Sea).

1984 *Arius thalassinus* : Jayaram, in Fishcher & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 1 : ARIID Ariu 4.

Material examined : 2, 100 & 118 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1790; 1, 113 mm, Off Mangalore, 27.01.89, ZSI/MBS-1789; 1, 98 mm, Someshwar, 28.01.89, ZSI/MBS-1764.

Distribution : Indo-West Pacific.

Order : AULOPIFORMES

Family : SYNODONTIDAE

28. *Saurida micropectoralis* Shindo & Yamada

1972. *Saurida micropectoralis* Shindo & Yamada, *Uo Jap. Soc. Ichthyol.*, 11 : 1-13; 12 : 1-14 (Gulf of Thailand).

Material examined : 2, 143 & 158 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1981; 1, 151 mm, Someshwar, 28.01.89, ZSI/MBS-1982.

Distribution : East coast of India; Andaman Sea to South China Sea, the Philippines.

Remarks : Studies of Dutt and Sagar (1981) revealed the distribution of this species upto the east coast of India. The present study further reveals the presence of this species also in the west coast of India.

29. *Saurida tumbil* (Bloch)

1795. *Salmo tumbil* Bloch, *Naturges. ausland. Fische*, 9 : 112, pl. 430 (Malabar).

1984. *Saurida tumbil* : Cressey & Waples, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 4 : SYNOD Sauri 2.

Material examined : 1, 188 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1980.

Distribution : East coast of Africa (excluding Kenya and Somalia) from Red Sea to Indonesia, Malay, north to China Sea, south to New South Wales (Australia).

Order : BELONIFORMES

Family : BELONIDAE

30. *Tylosurus crocodilus crocodilus* (Peron & LeSueur)

1821. *Belone crocodila* Peron & LeSueur, in LeSueur, *J. Acad. nat. Sci. Philad.*, 2 : 129 (Mauritius).

1986. *Tylosurus crocodilus crocodilus* : Collette, in Smith & Heemstra, *Smith's Sea Fishes* : 387, fig. 113.4.

Material examined : 1, 250 mm, Cannanore, 01.02.89, ZSI/MBS-1992.

Distribution : Tropical and Subtropical waters of Indo-West Pacific and Atlantic.

Family : HEMIRAMPHIDAE

31. *Hyporhamphus (Hyporhamphus) limbatus* (Valenciennes)

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

1984. *Hyporhamphus (Hyporhamphus) limbatus* : Collette, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 2 : HEMIR Hypor 4.

Material examined : 1, 134 mm, Cannanore, 01.02.89, ZSI/MBS-1979.

Distribution : Persian Gulf, through India, Myanmar to Thailand, China.

Order : SYNGNATHIFORMES

Family : FISTULARIIDAE

32. *Fistularia petimba* Lacepede

1803. *Fistularia petimba* Lacepede, *Hist. nat. poiss.*, 5 : 189 (New Britain, Reunion and equatorial Pacific).

Material examined : 1, 290 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1974.

Distribution : Indo-West Pacific, eastward to Hawaii; also in tropical Atlantic.

Order : SCORPAENIFORMES

Family : SCORPAENIDAE

33. *Pterois russellii* Bennett

1831. *Pterois russellii* Bennett, *Proc. zool. Soc. London*, 1 : 128 (India).

Material examined : 1, 121 mm, Bunder jetty, Mangalore, 26.01.89, ZSI/MBS-1947; 1, 135 mm, Puthiyangadi, 02.02.89, ZSI/MBS-2018; 1, 136 mm, Puthiyangadi, 02.02.89, ZSI/MBS-2019.

Distribution : Indo-West Pacific.

Remarks : It is interesting to note that the left pectoral fin of the third specimen (136 mm SL) is entirely absent without having any sign of being mutilated, and it was captured alive from the trawl net.

Family : PLATYCEPHALIDAE

34. *Grammoplites suppositus* (Troschel)

1840. *Platycephalus suppositus* Troschel, *Wiegmanns Arch. Naturgesch.*, 6 : 269 (no locality)

1984. *Grammoplites suppositus* : Knapp, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 3 : PLATY Gram 2.

Material examined : 1, 133 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1950; 2, 162 & 195 mm, Off Mangalore, 27. 01.89, ZSI/MBS-1949; 1, 152 mm, Cannanore, 01.02.89, ZSI/MBS-1989; 1, 153 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1948.

Distribution : Red Sea to south-east coast of India.

35. *Sorsogona melanoptera* Knapp & Wongratana

1987. *Sorsogona melanoptera* Knapp & Wongratana, *Proc. Biol. Soc. Wash.*, 100(2) : 381 (Cochin).

Material examined : 2, 83 mm each, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1952; 1, 87 mm, Off Mangalore, 27.01.89, ZSI/MBS-1951; 1, 80 mm, Someshwar, 28.01.89 ZSI/MBS-1771.

Distribution : Gulf of Oman to the Andaman Sea off southern Thailand.

Order : PERCIFORMES

Family : AMBASSIDAE

36. *Ambassis gymnocephalus* (Lacepede)

1801. *Lutjanus gymnocephalus* Lacepede, *Hist. nat. poiss.*, 3 : pl. 23, fig. 3; 4 (1802) : 181, 216 (Indo-Pacific).

1986. *Ambassis gymnocephalus* : Heemstra, in Smith & Heemstra, *Smith's Sea Fishes* : 507, fig. 163.1.

Material examined : 1, 58 mm, Off Mangalore, 27.01.89, ZSI/MBS-1966; 6, 35-60 mm, Kotikulam, 30.01.89, ZSI/MBS-2007; 11, 36-55 mm, Cannanore, 01.02.89, ZSI/MBS-1965.

Distribution : Tropical waters of Indian Ocean, Indonesia and the Philippines.

Family : SERRANIDAE

37. *Epinephelus diacanthus* (Valenciennes)

1828. *Serranus diacanthus* : Valenciennes, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 2 : 319 (Malabar coast, Kerala).

1993. *Epinephelus diacanthus* : Heemstra & Randall, *FAO Fish. Synop.*, (125) 6 : 140, fig. 291, pl. 121 a.

Material examined : 2, 134 & 149 mm, Off Mangalore, 27.01.89, ZSI/MBS-1973.

Distribution : Gulf of Aden to Sri Lanka, south-east coast of India.

Family : TERAPONIDAE

38. *Terapon jarbua* (Forsskal)

1775. *Sciaena jarbua* Forsskal, *Descript. animal.* : 50 (Djedda, Red Sea).

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

Material examined : 1, 106 mm, Off Mangalore, 27.01.89 ZSI/MBS-1884; 2, 87 & 113 mm, Someshwar, 28.01.89, ZSI/MBS-1987; 1, 57 mm, Kasaragod, 31.01.89, ZSI/MBS-1919; 1, 104 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1883.

Distribution : Indo-West Pacific.

39. *Terapon theraps* (Cuvier)

1829. *Terapon theraps* Cuvier, *Hist. nat. poiss.*, 3 : 129, pl. 53 (Java; Mahe, India).

1991. *Terapon theraps* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 812, fig. 251.

Material examined : 4, 87-105 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1880; 1, 88 mm, Off Mangalore, 27.01.89, ZSI/MBS-1881; 1, 107 mm, Someshwar, 28.01.89, ZSI/MBS-1986; 1, 120 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1882.

Distribution : Tropical Indo-West Pacific.

Family : PRIACANTHIDAE

40. *Priacanthus hamrur* (Forsskal)

1775. *Sciaena hamrur* Forsskal, *Descript. animal.* : 45 (Djedda, Red Sea).

1984. *Priacanthus hamrur* : Talwar & Kacker, *Commercial Sea Fishes of India* : 415.

Material examined : 2, 160 & 161 mm, Off Mangalore, 27.01.89, ZSI/MBS-1885.

Distribution : Indo-Pacific.

Family : APOGONIDAE

41. *Apogon quadrifaciatus* Cuvier

1828. *Apogon quadrifaciatus* Cuvier, in Cuvier & Valenciennes, 2 : 153 (Pondicherry).

Material examined : 1, 38 mm, Someshwar, 28.01.89, ZSI/MBS-1768.

Distribution : Indo-West Pacific.

Family : SILLAGINIDAE

42. *Sillago sihama* (Forsskal)

1775. *Atherina sihama* Forsskal, *Descript. animal.* : 70 (Lohaja, Red Sea).

1992. *Sillago sihama* : McKay, *FAO Fish. Synop.*, (125) 14 : 59, fig. 130.

Material examined : 3, 95-121 mm, Kasaragod, 31.01.89, ZSI/MBS-1985; 1, 86 mm, Cannanore, 01.02.89, ZSI/MBS-1911.

Distribution : Indo-West Pacific.

Family : LACTARIIDAE

43. *Lactarius lactarius* (Schneider)

1801. *Scomber lactarius* Schneider, *Syst. Ichthyol. Bloch* : 31 (Tranquebar).

1984. *Lactarius lactarius* : Talwar & Kacker, *Commercial Sea Fishes of India* : 427, fig. 165.

Material examined : 3, 93-128 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1944; 1, 133 mm, Kasaragod, 31.01.89, ZSI/MBS-1942; 1, 149 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1943.

Distribution : Tropical Indo-West Pacific.

Family : ECHENEIDAE

44. *Echeneis naucrates* Linnaeus

1758. *Echeneis naucrates* Linnaeus, *Syst. Nat.*, 1 : 261 (Pelago Indico) (Species name misspelled).

Material examined : 1, 220 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1975.

Distribution : In all tropical and temperate warm waters, except Eastern Pacific.

Family : CARANGIDAE

45. *Alepes djedaba* (Forsskal)

1775. *Scomber djedaba* Forsskal, *Descript. animal.* : 56 (Djedda, Red Sea).

1984. *Alepes djedaba* : Talwar & Kacker, *Commercial Sea Fishes of India* : 438, fig. 168.

Material examined : 2, 114 & 135 mm, Off Mangalore, 27.01.89, ZSI/MBS-1935; 1, 80 mm, Kasaragod, 31.01.89, ZSI/MBS-1936; 1, 101 mm, Puthiyangadi, 02.02.89, ZSI/MBS-2013.

Distribution : Indian Ocean, Sumatra, Thailand, the Philippines, Taiwan and eastern Mediterranean.

46. *Atropus atropos* (Schneider)

1801. *Brama atropos* Schneider, *Syst. Ichthyol. Bloch* : 98 (Tranquebar).

1984. *Atropus atropos* : Smith-Vaniz, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery purposes. W. Indian Ocean (Fishing Area 51)*, 1 : CARAN Atrop 1.

Material examined : 1, 97 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1929; 1, 154 mm, Off Mangalore, 27.01.89. ZSI/MBS-1930.

Distribution : Persian Gulf to Indonesia, Gulf of Thailand, Taiwan, Okinawa.

47. *Caranx para* Cuvier

1833. *Caranx para* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 9 : 58 (Malabar).

Material examined 3, 78-108 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1938; 1, 110 mm, Off Mangalore, 27.01.89, ZSI/MBS-1937; 1, 104 mm, Someshwar, 28.01.89, ZSI/MBS-1772, 3, 90-92 mm, Kasaragod, 31.01.89, ZSI/MBS-1939.

Distribution : Pakistan to Indonesia, east ward to Papua New Guinea, Australia, north to Japan.

Remarks Generic allocation is tentative (Smith-Vaniz, 1984).

48. *Decapterus russelli* (Ruppell)

1830. *Caranx russelli* Ruppell, *Atlas Reise nordl. Afrika, Fische Rothen Meeres* : 99 (Red Sea).

1986. *Decapterus russelli* : Smith-Vaniz, in Smith & Heemstra, *Smith's Sea Fishes* : 651, fig. 210.29.

Material examined : 1, 85 mm, Someshwar, 28.01.89, ZSI/MBS-1773.

Distribution : Indo-West Pacific.

49. *Megalaspis cordyla* (Linnaeus)

1758. *Scomber cordyla* Linnaeus, *Syst. Nat.*, : 1 (ed. 10) : 298 (no locality).

1991. *Megalaspis cordyla* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 824.

Material examined : 2, 154 & 173 mm, Off Mangalore, 27.01.89, ZSI/MBS-1930 & 1931; 1, 168 mm, Cannanore, 01.02.89, ZSI/MBS-1932.

Distribution : Indo-West Pacific.

50. *Scomberoides tala* (Cuvier)

1832. *Chorinemus tala* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 8 : 377 (Malabar).

1984. *Scomberoides tala* : Talwar & Kacker, *Commercial Sea Fishes of India* : 478.

Material examined : 1, 155 mm, Off Mangalore, 27.01.89, ZSI/MBS-1940; 1, 175 mm, Cannanore, 01.02.89, ZSI/MBS-1934; 1, 176 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1954.

Distribution : From south-west coast of India to Andamans, Indonesia, Gulf of Thailand, the Philippines. Australia and the Solomon Islands.

Remarks : According to Smith-Vaniz (1984) "it probably occurs on the west coast of India." But Talwar and Jhingran (1991) stated that this species is known only from Sri Lanka in the Indian Ocean. The presence of this species in the collected samples from the west coast of India confirms the view of Smith-Vaniz (1984).

Family : LEIOGNATHIDAE

51. *Leiognathus bindus* (Valenciennes)

1835. *Equula bindus* Valenciennes, *Hist. nat. poiss.*, 10 : 78 (Vizagapatnam).

1991. *Leiognathus bindus* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 829, fig. 256.

Material examined : 1, 83 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS- 1786.

Distribution : Indo-West Pacific.

52. *Leiognathus brevirostris* (Valenciennes)

1835. *Equula brevirostris* Valenciennes, *Hist. nat. poiss.*, 10 : 83 (Malabar).

1984. *Leiognathus brevirostris* : Talwar & Kacker, *Commercial Sea Fishes of India* : 506.

Material examined : 1, 81 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1799.

Distribution : Seas of India, Sri Lanka, through Indonesia to China, the Philippines.

53. *Leiognathus dussumieri* (Valenciennes)

1835. *Equula dussumieri* Valenciennes, *Hist. nat. poiss.*, 10 : 77, pl. 283 (Coromandel).

1984. *Leiognathus dussumieri* : Talwar & Kacker, *Commercial Sea Fishes of India* : 509.

Material examined : 1, 59 mm, Kasaragod, 31.01.89, ZSI/MBS- 1794.

Distribution : Madagascar; Pakistan, Sri Lanka, India, Singapore, Celebes, the Philippines.

54. *Leiognathus equulus* (Forsskal)

1775. *Scomber equula* Forsskal, *Descript. animal.* : 75 (Red Sea).

1984. *Leiognathus equulus* : Talwar & Kacker, *Commercial Sea Fishes of India* : 510, fig. 198.

Material examined : 1, 83 mm, Bunder Jetty, Mangalore, 26.01.89. ZSI/MBS-1787.

Distribution : Tropical Indo-West Pacific.

55. *Leiognathus splendens* (Cuvier)

1829. *Equula splendens* Cuvier, *Regne Animal*. (ed. 2), 2 : 212 (India).

1991. *Leiognathus splendens* : Talwar & Jhingran, *Inlands Fishes of India*, 2 : 832.

Material examined : 10, 41-84 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1788; 2, 41 & 68 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1796; 2, 66 & 68 mm, Off Mangalore, 27.01.89, ZSI/MBS-1795; 1, 47 mm, Off Mangalore, 27.01.89, ZSI/MBS-1904; 2, 70 & 80 mm, Someshwar, 28.01.89, ZSI/MBS-1769; 2, 45 & 50 mm, Kasaragod, 31.01.89, ZSI/MBS-1793; 1, 47 mm, Cannanore, 01.02.89, ZSI/MBS-1912; 5, 44-51 mm, Cannanore, 01.02.89, ZSI/MBS-1994.

Distribution : Indo-West Pacific.

56. *Secutor insidiator* (Bloch)

1787. *Zeus insidiator* Bloch, *Naturges. ausland. Fische*, 8 : 41, pl. 192, figs. 2 & 3 (Suratte, India).

1991. *Secutor insidiator* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 833, fig. 258

Material examined : 1, 77 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1797; 4, 72-79 mm, Off Mangalore, 27.01.89, ZSI/MBS-2022; 2, 68 & 76 mm, Someshwar, 28.01.89, ZSI/MBS-1770; 1, 75 mm, Kasaragod, 31.01.89, ZSI/MBS-1798.

Distribution : Indo-West Pacific.

Family : GERREIDAE**57. *Gerres lucidus* Cuvier**

1830. *Gerres lucidus* Cuvier, in Cuvier & Valenciennes, *Hist. nat. poiss.*, 6 : 477 (Pondicherry).

Material examined : 1, 72 mm, Cannanore, 01.02.89, ZSI/MBS-1916.

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

Remarks : This is often considered as *Gerres limbatus* Cuvier. According to Woodland (1984), "*G. limbatus* differs from *G. lucidus* mainly in absence of the black spot on the tip of spinous part of dorsal fin, but probably conspecific" Based on the descriptions provided by Day (1875), Weber and de Beaufort (1931) and Woodland (1984), it is observed that apart from the spinous dorsal fin tip with black spot, there are three rows of scales between 5th dorsal spine and lateral line (cf. four rows in *G. limbatus*); pectoral fin tip reaching to the level of anus (cf. reaching to anal fin origin in *G. limbatus*). Hence, it is considered that both the taxa are valid. Further, the authors are of the opinion that synonymising *G. lucidus* with *Gerres setifer* (Hamilton) by Weber and de Beaufort (1931) is erroneous.

Family : HAEMULIDAE

58. *Pomadasys maculatum* (Bloch)

1797. *Anthias maculatus* Bloch, *Naturges. ausland. Fische*, 7 : 9, pl. 326, fig. 2 (East Indies).

1986. *Pomadasys maculatum* : Smith & McKay, in Smith & Heemstra, *Smith's Sea Fishes* : 570, fig. 179.15.

Material examined : 1, 71 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS-1927; 1, 73 mm, Off Mangalore, 27.01.89, ZSI/MBS-1928; 1, 64 mm, Someshwar, 28.01.89, ZSI/MBS-1984; 1, 71 mm, Kasaragod, 31.01.89, ZSI/MBS- 1909.

Distribution : Indo-West Pacific.

Family : NEMIPTERIDAE

59. *Nemipterus japonicus* (Bloch)

1791. *Sparus japonicus* Bloch, *Naturges. ausland. Fische*, 5 : 110, (no locality).

1990. *Nemipterus japonicus* : Russel, *FAO Fish Synop.*, (125) 12 : 40, fig. 72, pl. 2 b.

Material examined : 2, 90-100 mm, Cannanore, 01.02.89, ZSI/MBS-1998 & 1970; 1, 87 mm, Puthiyangadi, 02.02.89, ZSI/MBS-1971.

Distribution : Indo-West Pacific.

60. *Nemipterus randalli* Russell

1986. *Nemipterus randalli* Russell, *Sanckenberg. Biol.*, 67 : 23, fig. 2 (Persian Gulf, Red Sea, Gulf of Aden, Zansibar, Seychelles, Madagascar, Pakistan, India).

Material examined : 1, 76 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS- 1968; 2, 68 & 87 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1967; 3, 63-73 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1969; 1, 87 mm, Cannanore, 01.02.89, ZSI/MBS- 1999.

Distribution : East coast of Africa, Red Sea, Persian Gulf to east coast of India, Andamans.

Family : SCIAENIDAE

61. *Johnieops sina* (Cuvier)

1830. *Corvina sina* Cuvier, *Hist. nat. poiss.*, 5 : 122 (Pondicherry and Malabar).

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

Material examined : 1, 55 mm, Someshwar, 28.01.89, ZSI/MBS-1767; 3, 57-63 mm, Kotikulam, 30.01.89, ZSI/MBS- 2010; 1, 88 mm, Cannanore, 01.02.89, ZSI/MBS-1959.

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

62. *Johnius belangerii* (Cuvier)

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

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

Material examined : 9, 40-111 mm, Cannanore, 01.02.89, ZSI/MBS- 1962.

Distribution : Pakistan, India through Indonesia to eastern coast of Australia, north to Japan.

63. *Johnius elongatus* Mohan

1976. *Johnius elongatus* Mohan, *Matsya*, 1 : 19, fig. 1 (Veraval, Gujarat).

Material examined : 1, 88 mm, Kotikulam, 30.01.89, ZSI/MBS- 2011.

Distribution : West coast of India, and Sri Lanka.

64. *Johnius glaucus* (Day)

1876. *Sciaena glaucus* Day, *Fishes of India* : 192, pl. 46, fig 2, (Malabar and Bombay).

1984. *Johnius glaucus* : Mohan, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 4 : SCIAEN John 8.

Material examined : 4, 60-78 mm, Cannanore, 01.02.89, ZSI/MBS-1996.

Distribution : West coast of India.

65. *Kathala axillaris* (Cuvier)

1830. *Corvina axillaris* Cuvier, *Hist. nat. poiss.*, 5 : 113 (Malabar).

1984. *Kathala axillaris* : Talwar & Kacker, *Commercial Sea Fishes of India* : 656, fig. 261.

Material examined : 3, 56-67 mm, Kasaragod, 31.01.89, ZSI/MBS- 1961; 4, 59-66 mm, Cannanore, 01.02.89, ZSI/MBS- 1995; 10, 55-110 mm, Cannanore, 01.02.89, ZSI/MBS- 1958.

Distribution : India, Sri Lanka, probably eastward to Malay.

66. *Otolithes ruber* (Schneider)

1801. *Johnius ruber* Schneider, *Syst. Ichthyol. Bloch* : 75, pl. 17 (Tranquebar).

1984. *Otolithes ruber* : Talwar & Kacker, *Commercial Sea Fishes of India* : 644, fig. 267.

Material examined : 7, 55-93 mm, Cannanore, 01.02.89, ZSI/MBS- 1960; 1, 64 mm, Cannanore, 01.02.89, ZSI/MBS- 1997.

Distribution : Indo-West Pacific.

Family : MULLIDAE

67. *Upeneus sulphureus* Cuvier

1829. *Upeneus sulphureus* Cuvier, *Hist. nat. poiss.*, 3 : 450 (Anjer Straits of Sunda).

Material examined : 1, 133 mm, Off Mangalore, 27.01.89, ZSI/MBS-1946.

Distribution : Tropical Indo-West Pacific.

68. *Upeneus vittatus* (Forsskal)

1775. *Mullus vittatus* Forsskal, *Descript. animal.* : 31 (Djedda).

1986. *Upeneus vittatus* : Ben-Tuvia, in Smith & Heemstra, *Smith's Sea Fishes*: 613, pl. 70, fig. 196.13.

Material examined : 2, 84 & 108 mm, Someshwar, 28.01.89, ZSI/MBS- 1785; 1, 125 mm, Puthiyangadi, 02.02.89, ZSI/MBS- 1943.

Distribution : Indo-West Pacific.

Family : SCATOPHAGIDAE

69. *Scatophagus argus* (Linnaeus)

1766. *Chaetodon argus* Linnaeus, *Syst. Nat.* (ed. 12), 1 : 464 (India).

1991. *Scatophagus argus* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 875, fig. 264.

Material examined : 1, 110 mm, Cannanore, 01.02.89, ZSI/MBS- 1990.

Distribution : India, Sri Lanka, through Indonesia, to Australia, the New Hebrides and the Solomon Islands.

Family : MUGILIDAE

70. *Liza macrolepis* (Smith)

1849. *Mugil macrolepis* Smith, *Illustr. Zool. S. Africa*, 4 : pl. 28, fig. 2 (Freshwater lakes and rivers of South Africa).

1991. *Liza macrolepis* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 891.

Material examined : 1, 115 mm, Kasaragod, 31.01.89, ZSI/MBS-2017.

Distribution : Indo-West Pacific.

Family : SPHYRAENIDAE

71. *Sphyraena obtusata* Cuvier

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

Material examined : 2, 142 & 182 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1953.

Distribution : Indo-Pacific.

Remarks : The exact distribution of small baracudas of the Indo-Pacific is not known because of difficulties in identification of the types and other museum specimens (De Sylva and Williams, 1986). The present specimens are assigned to the species after de Sylva (1975) and Rose (1984).

Family : POLYNEMIDAE

72. *Eleutheronema tetradactylum* (Shaw)

1804. *Polynemus tetradactylus* Shaw, *General Zoology*, 5 : 155 (Vizagapatnam).

1991. *Eleutheronema tetradactylum* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 907, fig. 271.

Material examined : 1, 65 mm, Cannanore, 01.02.89, ZSI/MBS- 1910.

Distribution : Persian Gulf, through India to Indonesia, to China, the Philippines and north and western Australia.

Family : CALLIONYMIDAE

73. *Callionymus japonicus* Houttuyn

1782. *Callionymus japonicus* Houttuyn, *Verh. Holl. Maatsch. Wet. Haarlem*, 20 : 311 (Japan ?).

Material examined : 1, 76 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS- 2020.

Distribution : India, eastward to Western Pacific.

Remarks : The assignement of the taxon is tentative. The present specimen resembles *Callionymus longicaudatus* Schlegel as it is described by Day (1876). Although de Beaufort (1951) has doubtfully synonymised it with *C. japonicus* Houttuyn, the same is followed by latter authors. The specimen under study has 18 rays in pectoral fin, second spine of the first dorsal fin not elongated and the first dorsal fin is freckled but a large black spot between the first and second spine absent.

Family : TRICHIURIDAE

74. *Trichiurus lepturus* Linnaeus

1758. *Trichiurus lepturus* Linnaeus, *Syst. Nat.* (ed. 10) : 246 (South Carolina, North America).

Material examined : 1, 395 mm TL, Off Mangalore, 27.01.89, ZSI/MBS- 1963; 2, 435 mm TL (in the second specimen the tail portion broken), Cannanore, 01.02.89, ZSI/MBS- 1964.

Distribution : Throughout tropical and temperate waters of the world.

Family : SCOMBRIDAE

75. *Rastrelliger kanagurta* (Cuvier)

1817. *Scomber kanagurta* Cuvier, *Regne Animal.*, 2 : 313 (Vizagapatnam).

1983. *Rastrelliger kanagurta* : Collette & Nauen, *FAO Fish. Synop.*, (125) 2 : 48.

Material examined : 1, 146 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1956; 2, 107 & 144 mm, Kasaragod, 31.01.89, ZSI/MBS- 1957.

Distribution : Indo-West Pacific.

76. *Scomberomorus commerson* (Lacepede)

1800. *Scomber commerson* Lacepede, *Hist. nat. poiss.*, 1 : 598, 600-603, pl. 20, fig. 1 (Mauritius).

1983. *Scomberomorus commerson* : Collette & Nauen, *FAO Fish. Synop.*, (125) 2 : 63.

Material examined : 1, 200 mm, Off Mangalore, 27.01.89, ZSI/MBS- 2015; 1, 205 mm, Kasaragod, 31.01.89, ZSI/MBS-2016; 1, 250 mm, Puthiyangadi, 02.02.,89 ZSI/MBS- 2014.

Distribution : Indo-West Pacific.

Family : STROMATEIDAE

77. *Pampus argenteus* (Euphrasen)

1788. *Stromateus argenteus* Euphrasen, *Kongl. Vet. Acad. Handl. Stockholm*, 9 : 49 (Castellum Chinese Bocca Tigris Dictum).

1984. *Pampus argenteus* : Talwar & Kacker, *Commercial Sea Fishes of India* : 837, fig. 344.

Material examined : 1, 34 mm, Kasaragod, 31.01.89, ZSI/MBS- 1941.

Distribution : Persian Gulf, through Indonesia to Japan.

Order : PLEURONECTIFORMES

Family : PSETTODIDAE

78. *Psettodes erumei* (Schneider)

1801. *Pleuronectes erumei* Schneider, *Syst. Ichthyol. Bloch* : 150 (Tranquebariam, India).

1984. *Psettodes erumei* : Talwar & Kacker, *Commercial Sea Fishes of India* : 842, fig. 346.

Material examined : 1, 150 mm, Someshwar, 28.01.89, ZSI/MBS- 1983.

Distribution : Indo-West Pacific.

Family : BOTHIDAE

79. *Pseudorhombus triocellatus* (Schneider)

1801. *Pleuronectes triocellatus* Schneider, *Syst. Ichthyol. Bloch* : 145 (East Indian Seas).

1984. *Pseudorhombus triocellatus* : Nielson, in Fischer & Bianchi, *FAO Species Identification Sheets for Fishery Purposes. W. Indian Ocean (Fishing Area 51)*, 1 : BOTH Pseud 7.

Material examined : 2, 74 & 77 mm, Kasaragod, 31.01.89, ZSI/MBS- 1972.

Distribution : West coast of India, eastward to Malay Archipelago.

Family : CYNOGLOSSIDAE

80. *Cynoglossus dubius* Day

1873. *Cynoglossus dubius* Day, *J. Linn. Soc. Zool.*, 11 : 525 (Gwadar).

Material examined : 1, 121 mm, Cannanore, 01.02.89, ZSI/MBS- 1918.

Distribution : West coast of India and Pakistan.

81. *Cynoglossus macrostomus* Norman

1928. *Cynoglossus macrostomus* Norman, *Rec. Indian Mus.*, 30 (2) : 204, fig. 20 (Hooghly estuary, Calcutta).

Material examined : 1, 60 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1906; 2, 115 & 134 mm, Someshwar, 28.01.89, ZSI/MBS-1764; 6, 58-114 mm, Kotikulam, 30.01.89, ZSI/MBS- 2008; 1, 125 mm TL, Kotikulam, 30.01.89, ZSI/MBS- 2009; 1, 119 mm, Kasaragod, 31.01.89, ZSI/MBS- 1907.

Distribution : Coasts of India.

Remarks : The hind part of the body seems to have broken and a regeneration of rays seem to have occurred from the broken area in the specimen numbered ZSI/MBS- 2009.

Order : TETRAODONTIFORMES

Family : TRIACANTHIDAE

82. *Triacanthus biaculeatus* (Bloch)

1786. *Balistes biaculeatus* Bloch, *Naturges. ausland. Fische*, 2 : 19 (East Indies).

1991. *Triacanthus biaculeatus* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 1051.

Material examined : 1, 67 mm, Kasaragod, 31.01.89, ZSI/MBS-1920; 2, 89 & 98 mm, Cannanore, 01.02.89, ZSI/MBS- 1879 & 1988.

Distribution : Indo-West Pacific.

Family : TETRAODONTIDAE

83. *Lagocephalus spadiceus* (Richardson)

1845. *Tetrodon spadiceus* Richardson, *Voy. Sulphur Ichth.* : 123, pl. 58, figs. 4 & 5 (Canton, China).

1991. *Lagocephalus spadiceus* : Talwar & Jhingran, *Inland Fishes of India*, 2 : 1059.

Material examined : 1, 89 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS- 1976; 5, 57-95 mm, Bunder Jetty, Mangalore, 26.01.89, ZSI/MBS- 1978; 1, 61 mm, Off Mangalore, 27.01.89, ZSI/MBS- 1905; 1, 77 mm, Kasaragod, 31.01. 89, ZSI/MBS- 1977.

Distribution : Indo-West Pacific.

ZOOGEOGRAPHICAL REMARKS

The range of distribution of the species included in this paper was studied to throw more light on the zoogeographical affinities of the fish fauna of the Cannanore- Mangalore sector of the west coast of India and arranged in five groups according to zoogeographical relations.

Of the 83 species reported here, four species (4.82%), viz. *Echeneis naucrates* Linnaeus, *Fistularia petimba* Lacepede, *Trichiurus lepturus* Linnaeus and *Sphyrna lewini* (Griffith and Smith) are nearly circumtropical (Group I) in distribution. Thirty seven species (44.58%) are widely distributed in the Indo-West Pacific region (Group II) of which *Rhizoprionodon acutus* (Ruppell) and *Tylosurus crocodilus crocodilus* (Peron and LeSueur) are also found in the Atlantic Ocean. Twenty eight species (33.73%) are spread over the Indo-Polynesian province (Group III) of which *Saurida micropectoralis* Shindo and Yamada is recorded for the first time from the west coast of India.

Seven species (8.43%), viz., *Epinephelus diacanthus* (Valenciennes), *Grammoplites suppositus* (Troschel), *Kathala axillaris* (Cuvier), *Nemipterus randalli* Russell, *Sardinella longiceps* Valenciennes, *Sorsogona melanoptera* Knapp and Wongratana and *Thryssa*

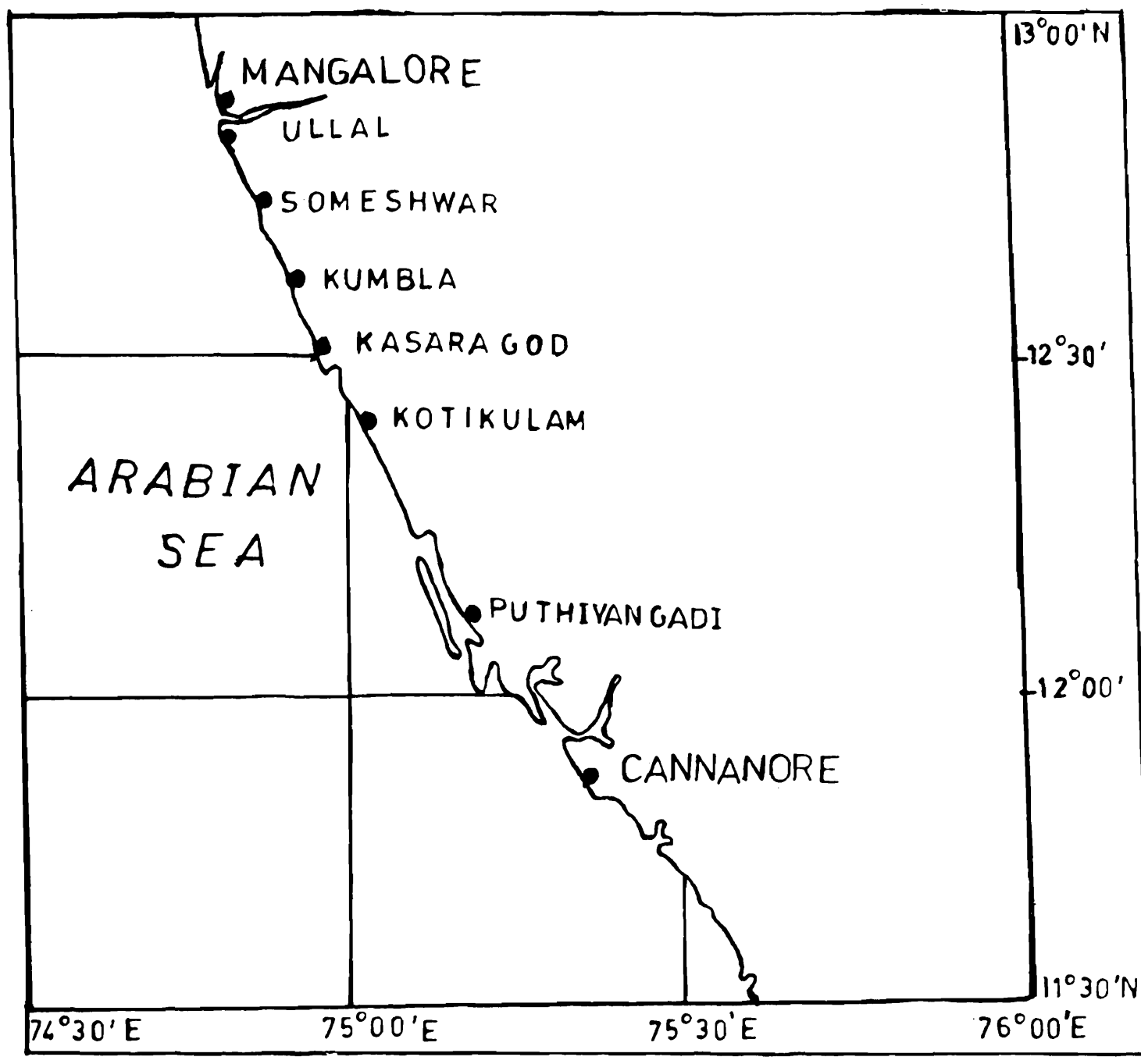


Fig. 1. Map showing the sampling stations.

polybranchialis Wongratana are more or less restricted to the northern Indian Ocean (Group IV). The remaining seven species (8.43%) are endemic to Indian Subcontinental coastal waters (Group V) of which *Cynoglossus dubius* Day, *Johnius elongatus* Mohan and *Johnius glaucus* (Day) are restricted to the West coast of India with ranges extending between Pakistan and Sri Lanka; While *Arius dussumieri* Valenciennes, *Cynoglossus macrostomus* Norman, *Ilisha striatula* Wongratana and *Thryssa dayi* Wongratana are found between the coasts of Pakistan and Myanmar.

Thus, 83.13% of fishes of the Group I, II and III are found in Malay Peninsula, which is considered as the richest faunistic centre and the centre of evolution of most of the shore fauna of the Indo-Pacific region (Ekman, 1953). In accordance with the observations of Menon (1966), the present study too indicates that India has derived its shore fish fauna from this centre of distribution. The rest 16.86% (Group IV and V) of fishes in this composition are certainly the species arising in the peripheral region and as inferred by Briggs (1974), they apparently have been unable to penetrate and successfully colonise the eco-stable evolutionary centre of the Malayan region.

SUMMARY

Fishes collected during the Survey along the Cannanore-Mangalore coasts in January-February, 1989 are studied and a systematic account of 83 species belonging to 61 genera and 43 families are presented. *Saurida microptoralis* Shindo and Yamada is reported for the first time from the west coast of India and the occurrence of *Scoberoides tala* (Cuvier) in the west coast is confirmed. Validity of two taxa, *Gerres limbatus* Cuvier and *Gerres lucidus* Cuvier is discussed. A teratogenic phenomenon of the absence of pectoral fin in *Pterois russellii* Bennett and a case of regeneration of caudal fin rays in *Cynoglossus macrostomus* Norman are reported. Further, a brief zoogeographical discussion of the fishes in the collection is also given in this account.

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, Calcutta and Dr. P. Dhandapani, Deputy Director and Officer in Charge, Marine Biological Station, Zoological Survey of India, Madras for the facilities provided and encouragement. They are grateful to Dr. A. G. K. Menon, Emeritus Scientist for his critical suggestions, to Dr. (Mrs) K. Rema Devi and Dr. (Mrs) T. J. Indra of the Southern Regional Station, Zoological Survey of India, Madras for the help rendered and to the Director, Mangalore Fisheries College, Mangalore for providing their Departmental Boat, M. V Dolphin to collect samples along the Mangalore coast.

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TWO NEW SPECIES OF THE GENUS *PHANEROTOMA* WESMAEL (HYMENOPTERA : BRACONIDAE) FROM INDIA

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INTRODUCTION

The genus *Phanerotoma* Wesmael belongs to the subfamily Cheloninae of the family Braconidae. The genus was first described by Wesmael 1838 to accomodate type species *Chelonus dentatus* Panzer. The genus is divided into two subgenera : *Bracotritoma* Csiki and *Phanerotoma* Wesmael (Achterberg, 1990). The genus is represented by two species viz., *p. hendecasisella* Cameron 1905 and *p. buchneri* Fahringer 1932 from India (Shenefelt, 1973). In the present work two new species of the genus are described from India viz., *Phanerotoma* (*Phanerotoma*) *agarwali* and *Phanerotoma* (*Phanerotoma*) *indica*. The terminology followed after Achterberg (1993).

Phanerotoma (*Phanerotoma*) *agarwali** sp. n.

(Figs. 1A-C)

Female : Head, ocelli, antennae and mesosoma yellowish-brown ; mesoscutum with three yellowish-brown longitudinal bands ; eyes yellowish-black ; ocellar spot black ; legs and metasoma yellow to yellowish-brown. Wings hyaline with brown infuscation below pterostigma ; parastigma, pterostigma, C + SC + R, 1-Ul, 1-M, R, 3-SR, proximal portions of 2-SR and SR1, 1-CU1 and cu-a brown, rest of the veins pale.

Head 1.2X wider than maximum width of mesoscutum ; frons transversally rugose, not depressed behind antennae, with a distinct broad carina ; OOL = 4.0X POL ; length of eye in dorsal view 1.7X length of temple, the latter transversally rugose ; diameter of anterior ocellus 0.8X diameter of posterior ocellus ; face 1.7X as wide as high, transversally rugose,

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

carina in the form of a broad raised band ; clypeus punctate, with three teeth ; malar space 0.86X basal width of mandible ; inner tooth of mandible much shorter than outer. Antenna (fig. B & C) 23-segmented, shorter than body ; scape 2.1X as long as broad, further segments gradually shortening, subapical segments not moniliform, rather robust, apical segment twice as long as broad.

Mesoscutum reticulo-granulate ; scutellum granulate ; propodeum rugose, carina formed by rugosities, lateral tubercles very small. Fore wing (fig. A) 1.4X shorter than body ; pterostigma 2.85X as long as broad, 1.75X shorter than 1-R1 ; maximum width of pterostigma 0.54X vein 3-SR (but pterostigma rolled in) ; r emerging much beyond the middle of pterostigma, 4.8X shorter than 3-SR ; SR1 slightly curved, 2.3X as long as 3-SR ; 2-SR slightly curved at its base ; r-m 1.3X as long as r ; 2-SR + M not distinct (or 2-SR interstitial with m-cu). Mid tibia with blister ; hind femur 4.0X as long as broad, 1.2X shorter than hind tibia ; hind basitarsus 1.3X shorter than tarsal joints 2-4 combined.

Metasoma longitudinally rugose, 1.14X as long as mesosoma ; first and second tergites almost equal, third longer (20 : 21 : 33), with converging carinae on basal half, not reaching up to first suture ; third tergite convex ; apex of metasoma excised with two small lateral tubercles ; ovipositor sheath protruding much beyond the apex of metasoma.

Length : 4.15 mm.

Male : Subapical antennal segments slender than in female ; apex of metasoma less excised, lateral tubercles indistinct.

Holotype " : 2 " ", 2 ♂♂ paratypes ; INDIA : Uttar Pradesh, Aligarh, 29.IX.1971 ; ex *Sylepta derogata* Fabricius on *Gossypium arboreum* L. ; coll. (Shujauddin).

Remarks : The new species *Phanerotoma (Phanerotoma) agarwali* runs close to *P. (P.) hendecasisella* Cameron, but differs in having : (i) antennae shorter than body (ii) clypeus punctate, (iii) vein r and 3-SR of fore wing not forming an arc.

***Phanerotoma (Phanerotoma) indica* sp. n.**

(Figs. 1D-F)

Male : Head, ocelli and first tergite brownish-yellow ; eyes yellowish-black ; ocellar spot black ; antennae yellowish-brown gradually becoming darker apically ; mesoscutum brownish-yellow with two lateral and one medio-basal brown bands, rest of the mesosoma, second and third tergites brown ; legs yellow to brownish-yellow. Wings subhaline with brown infuscation below pterostigma ; pterostigma, C + SC + R, 1-R1, 1-M, r, 3-SR, proximal portion of 2-SR and SR1, 1-CU1 and cu-a brown, rest of the veins pale.

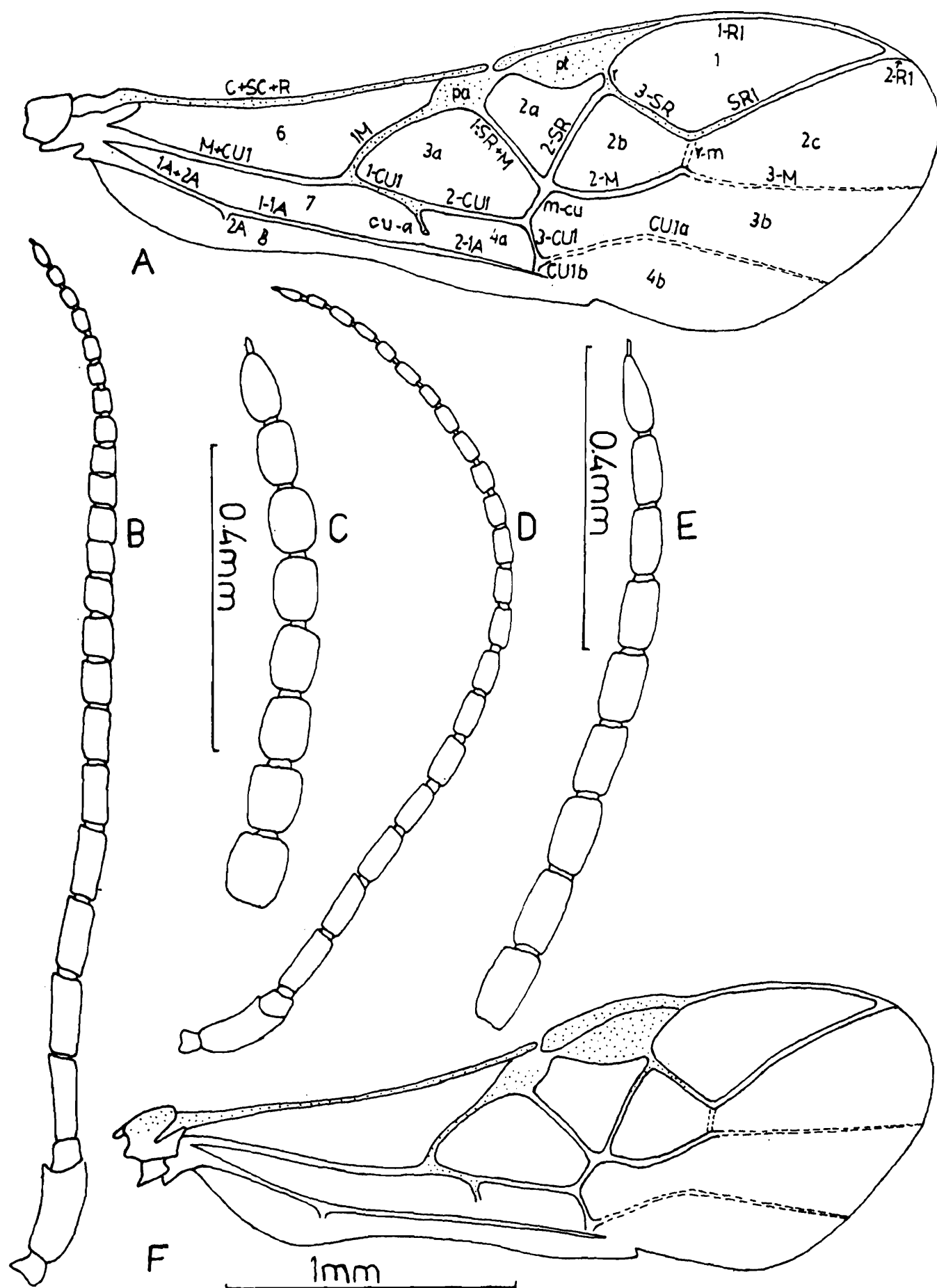


Fig. A-C. *Phanerotoma (Phanerotoma) agarwali* sp. n. ♀. A : Fore wing. B : Antenna. C : Apical part of antenna.
Fig. D-F. *Phanerotoma (Phanerotoma) indica* sp. n. ♂. D : Antenna. E : Apical part of antenna. F : Fore wing.

Head 0.9X wider than maximum width of mesoscutum ; frons reticulate granulate, slightly depressed behind antennae, with a distinct carina (not reaching up to anterior ocellus in 2 ♂♂) ; OOL = 3.3X POL ; length of eye in dorsal vein 1.8X length of temple, the latter reticulate-rugose ; ocelli equal in diameter ; face 1.8X as wide as high, rugose-granulate, carina ending in a tubercle medially ; clypeus punctate, with three teeth ; malar space 0.43X basal width of mandible ; inner tooth of mandible much shorter than outer. Antenna (fig. D & E) 23-segmented, almost as long as body ; scape 2.2X as long as broad, first flagellar segment 2.8X as long as broad, further segments gradually shortening, sub-apical segment slender and elongated, apical segment 3.3X as long as broad.

Mesoscutum reticulate-granulate ; scutellum granulate ; propodeum rugose, with mid transverse carina ; lateral tubercles small. Fore wing (fig. F) 1.4X shorter than body ; pterostigma 2.4X as long as broad, 1.5X shorter than 1-R1 ; maximum width of pterostigma 0.8X vein 3-SR ; r emerging much beyond the middle of pterostigma, 4.0X shorter than 3-SR ; SR1 slightly curved, 2.8X as long as 3-SR ; 2-SR slightly curved at its base ; r-m 1.3X as long as r ; 2-SR + M distinct (or 2-SR not interstitial with m-cu). Mid tibia with blister ; hind femur 3.5X as long as broad ; 1.14X shorter than hind tibia ; hind basitarsus 1.14X shorter than tarsal joints 2-4 combined.

Metasoma with first and third tergites reticulate, second tergite longitudinally rugose ; metasoma 1.3X as long as mesosoma ; first tergite longer than second but shorter than third (18 : 16 : 20), with carinae converging on basal two-third then becoming parallel up to first suture ; third tergite convex ; apex of metasoma not excised.

Length : 3.63 mm.

Male : Unknown.

Holotype " : 6 ♂♂ paratypes ; INDIA : Uttar Pradesh, Aligarh, 2.IX.1968, light trap ; Coll. (Shujauddin).

Remarks : The new species *Phanerotoma (Phanerotoma) indica* differs from *P. (P.) agarwali* sp. n. in having : (i) fore wing with vein 2-SR not interstitial with m-cu (ii) antennae almost as long as body (iii) subapical antennal segments slender and elongated (iv) carinae on first metasomal tergite reaching up to first suture (v) malar space 0.43X basal width of mandible and (vi) OOL = 3.3X POL.

The type material is deposited in the Museum, Department of Zoology, Aligarh Muslim University, Aligarh.

ACKNOWLEDGEMENTS

The authors are grateful to the Chairman, Department of Zoology, Aligarh Muslim University, Aligarh for providing laboratory facilities.

SUMMARY

Two new species of the Genus *Phanerotoma* Wesmael 1938 namely *Phanerotoma (Phanerotoma) agarwaali* and *Phanerotoma (Phanerotoma) indica*, collected from Aligarh (U. P.) India have been described. *P. (P.) agarwali* runs close to *P. (P.) hendecasisella* Cameron 1905 but differs in having (i) antennae shorter than body, (ii) clypeus punctate and (iii) vein r and 3-SR of forewing not forming an arc. *P. (P.) indica* differs from *P. (P.) agarwali* mainly in having (i) forewing with vein 2-SR not interstitial with m -cu, (ii) antennae as long as body, (iii) subapical antennal segment slender and elongated and (iv) carinae on first metasomal tergite reaching upto first suture.

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