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Dr. J. R. B. ALFRED
*Director*
Zoological Survey of India

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Dr. J. R. B. ALFRED
*Director*
Zoological Survey of India

# RECORDS
# OF THE
# ZOOLOGICAL SURVEY OF INDIA

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*Rec. zool. Surv. India :* **99** (Part 1–4) : 1-4, 2001

# ON A NEW SPECIES OF *APACHYUS* SERVILLE (INSECTA : DERMAPTERA) FROM LAOS

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## INTRODUCTION

The genus *Apachyus* Serville, 1831, is known by 11 species (Steinmann, 1989) distributed in Oriental, Ethiopian and Australian Regions. It is characterised by strongly flattened body and the enlargement of ultimate tergite which is termed as anal process or squampygidium occupying bulk of the space between the branches of forceps.

In the Oriental Region four species *viz., A. feae* Bormans, 1894, *A. javanus* Verhoeff, 1902, *A. chartaceus* Haan, 1842, and *A. philipinensis* Srivastava, 1976 are known.

Besides *A. sumatranus* Boesman, 1954, known by males, has been treated as synonym of *A. javanus* Verhoeff, 1902 known on females only by Steinmann (1980) which does not seen convincing. It may be mentioned that Steinmann (1981, p. 141, fig. 19) records *A. javanus* on a male from Luzon (Philippine) which is referrable to *A. sumatranus*.

A new species is described here which differs from all the known species by the shape of anal process.

Family : APACHYIDAE

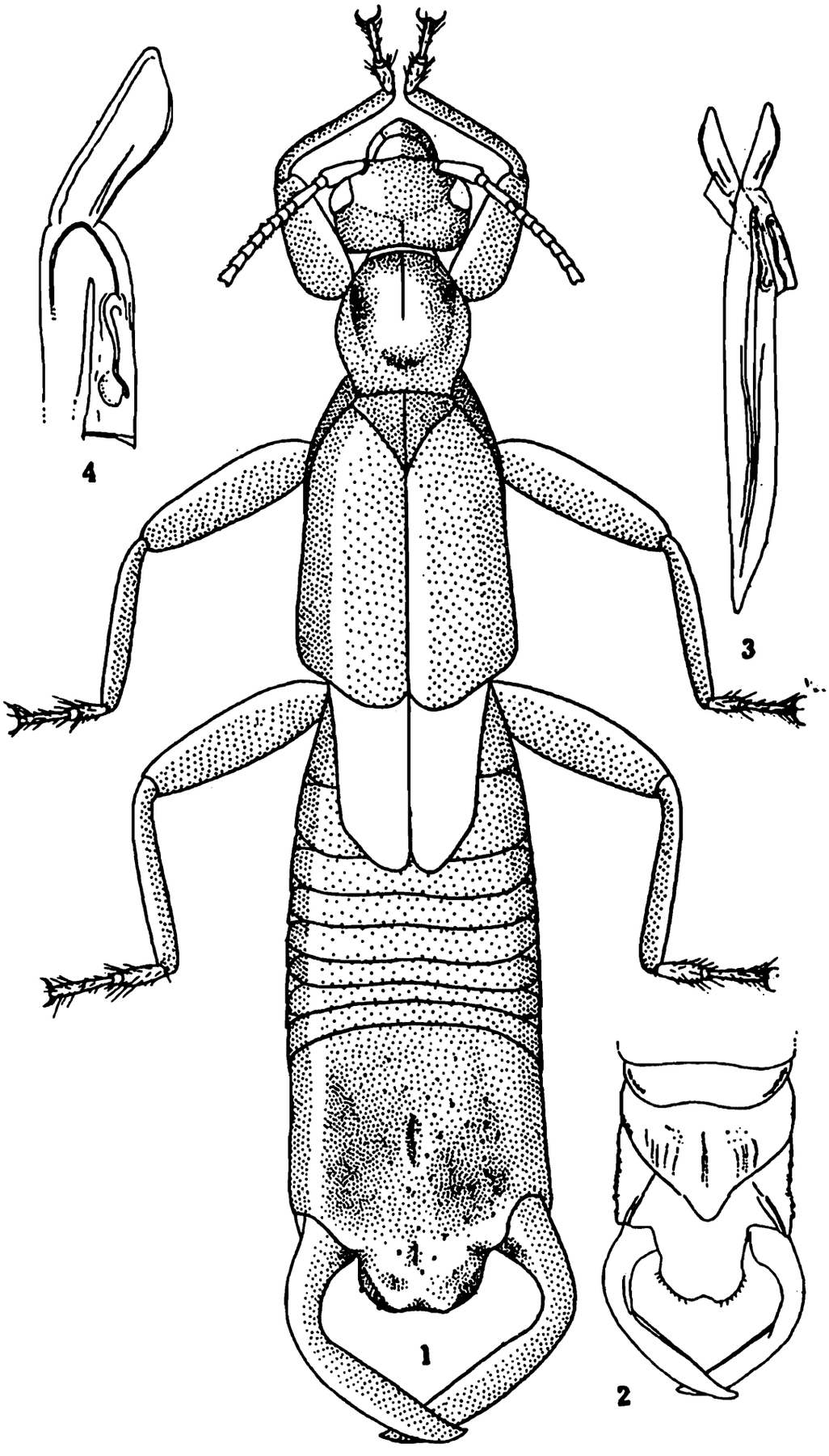
Subfamily : APACHYINAE

***Apachyus brindlei*** sp.n.

(Figs. 1–4)

*Male :* Body strongly depressed. General colour blackish brown, mouth parts, basal three antennal segments and legs yellowish; wings yellow with external and apical margins blackish brown; sides of abdominal tergites, hind margin of ultimate tergite and anal process bordered with black.

Head longer than broad, smooth, sutures fine but distinct, post-ocular area slightly raised, hind margin emarginate in middle. Eyes slightly shorter than post-ocular length. Antennae 42-segmented (or more since apical segments appear to be broken), 1st segment stout, expanded apically, slightly shorter than the distance between antennal bases; 2nd transverse; 3rd long and slender, almost equal




**Figs. 1-4.** *Apachyus brindlei* sp.n., Holotype Male; 1, Dorsal view; 2, Hind portion of body, vertral view; 3, Genitalia; 4, Paramere with distal lobe and apical portion of proparamere—enlarged.

to the combined length of 4th to 6th; 4th and 5th transverse; 6th about as long as broad; 7th slightly longer than broad, remaining gradually increasing in length and thining. Pronotum about as long as broad, anterior margin convex, sides depressed and strongly convex in middle, hind margin truncate, median sulcus distinct. Elytra well developed, shoulder weak, expanded apically, axillary angles rounded off, showing a broad triangular scutellum with a median sulcus. Wings about 2/3 as long as elytra, smooth. Prosternum slightly longer than broad, paralled sided, constricted at the insertion of fore-coxae; afterward greatly expanded, anterior margin convex, hind margin in middle truncate, laterally oblique and straight. Mesosternum transvrse, gently expanded posteriorly, hind margin subrotundate with emargination in middle. Metasternum weakly transverse, gently narrowed beyond the insertion of hind-coxae, posterior margin truncate with faint emargination in middle. Legs typical of the genus. Abdomen slightly narrowed at base, afterwards almost parallel sided, tergite with faint longitutional striolations, ventrally with striolations, sides of sternites 7th to 9th with tuberculated ridge, ridge complete on 7th and 8th but on 9th restricted at base only for a short distance, 8th sternite with hind margin emerginate in middle. Penultimate sternite triangular, obtusely produced in middle posteriorly, median sulcus faint, obsolete in basal $^1/_4$. Ultimate tergite longer than broad, sides almost parallel and vertrally provided with a row of small tubercles, disc above medially with a shallow depression, surface rough with numerous small tubercles, more closely placed at base and gradually distantly placed apically. Anal process somewhat broadly rounded, laterally with two or three tubercles, hind margin emarginate in middle, upper surface smooth, slightly depressed medially, ventrally surface striolate laterally, medially feebly sulcate, postero-laterally slightly convex or thickened. Forceps with branches cylindrical and regularly curved in a little over basal 1/3, afterwards, abruptly bent, depressed, inner margin straight, externally curved, apices gently hooked, pointed and crossing. Male genitalia with parameres 3 times longer than broad, external and internal margin straight, apical margin oblique and straight, inner apical angle rounded, external apical angle produced into a short obtute lobe, distal lobes slightly longer than parameres; virga tubular, short, stout and undulate. Length : body –40.5 mm, forceps –5.0 mm.

*Female* : Unknown.

*Material examined* : Holotype Male (genitalia mounted between two coverslips and attached to the pin of the specimen), LAOS : Van Eeva, 16.III.1966, Randon coll.; deposited in B. P. Bishop Museum, Honolulu, Hawaii, U.S.A.

*Remarks* : In having yellow wings the described species comes close to *A. feae* Bormans, with Brindles' Key (1965, p. 441) but differs by the shape of anal process, in males, which is rounded posteriorly and emarginate in middle and virga comparatively shorter.

It can be separated from *A. philippinensis* Srivastava, 1976, which is described on female only, by shape of pronotum being about as long as broad and narrowed apically and basally.

## ACKNOWLEDGEMENTS

I am thankful to the Director, Zoological Survey of India, for necessary facilities and to the Curator, B. P. Bishop Museum, Honolulu, Hawaii, U.S.A., for placing this interesting specimen at my disposal for study.

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# STUDIES ON *PTEROMALUS* SWEDERUS (HYMENOPTERA: CHALCIDOIDEA : PTEROMALIDAE) OF THE INDIAN SUBCONTINENT WITH THE DESCRIPTION OF THREE NEW SPECIES

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## INTRODUCTION

*Pteromalus* Swederus is a cosmopoliton genus of Pteromalidae which includes over 100 species throughout the world (Boucek, 1988). They are mainly parasites in pupae of various Lepidoptera, Coleoptera, Hymenoptera, gall making Tephritidae (Diptera) etc., of which *P. puparum* (Linnaeus) is well known as a cosmopolitan parasite of Pieridae. Graham (1969) treated most of the European species of *Pteromalus* under *Habrocytus* Thomson but the latter was merged with *Pteromalus* by Boucek & Graham (1978) maintaining it as a subgenus.

So far only three species are known under *Pteromalus* from the Indian subcontinent *viz.*, *P. puparum* (Linnaeus), *P. semotus* (Walker) and *P. sequester* Walker (Boucek *et. al.*, 1979). Here three new species are described under the genus from India. *P. semotus* (Walker) and *P. sequester* Walker are redescribed based on the study of the type material obtained from BMNH. A key to separate the species of *Pteromalus* of the Indian subcontinent is also provided.

*Abbreviations used* : F1–F6–Funicular segments 1 to 6; POL–Postocellar length; OOL–Ocellocular length; SMV–Submarginal vein; MV–Marginal vein; PMV–Postmarginal vein; STV–Stigmal vein; T1–Gastral tergie 1, BMNH–British Museum (Natural HIstory), London, U.K.; ZSIC–Zoological Survey of India, Western Ghat Field Research Station, Calicut.

*Key to the species of* ***Pteromalus*** *from the Indian subcontinent*

1. Clypeus with anterior margin deeply incised medially, hence appearing almost bidentate (Fig. 1);.propodeum (Fig. 24) with median area almost shiny with complete median carina ..... ..... *sequester* Walker.

— Clypeus with anterior margin not as above, shallowly to moderately emarginate; propodeum with median area finely or moderately reticulate; median carina not complete, if complete, only vaguely indicated ..... 2

2. Propodeum (Figs. 10, 23) with costula indicated, plicae not complete, not reaching hind margin of nucha ..... 3

— Propodeum (Figs. 21, 22, 25) with costula not indicated, plicae complete, reaching hind margin of nucha ..... 4

3. Gaster (Fig. 15) elongate, 1.2x as long as head plus mesosoma combined, length 2.6x width in dorsal view; antennal scape reaching to upper margin of median ocellus; F1 (Fig. 4) longer than pedicel (6 : 5), clava as long as two preceding segments combined; body dark metallic blue ..... *metallicus* sp. nov.

— Gaster (Fig. 8, 12) short, a little shorter than head plus mesosoma combined, length 1.6x width in dorsal view; scape hardly reaching median ocellus; F1 a little shorter than pedicel (0.8 – 0.9x); clava a little shorter than two preceding segments combined; body black ..... *keralensis* sp. nov.

4. Propodeum (Fig. 21) with nucha long, medially propodeum 0.7x as long as scutellum; POL as long as OOL; gaster (Fig. 16) shorter than head plus mesosoma combined; temple (Fig. 19) wide, length 0.6x eye length ..... *puparum* (Linnaeus).

— Propodeum with nucha short, medially propodeum 0.4 – 0.5 x as long as scutellum; POL 1.8 to 2x OOL; gaster longer than head plus mesosoma combined; temple narrow, length 0.3 – 0.4x eye length ..... 5

5. Antennae (Fig. 5) with F1 longer than pedicel; propodeum (Fig. 22) medially 0.4x as long as scutellum; gaster (Fig. 17) 1.3x as long as head plus mesosoma combined and 2.5x as long as wide in dorsal view; MV (Fig. 7) 2x as long as STV; POL 2x OOL ..... *nigrus* sp. nov.

— F1 little shorter than pedicel; propodeum (Fig. 25) medially 0.5x as long as scutellum; gaster (Fig. 14) 1.1x as long as head plus mesosoma combined and 2.1x as long as wide; MV short, 1.1 – 1.6x as long as STV; POL 1.8x OOL ..... *semotus* (Walker)

### 1. *Pteromalus sequester* Walker

(Figs. 1, 3, 13, 24)

1835. *Pteromalus sequester* Walker : *Ent. Mag.* 2 : 495.

1914. *Habrocytus medicaginis* Gahan : *Proc. U. S. natn. Mus.* 48. 163–164. (Synonymy by Boucek, 1988 : 432.)

For lectotype selection and various synonyms see Graham, 1969 : 554–555.

The species is redescribed here based on the study of the lectotype of *Pteromalus sequester* Walker selected by Graham, 1969 : 554.

*Female* : Length 3 mm. Head and mesosoma metallic bluish green; gaster mostly brown with metallic blue reflection on T1 and dorsolateral sides. Antennae with scape testaceous, remainder dark brown. Coxae concolrous with mesosoma; femora dark brown, remainder of legs testaceous with tips of tarsi brown. Tegulae dark brown; wings hyaline; veins brown.

*Head* : Closely and moderately reticulate, pubescence short and sparse; clypeus (Fig. 1) radiately striated, anterior margin deeply incised medially. In dorsal view head width 2x length; POL 1.4x OOL; temple round, length 0.6x eye length; eye height 1.7x width. Antennal scape nearly reaching level of vertex, pedicel plus falgellum length 0.9x head width; pedicel as long as F1; proximal funicular segments longer than wide, distal segments subquadrate or at most the sixth transverse; clava as long as two preceding segments combined.

*Mesosoma* : Moderately reticulate; pubescence short and sparse. Mesoscutum width 1.5x length. Scutlellum medially 0.83x as long as mesoscutum, slightly longer than broad, frenal line indicated on sides. Propodeum (Fig. 24) shiny, median carina complete; propodeal nucha represented only by a narrow, transverse strip; spiracles elongate, oval, close to hind margin of metanotum. Forewing almost bare in the basal half, otherwise pubescence moderately dense; costal cell hairy towards the tip. Relative lengths : SMV 35, MV 18.5, PMV 15, STV 12.

*Gaster* : (Fig. 13) Dorsally collapsihg, elongate, in dorsal view length 2x width and 1.3x as long as head plus mesosoma combined.

*Material examined* : Lectotype : Female : ENGLAND (BMNH type Hym. 5. 2754) Det. Graham, 1968.

### 2. *Pteromalus semotus* (Walker)

(Figs. 14, 18, 25)

1834. *Eutelus semotus* Walker : *Ent. Mag.* 2 : 367.

1906. *Etroxys marginicolis* Cameron, *J. Bombay. Nat. Hist. Soc.* 17 : 97. (Synonymy by Boucek *et. al.*, 1979 : 454).

1953. *Habrocytus milleri* Delucchi & Verbeke : *Bull. Inst. r. Sci. nat. Belg.* 29(3) : 1–14. (Synonymy by Graham, 1969 : 529).

For various synonyms see Graham, 1969 : 529–531.

The species is redescribed here based on the study of the lectotype of *Etroxys marginicolis* Cameron.

*Female* : Length 2.8mm. Body dark metallic green with golden reflection, prominent on dorsal part of gaster. Antennae testaceous. Coxae concolrous with mesosoma, femora brown, remainder of legs pale yellow. Tegulae brown; wings hyaline, veins yellow.

*Head* : (Fig. 18) Reticulation and pubescence as in *P. sequester*. In dorsal view head width 2x length; POL 1.8x OOL; temple length 0.4x eye length. In front view head width 1.3x height; eyes separated by 1.3x their height; malar space length 0.5x eye height; eye height 1.5x width; anterior margin of clypeus weakly emarginate; malar grooves weakly indicated. Antennae with scape reaching to upper margin of median ocellus, length 0.9x eye height; pedicel little longer than F1 (4.5 : 3.5).

*Mesosoma* : Reticulation and pubescence as in *P. sequester*; anterior margin of pronotum sharp, not margined. Scutellum slightly longer than broad, medially 0.8x as long as mesoscutum, frenal line indicated on the sides. Propodeum (Fig. 25) with median area moderately reticulate, lateral area

finely reticulate, medially propodeum 0.5x as long as scutellum, nucha short. Metapleuron finely reticulate. Forewing with pubescence less dense, marginal fringe short. Relative lengths : SMV 31, MV 13, PMV 15.5, STV 11.5.

*Gaster* : (Fig. 14) Little longer than head plus mesosoma combined (62 : 55) and 2.1x as long as broad in dorsal view.

*Material examined* : Lectotype : Female : PAKISTAN : Quetta, 7.03. Nurse coll. 1915–34. (BMNH type Hym. 6.704), Det. Boucek, 1978.

*Other material examined* : 1 Female, INDIA : Kerala; Trichur district, Vazhani, 7.ii.1989; 1 Female, Waynad district, Thariyod, 22.ii.1988; 2 Female, Ernakulam, 9.ii.1989; 1 Female, Kannur district, Kannavam forest, 1.ii.1995; Coll. P. M. Sureshan; 25 Female, Malappuram district, Calicut University campus, 1987–1989, Coll. T. C. Narendran & party; 15 Female, Idukki district, Eravikulam National Park, 1993–1995, Coll. P. M. Sureshan (in ZSI. Calicut).

### 3. ***Pteromalus puparum*** (Linnaeus)

(Figs. 2, 6, 16, 21)

1758. *Ichneumon puparum* Linnaeus : *Syst. Nat.* 1 : 567

For lectotype designation and various synonyms see Graham, 1969 : 489–490.

Description of the species is provided below based on the study of Indian specimens.

*Female* : Length 2.4–3 mm. Body dark metallic blue. Antennae with scape testaceous, remainder brown. Coxae concolrous with mesosoma, femora dark brown except tips and remainder of legs testaceous with tips of tarsi brown. Tegulae dark brown, wings hyaline, veins pale brown.

*Head* : Moderately and closely reticulate, pubescence short and sparse. In dorsal view head width 2.1x length and in front view width 1.5x height; temple length 0.6x eye length; POL as long as OOL; eyes seperated by 1.7x their height; eye height 1.7x width; malar space length 0.7x eye height; malar grooves weakly indicated; anterior margin of clypeus shallowly emarginate. Antennae (Fig. 2) with scape reaching level of vertex, little shorter than eye height (0.9x), combined length of pedicel plus flagellum equal to head width; F1 longer than pedicel; funicular segments longer than wide; clava almost equal to two preceding segments combined.

*Mesosoma* : Reticulate punctate; pronotal collar distinctly narrower than head, width 7.7x length. Mesoscutum width 2x length. Scutellum medially little longer than mesoscutum (20.5 : 19), frenal line vaguely indicated. Propodeum (Fig. 21) medially 0.7x as long as scutellum, median area moderately reticulate, lateral area finely reticulate, median carina vaguely indicated; plicae complete, nucha long, about one third as long as propodeum. Forewing (Fig. 6) with basal part almost bare, costal cell hairy on the upper part, basal hairline indicated. Relative lengths : SMV 42, MV 20, PMV 21, STV 13.

*Gaster* : (Fig. 16) Ovate, shorter than head plus mesosoma combined and 1.6x as long as broad in dorsal view.

*Material examined* : 1 Female : INDIA : Kerala : Palghat district, Anakkatty, 12.xii.1987; 1 Female, Palghat district, Mukali, 10.xii.1987, Coll. P. M. Sureshan; 1 Female, Wynad district, Sultan's Battery, 19.ix.1985, Coll. T. C. Narendran (in ZSI, Calicut).

### 4. ***Pteromalus metallicus*** sp. nov.

(Figs. 4, 15, 23)

*Female* : Length 2.6–3.6 mm (Holotype 3.6 mm). Head and mesosoma dark metallic blue with bronzy reflection; gaster blackish blue, T1 dorsally with strong metallic blue reflection. Antennae testaceous with scape and pedicel pale. Coxae concolrous with mesosoma, femora dark brown except tips and remainder of legs yellow with tips of tarsi brown. Tegulae pale brown, wings hyaline, veins yellow.

*Head* : Moderately reticulate, reticulation finer on lower face and gena, pubescence small and sparse; clypeus radiately striated, anterior margin moderately emarginate; in dorsal view head width 2.3x length and in front view width 1.2x height; temple length 0.6x eye length; POL 1.5x OOL; eyes separated by 1.4 their height; eye height 1.6x width; malar space length 0.5x eye height; scape length 0.9x eye height; pedicel plus flagellum (Fig. 4) length 0.9x head width, pedicel little shorter than F1; clava as long as two preceding segments combined.

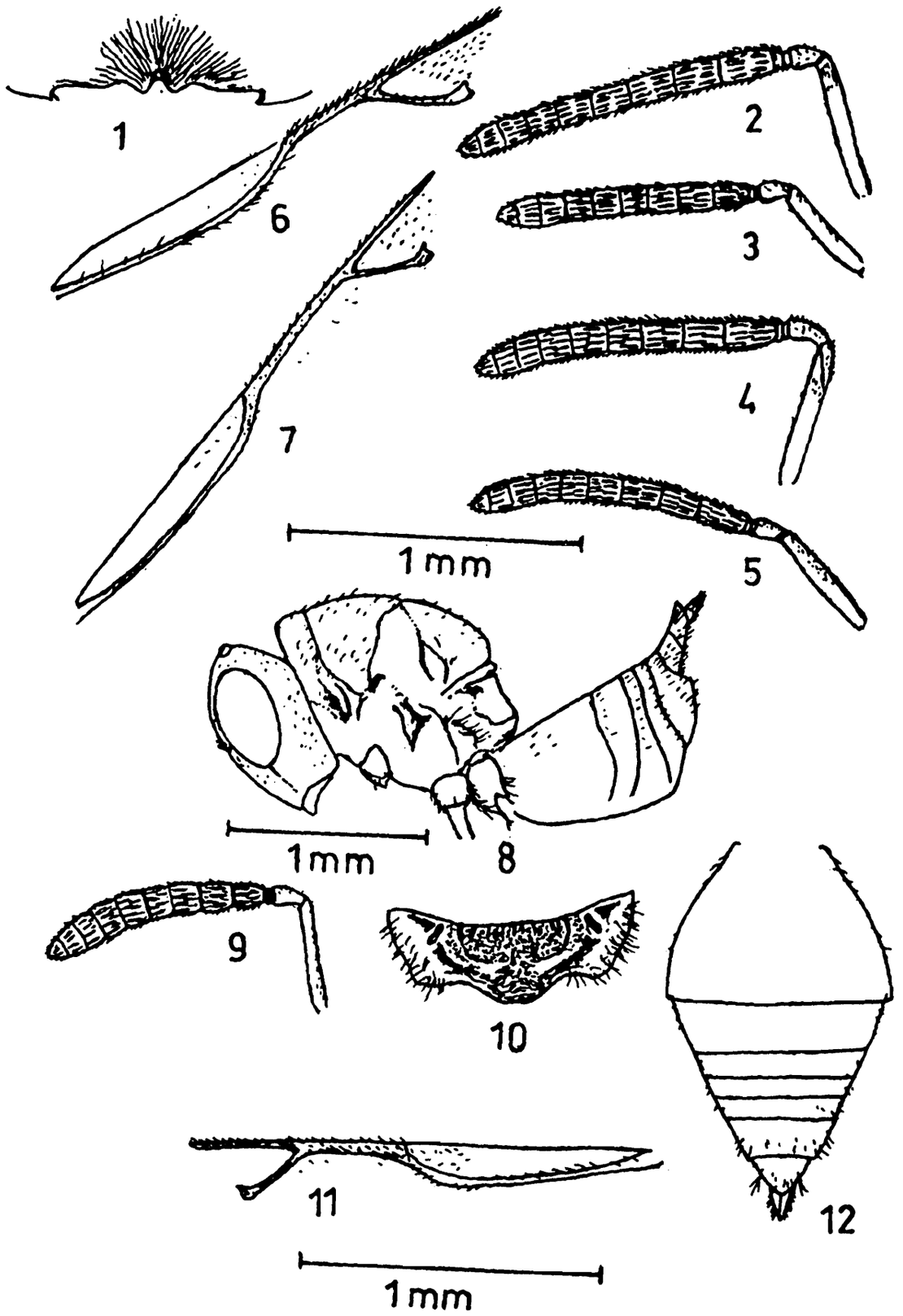
*Mesosoma* : Distinctly reticulate punctate. Pronotal collar anteriorly sharp. Mesoscutum width 2.1x length. Scutellum medially little longer than mesoscutum (21 : 20). Propodeum (Fig. 23) medially 0.6x as long as scutellum, median area moderately reticulate, other areas and nucha finely reticulate, median carina indicated only anteriorly, plicae not indicated beyond weak costula, the area infront of costula slightly depressed, spiracles oval, elongate, very close to metanotum. Forewing with costal cell hairy towards the tip, basal hairline indicated by 3 or 4 hairs. Relative lenghts : SMV 40, MV 19, PMV 18, STV 12.

*Gaster* : (Fig. 15) 1.2x as long as head plus mesosoma combined, in dorsal view length 2.6x width, lanceolate.

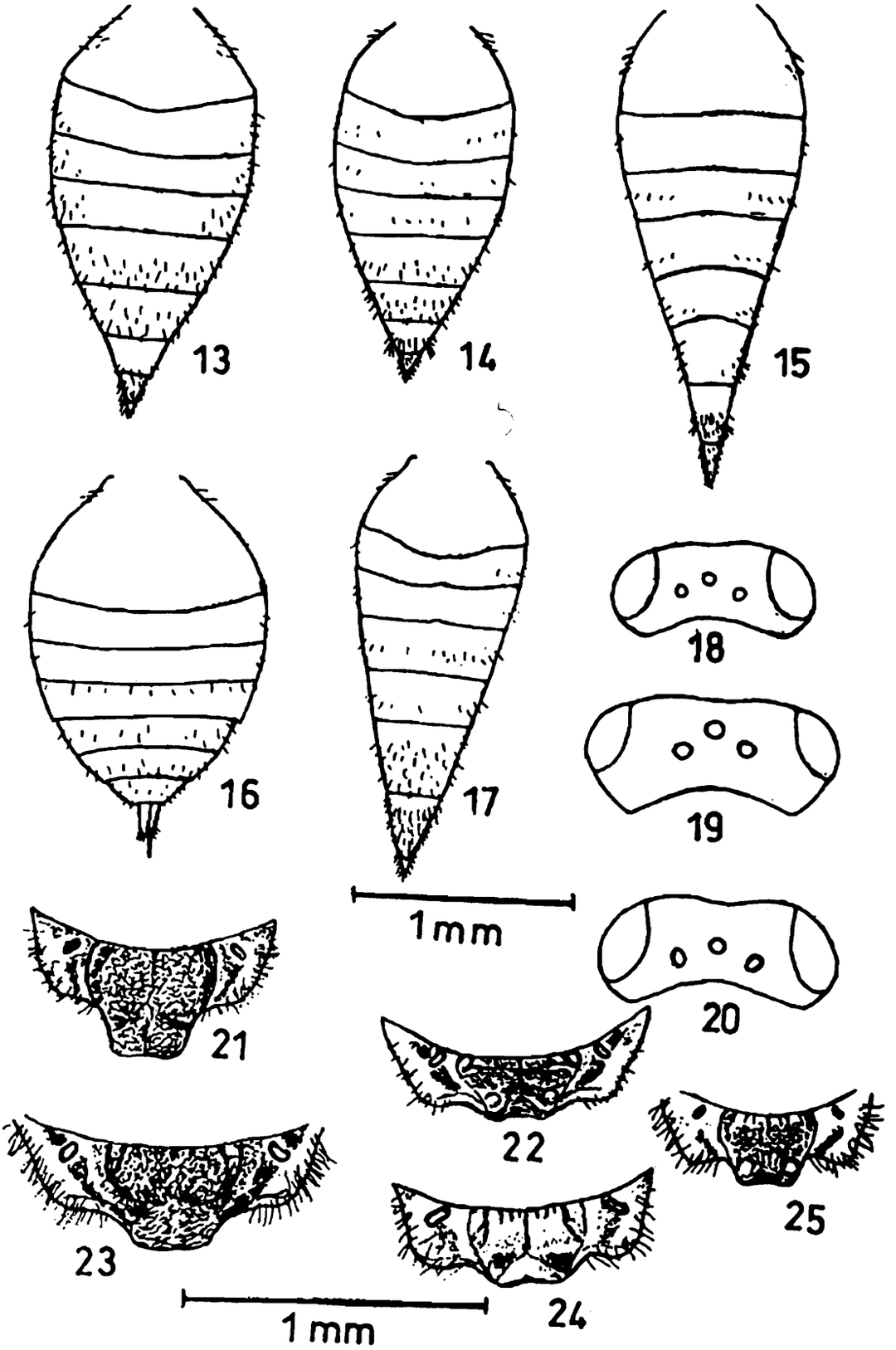
*Male* : Length 2.2 mm. Resembles female but differs in having gaster short and compressed, with a yellow spot dorsally on basal half, antennae with dense pubescence.

*Holotype* : Female : INDIA : Kerala, Kannur district, Tellicherry, 4.ii.1995, Coll. P. M. Sureshan; *Paratypes* : 4 Female, 1 Male, same data as that of holotype; 1 Female, Kerala, Kannur district, Kottiyoor Forest, 2.ii.1995, 1 Female, Kannavam forest, 1.ii.1995, 1 Female, Malappuram district, Calicut University campus, ix.1985; 1 Female, Alappuzha district, Kayamkulam, 19.ii.1989; 1 Female, Karnataka, Coorg district, Nemanakolly, 7.ii.1994, Coll. P. M. Sureshan (in ZSI, Calicut).

*Remarks* : This species resembles *P. integer* (Walker) in having propodeum with posterior part of plicae strongly converging, median area with a costula, in body colour and large size but differs in having proximal segments of antennal funicle longer than wide and F1 longer than pedicel (in *integer* proximal segments of antennal funicle subquadrate and F1 hardly as long as pedicel).




**Figs. 1-12.** *Pteromalus* spp. 1, *P. sequester* Walker, female, clypeus; 2, *P. puparum* (Linnaeus) female, antenna; 3, *P. sequester* Walker, female antenna; 4, *P. metallicus* sp. nov. female, antenna; 5, *P nigrus* sp. nov. female antenna; 6, *P. puparum* (Linnaeus), female, forewing venation; 7, *P. nigrus* sp. nov. forewing venation; 8–12. *P. keralensis* sp. nov. female, 8, body in profile; 9, antenna; 10, propodeum in dorsal view; 11, forewing venation; 12, gaster in dorsal view.




**Figs. 13–25.** *Pteromalus* spp. gaster in dorsal view. 13, *P. sequester* Walker, 14, *P. semotus* (Walker); 15, *P. metallicus* sp. nov.; 16, *P. puparum* (Linnaeus); 17, *P. nigrus* sp. nov.; 18–20. *Pteromalus* spp. head in dorsal view. 18, *P. semotus* (Walker); 19, *P. puparum* (Linnaeus); 20, *P. nigrus* sp. nov.; 21–25. *Pteromalus* spp. propodeum in dorsal view. 21, *P. puparum* (Linnaeus), 22, *P. nigrus* sp. nov.; 23, *P. metallicus* sp. nov.; 24, *P. sequester* Walker; 25, *P. semotus* (Walker).

### 5. *Pteromalus nigrus* sp. nov.

(Figs. 5, 7, 17, 20, 22)

*Female* : Length 1.8–3.8 mm (Holotype 3.2 mm) Head and mesosoma bluish black; gaster brownish black with blue reflection mainly on dorsal and lateral areas. Antennae with scape and pedicel testaceous, remainder dark brown. Coxae concolrous with mesosoma, femora brown, remainder of legs pale testaceous with tips of tarsi brown. Tegulae brown, wings hyaline, veins pale brown.

*Head* : (Fig. 20) Uniformly and finely reticulate, 1.1x as broad as mesosoma, in dorsal view width 2.2x length and in front view width 1.3x height; vertex narrow, abruptly sloping; temple narrow, length 0.3x eye length; POL 2x OOL; anterior margin of clypeus emarginate; malar space length 0.34x eye height; eye height 1.5x width; eyes separated by 1.3x their height. Antennae (Fig. 5) inserted below centre of face, scape length 0.7x eye height, combined length of pedicel plus flagellum 0.9x head width; F1 1.5x as long as pedicel, all funicular segments longer than wide; clava as long as two preceding segments combined.

*Mesosoma* : Moderately reticulate. Mesoscutum width 1.8x length. Scutellum with frenal line vaguely indicated, medially 0.84x as long as mesoscutum. Propodeum (Fig. 22) with median area finely reticulate, medially 0.4x as long as scutellum; median area with two transverse depressions connecting basal and apical foveae of both sides; plicae less sharp, spiracles large and oval, median carina vaguely indicated at the base. Forewing (Fig. 7) length 2.2x width; pubescence less dense, basal hair line not indicated. Relative lengths : SMV 34, MV 20.5, PMV 16.5, STV 10.5.

*Gaster* : (Fig. 17) Elongate, 1.3x as long as head plus mesosoma combined and 2.5x as long as wide in dorsal view; hind margin of T1 produced.

*Holotype* : Female : INDIA : Kerala : Palghat district, Malampuzha, i.1986, Coll. P. M. Sureshan; *Paratypes* : 1 Female, same data as that of holotype; 1 Female, Malampuzha, 13.i.1986; 1 Female, Palghat district, Kalkandi, 13.xii.1987; 3 Female, Malampuzha, 21.v.1985, 15.i.1986, 21.ii.1997, Coll. P. M. Sureshan (in ZSI, Calicut).

*Remarks* : This species resembles *P. fasciatus* Thomson in the nature of propodeum, pronotum and having longer MV but differs in having scape not reaching level of vertex and upper surface of mesoscutum not distinctly curved (in *fasciatus* scape raching level of vertex or even slightly above it and upper surface of mesoscutum distinctly curved).

### 6. *Pteromalus keralensis* sp. nov.

(Figs. 8–12)

*Female* : Length 1.4–2.4 mm (Holotype 2.2 mm). Body black with metallic blue reflection on dorsal part of gaster. Antennae with scape and pedicel testaceous, remainder pale brown. Coxae concolrous with mesosoma, femora dark brown except at tips and remaining parts testaceous with tips of tarsi brown. Tegulae dark brown; wings hyaline, veins pale brown.

*Head* : (Fig. 8) Moderately and closely reticulate; pubescence sparse and small. In dorsal view head width 2.4x length and in front view width 1.3x height; temple length 0.5x eye length; POL 1.8x OOL; malar grooves indistinct; malar space length 0.5x eye height; eye height 1.7x width; eyes separated by 1.5x their height; clypeus anteriorly emarginate. Antennae (Fig. 9) with scape hardly reaching median ocellus, length 0.8x eye height; pedicel plus flagellum length 0.8x head width; F1 almost equal to pedicel; F1–F3 longer than wide; F4 sub quadrate; F5 and F6 quadrate; clava 1.2x as long as two preceding segments combined.

*Mesosoma* : (Fig. 8) Moderately reticulate, pubescence less distinct; anterior margin of pronotal collar rounded. Mesoscutum width 2.1x length. Scutellum medially as long as mesoscutum. Propodeum (Fig. 10) medially half as long as scutellum, median area closely and moderately reticulate, otherwise finely reticulate, almost shiny; median carina vaguely indicated; plicae distinct; costula indicated, nucha moderate; spiracles large and oval, almost touching metanotum. Forewing (Fig. 11) length 2.4x width, almost bare on the basal part, costal cell hairy towards the tip. Relative lengths : SMV 30, MV 15.5, PMV 13, STV 9.

*Gaster* : (Figs. 8, 12) Short, ovate, length 1.6x width, little shorter than head plus mesosoma combined (0.9x), length 1.6x width in dorsal view.

*Male* : Length 1.9 mm. Resembles female but differs in having gaster compressed with an yellow spot at base and flagellum with pubescence dense.

*Holotype* : Female : INDIA : Kerala, Alappuzha district, Kayamkulam, 19.ii.1989, Coll. P. M. Sureshan; *Paratypes* : 1 Male, 1 Female, Kerala : Palghat district, Anakkatty, 7.i.1989; 19 Female, Ernakulam, 9.ii.1989, 6 Female, data same as that of holotype; 2 Female, Kerala, Eravikulam National Park, 28.ii.1995, 1 Female, Kerala : Parambikulam wild life sanctuary, Anappady, 6.v.1989; 1 Female, Karnataka : Coorg district, Sollekolly, 6.iii.1994; 1 Female, Kerala : Kannur district, Aralam farm, 25.ii.1988, Coll. P. M. Sureshan; 1 Female, Kerala : Palghat district, Silent valley, 30.xii.1988; 13 Female, Kerala : Malampuzha, i.1986, Coll. Narendran & party (in ZSI, Calicut).

*Remarks* : In the nature of propodeum, gaster and forewing venation this species resembles *P (H) scandiae* Graham but differs in having antennal flagellum proximally stouter than pedicel, pedicel as long as F1, mesoscutum 2.1x as broad as long (in *scandiae* antennal flagellum proximally not stouter than pedicel, pedicel distinctly longer than F1, and mesoscutum about 1.6x as broad as long).

## SUMMARY

Three new species of *Pteromalus* Swederus *viz. P. metallicus*, *P. nigrus* and *P. keralensis* are described from India. *P. sequester* Walker and *P. semotus* (Walker) are redescribed from the lectotype.

## ACKNOWLEDGEMENTS

I am grateful to the Director, Zoological Survey of India, Calcutta and the Officer-in-charge, Zoological Survey of India, Western Ghats Field Research Station, Calicut for providing facilities

and encouragement. I am also grateful to Dr. John. S. Noyes and Miss. Suzanne Lewis, BMNH, London for providing the type material on loan and to Dr. T. C. Narendran, University of Calicut for encouragement and useful suggestions.

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*Rec. zool. Surv. India* **99** (Part 1–4) : 15-21, 2001

# A NEW SPECIES AND A NEW RECORD OF THE GENUS *PERGAMASUS* (ACARINA : MESOSTIGMATA : PARASITIDAE) FROM INDIA

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## INTRODUCTION

Berlese (1904) proposed the subgenus *Pergamasus* under the genus *Gamasus* Latr. and designated *Acarus crassipes* Linn. as typespecies. Hull (1918) first elevated *Pergamasus* to generic rank. The genus is cosmopolitan in distribution but so far it is not known from India.

In the present paper, *Pergamasus* (*Pergamasus*) *ranikhetensis* sp. nov. has been described and illustrated as a new species while *Pergamasus* (*Pergamasus*) *longicornis* Berlese (1906) is the first record from the Indian as well as Oriental region.

The specimens were prepared for microscopical study by clearing them in 60% lactic acid. All the figures have been drawn from the temporary preparation in lactic acid. Structures requiring detailed study, for example leg II of male, chelicerae, pedipalps and genital shield of female were dissected and prepared separately.

The type-material is deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

### *Pergamasus (Paragamasus) ranikhetensis* sp. nov.

(Text-figs. 1–4)

*Male* : Holodorsal shield 1.315 mm long, 0.775 mm wide, entire, with 43 pairs of simple and pilose setae (Fig. 1). Posterior of idiosoma show tendency of neotrichy.

Genital aperture situated on antero-median margin of holoventral shield. Chaetotactic pattern as in fig. 2. Stigma situated between coxae III and IV; peritreme narrow, extending posterior to coxa I.

Tectum basically with two spines, one spine slightly denticulate (Fig. 3). Palpal trochanter, femur and genu with 2, 5 and 7 setae respectively; apotele 3-tined. Ventrally gnathosma with four pairs of hypostomatic setae. Internal malae partly fringed.

All legs with claws and pulvilli. Distinctive features of femur, genu and tibia of leg II with variously shaped spurs (Fig. 4).

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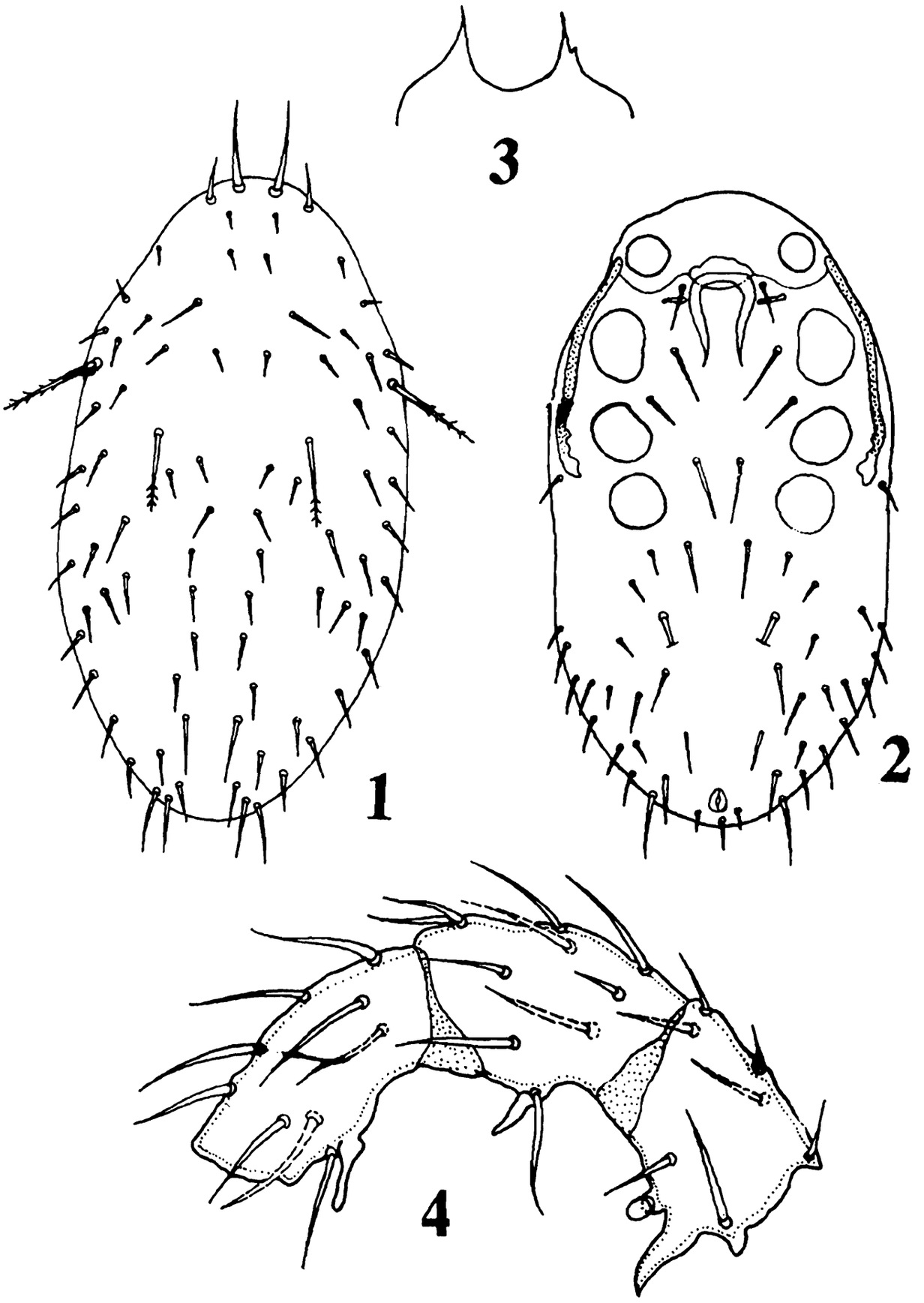


**Figs. 1-4.** *Pergamasus (Pergamasus) ranikhetensis* sp. nov., male. 1. Dorsum, 2. Venter, 3. Tectum, 4. Leg II (partly).

*Female* : Unknown.

*Material Examined* : Holotype male, ex. leaf litter under raddish and pea plants; Rajpur Gaon, Ranikhet, Almora District, Uttar Pradesh; 20.iv.1971; S. K. Bhattacharyya coll.

*Differential Diagnosis* : The new species, *Pergamasus* (*Paragamasus*) *ranikhetensis* sp. nov. differs more markedly from *Pergamasus* (*Paragamasus*) *dilatatellus* Berlese, 1905 by the shape of accessory spur of the femur and the relative length of other spurs of the leg II.

*Etymology* : The species is named after the type-locality.

### *Pergamasus (Pergamasus) longicornis* Berlese

(Text-figs. 5–15)

1906 *Gamasus* (*Pergamasus*) *crassipes* var. *longicornis* Berlese, *Redia*, **3** : 232.

1906. *Gamasus* (*Pergamasus*) *crassipes* (L.) Latr. Berlese, *Redia*, **3** : 229.

1912. *Pergamasus crassipes* (L.) var. *longicornis* : Tragardh, *Arch, Zool. Exper. gen.*, **8** : 523.

1915. *Gamasus* (*Pergamasus*) *crassipes* (L.) var. *longicornis*, Tragardh, The Natural History of Juan Fernandez and Easter Islands, **3** : 603.

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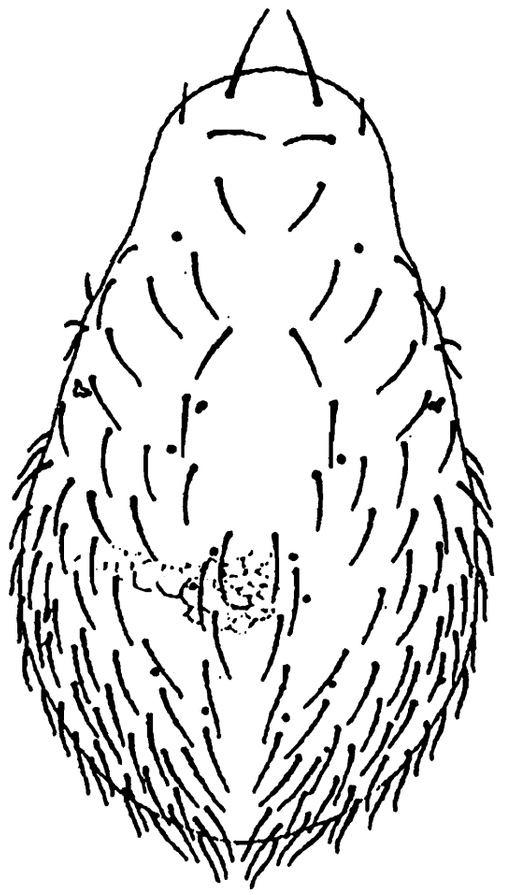
1988. *Pergamasus* (*Pergamasus*) *longocornis*, Hennessey and Farrier, *N. Carolina Agric. Res. Serv. Tech. Bull.* **285** : 13.

1989. *Pergamasus* (*Pergamasus*) *longicornis*, Hennessey and Farrier, *N. Carolina Agric. Res. Serv. Tech. Bull.*, **289** : 54.

*Male* : Dark brown, strongly sclerotized. Holodorsal shield 1.275–1.284 mm long, 0.714–0.747 mm wide, pear-shaped, regionally reticulated. Opisthosomal region densely covered with setae (Fig. 5).

Two large presternal shields flanking genital sclerite. Tritosternum with a basal part and a pair of pilose lacinae. Genital lamina produced anteriorly into a sharply pointed spine (Fig. 6) and covering tritosternal base. Chaetotactic pattern of holovenural shield as figured. Stigma placed between coxae III and IV; peritreme extending to coxa I; post-stigmatal extension of peritrematal shield reaching to podal shield of coxa IV.

Tectum as in fig. 7. Palpal trochanter without any tubercle; femur bearing a comb-like seta and genu with two spatulate setae. Fixed and movable digits of chelicera with rows of teeth (Fig. 8).



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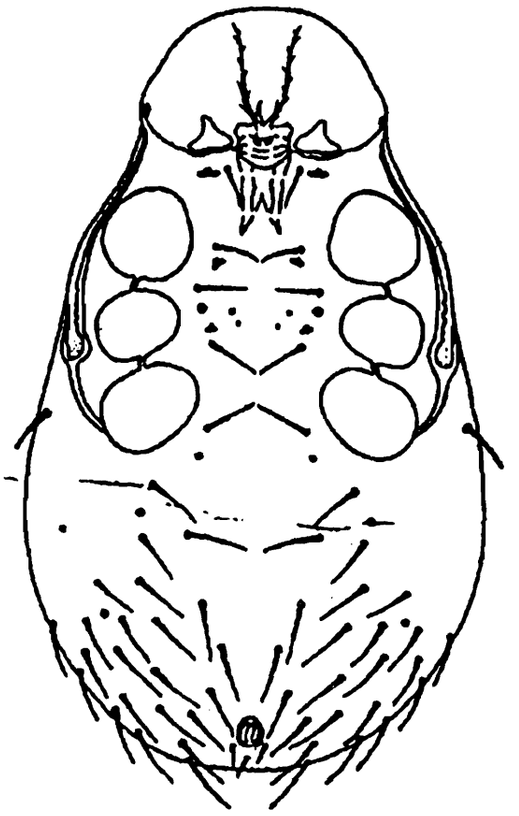

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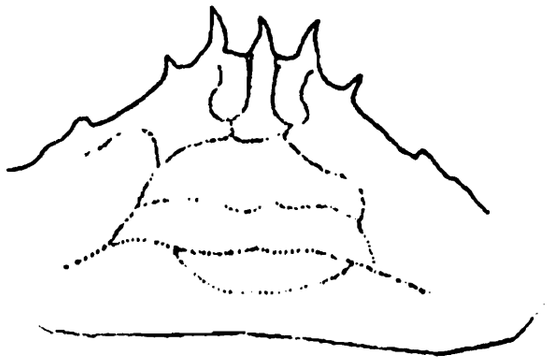

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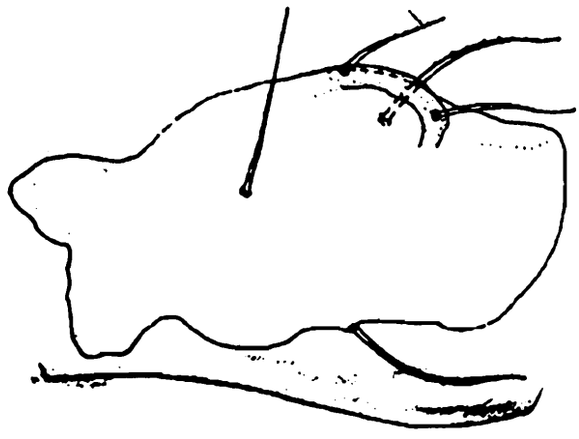
Figs. 5–8. *Pergamasus* (*Pergamasus*) *longicornis* Berlese, male. 5. Dorsum, 6. Venter, 7. Tectum, 8. Chelicera.



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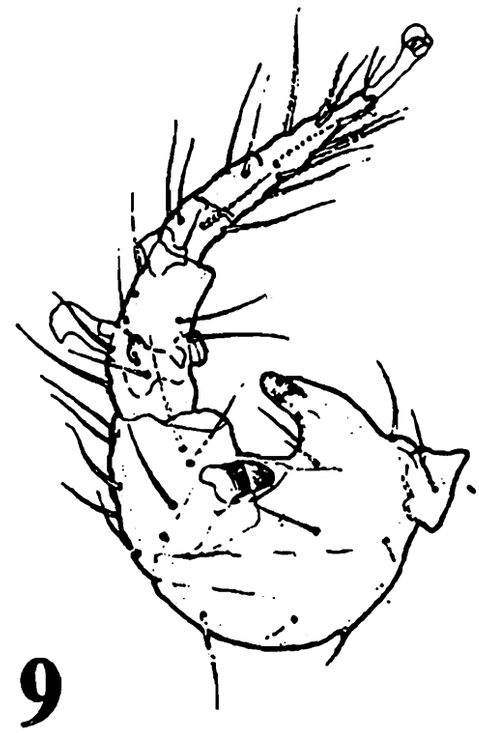

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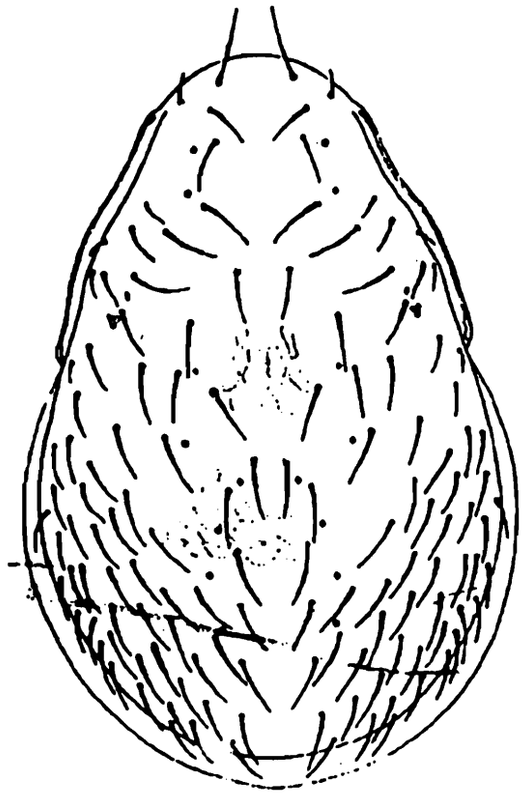

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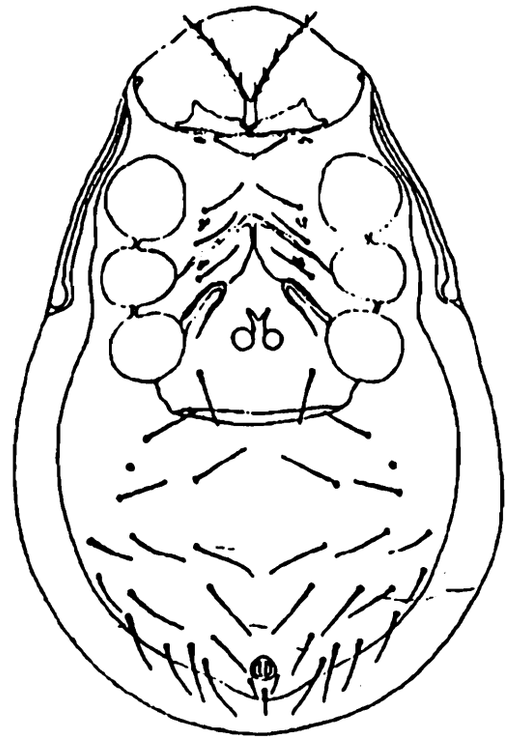

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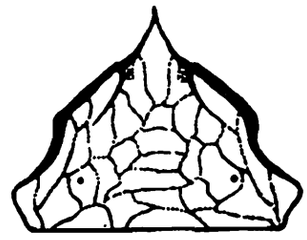
**Figs. 9–10.** *Pergamasus* (*Pergamasus*) *longicornis* Berlese, male. 9. Armature of leg II, 10. Trochanter of leg IV

**Figs. 11–12.** *Pergamasus* (*Pergamasus*) *longicornis* Berlese, female. 11. Dorsum, 12. Venter.



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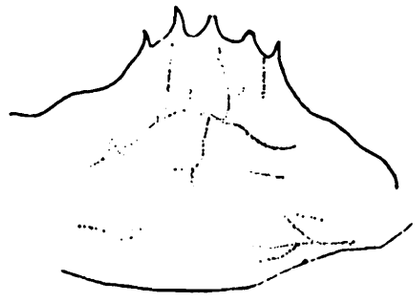

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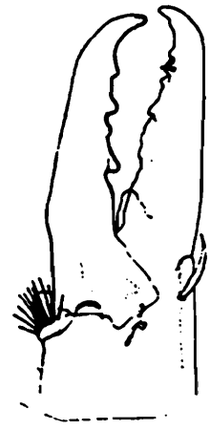

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**Figs. 13–15.** *Pergamasus* (*Pergamasus*) *longicornis* Berlese, female. 13. Genital shield, 14. Tectum, 15. Chelicera.

Spermadactyl normal. Corniculus distinctly stalled. Entire lateral (outer) margin of internal mala fringed. Hypognathal groove of gnathosoma with eleven rows of denticles.

Leg II variously spurred (Fig. 9). Femur crassata with a strong falcate spur; genual spur tubular. Tibia with a distal, medial and lateral spurs, median process terminating in a hooklike structure. Trochanter of leg IV as in fig. 10.

*Female* : Dorsal shield 1.268–1.317 mm long, 0.797–0.815 mm wide, oval, regionally regticulated, neotrichous (Fig. 11).

Tritosternum with a long basal part and a pair of pilose lacinae. A pair of broad presternal shields situated near anterior margin of sternal shield and almost meeting in medial line. Metasternal shields free. Endogynium consisting of a pair of round sacs with a bifurcate median process (Fig. 12). Genital shield as in fig. 13. Chaetotaxy of opisthogastric shield as delineated. Stigma positioned between coxae III and IV; peritreme extending to coxa I. Peritrematal shield entirely fused with dorsal shield.

Tectum 5-pronged (Fig. 14). Pedipalp essentially same as in male. Dentition of chelicera shown in fig. 15. Proximal portion of internal malae fringed. Hypognathal denticles arranged in twelve rows.

Trochanter of leg IV without any spur.

*Material Examined* · One male, under grass, Regional Fruit Research Station, Mashorba, Shimla, Himachal Pradesh, 13.ii.1978, S. K. Bhattacharyya coll. Eight males, leaf litter, Botanical Garden, Ooty, Nilgiri Dist., Tamil Nadu, 9.ii.1982, S. K. Bhattacharyya coll. One female, rotten water hyacinth, bank of Ooty Lake, Ooty, Nilgiri Dist., Tamil Nadu, 11.ii.1982, S. K. Bhattacharyya coll. One female, leaf litter, near Aruvankadu Railway Station, Nilgiri Dist., Tamil Nadu, 7.ii.1982, S. K. Bhattacharyya coll. One female, *Datura* leaf litter, Kotagiri, Nilgiri Dist., Tamil Nadu, 14.ii.1982, S. K. Bhattacharyya coll. Four females, wild leaf litter, Kotagiri, Nilgiri Dist., Tamil Nadu, 14.ii.1982, S. K. Bhattacharyya coll. Two females, litter under creeper, Pomberpuram, Kodaikanal, Madurai Dist., Tamil Nadu, 24.ii.1982, S. K. Bhattacharyya coll. Two females, berry leaf litter, St. Mary Road, Kodaikanal, Madurai Dist., Tamil Nadu, 24.ii.1982, S. K. Bhattacharyya coll. Two females, leaf litter, bank of Kodaikanal Lake, Kodaikanal, Madurai Dist., Tamil Nadu, 23.ii.1982, S. K. Bhattacharyya coll.

*Distribution* : The species is reported from Northern Europe, Norway, Germany, Ireland, Australia, Juan Fernandez and Eastern Islands, Belgium, Switzerland, British Isles, Austria, Spain, France, Hungary, New Zealand, South Africa, U.S.A., Canada.

*Type* : In Berlese's Collection, Stazione di Entomologia Agraria Firenze, Italy.

*Remarks* : The species is sympatric and sometimes coexist with *P.* (*P.*) *crassipes*. The two species are easily confused but can be distinguished by a number of morphological characters.

## ACKNOWLEDGEMENTS

The authors are gateful to the Director, Zoological Survey of India for providing necessary facilities.

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*Rec. zool. Surv. India* : **99** (Part 1–4) : 23-26, 2001

# A NEW SPECIES OF THE GENUS *LASIOSEIUS* BERLESE (ACARI : GAMASIDA : ASCIDAE) FROM INDIA

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## INTRODUCTION

The members of the genus *Lasioseius* form a dominant group among the free-living ascid mites in India. The genus *Lasioseius* was proposed by Berlese in 1916 for *Lasioseius muricatus* (Koch, 1839). Literature studies reveal the presence of nearly one hundred species of *Lasioseius* all over the world. Bhattacharyya *et al.* (2000) reported the presence of eight species of *Lasioseius* in the Indian region. In the present paper the authors are going to describe a new species, *Lasioseius annandalei*. The holotype and the paratype are deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

Soil samples were brought to the laboratory in the polythene bags, and the mites were extracted by using modified Tullgren apparatus. The specimens were preserved in 70% ethanol, cleared in lactic acid, and mounted in Hoyer's medium.

### *Lasioseius annandalei* sp. nov.

*Female* : Dorsal shield reticulated over entire surface, longer (395.61μ) than wide (276.07 μ), with twenty-three pairs of faintly serrated setae (Fig. 1); anterior region with eleven pairs of setae, r2 absent, j1 and r3 measuring 34.15 μ and 54.07 μ respectively; posterior region with twelve pairs of setae, J-series imcomplete, with only three pairs of satae; length of J-series setae shorter than their distances between their bases; setae J5 (17.07 μ) and Z5 (76.84 μ) are respectively the shortest and longest setae of all dorsal setae; Z4 and S5 subequal in length (71 μ); four pairs of short, simple marginal setae arise from the body margin; peritreme visible dorsally extending beyond setae j1.

Tritosternum well-developed, lacinae pilose only at anterior region (Fig. 2); pre-sternal area lineated; sternal shield reticulated, 82.53 μ long along its midline, 130.92 μ wide between two anterolateral corners, with three pairs of subequal sternal setae; anteromedian margin of sternal shield wavy, anterolateral portion slightly extended anteriorly, posterior margin highly concave; fourth pair of sternal setae on metasternal shield. Genital shield truncate posteriorly, narrowing

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anteriorly, with a pair of genital setae on its lateral margin. Ventri-anal shield (162.2 μ long, 210.6 μ wide at their widest point) reticulated, with five pairs of pre-anal setae excluding a pair of para- and a post-anal setae, posterior end forming a cribrum; ventral membrane with five pairs of setae around ventri-anal shield, largest one serrated in nature. Paired conspicuous metapodal shields present along lateral margin. Remnants of free endopodal shields present between coxae III and IV. Peritrematal shield wide, extending upto posterior level of coxa II; peritreme long, narrow, extending from stigma to level of paravertical setae; stigma situated at level of anterior half of coxa IV.

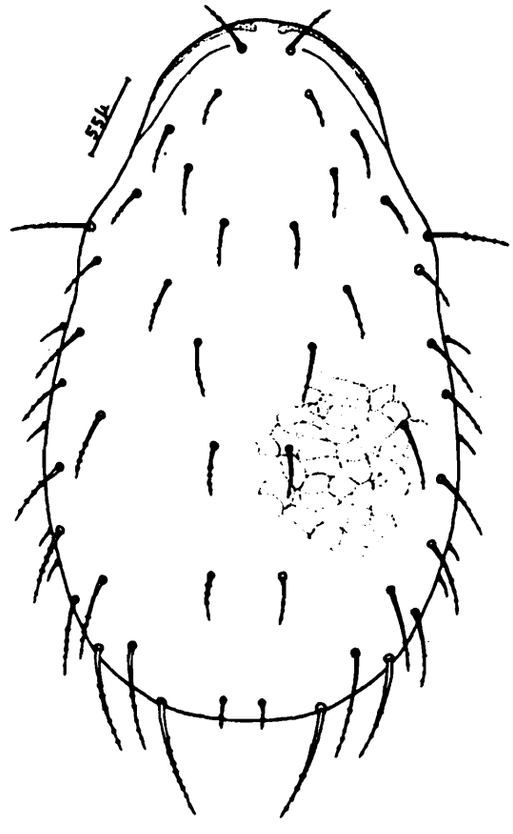
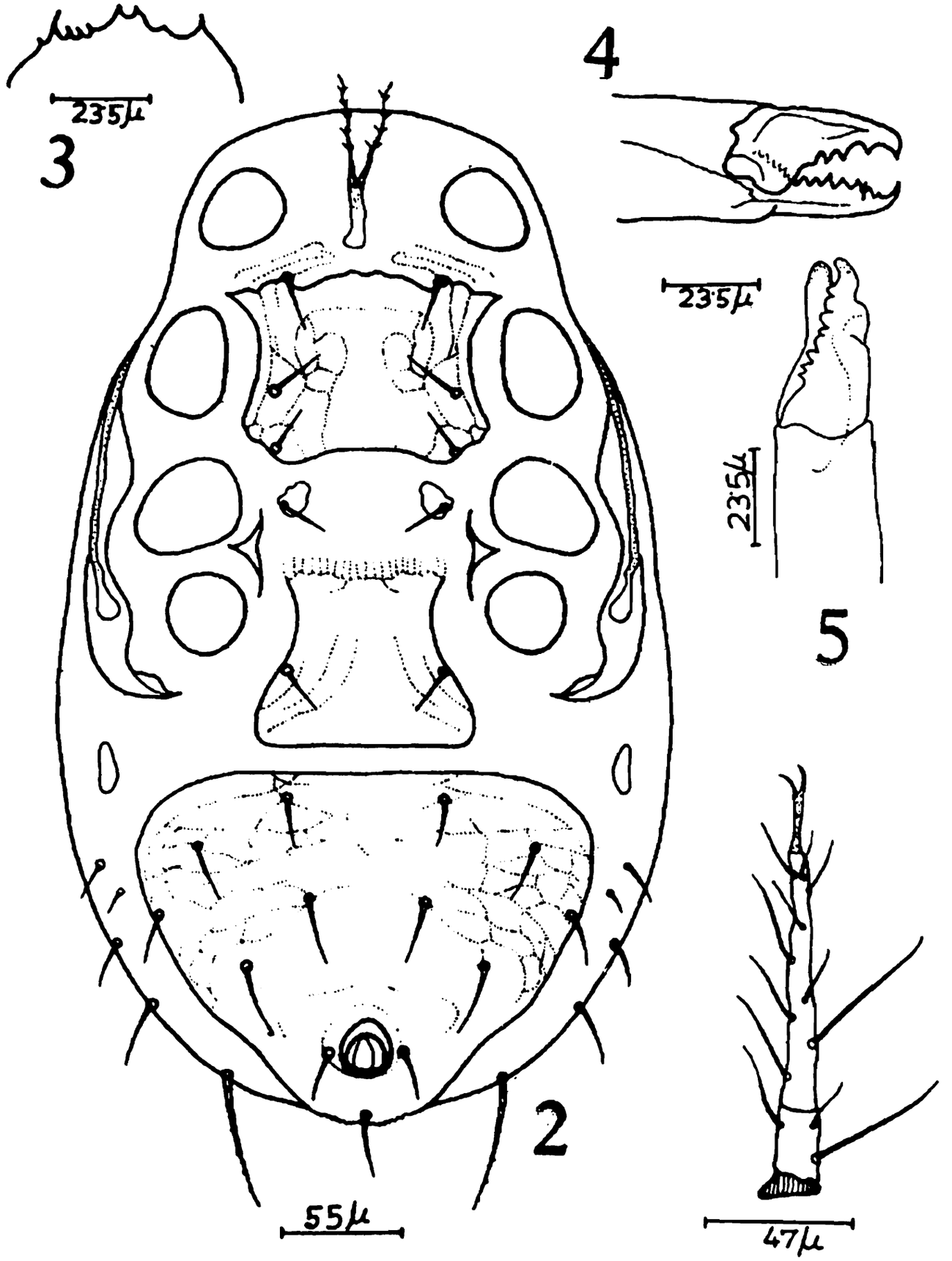


**Fig. 1.** *Lasioseius annandalei* sp. nov., female. 1. Dorsum.

Tectum basically trispinate, median projection bifurcate, several denticulate ridges present (Fig. 3). Pedipalp five-segmented, specialised setae on palpal tarsus two-tined. Six rows of deutosternal denticles present in the capitular groove, anterior four rows and sixth row narrow with few denticles, fifth row widened with 6–9 teeth. Corniculi normal, internal malae extending beyond tips of corniculi. Chelicera dentate, movable digit with four teeth, distal tooth smaller than others; fixed digit with a distinctive set of teeth of unequal size, setiform pilus dentilis at its proximal end (Figs. 4 & 5).

All legs with ambulacra and claws; chaetotaxy of legs I-II-III-IV : genua 13-11-9-9, tibiae 13-10-8-9; leg II and leg III subequal in length, *i.e.*, 358.9 μ and 362.6 μ respectively, leg IV (492.1 μ) longer than leg I (451.9 μ); tarsus IV with paired macrosetae laterally (Fig. 6).




**Figs. 2-5.** *Lasioseius annandalei* sp. nov., female. 2. Venter, 3. Tectum, 4. Chelicera, axial view, 5. Chelicera, lateral view.

*Male* : Unknown.

*Material Examined* : Holotype female, Gulmarg, Jammu and Kashmir; ex. soil with moss; 6.xi.1997; S. K. Bhattacharyya coll. One paratype female, Gulmarg, Jammu and Kashmir; ex. pine leaf litter; 6.xi.1997; S. K. Bhattacharyya coll.

*Differential Diagnosis* : *Lasioseius lasiodactyli* Ishikawa, 1969 shows some similarities with the new species, *Lasioseius annandalei* in the following characteristics : twenty-three pairs of serrated dorsal setae, number and nature of setae of J-series, reticulation of dorsal shield, shape of endopodal shield, tritosternum and tectum, length of internal malae and peritreme. However, the new species differs from its related species in the following combinations : subequal length of Z1 and S2, number of setae on ventral membrane and ventri-anal shield, shape of metasternal shield, absence of exopodal shield and components of metapodal shield.

*Etymology* : The species is named after Dr. T. A. Annandale, the founder-director of the Zoological Survey of India.

## ACKNOWLEDGEMENTS

Thanks are due to the Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for providing necessary facilities.

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# A NEW SPECIES OF THE GENUS *ARCTOSEIUS* THOR, 1930 (ACARINA : MESOSTIGMATA : ASCIDAE) FROM WEST BENGAL, INDIA

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## INTRODUCTION

Thor (1930) established the genus *Arctoseius* and designated *Arctoseius laterincisus* as type-species. Thirty-five species of this genus are known to occur in North America, Australia and Europe belonging to three different zoo-geographical regions *i.e.*, Nearctic, Australian and Palaearctic region (Halliday *et al.*, 1998).

In the present paper *Arctoseius himalayensis* is described and illustrated as a new species. This is the first report of the genus from the Indian as well as Oriental region.

Chaetotactic pattern of Lindquist and Evans (1965) is followed in this description.

Type-material is deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

### *Arctoseius himalayensis* sp. nov.

*Female* : Dorsal shield more than two times longer (360 μ) than wide (174 μ), distinctly reticulated, incompletely divided by a strong lateral incision, with 31 pairs of setae, 17 pairs situated on anterior region, rest on posterior region (Fig. 1); setae of J-series subequal in length (12 μ); all setae simple; setae j1, Z5 and S5 16 μ, 24 μ and 18 μ respectively. Lateral membrane lineated, with 6 pairs of marginal setae, equally distributed on each half; peritreme prominently visible dorsally.

Base of tritosternum wide, lacinae pilose, paired. Sternal shield distinctly reticulated, with three pairs of sternal setae of equal length (12 μ); sclerotization of anterior margin of sternal shield not properly discernible; posteromedian margin of sternal shield highly concave (Fig. 2). Pre-endopodal platalets elongate, well-developed. Metasternal setae placed on ventral membrane. Genital shield flask-shaped, convex posteriorly; genital setae present on ventral membrane beside genital shield at level of posterior to coxa IV. Anal shield longer (66 μ) than wide (62 μ), with lineation and reticulation; post-anal seta a little over two and half times longer than para-anal setae. Ventral membrane with

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seven pairs of setae around genital and anal shield, excluding metasternal and genital setae; area of lineation on ventral membrane demarcated as in fig. 2. Metapodal shield long, sclerotized, placed laterally along body margin. Endopodal shield present between coxae III and IV; remnants of exopodal shield fused with peritrematal shield at level of coxa II; peritrematal shield wide, fused with body margin; peritreme wide, extending well beyond coxa I; stigma large, situated at level of anterior half of coxa IV.

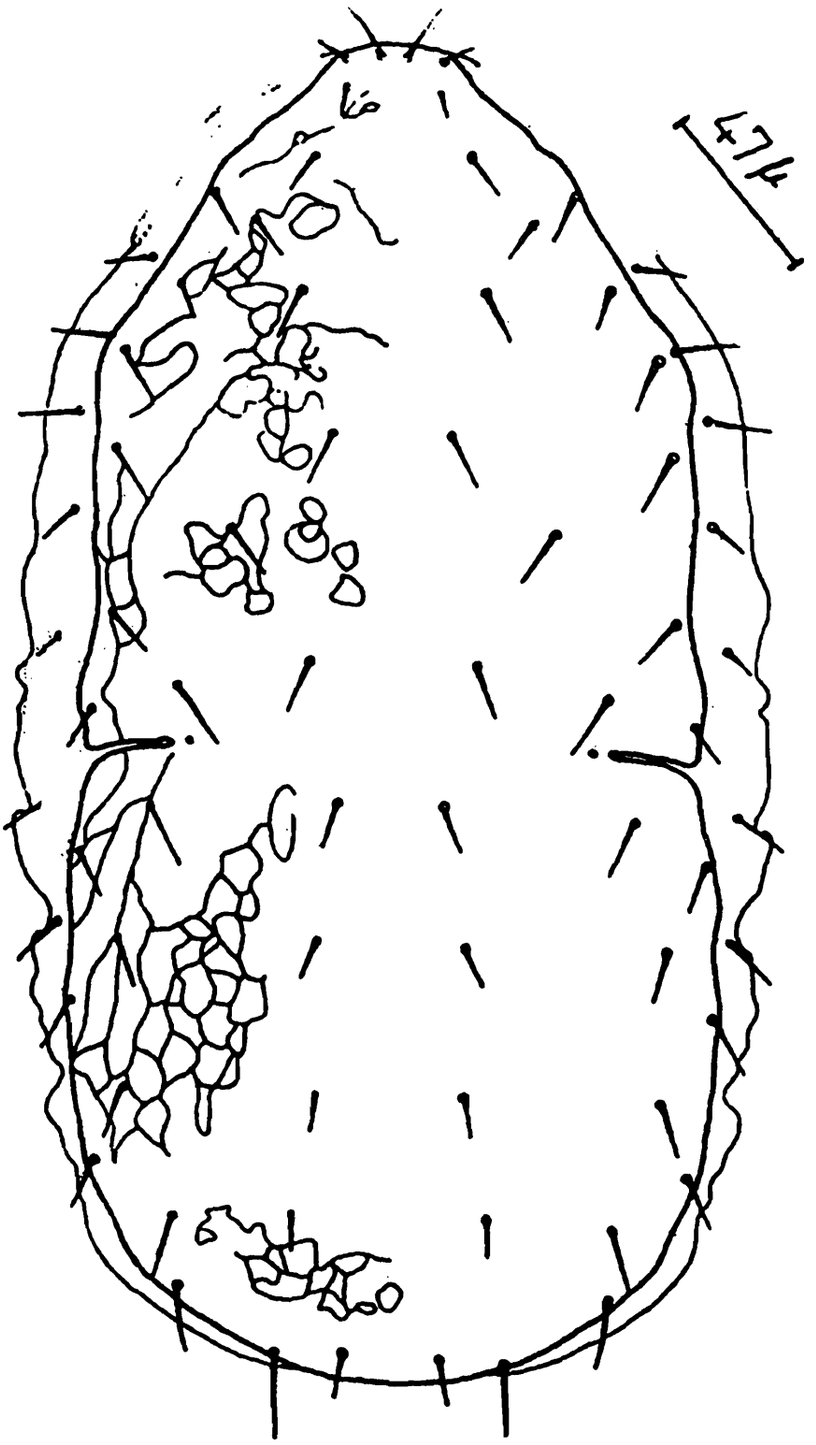

Fig. 1. *Arctoseius himalayensis* sp. nov., female Dorsal view.

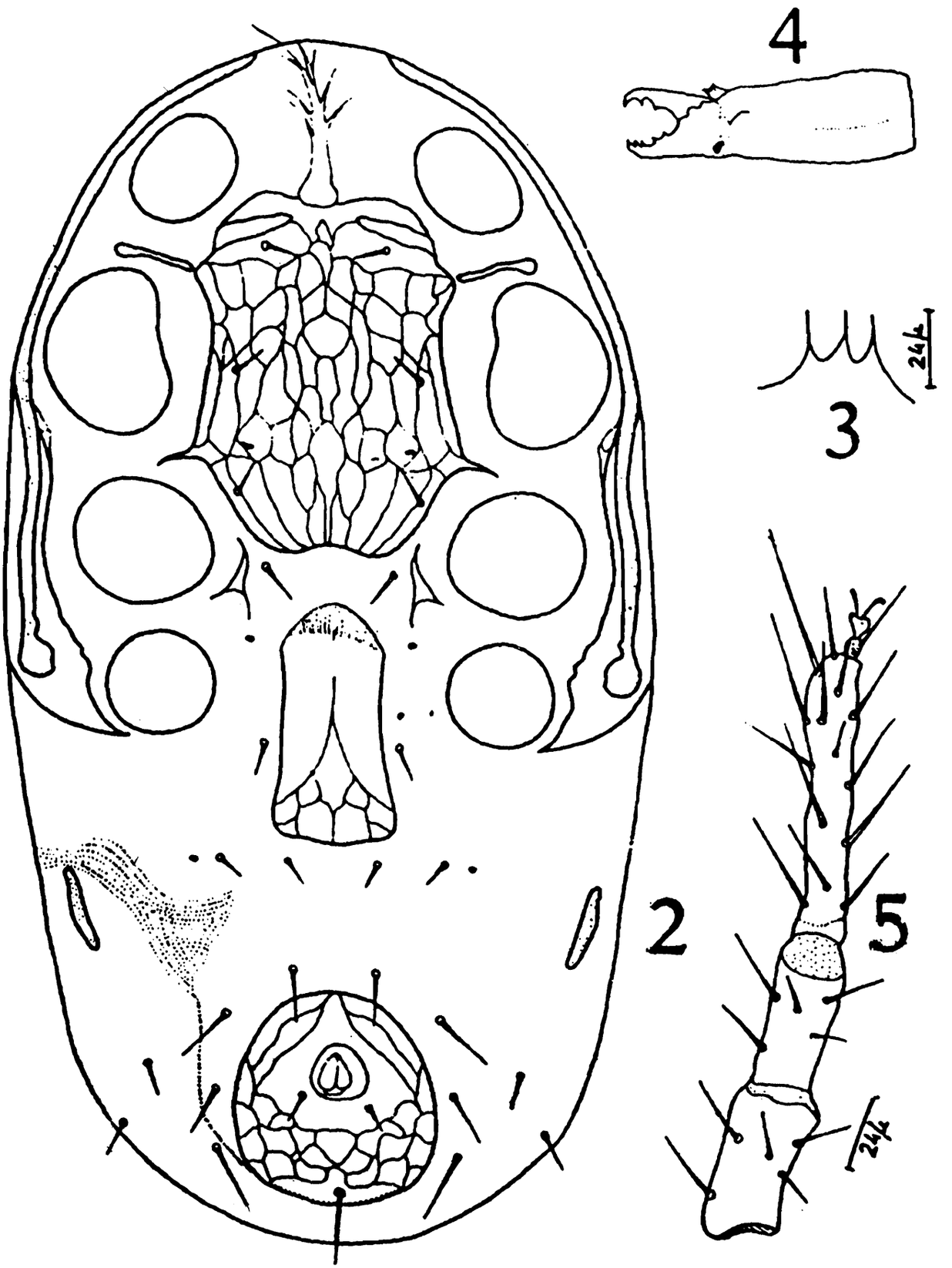


**Fig. 2-5.** ***Arctoseius himalayensis*** sp. nov., female.

**Fig. 2.** Ventral view.

**Fig. 3.** Tectum.

**Fig. 4.** Chelicera.

**Fig. 5.** Genu, tibia and tarsus of leg 1.

Tectum trispinate, spines of equal length (Fig. 3). Pedipalp 5-segmented; palp apotele two-tined.

Ventrally gnathosoma with four pairs of hypostomatic setae. Corniculi short but stout, not extending beyond tips of internal malae. Seven rows of hypognathal deutosternal denticles present, 12–16 denticles present in each row, most anterior pair widest with maximum number of teeth. Chelicerae chelate-dentate type; movable digit bidentate, fixed digit with a set of four small teeth (Fig. 4).

All legs with ambulacra and claws; tarsus I without any rod-like or clubbed setae; enlarged sensory setae present terminally on tarsus I (Fig. 5); legs I-II-III-IV 314.5 μ, 185 μ, 159.1μ and 222 μ long respectively; chaetotaxy of genua and tibiae of legs I-II-III-IV observed as 12-10-7-7 and 12-9-7-6.

*Male* : Unknown.

*Material Examined* : Holotype female : Namchi, Sandak-Fu Range, West Bengal; ex. soil under grass; 8.i.1997; S. Khaling coll.

*Differential Diagnosis* : The new species, *Arctoseius himalayensis* superficially resembles to its congeneric member *Arctoseius pristinus* Karg, 1962 in number, nature and length of dorsal setae, shape of peritrematal shield and presence of endopodal shield, but the new species largely differs from *pristinus* in regard to reticulation of sternal shield, presence of exopodal shield, shape of tritosternum, tectum, chelicerae and anal shield and also in the total number of ventral setae.

## ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India. Thanks are also due to Dr. S. Khaling who collected the specimen in adverse climatic condition.

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# CONTRIBUTIONS TO THE CLADOCERAN FAUNA (CRUSTACEA : BRANCHIOPODA : CLADOCERA) OF BIHAR

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## INTRODUCTION

Although taxonomic studies on the Indian freshwater Cladocera were initiated by Baird (1860), these micro-crustaceans are still poorly documented from different regions and states of India (Sharma and Michael, 1987; Sharma, 1991). This generalization holds particularly true to the cladoceran fauna of Bihar and the earlier investigations from this state are so far restricted to the preliminary reports by Gurney (1907), Brehm (1950) and Nasar (1977).

This paper, an attempt to fill up the stated lacuna, deals with 41 species and subspecies of Cladocera from Bihar, with systematic notes on various rare and interesting taxa. Comments are made on the nature and composition of the examined taxocoenosis and on the distribution of the reported species and subspecies.

## MATERIALS AND METHODS

The material for the present study was obtained from wide range of aquatic biotopes from Dharbanga city (Lat. 26° 10′ N; Long. 85° 57′ E), Patna city (Lat. 25° 37′ N; Long. 85° 13′ E) and their adjacent localities. In all about 95 plankton samples were collected by towing a nylobolt plankton net (No. 25) and preserved in 5% formalin. Various cladocerans and their disarticulated appendages were mounted in Polyvinyl alcohol–lectophenol mixture. The details of head pores and their arrangements in the Chydorids were studied following the technique given by Megard (1965). Different species and subspecies were identified following the monographic works of Smirnov (1971, 1976, 1996), Smirnov and Timms (1983) and Michael and Sharma (1988). The drawings are made with Leitz-Dialux phase contrast microscope using a drawing-tube attachment and the measurements are indicated in millimeters (mm). The reference material is deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong-22.

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## LIST OF THE EXAMINED TAXA

Family : SIDIDAE

*Diaphanosoma sarsi* Richard, 1895

*D. excisum* Sars, 1885

*Sida crystallina* (O. F. Müller, 1776)*

Family : DAPHNIIDAE

*Ceriodaphnia cornuta* Sars, 1885

*C. reticulata* (Jurine, 1820)

*Scapholeberis kingi* Sars, 1903*

*Simocephalus vetulus* (O. F. Müller, 1776)

*S. acutirostratus* (King, 1853)*

*S. exspinosus* (Koch, 1841)

S. *serrulatus* (Koch, 1841)*

*Daphnia lumholtzi* Sars, 1885

*D. carinata* King, 1853

Family : BOSMINIDAE

*Bosmina longirostris* (O. F. Müller, 1776)*

*Bosminopsis deitersi* Richard, 1895*

Family : MOINIDAE

*Moina micrura* Kurz, 1874*

*Moinodaphnia macleayi* (King, 1853)*

Family : MACROTHRICIDAE

*Macrothrix spinosa* (King, 1853)*

*Echinisca triserialis* (Gurney, 1907)

*Ilyocryptus spinifer* Herrick, 1882*

*Guernella raphaelis* Richard, 1892*

Family : CHYDORIDAE

Subfamily : CHYDORINAE

*Alonella clathratula* Sars, 1896**

*Chydorus sphaericus* (O. F. Müller, 1776)

*C. faviformis* Birge, 1893*

*C. pubescens* Sars, 1901*

*Ephemeroporus barroisi* Richard, 1894*

*Dunhevedia crassa* King, 1853*

Subfamily : ALONINAE

*Alona rectangula* Sars, 1862*

*Alona costata* Sars, 1862*

*A. guttata* Sars, 1862*

*A. pulchella* King, 1853*

*A. monacantha tridentata* (Stingelin, 1904)*

*A. quadrangularis* (O. F. Müller, 1776)*

*Notalona globulosa* (Daday, 1905)*

*Biapertura karua* (King, 1853)*

*B. verrucosa pseudoverrucosa* (Sars, 1901)*

*Acroperus harpae* (Baird, 1894)*

*Leydigia australis ceylonica* (Daday, 1898)*

*Camptocercus fennicus* Stenroos, 1898**

*Oxyurella singalensis* (Daday, 1898)*

*Kurzia longirostris* (Daday, 1898)*

*Euryalona orientalis* (Daday, 1898)*

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New record from Bihar* New record from India**

## NOTES ON RARE AND INTERESTING TAXA

***Sida crystallina*** (O. F. Müller, 1776)

(Figs. 1 & 2)

Large littoral species. Body oblong, carapace transparent; head large and clearly separated from body by a cervical depression. Distinct dorsal gland present. Postabdomen elongated, with about 14 lateral anal spines and a row of lateral setae. Rare in the examined material.

***Ceriodaphnia reticulata*** (Jurine, 1820)

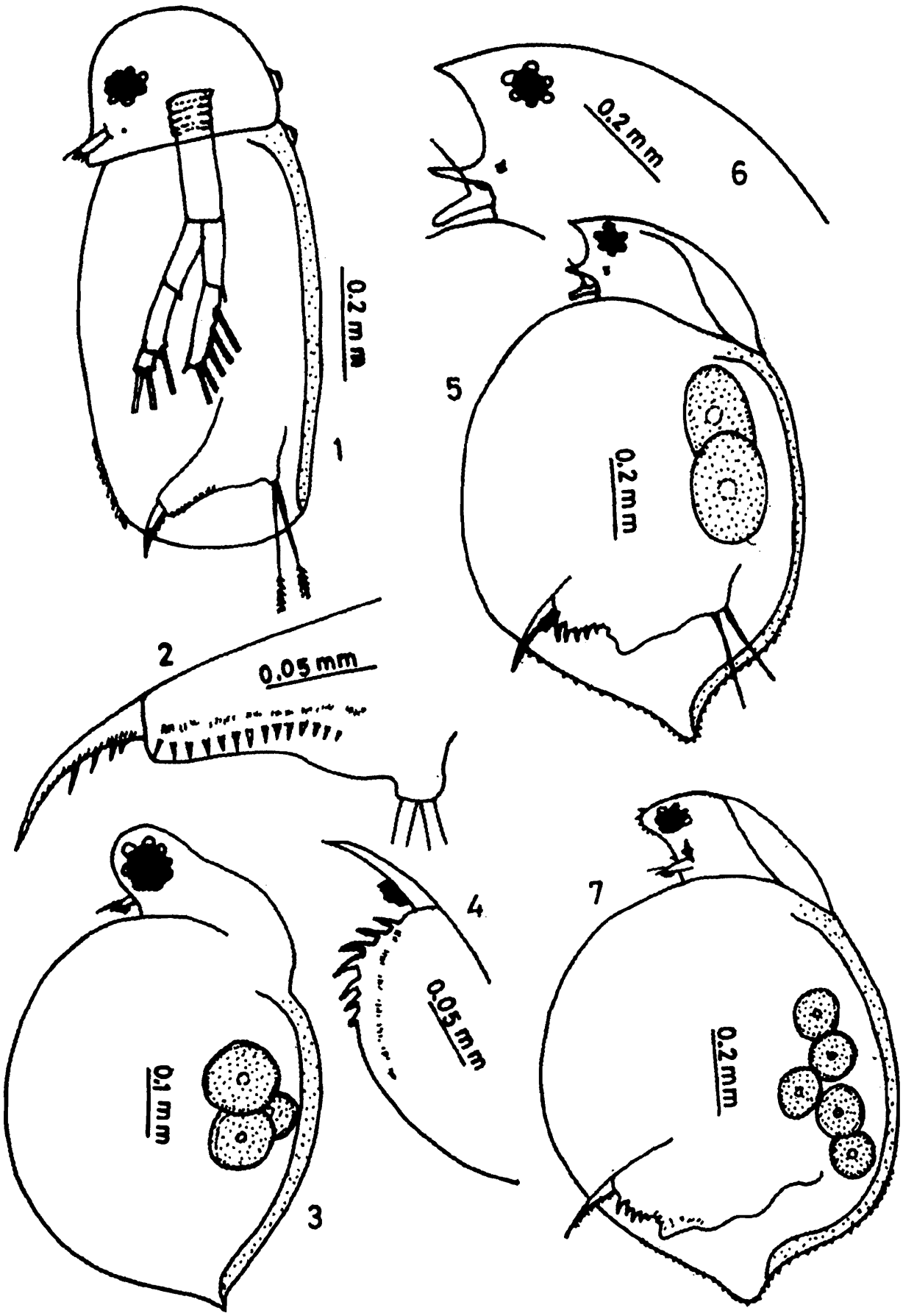
(Figs. 3 & 4)

Carapace broadly rounded oval, valves with reticulate pattern. Head small and rounded. Eyes large and nearly filling frontal region of head. Postabdomen with 7 marginal anal spines and claw with a distinct pecten. Rare in the studied collections.

***Simocephalus acutirostratus*** (King, 1853)

(Figs. 5 & 6)

Carapace large, oval or rhomboid and with a distinct posterior protuberance situated in the longitudinal axis of body. Head small and produced anteriorly into characteristic acute projection.




**Figs. 1-7.** *Sida crystallina* (O. F. Müller) : Fig. 1, parthenogenetic female, Fig. 2, postabdomen; *Ceriodaphnia reticulata* (Jurine) : Fig. 3, parthenogenetic female, Fig. 4, postabdomen; *Simocephalus acutirostratus* (King) : Fig. 5, parthenogenetic female, Fig. 6, head (enlarged); *S. serrulatus* (Koch) : Fig. 7, parthenogenetic female.

Rostrum pointed. Ocellus small and punctiform. Postabdomen broad, with 7 anal spines increasing in size distally. Claw long and slender, with pecten of 10–12 teeth and denticles.

***Simocephalus serrulatus*** (Koch, 1841)

(Fig. 7)

Carapace oval, broadened behind middle and with small posterior protuberance. Head with salient acute anterior angle and number of minute denticles. Ocellus rhomboidal. Postabdomen with about 8 anal spines; claw elongated and with fine setules on its concave margin. Rare in the studied material.

***Bosminopsis deitersi*** Richard, 1895

(Figs. 8 & 9)

Carapace oval or oblong; posterior-ventral corner with small mucro-like process and 1–2 spinules. Head large, with supraocular depression. Antennulus united at base and diverging at apex. Postabdomen tapering distally and with 7 small anal spines. Claw large and with a large basal spine. Rare in the examined material.

***Moinodaphnia macleayi*** (King, 1853)

(Figs. 10–12)

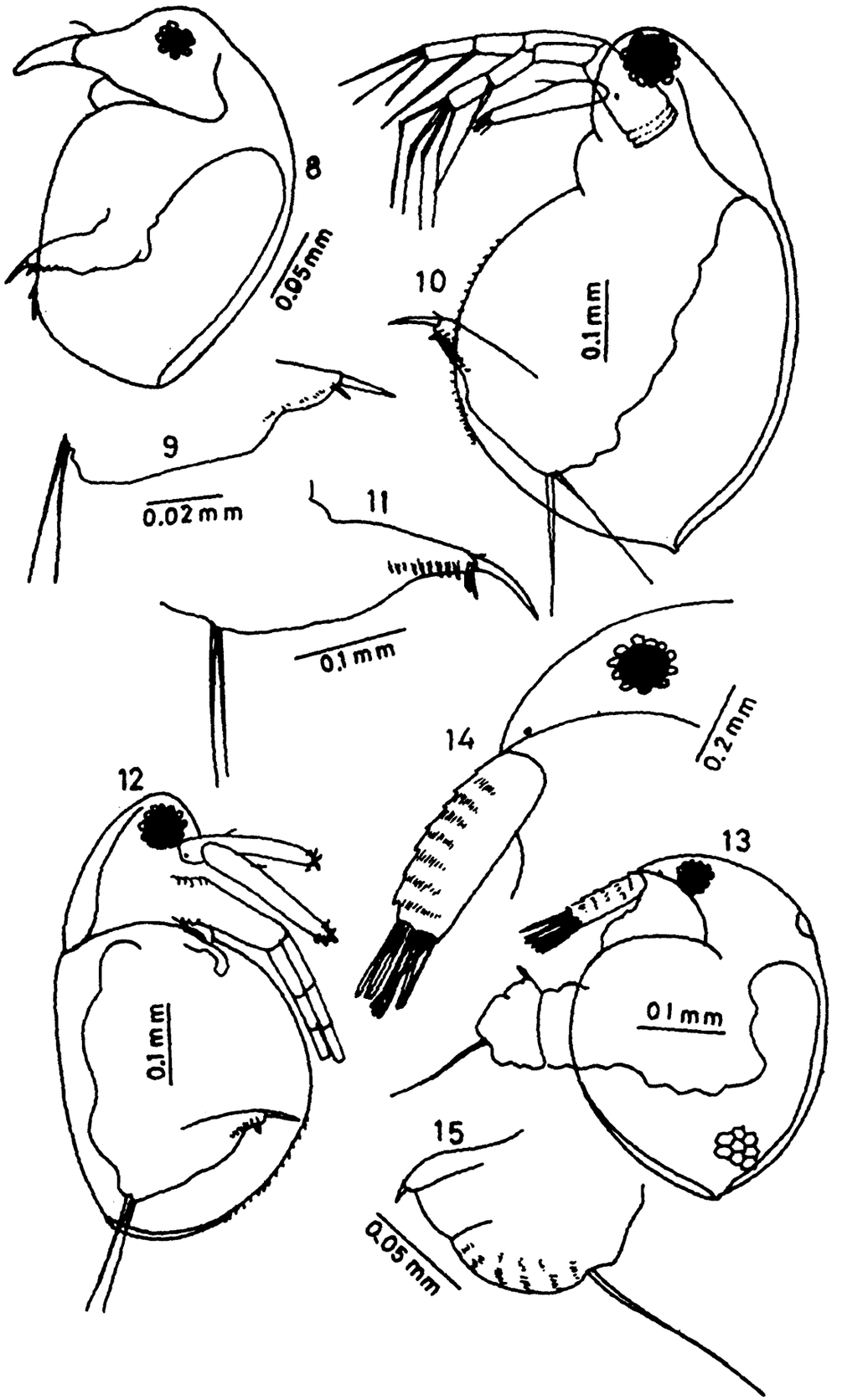
*Female* : Body large and compressed. Head small and trigonal in shape; eyes large and filling frontal part of head, ocellus present; antennules elongated, thin and movable. Abdominal process large and horse-shoe shaped. Postabdomen elongated distally, with 7–12 feathered teeth and a distinct bident tooth; claw distinct and with setae on concave margin. Several specimens observed presently.

*Male* : Body slender and elongated. Head distinct, antennules large, with sensory papillae and hook at distal end. First leg with distinct hook. Postabdomen with 6–8 feathered teeth and a bident tooth. Claw with setae on concave margin. Rare in the studied material.

***Guernella raphaelis*** Richard, 1892

(Figs. 13–15)

Carapace small and oval in outline; valves with reticulations. Head broad, with distinct eye and small ocellus. Antennules short and robust, with incisions and serrulations on anterior margin. Postabdomen small, tapering distally and with transverse row of spinules. Claw short. Very rare in the examined material.




**Figs. 8–15.** *Bosminopsis deitersi* Richard : Fig. 8, parthenogenetic female; Fig. 9, postabdomen; *Moinodaphnia macleayi* (King) : Fig. 10, parthenogenetic female, Fig. 11, postabdomen, Fig. 12, male; *Guernella raphaelis* Richard : Fig. 13, parthenogenetic female, Fig. 14, head (enlarged), Fig. 15, postabdomen.

*Alonella clathratula* Sars, 1896

(Figs. 16–19)

Differentiated from the closely related *A. excisa* in having more elongated body; valves with polygons and longitudinal striations; posterior margin of valves almost straight and at right angle with the ventral margin. Rare in the studied material.

*Chydorus faviformis* Birge, 1893

(Fig. 20)

Body rounded in outline; head-shield and carapace with characteristic deep polygonal cells. Rostrum pointed and ventrally directed. Labral plate with convex anterior margin. Postabdomen wide, with 9–10 anal spines and groups of lateral setae; preanal corner distinctly projecting. Claw with two basal spines and setae on concave margin.

*Chydorus pubescens* Sars, 1901

(Fig. 21)

Body almost globular, valves reticulated and covered with diagnostic velvet-like coating of short, stiff setules. Head broad, rostral projection less protruded. Labral plate rounded. Postabdomen slightly tapering distally, with 8–10 anal spines and groups of lateral setae; with distinct preanal corner. Claw with two basal spines and setae on concave margin.

*Alona monacantha tridentata* (Stingelin, 1904)

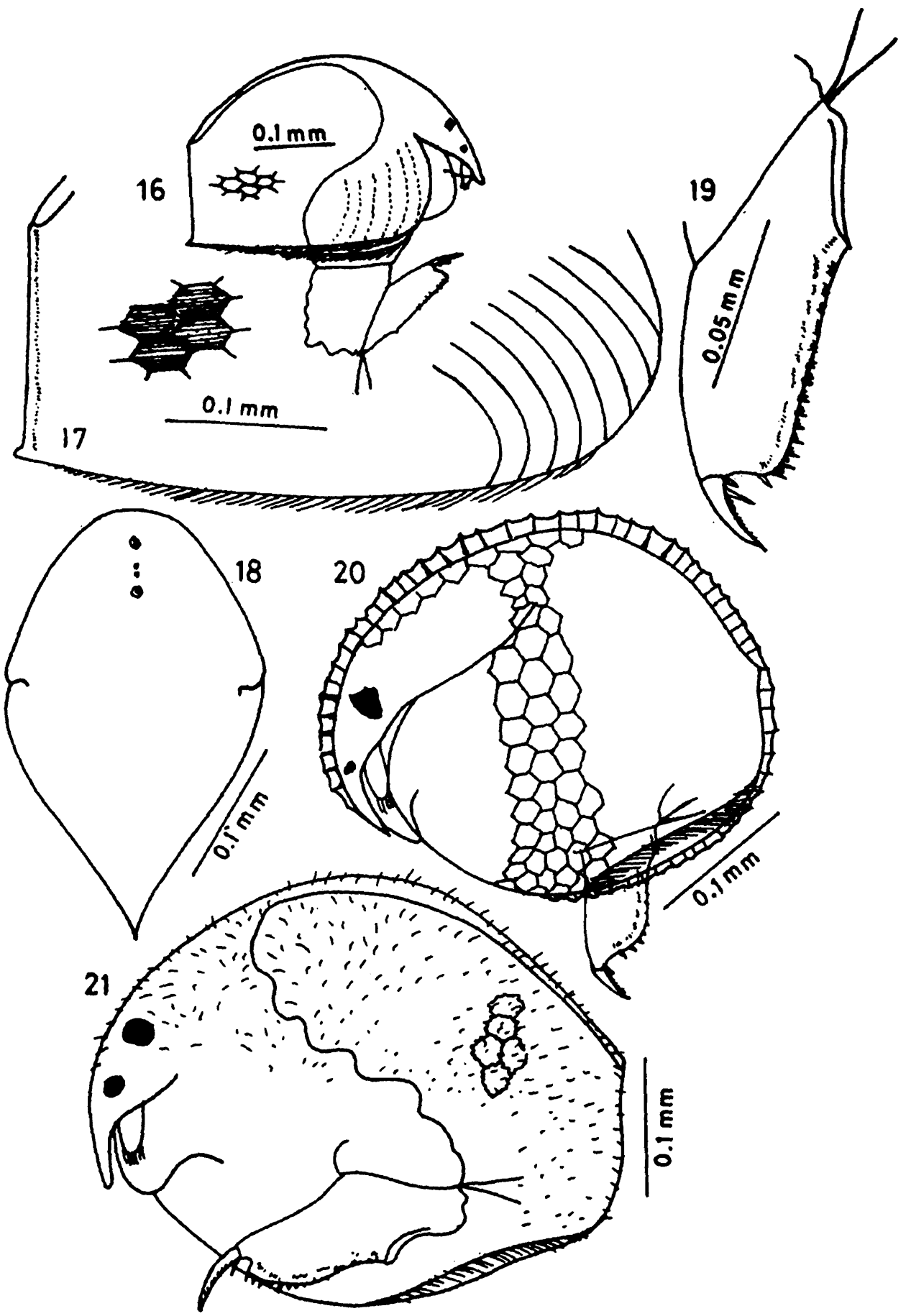
(Figs. 22 & 23)

Body oval in outline, valves marked with longitudinal lines; postero-ventral corner of valves with 2–3 denticles. Rostrum long and blunt, antennules not reaching apex of rostrum. Postabdomen with distinct preanal corner, with about 10 anal spines and groups of lateral setae; distal seta in each group longest and a few distal setae projecting beyond dorsal margin of postabdomen. Claw with a basal spine and setae on concave margin.

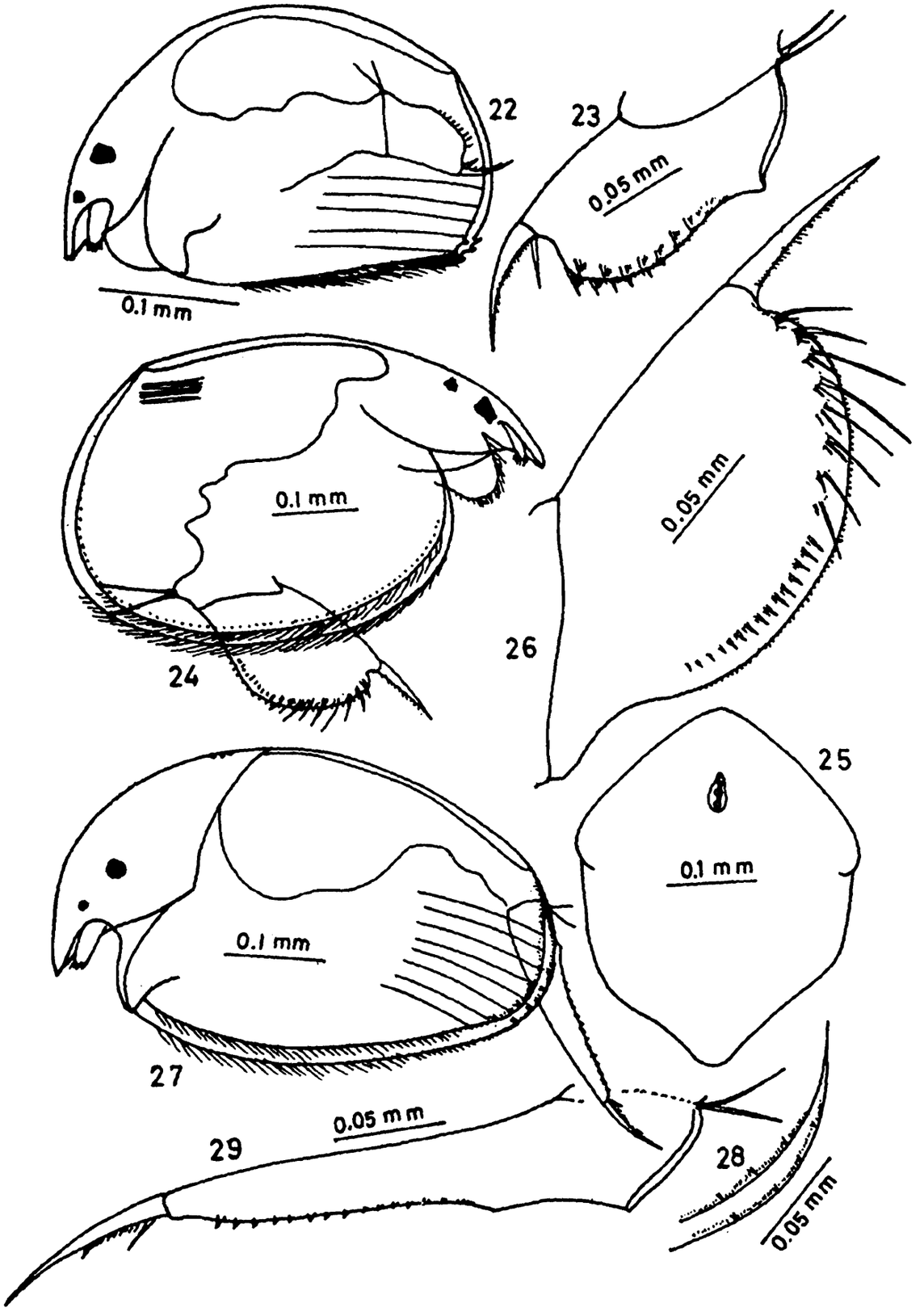
*Leydigia australis ceylonica* (Daday, 1898)

(Figs. 24–26)

Body oblong, valves with longitudinal lines and dots. Ocellus larger than eye, situated nearer to eye than to apex of rostrum. Postabdomen widest in middle, distal corner rounded; lateral setae in groups of three, distal seta longest in each group and proximal seta shortest; 12–14 groups of spinules present. Claw without basal spine, with setae on concave margin. Only two specimens observed presently.




**Figs. 16–21.** *Alonella clathratula* Sars : Fig. 16, parthenogenetic female, Fig. 17, valve (enlarged), Fig. 18, head-shield, Fig. 19, postabdomen; *Chydorus faviformis* Birge : Fig. 20, parthenogenetic female; *C. pubescens* Sars : Fig. 21, parthenogenetic female.




**Figs. 22–29.** *Alona monacantha tridentata* (Stengelin) : Fig. 22, parthenogenetic female, Fig. 23, postabdomen; *Leydigia australis ceylonica* (Daday) : Fig. 24, parthenogenetic female, Fig. 25, head-shield, Fig. 26, postabdomen; *Camptocercus fennicus* Stenroos : Fig. 27, parthenogenetic female, Fig. 28, postero-ventral corner of valves, Fig. 29, postabdomen.

*Camptocercus fennicus* Stenroos, 1898

(Figs. 27–29)

Body elongated, postero-ventral corner of valves with 2–5 denticles distinctly separated by margin of valves. Rostrum pointed. Valves with longitudinal lines. Antennules almost reaching apex of rostrum. Postabdomen with 19–20 anal denticles and a row of lateral groups of setae. Claw with setae on concave margin and with a basal spine at some distance from the base of each claw.

## DISCUSSION

Forty-one species and subspecies of Cladocera documented presently from Bihar reflect fairly rich and diversified taxocoenosis. This feature is important in light of a conservative estimate (Fernando and Kanduru, 1984; Sharma and Michael, 1987) of occurrence of upto 60–65 species of these entomostraceous crustaceans from tropical and subtropical parts of India. The examined taxa, however, present a distinct contrast to only nineteen species reported by earlier workers (Gurney, 1907; Brehm, 1950; Nasar, 1977) and, hence, raise their overall qualitative diversity from Bihar to 48 species. In addition, the studied cladoceran communities register greater generic diversity (27 genera) as compared with 37 genera so far known from India (Sharma, 1991). Further, the recorded species and subspecies belong to six families which, in turn, represent two phylogenetic stems of this group (Smirnov and Timms, 1983) namely the Ctenopoda and the Anomopoda; the former includes only the family Sididae while all the five families of the latter (Macrothricidae-Chydoridae-Bosminidae-Moinidae-Daphniidae) are represented in this study.

*Alonella clathratula* and *Camptocercus fennicus* are interesting new records to the Indian Cladocera. In addition, 29 species and subspecies are new records from Bihar. The former chydorid was designated (Smirnov, 1971) as a subspecies of *Alonella excisa* while Smirnov (1996) subsequently raised it to the status of a distinct species. Besides certain morphological differences, the two species are characterized by differences in their distributional limits; *A. clathratula* occurs in the Neotropical region, South America, Australia and Java while *A. excisa* is a cosmopolitan species. On the other hand, *Camptocercus fennicus* comprises first report from the Oriental region and it is so far known from the Palaearctic region and N. W. part of erstwhile European USSR. The authors, however, believe that re-examination of earlier Indian records particularly of *Camptocercus rectirostris-australis* group may reveal wider distribution of the stated species in this country. Overall cladoceran diversity from Bihar figures next to that of Jammu & Kashmir (59 species) and West Bengal (52 species). Chydoridae (21 species) > Daphniidae (9 species) constitute dominant fraction of the documented species. Such a feature confirms with the general composition of the Indian Cladocera (Sharma, 1991) and also with the faunas of various regions/states of this country.

Abundance of Cosmopolitan species and occurrence of several Cosmotropical species in the examined material imparts general tropical character to the cladoceran fauna of Bihar. This salient feature is in conformity with the general composition of cladoceran communities from other tropical

regions (Fernando, 1980; Fernando and Kanduru, 1984; Dussart *et al.* 1984; Sharma and Michael, 1987; Sharma, 1991). Further, the samples studied from Bihar are notable for qualitative dominance of littoral or periphytic forms (29 species) and fewer euplanktonic species namely *Diaphanosoma sarsi, D. excisum, Daphnia carinata, D. lumholtzi, Ceriodaphnia cornuta, C. reticulata, Bosmina longirostris, Bosminopsis deitersi, Moina micrura* and *Moinodaphnia macleayi*. Of these, the members of the Bosminidae depict rare occurrence while *D. carinata, D. lumholtzi, C. cornuta* and *Moina micrura*, often, indicate swarms in eutrophic ponds characterized by the blooms of the blue-green alga, *Microcystis aeruginosa*. Identical feature is commonly noticed in eutrophic astatic waters in peninsular India (Sharma, 1991). The general paucity of planktonic Cladocera is attributed to the fact that majority of the samples are obtained from water bodies with aquatic macrophytes and relatively few collections belonged to open-water habitats.

The majority of the documented species are identified by their parthenogenetic females. Interestingly, the males of seven species viz., *Daphnia lumholtzi, D. carinata, Moina micrura, Moinodaphnia macleayi, Ephemeroporus barroisi, Biapertura karua* and *Acroperus harpae* are, however, examined in the present study. Among these, *M. macleayi* deserves special mention as its male is known till now only from South Andamans (Venkataraman, 1992). Hence, the present report of the male of the stated moinid species is the first record from the Indian mainland and the second record from the Oriental region.

The present study indicates several examples of local distributional interest from India. The macrothricid *Guernella raphaelis* is known for disjunct distribution, with reports from Rajasthan and West Bengal. *Simocephalus acutirostratus* appears to occur in Central India and southwards (Sharma, 1991) while *S. serrulatus* is so far known from S. India and Meghalaya. Of the other notable species, *Chydorus faviformis* is documented from Jammu & Kashmir and Meghalaya; *C. pubescens* is known from Assam and Meghalaya in N. E. India; *Alona monacantha tridentata* is confined to Tamil Nadu; *Alona guttata* is restricted to Jammu & Kashmir and Nilgiri hills while *Leydigia australis ceylonica* is recorded from Tamil Nadu and Kerala in S. India. In addition, *Ceriodaphnia reticulata* is examined so far from Rajasthan; *Macrothrix spinosa* is distributed in Rajasthan, Manipur and Tamil Nadu and *Kurzia longiristris* is observed from West Bengal, Kerala, Tamil Nadu and Rajasthan. Fernando and Kanduru (1984) indicated more southern distribution of *Bosminopsis deitersi* in India; Michael and Sharma (1988) examined it from Kerala, Delhi and Rajasthan; the authors (unpublished data) noticed its wider distribution in North-Eastern India while the stated species is very rare in the samples examined from Bihar.

## SUMMARY

Forty-one species and subspecies of Cladocera belonging to 27 genera and six families are presently recorded from Bihar. *Alona clathratula* and *Camptocercus fennicus* are new records from India. In addition, 29 species and subspecies are new to the fauna of Bihar. The males of seven species are observed in this study, including the first report of the male of *Moinodaphnia macleayi*

from the Indian mainland. The examined taxocoenosis depicts general tropical character, shows qualitative importance of Cosmopolitan and littoral or periphytic elements, registers abundance of the members of the Chydoridae. *Guernella raphaelis, Simocephalus acutirostratus, S. serrulatus, Chydorus faviformis, C. pubescens, Alona monacantha tridentata, A. guttata, Leydigia australis ceylonica, Ceriodaphnia reticulata, Macrothrix spinosa, Kurzia longirostris* and *Bosminopsis deitersi* are examples of local biogeographic interest in India. In general, the cladoceran fauna of Bihar exhibits fairly rich species and generic diversity.

## ACKNOWLEDGEMENTS

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*Rec. zool. Surv. India* : **99** (Part 1–4) : 45-48, 2001

# ON A NEW SPECIES OF *PLACOLABIS* BEY-BIENKO (DERMAPTERA : ANISOLABIDIDAE) FROM LAOS

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## INTRODUCTION

Srivastava (1999) erected Placolabidinae with *Placolabis* Bey-Bienko, 1959, as its type genus. It is mainly characterised by the median posterior prolongation of eight sternite into a narrow lobe.

So far *Placolabis* Bey-Bienko, 1959, is known by two species *viz.*, *P. mira* Bey-Bienko, 1959 from China (Yunnan) and *P. thailandenis* Ramamurthi, 1973 from Thailand. A new species from Laos is described here.

This genus is externally similar to other Anisolabid genera but abdomen dorsally and ventrally have long recumbent hairs, lateral tubercles on 3rd and 4th tergites weakly developed, in males 8th sternite with a median broad or narrow lobe and genitalia without virga and preputial sacs with or without denticulated pads.

All the three species can be separated by the following key which is based upon male only :

1(2). Posterior median prolongation of 8th sternite about one and half times longer than broad, gently widened posteriorly with hind margin truncate; posterior margin of 9th sternite rounded in middle (figs. 1–3).
..... *P. brindlei* **sp. n.**

2(1). Posterior median prolongation of 8th sternite a little over twice longer than broad, parallel sided with hind margin concave; posterior margin of penultimate sternite in middle truncate.

3(4). Posterior margin of median prolongation of 8th sternite with a faint triangular emargination, postero-lateral angles not paroduced; parameres with external apical angle produced and distal lobes without denticulated pads (figs. 4–5).
..... *P. mira* Bey-Bienko, 1959

4(3). Posterior margin of median prolongation of 8th sternite broadly concave, postero-lateral angles with acute points; parameres with apical external angle rounded and distal lobes with chitinous pad apically (figs. 6–7).
..... *P. thailandensis* Ramamurthi, 1973

## ANISOLABIDIDAE

## PLACOLABIDINAE

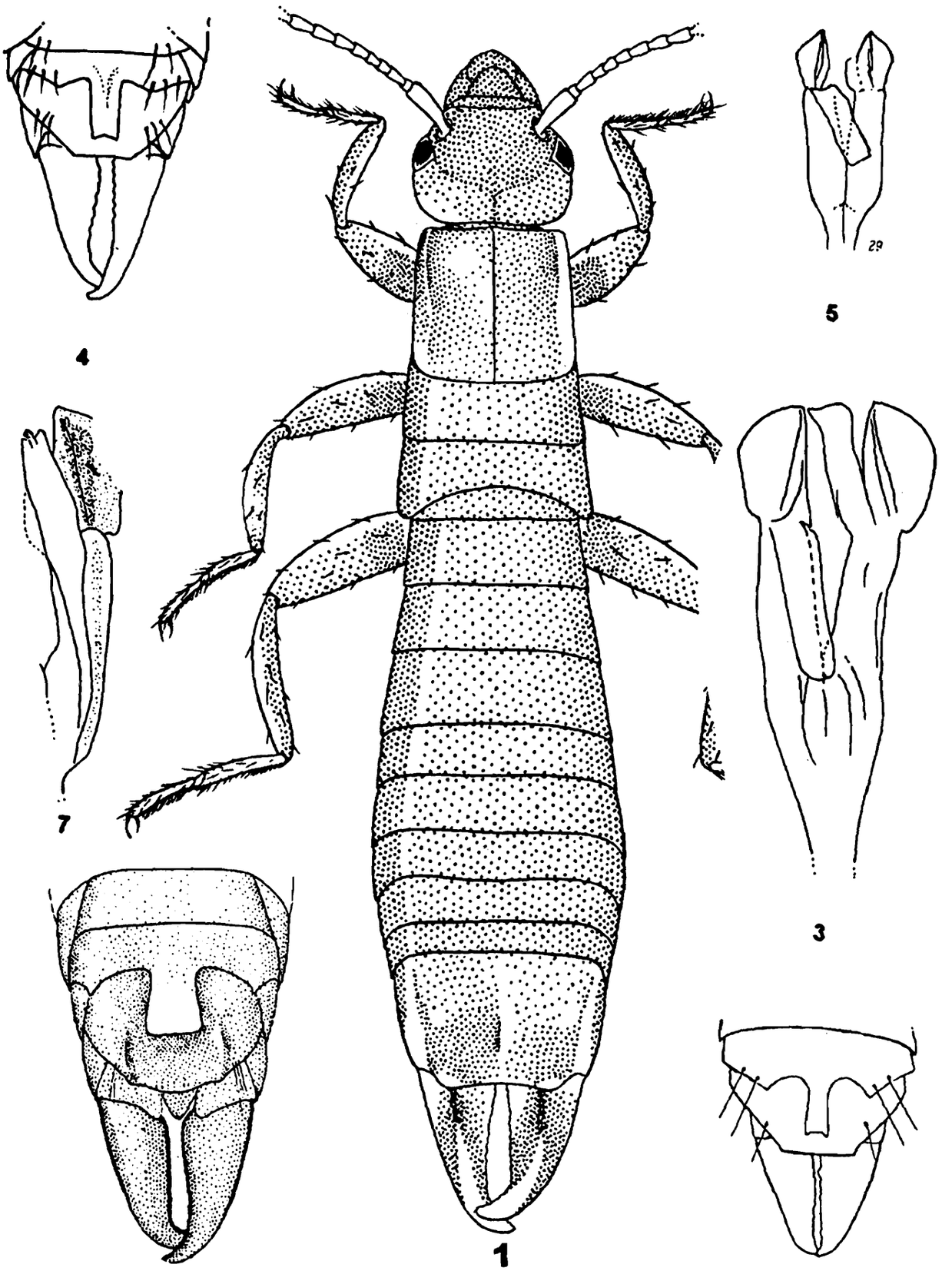
### *Placolabis brindlei* sp. n.

(Figs. 1–3)

*Male* : General colour dark brownish black; antennae black; 1st segment blackish brown and 2nd and 3rd yellowish brown but latter black near apex; mouth parts yellowish; legs brownish yellow, femora blackish in basal half.

Head longer than broad, smooth, moderately convex, sutures fine but distinct, hind margin feebly emarginate in middle. Eyes shorter than the post-ocular area and basal antennal segment in length. Antennae partly broken, 13 segments remaining, 1st stout, expanded apically, slightly shorter the distance between scapi; 2nd short, about as long broad; 3rd long and slender; 4th subconical, shorter than 3rd; 5th slightly longer than 4th but shorter than 3rd, gently expanded apically; 6th about as long as the 3rd and remaining gradually increasing in length but stout. Pronotum about as long as broad, sides straight, feebly reflexed, gently widened posteriorly, hind margin subtruncate, median sulcus faint, prozona and metazona not well differentiated. Mesonotum truncate and metanotum broadly emarginate posteriorly. Prosternum three times longer than broad, gently constricted between fore-coxae, anterior margin somewhat convex and hind margin truncate; mesosternum slightly longer than broad, hind margin rounded; metasternum broader than long, narrowed posteriorly between hind coxae with hind margin truncate. Legs typical of the family, hind femore with 1st segment slightly longer than 3rd. Abdomen moderately convex, gently expanded in middle, finely punctulate, lateral folds and 3rd and 4th tergites obsolete, sides of segment 4th obtuse, 5th acute angled and both provided posteriorly with a short tubercle and finely punctulate, sides of segments 6th to 9th rugose, acute angled but a short median longitudinal carina present on 6th to 8th only. Eighth sternite with posterior margin emarginate and angles produced into minute points and medially produced into a longitudinal process, about one and half times longer than broad, expanded posteriorly with its hind margin truncate. Penultimate strnite with a median quadrate depression in apical half, hind margin rounded but wavey in middle and postero-lateral angles produced into minute point. Ultimate tergite transverse, faint vertical rows of punctulations present, sloping backwards, sides rugose with a faint longitudinal carina especially in posterior half only, hind margin faintly emarginate in middle, laterally oblique and emarginate, median sulcus faintly marked in middle only. Forceps subcontiguous, broadened at base, tapering apically, almost straight, gently incurved in apical one third only, right branch crossing over left, apices gently hooked and pointed, trigonal above in basal one third, thence depressed, inner margin crenulate; branches below convex medially. Genitalia with parameres longer than broad, slightly narrowed at base, apices rounded, anterior margin and external angles forming a rounded arc; distal lobes long, without virga or chitinous teeth. Length : body – 17.2 mm; forceps –2.6 mm.

*Female* : Unknown.




**Figs. 1-7.** *Placolabis brindlei* Srivastava, Holotype Male, 1. Dorsal view; 2. Hind portion of body, in ventral view, showing sternites 7–10 & forceps; 3. Genitalia; *P. mira* Bey-Bienko, Male, 4. Hind portion of body, in ventral view; 5. Genitalia; *P. thailandensis* Ramamurthi, Male; 6. Hind portion of body, in ventral view; 7. A portion of genitalia.

(Figs. 4 & 5 after Bey-Bienko, 1959 and 6–7 after Ramamurthi, 1973).

*Material examined* : Holotype male (genitalia mounted between two celluloid slips and pinned with the specimen), LAOS : Vientiane Prov., Ban Van Eue, 29.iii.1966, Native Collector; deposited in the Bishop P. Museum, Honolulu, Hawaii, U.S.A.

*Remarks* : This species differs from the other two known species *viz.*, *P. mira* Bey-Bienko and *P. thailandensis* Ramamuarthi, in males, by the shape of median longitudinal process of the eight sternite in being truncate posteriorly and penultimate sternite with hind margin rounded and in middle wavey.

## ACKNOWLEDGEMENTS

I am thankful to the Curator, Bishop P. Museum, Honolulu, Hawaii (U.S.A.) for placing this interesting collection for study and Director, Zoological Survey of India, Calcutta for providing necessary facilities.

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*Rec. zool. Surv. India* : 99 (Part 1–4) : 49-58, 2001

# NEW SPECIES AND NEW RECORDS OF DERMAPTERA (INSECTA) FROM ANDAMAN AND NICOBAR ISLANDS, INDIA

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## INTRODUCTION

The present paper deals with three species new to science *viz., Circolabia bhatiai* from North and South Andaman; *Chaetolabia sahai* and *Hamaxas chandrai* both from Great Nicobar.

Besides, three other species, namely, *Cranopygia similis* (Zacher, 1910) from South Andaman; *Nesogaster minusculus* Rehn, 1946 and *Circolabia dubronyi* (Hebard, 1922) from Great Nicobar are reported for the first time within Indian limits.

Family Nesogastrinae, well represent in other parts of Oriental & Australian regions, is now reported from Great Nicobar Isls. It exhibits the presence of Indo-Malayan element in the area.

It along with *Cranopytgia similis* and *Circolabia dubronyi* exhibits the presence of derivatives from the Indo-Malayan & Australian fauna, in the area especially Great Nicobar Isls.

PYGIDICRANOIDEA

PYGIDICRANIDAE

PYGIDICRANINAE

***Cranopygia similis*** (Zacher)

(Figs. 1–2)

*Material Examined* : India : Andaman Isls, South Andaman, Wandoor, 1 Male (genitalia mounted between two coverslips and attached to the pin of specimen), 15.6.1982, at light (*R. N. Sharma* coll).

*Distribution* : Malay Peninsula, Sumatra, Java and India (Andaman Islands).

*Remarks* : This species is very close to *Pygidicrana siamensis* (Dohrn, 1863) from Thailand but differs by the slight differences in the shape of parameres.

FORFICULOIDEA

SPONGIPHORIDAE

NESOGASTRINAE

***Nesogaster minusculus*** Rehn

(Figs. 3–7)

*Material Examined* : India : Great Nicobar Isl, near Galathea, 40 kmp on N. S. Road, 1 Male, 2 Females, 4 nymphs, 30.7.1994; South Bay, 4 km from N. S. Road, 2 Males (brachylabic and

macrolabic), 1 Female, 1 nymph, 6.8.1984; South Bay, 45 km of N. S. Road, 1 Male (macrolabic), 10.8.1984; Pygmalion Point, 1 Female, 1 nymph, 18.8.1984, all under bark of rotten logs (*S. S. Saha* coll.); Paulo Baha Coast, 1 Male (macrolabic), 5 Females, 21.8.1984; Cambell Bay, 24 Kmp from Cambell Bay, 1 Female, 1.12.1978, ex bark of log; Cambell Bay, near Lakshman Beach, 2 Males, 1 nymph, 4.12.1978 (*B. Nandi* coll.).

*Distribution* : Sumatra : Mentawei Isls and India : Great Nicobar Islands.

*Remarks* : Some variation in the body colour and in the length of male forceps were noted in the material from Nicobar Islands present in the Zoological Survey of India.

## LABIINAE

### *Circolabia dubronyi* (Hebard)

(Figs. 8–10)

*Material Examined*: India : Great Nicobar Island, Pygmalion Point, 2 Males, 4 Females, 18.7.1984, under the bark of a dead rottening giant tree; Near Galathea, 40 Kmp on N. S. Road, 3 Males, 1 Female, 1 nymph, under bark of dead rotten tree, 30.7.1984 (*S. S. Saha* coll.).

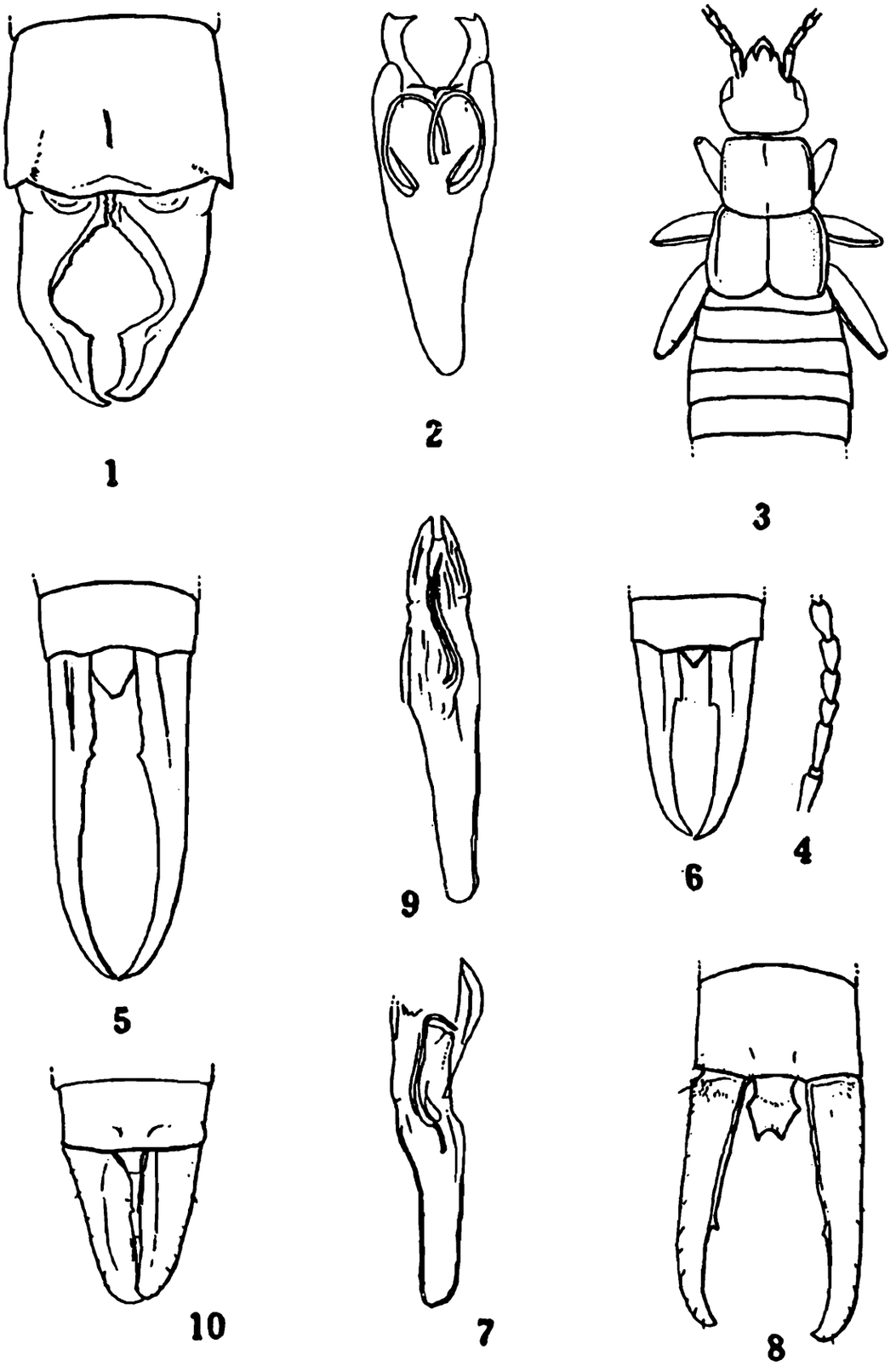
Distribution : Hawaii, Micronesia (Hebard, 1992) and India (Great Nicobar Islands).

### *Circolabia bhatiai* sp. n.

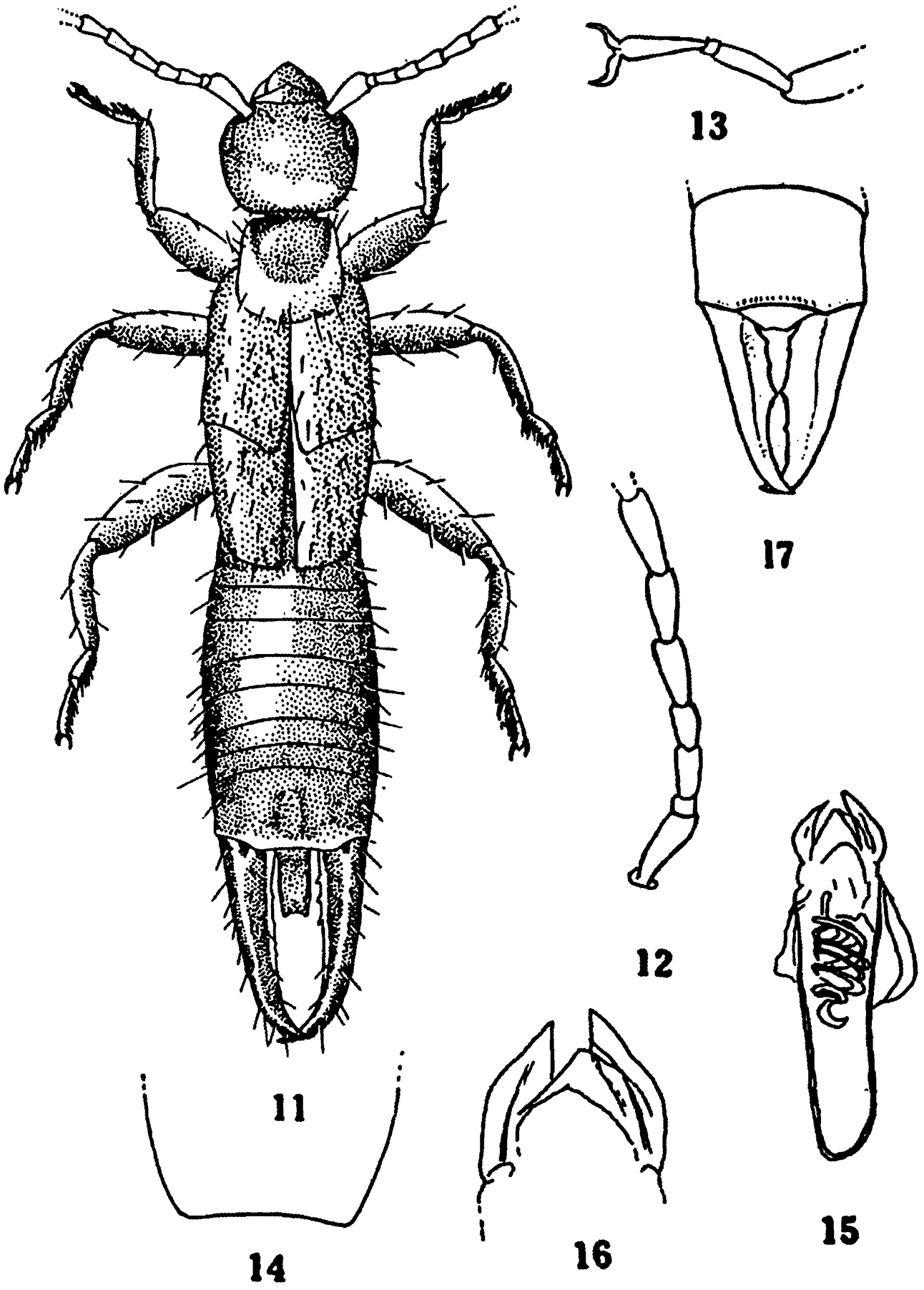
(Figs. 11–17)

General colour blackish brown; antennae light brown; posterior half of pronotum, tibia & tarsi yellow; some of the abdominal tergites, pygidium and forceps light brown; ultimate tergite dark. Body sparsely pubescent, with oily lusture.

Head smooth, slightly longer than broad, frons convex, sutures obsolete, hind margin hardly emarginate in middle. Antennae with 12(+) segmented, first segment stout, gently expanded apically, slightly shorter than the distance between antennal bases; 2$^{nd}$ short, about as long as broad; 3$^{rd}$ long, slender; 4$^{th}$ a little shorter than preceding, stouter, gently expanded apically; 5$^{th}$ about as long as the 3$^{rd}$ but gently narrowed at base, ramaining gradually increasing in length and each narrowed at base. Pronotum a trifle longer than broad, smooth, anteriorly about as broad as head, sides straight, depressed, gently widened posteriorly, postero-lateral angles and margin rounded, median sulcus, fine but distinct, prozona tumid, well differentiated from flat metazona. Elytra and wings well developed, former with hind margin obliquly truncate, almost of equal length, sparsely pubescent, smooth. Legs short, femora swollen, hind tarsi with 1$^{st}$ segment slightly shorter than the 3rd; 2$^{nd}$ short, about as long as broad; claw without an arolium. Abdomen fusiform, tergites convex, smooth, lateral folds on 3$^{rd}$ & 4$^{th}$ tergites almost obsolete. Penultimate sternite transverse, smooth, hind margin lightly concave, postero-lateral angles distinct. Ultimate tergite transverse, smooth, disc weakly convex, in middle posteriorly with a shallow depression, gently narrowed posteriorly, hind margin in middle, subtruncate, oblique & concave laterally above base of forceps. Pygidium a little over tiwce longer




**Figs. 1-10.** *Cranopygia similis* Zacher, Male, 1. Ultimate tergite and forceps; 2. Genitalia; *Nesogaster minusculus* Rehn, Male; 3. Anterior portion of body; 4. A few basal antennal segments; 5. Ultimate tergite & forceps (macrolabic); 6. Ultimate tergite and forceps (microlabic); 7. Genitalia (right paramere missing); *Circolabia dubronyi* Rehn, Male; 8. Ultimate tergite and forceps; 9. Genitalia; Female; 10. Ultimate tergite and forceps.




**Figs. 11-17.** *Circolabia bhatiai* **sp. n.**, Holotype Male; 11. Dorsal view; 12. A few basal antennal segments—enlarged; 15. Genitalia; 16. Parameres—enlarged; Paratype Female; 17. Ultimate tergite and forceps.

than broad, at base subvertical, afterwards horizontal, sides lightly convex, hind margin emarginate, postero-lateral angles acute. Forceps remote, stout at base, afterwards gradually tapering, cylindrical, almost straight, in apical 1/3 gently incurved, apices hooked & pointed, internal margin differentiated in to dorsal & ventral borders, ventral border with a few fine teeth in basal 1/2. Genitalia with paramere narrowed apically, virga with concentrict coils.

*Female* : Agrees with male in most characters except that the penultimate sternite obtuse in middle posteriorly; ultimate tergite weakly transverse; pygidium vertical, transverse, narrowed apically with slight emargination in middle; forceps simple & straight, inner margin with fine teeth and in middle with a distinct tooth.

*Measurements* : (in mm)

| | Holotype | Paratypes | |
|---|---|---|---|
| | Male | Males | Females |
| Length of body | 4.4 | 4.2–4.3 | 4.0–5.2 |
| Length of forceps | 1.1 | 1.1–1.15 | 0.9–1.0 |

*Material Examined* : India : North Andaman, Holotype Male (genitalia mounted between two converslips and attached to the pin of specimen; penultimate sternite mounted on a card attached with the specimen, *Canarium euphyllum*, RRD 917, BCR 334;. Cage 511, 18.1.1929; Andaman Islands, Paratype 1 Female, R & D 88, BCR 44, Cage GX, Ex unknown wood bark 29.11.1930; Paratype 1 Male (genitalia mounted between two converslips and attached to the pin of specimen and penultimate sternite mounted on a card attached with the specimen), RRD 88, BCR 42, Cage GZ, Ex *Rhizophora mucronata* bark, 24.IV.1930; Paratypes 1 Male, 1 Female, RRD 88, BCR 37, Cage 716, Ex *Sideroxylon longepetiolatum*, 17.VIII.1930; Paratype 1 Female, 12.IX.1930, Paratype 1 Female, 14.IX.1930, Paratype 1 Female, 21.XI.1930 and Paratype 1 Female 3.01.1931, all RRD 88, BCR 37, Cage 716, Ex *Sideroxylon longipetiolatum*, ex FRI Dehra Dun coll. (all *C. F. C. Beeson* coll.); South Andaman, Burmanala, Paratype 1 Female, ex under bark of dead decaying tree trunk, 22.1.2000 (*G. K. Srivastava* coll.); deposited in the National Zoological Collection at the Zoological Survey of India, Calcutta.

*Remarks* : The described species comes very close to *Circolabia emarginata* (Srivastava, 1978) from Philippines in general body colour & shape of male genitalia especially virga with concentric coils but differs by it shorter (maximum length 6.2 mm, including forceps) body size (*vs* 7.8 mm, including forceps in *C. emarginata*) and male pygidium narrow, a little over twice as long as broad with hind margin faintly concave (*vs* broad, flattened, only slightly longer than broad with hind margin deeply emarginate in middle).

***Chaetolabia sahai*** sp. n.

(Figs. 18–23)

*Male* : General colour dark brown with shades of blackish brown on certain body parts; mouth parts, pronotum and legs slightly lighter in colour.

Head smooth, about as long as broad, convex, sutures obliterated, hind margin emarginate. Eyes small, much shorter than post-ocular area. Antennae multi-segmented (partly damaged, 7 segments on the left and 12 on the right remaining), basal segment stout, narrowed basally, about as long as the distance between antennal bases; 2nd short, about as long as broad; 3rd long & cylindrical; 4th stouter, slightly shorter than preceding, distinctly narrowed basally; 5th about as long as 3rd but a little stouter; 6th onwards gradually increasing in length but one or two apical ones shorter and globular. Pronotum longer than broad, anteriorly about as broad as head, sides straight, gently reflexed, scarcely widened posteriorly, hind margin rounded, median sulcus distinct, prozona convex and well differentiated from flat metazona. Elytra smooth, well developed, finely pubescent, shoulders weak, hind margin straight, oblique. Wings of same texture as the elytra, projecting beyond elytra as narrow lateral, ovate flaps. Legs typical of the genus, hind tarsi with first segment about equal to third; second about as long as broad, on underside thick hairs present. Abdomen cylindrical, narrowed at base, gradually enlarging posteriorly, tergites convex, smooth, sides of segments broadly convex, finely pubescent. Penultimate sternite transverse, hind margin rounded with a faint emargination in middle; manubarium about as long as broad, narrowed apically. Ultimate tergite weakly convex, smooth, with an oily lustre, transverse, feebly sloping backwards, hind margin in middle straight, laterally above the base of forceps oblique & faintly emarginate. Pygidium distinct, at base narrow, declivent, apically broader, postero-lateral angles markedly projecting, hind margin faintly & broadly emarginate. Forceps covered with short & long pubescence, branches remote at base to accommodate pygidium, depressed above, almost straight, narrowed apically with tip gently incurved, internal margin with a faint flange terminating into a small, sharp posteriorly directed tooth at apical 1/3. Genitalia with parameres narrowed apically, tip acute, gently incurved; virga thick tubular.

*Female* : Unknown.

*Measurements* (in mm).

| | Holotype Male |
|---|---|
| Length of body | 6.5 |
| Length of forceps | 2.0 |

*Material Examined* : India : Great Nicobar Island, Paulo Baha, West Coast, Holotype Male (genitalia mounted between two coverslips and pinned with the specimen), 21.8.1984 (*S. S. Saha* coll.); deposited in the National collection at the Zoological Survey of India, Calcutta.

*Remarks* : This species can be easily separated from all the known species of the genus by the shape of male pygidium..

It comes close to *Chaetospania borellii* Srivastava, from Philippine Is, in having some what similar male pygidium but differs by the pronotum being longer than broad; pygidium with postero-lateral angles more strongly projecting and the inner flang of forceps weakly marked and the parameres acute apically.

## CHELISOCHIDAE

## CHELISOCHINAE

### *Hamaxas chandrai* sp. n.

(Figs. 24–30)

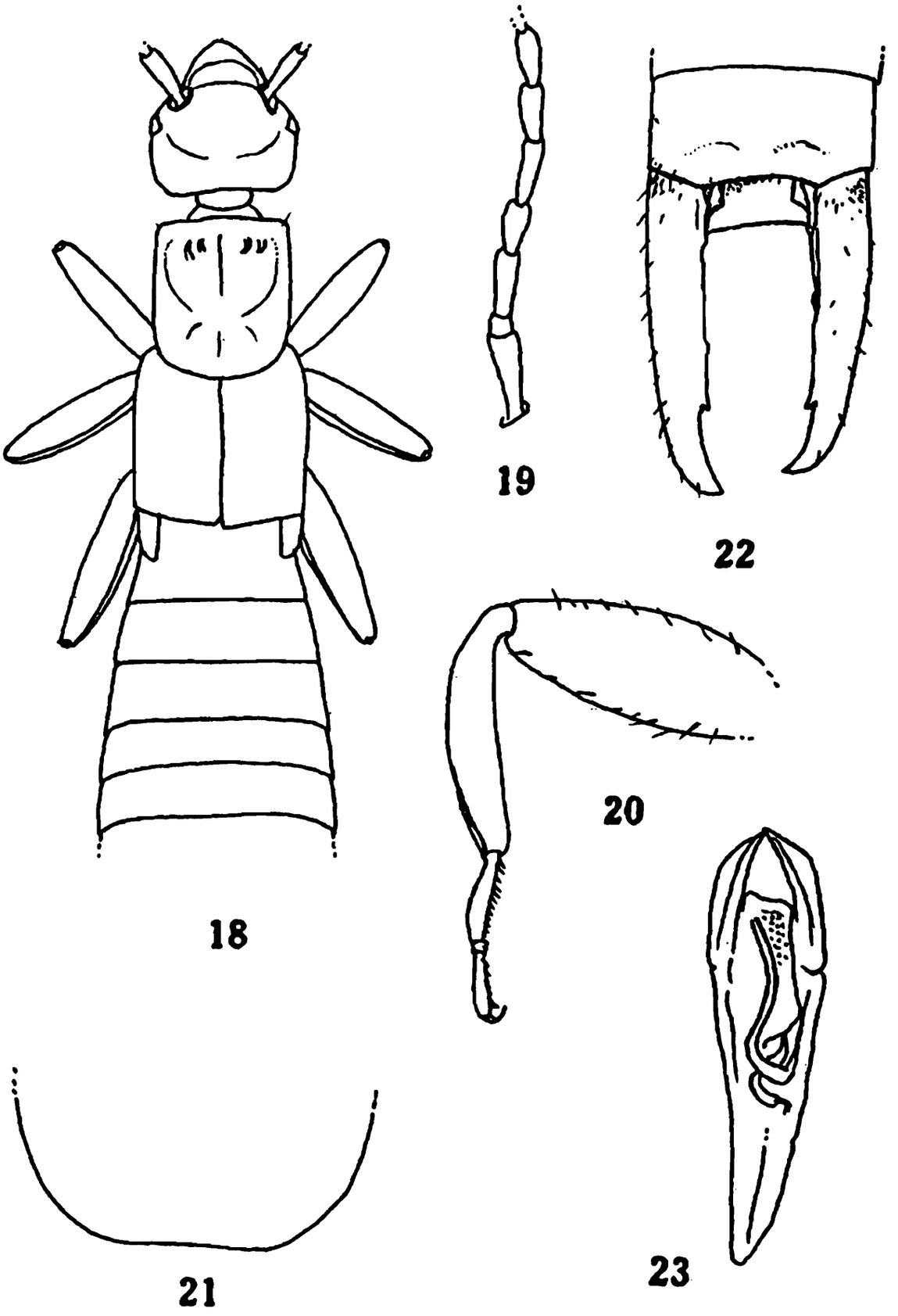
*Male* : Head, antennae, elytra and wings brownish black but one or two apical segments of antennae and sides of pronotum yellowish brown; legs brownish yellow; abdominal tergites & forceps reddish brown with shades of black on certain parts. Body pubescent, especially wings and elytra.

Head about as long as broad, frons depressed, smooth, occiput moderately raised, median suture distinct, transvere suture marked by depressed area on the border of raised occiput, postero-lateral angles rounded, hind margin emarginate in middle. Antenna 14-segmented, 1st stout, narrowed basally, cylindrical, slightly longer than the distance between antennal bases; 2nd short, about as long as broad; 3rd long & slender; 4th a trifle shorter & stouter than 3rd; 5th slightly longer than 3rd, stouter, narrowed basally, afterwards segments gradually thinning & increasing in length. Eyes small, about 1/3 as long as the post-ocular area. Pronotum longer than broad, anteriorly convex in middle, sides parallel, gently reflexed, hind margin rounded, oscurely punctulated, prozona tumid, well differentiated from flat metazona. Elytra and wings well developed, shallowly punctulated. Legs typical of the genus, hind tibiae feebly sulcate near apex, hind tarsi with 1st segment equal to 3rd; 2nd narrow, produced below the third. Abdomen narrowed at base, modrately convex, tergites densely punctate, lateral folds on 3rd & 4th tergites distinct but former weakly developed, sides of segments convex. Penultimate sternite transverse, oscurely punctate, hind margin rounded with a slight emargination in middle. Ultimate tergite transverse, smooth, weakly convex above, in the middle posteriorly with a faint triangular depression, median sulcus faintly marked, above the base of forceps with a rounded elevation and a small tubercle present above it in the middle close to hind margin, posterior margin straight, oblique above base of forceps. Pygidium vertical, narrowed posteriorly, postero-lateral angles produced into a minute point and hind margin faintly concave. Forceps remote, stout, cylindrical in cross section in basal half, afterwards depressed, tapering apically, bent inwards at base, thence straight, in apical 1/3 gently incurved with apices hooked, internal margin with border sharp & serrations, a posteriorly directed tooth at apical one third, afterwards, unarmed. Genitalia with parameres flat, external apical angle convex, narrowed apically with tip pointed; virga short, tubular, at base with a pair of chitinous plates.

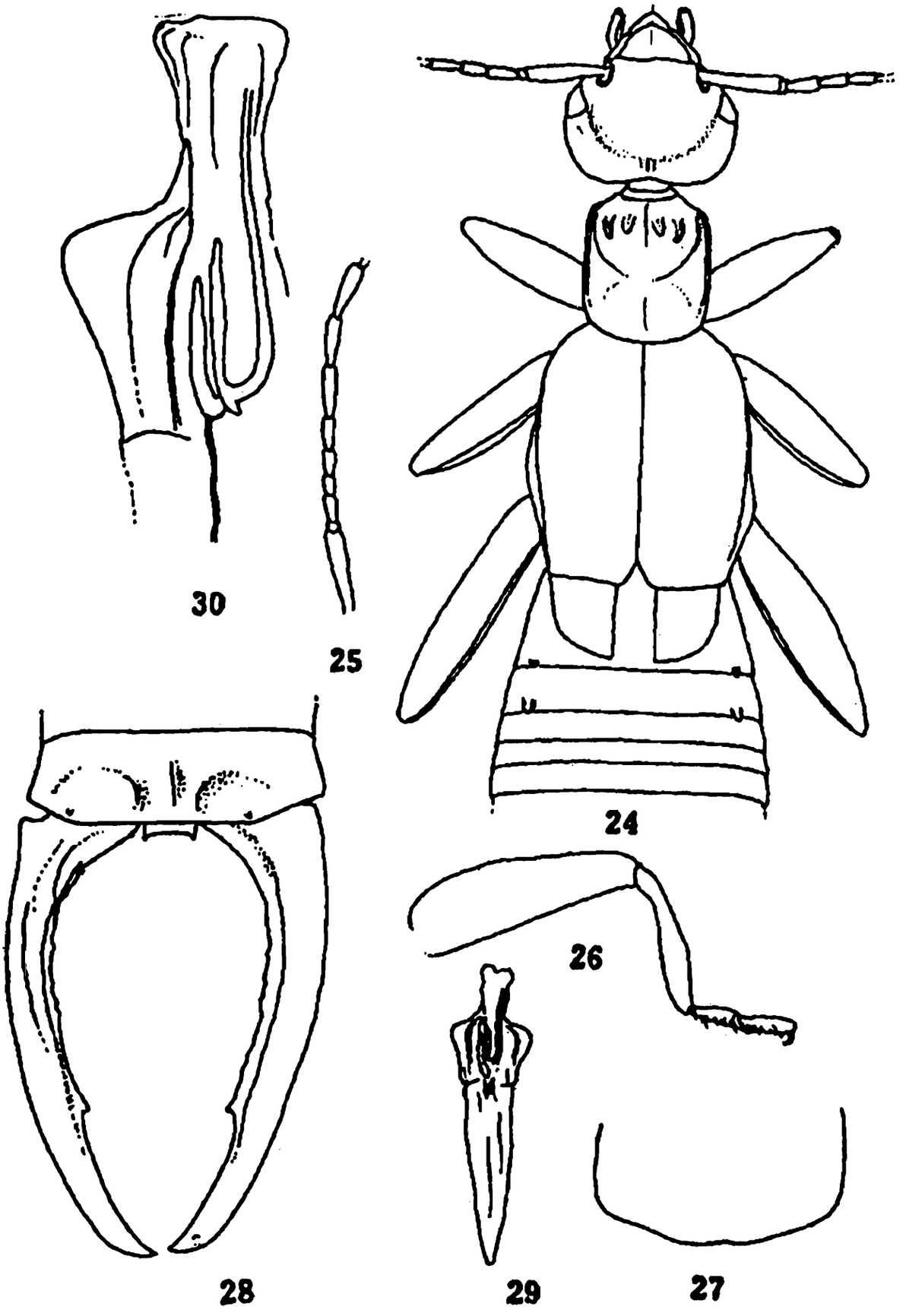
*Female* : Unknown.

*Measurements* : (in mm)

| | Male |
|---|---|
| Length of body | 7.8 |
| Length of forceps | 3.4 |




**Figs. 18-23.** *Chaetolabia sahai* **sp. n.**, Holotype Male; 18. Anterior portion of body; 19. A few basal antennal segments; 20. Hind leg; 21. Hind portion of penultimate sternite; 22. Ultimate tergite and forceps; 23. Genitalia.




**Figs. 24-30.** *Hamaxas chandrai* **sp. n.**, Holotype Male; 24. Anterior portion of body; 25. A few basal antennal segments; 26. Hind leg; 27. Hind portion of penultimate sternite; 28. Ultimate tergite and forceps; 29. Genitalia; 30. Paramere alongwith a portion of preputical sac—enlarged.

*Material Examined* : India : Great Nicobar Island, Great Nicobar Biosphere Reserve, 41 km Galathea National Park, 1 Male (genitalia mounted between two coverslips and pinned with the specimen), 18.11.1993, on wings (*K. Chandra* coll.); deposited in the Zoological Survey of India, Calcutta.

*Remarks* : The described species comes close to *Hamaxas nigrorufus* (Burr), from New Guinea, in general appearance and sigmoid forceps, in males, but differes by the shape of pronotum in being parallel sided (*vs* gently widened posteriorly in *H nigrorufus*); forceps internally differentiated into dorsal and ventral borders with fine serrations and terminating into a short toot directed posteriorly (*vs* with a short tooth at base above and another slightly larger at apical 1/3 and internal border serrated or smooth) and external apical angle of paramere convex (*vs* angle sharply triangular with tip acute).

## ACKNOWLEDGEMENTS

I am thankful to Dr. J. R. B. Alfred, Director, Zoological Survey of India, Calcutta for providing necessary facilities.

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*Rec. zool. Surv. India* : **99** (Part 1–4) : 59-63, 2001

# A STUDY OF THREE NEW SPECIES OF SPIDERS OF THE GENERA *CHORIZOPES* CAMBRIDGE, *LARINIA* SIMON AND *NEOSCONA* SIMON (ARANEAE : ARANEIDAE) FROM MADHYA PRADESH, INDIA

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## INTRODUCTION

The spiders of the family Araneidae are well known for their extremely intricate and beautiful orb webs. While studying the spider collection, collected by the second author from different parts of Jabalpur, M. P., we came across three new species of the family Araneidae which are described here.

The genus *Chorizopes* was established by Cambridge, 1870, with the type-species *Chorizopes frontalis* Cambridge. Since the establishment of the genus, Tikader, 1982, redescribed and reillustrated four species of *Chorozopes* from different parts of India, in his *Fauna* of *India, Spiders* volume.

The genus *Larinia* was established by Simon in 1874 with the type-species *Larinia lineata* (Lucas). Patel (1975) described two new species of *Larinia* from Gujarat. Tikader (1982), reillustrated and redescribed, two more species of *Larinia* in *Fauna* of *India, Spiders* volume.

The genus *Neoscona* was established by Simon in 1864 with the type-species *Neoscona anabesca* (Walckenaer). Tikader (1982), reillustrated and redescribed seventeen species in *Fauna* of *India, Spiders*, volume. Patel & Reddy (1992) described one species from coastal Andhra Pradesh.

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

### *Chorizopes tikaderi* sp. nov.

*General* : Cephalothorax, legs and abdomen reddish-brown with black patches. Total length 4.30 mm. Carapace 1.60 mm. long, 1.80 mm. wide; abdomen 3.10 mm. long 3.00 mm. wide.

*Cephalothorax* : Wider than long, broadest posteriorly, narrowing anteriorly; clothed with fine pubescence and provided with a pair of black patches as in fig. 1. Cephalic region slightly elevated, convex. Ocular quad nearly squarer, eyes pearly white, both rows strongly recurved. Posterior medians encircled by black ring and larger than anterior medians, laterals closely situated. Sternum heart-shaped, pointed behind, blackish, clothed with grey pubescence. Labium wider than long,

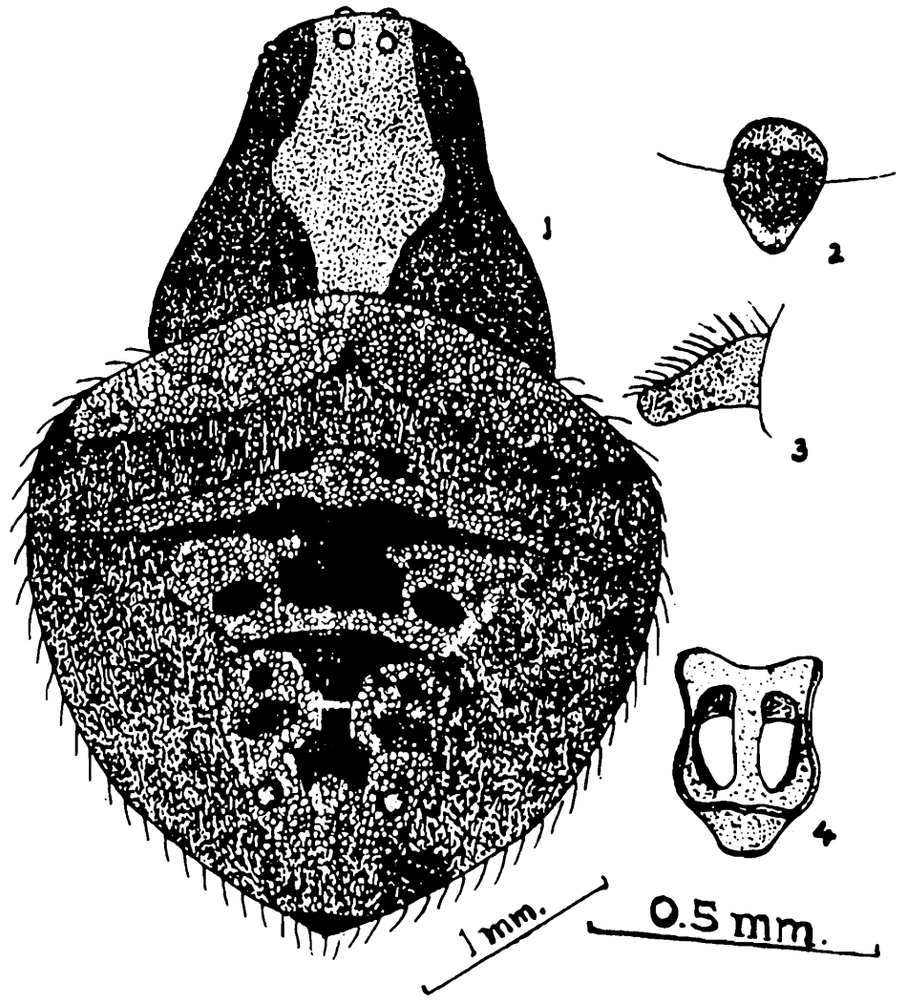
triangular, dark brown with pale distal margin. Maxillae broad, dark brown with pale inner margins, provided with distinct scopulae, Chelicerae strong and stout, deep brown. Legs relatively long and strong, clothed with hairs and spines, posterior region of each femur with a transverse blackish patch.

*Abdomen* : Slightly longer than wide, clothed with pubescence and provided with a beautiful design of blackish patches and sigilla as in fig. 1. Ventral side blackish with two big chalk white spots between the epigynal furrow and spinnerets. Epigyne having a short scape as in figs. 2 & 3. Internal genitalia as in fig. 4.

*Type-specimen* : *Holotype* : One female, in spirit, other details as above. (Reg. No. 5516/18)

*Type-locality* : Khandari, Jabalpur, M. P., India, Coll. Pawan Gajbe, 11.8.1998.

This species resembles with *Chorizopes bengalensis* Tikader but differs from it as follows : (i) Cephalothorax wider than long but in *C. bengalensis*, cephalothorax longer than wide. (ii) Abdomen reddish-brown with a beautiful design of blackish patches and sigilla but in *C. bengalensis*, abdomen brownish and provided with black and white patches. (iii) Epigyne and internal genitalia also structurally different.




**Figs. 1-4.** *Chorizopes tikaderi* sp. nov., 1. Dorsal view of female, legs omitted. 2. Epigyne, ventral view. 3. Epigyne, lateral view. 4. Internal genitalia.

***Larinia bharatae*** sp. nov.

*General* : Cephalothorax and legs yellow with blackish patches, abdomen brownish black. Total length 7.20 mm. Carapace 2.80 mm. long, 1.90 mm. wide; abdomen 4.70 mm. long, 1.80 mm. wide.

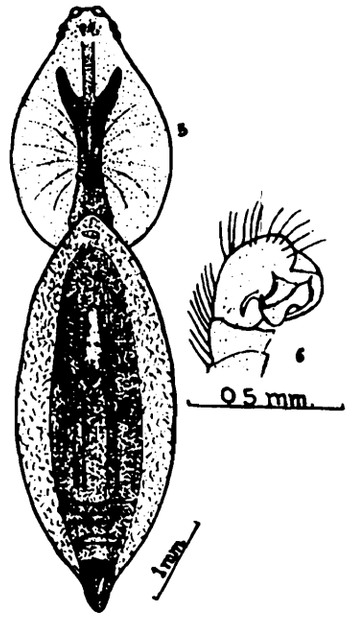
*Cephalothorax* : Nearly one and a half times longer than wide; narrowing in front, clothed with fine pubescence; provided with a mid-dorsal longitudinal blackish patch; double lines running just behind the posterior median eyes and end just before the longitudinal thoracic furrow. Ocular quad forming a trapezium, wider in front than behind; anterior medians larger than posterior medians; posterior medians closely situated; laterals subequal, close to each other and situated on distinct tubercles; both rows of eyes recurved but posterior row very narrowly recurved. Sternum much elongated, heart shaped, pointed behind, uniform pale yellow in colour. Labium as long as wide, brownish with pale distal border; maxillae longer than broad, yellowish, provided with distinct scopulae. Chelicerae strong and stout, yellowish, provided with distinct boss. Legs long and strong, clothed with hairs and spines, provided with black spots. Male palp as in fig. 6.

*Abdomen* : Longer than wide, pointed anteriorly over the carapace, clothed with hairs and pubescence, mid-dorsally provided with a blackish patch running the whole length of the abdomen as in fig. 5. Lateral sides lighter in colour. Ventral side pale yellow. Female unknown.

*Type-specimen* : *Holotype* : Male, in spirit, other details as above. (Reg. No. 5517/18)

*Type-locality* : Barela, Jabalpur, M. P., India, Coll. Pawan Gajbe, 28.9.1997.

This species resembles with *Larinia chloris* Audouin but differs from it as follows : (i) Cephalothorax provided with a mid-dorsal longitudinal blackish patch but in *L. chloris* such patch is absent. (ii) Male palp also structurally different.

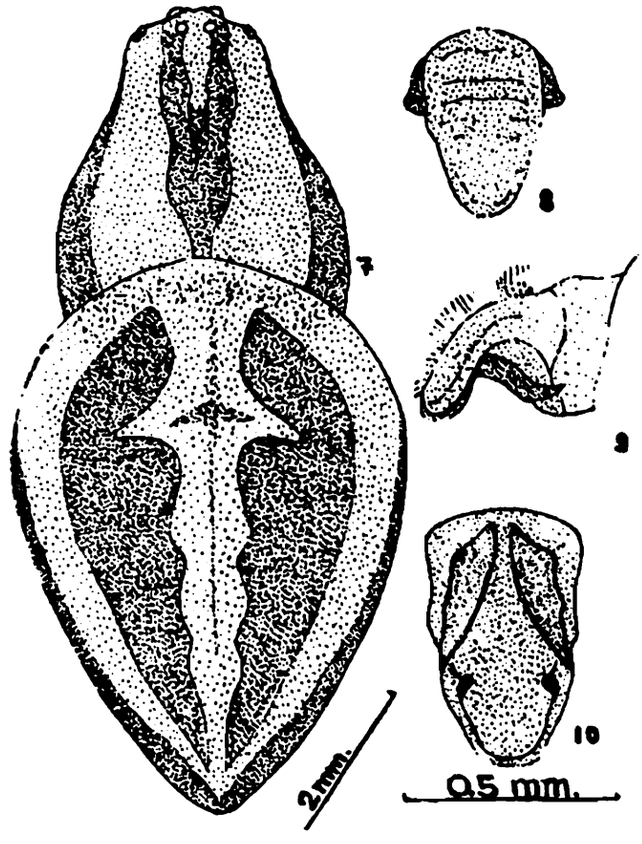



**Figs. 5-6.** *Larinia bharatae* sp. nov., 5. Dorsal view of male, legs omitted. 6. Left male palp, ventral view.

*Neoscona biswasi* sp. nov.

*General* : Cephalothorax and legs greyish brown, abdomen dark brown. Total length 3.90 mm. Carapace 1.50 mm. long, 1.20 mm. wide; abdomen 2.70 mm. long, 1.80 mm. wide.

*Cephalothorax* : Longer than wide, narrowing in front, clothed with pubescence and hairs, provided with one mid-dorsal and two lateral brown bands as in fig. 7. Cephalic region slightly high, ocular quad nearly as long as wide and slightly wider in front than behind; anterior medians larger than posterior medians; posterior medians encircled by black ring; laterals close and situated on small tubercles; both eye rows recurved but posterior row only slightly recurved. Sternum heart-shaped, pointed behind, blackish-brown, provided with a mid-longitudinal greyish band. Labium wider than long, dark brown with pale distal margin. Maxillae broad, nearly as long as wide, proximal portion dark brown, distal portion pale yellow; provided with distinct scopulae. Chelicerae strong, dark brown, having moderate boss. Legs long and moderately strong, clothed with hairs and spines, distal ends of segments with transverse brown bands.




**Figs. 7-10.** *Neoscona biswasi* sp. nov., 7. Dorsal view of female, legs omitted. 8. Epigyne, ventral view. 9. Epigyne, lateral view. 10. Internal genitalia.

*Abdomen* : Nearly elliptical, longer than wide, clothed with pubescence and hairs, strongly overlapping on the cephalothorax; provided with two mid-dorsal and two lateral light brown patches along the whole length of the abdomen as in fig. 7. Ventral side dark brown; a big black patch present

between the epigastric furrow and spinnerets and is bordered by two dumbel-shaped light brown patches. Scape of the epigyne curved, long and thin with a broad, dirty white base as in figs. 8 & 9. Internal genitalia as in fig. 10.

*Type-specimen* : *Holotype* : Female, in spirit, other details as above (Reg. No. 5515/18).

*Type-locality* : Vijay Nagar, Jabalpur, M. P., India, Coll. Pawan Gajbe, 12.10.1997.

This species resembles with *Neoscona molemensis* Tikader & Bal but can be distinguished from it as follows : (i) Cephalothorax provided with one mid-dorsal and two lateral brown bands but in *N. molemensis*, only cephalic region provided with two lateral longitudinal brown patches (ii) Abdomen provided with longitudinal brown bands but in *N. molemensis*, abdomen with chalk white bands. (iii) Epigyne and internal genitalia also structurally different.

## ACKNOWLEDGEMENTS

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# DIVERSITY IN TICKS (ACARI) OF WEST BENGAL

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## INTRODUCTION

The ticks are a small group of acarines under the order Metastigmata or Ixodida. They occur throughout the world, but are more frequently encountered in tropical and subtropical realms. They are grouped into three families *vig.*, Argasidae or soft ticks. Ixodidae or hard ticks and Nuttalliellidae (known only from Africa).

The ticks show morphological characters typical of other acari, but their peculiarities and greater size (2,000 μm to over 30,000 μm) clearly distinguish them from most other acarines. Besides, there are certain characters which are present and distinct throughout the ontogeny of ticks. A hypostome armed with retrose teeth serves to anchor the tick to its host. A complex sensory setal field, Haller's organ, is located on the dorsal side of tarsus-I in all postembryonic stages, providing sites for contact or olfactory chemoreception. Other distinguishing features are : a pair of stigmata situated posterior to coxa IV or dorsal to coxa III-IV, palp with only three or four segments, chelicera 2-segmented, digits of chelicerae working in horizontal plane with their dentate faces directed externally.

The argasid ticks are non-scutate with leathery integument, sexual dimorphism slight, spiracles small and anterior to coxa-IV and pads, porose areas and festoon are absent. The ixodid ticks are scutate with terminal capitulum, sexual dimorphism well marked, spiracles posterior to coxa-IV and pads, porose areas and festoon are present.

The ticks live as ectoparasites of vertebrates and feed obligatorily on the blood of mammals, reptiles and birds. Some of them are significant pests of man and animals. In temperate and tropical countries, they surpass all other arthropods as transmitters in the number and variety of diseases of man and domestic animals. They cause paralysis and anaemia and serve as reservoir and vectors for many infective viruses, rickettsia, bacteria, sporozoans and spirochaetes. Ticks are the main vectors of Kyasanur Forest Disease (KFD) in man and monkeys in Karnataka state. Other arboviruses like Kaisodi, Ganjam and Bhanja have also been isolated from ticks in India. Ticks are oviparous. The life history passes through egg, larva, nymph and adult stages.

Though the study of ticks in India was initiated by Linnaeus in 1758, the first record of tick from West Bengal was done by Rudow (1870). He described an ixodid tick *Amblyomma bengalense* from

*Python* sp. But Neumann (1911) reported the species as doubtful and since then there is no record of the species.

The first record of any valid species of ixodid tick from West Bengal was made by Warburton (1910). Later, medical entomologists and acarologists got interested about ixodid tick of the state and described and recorded a good number of genera and species of ticks from the state. The detailed accounts of those studies have been summarised by Sanyal and De (1991, 1992).

## RANGE OF DIVERSITY

The number of tick species of West Bengal (Table-I). When compared with the total number of species known from India, it is noted that West Bengal alone represents 30% of the total Indian tick fauna. The total number of taxa of ticks so far known from West Bengal is represented by 9 genera

**Table-I.** Total number of taxa of tick in India and West Bengal.

| Place | Genera | Species |
|---|---|---|
| India | 12 | 107 |
| West Bengal | 09 | 32 |
| Bankura | 02 | 04 |
| Bardhaman | 04 | 04 |
| Birbhum | 03 | 03 |
| Calcutta | 06 | 11 |
| Darjiling | 07 | 18 |
| Howrah | 03 | 03 |
| Hooghly | 04 | 05 |
| Jalpaiguri | 05 | 13 |
| Coochbihar | 03 | 03 |
| Malda | 02 | 02 |
| Medinipur | 05 | 07 |
| Murshidabad | 02 | 02 |
| Nadia | 03 | 03 |
| North 24-Parganas | 05 | 06 |
| South 24-Parganas | 03 | 03 |
| Purulia | 04 | 06 |
| West Dinajpur | 03 | 03 |

and 32 species under one family Ixodidae. There is no record of tick of the family Argasidae from the state. This may be due to lack of attention to this family by the acarologists.

While analysing the status of taxa of ticks in West Bengal, it is observed that three species of ixodid tick *viz.*, *Hyalomma brevipunctata*, *Haemaphysalis darjeeling* and *H. ramachandrai* have been described as new to science from this state. It is also recorded that among the species so far known from West Bengal, *Boophilus microplus, Dermacentor auratus, Haemaphysalis bisponosa* and *Hyalomma anatolicum anatolicum* are most dominant in population in the state.

Table-II showing the host and distribution of ticks in the state, indicates that they have adapted themselves to live on different hosts in different areas in the state from plains to higher elevation of the Himalayas.

The Zoogeographical relationship of ticks so far known from West Bengal is shown in Figure-I. It shows that the tick species recorded from the state show maximum similarity in species composition with Palaearctic region (25%). The other regions in order of degree of similarity are Ethiopian (12.5%), Pacific (9.4%), Nearctic and Neotropical (each 6.3%). It is also noted from the figure that 62.5% of tick species found in West Bengal are known to occur only in the oriental region. The available data records that *Amblyomma supinoi* is known only from West Bengal. Table-II also shows that none of the species of tick known from West Bengal is endemic as all the species are known from outside India.

## DISTRIBUTION OF TICK FAUNA IN WEST BENGAL

The number of genera and species of ticks in different districts of West Bengal is shown in Table-I and Figure-2. These indicate that ticks are known from all the districts in the state. They show that Darjiling district alone represents 77.8% of genera and 56.3% of species of the total genera and species of tick known from the state and the district occupies highest position among the other districts. The district Jalpaiguri occupies the second highest position (40.8%). The other districts in order of number of total species are Calcutta (34.4%). Medinipur (21.9%), North 24-Parganas and Purulia (each 18.8%), Hooghly (15.6%), Bankura and Bardhaman (each 12.6%), Birbhum, Howrah, Coochbihar, Nadia, South 24-Parganas and West Dinajpur (each 9.4%) and Malda and Murshidabad (each 6.3%).

## ACKNOWLEDGEMENTS

The authors express gratefulness and sincere thanks to the Director, Zoological Survey of India for extending working facilities.

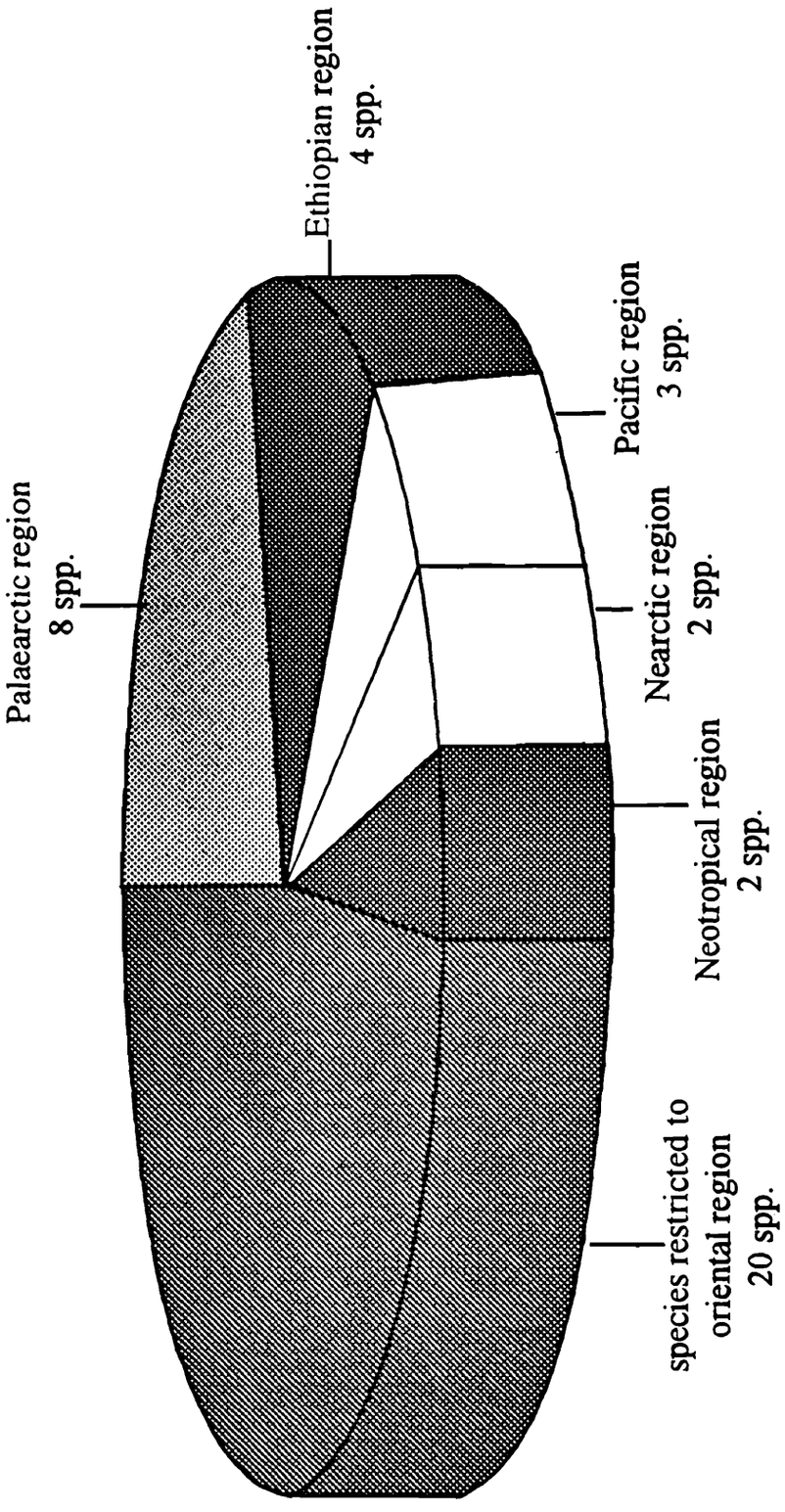


**Fig. 1. Zoogeographical distribution of tick species of West Bengal.**

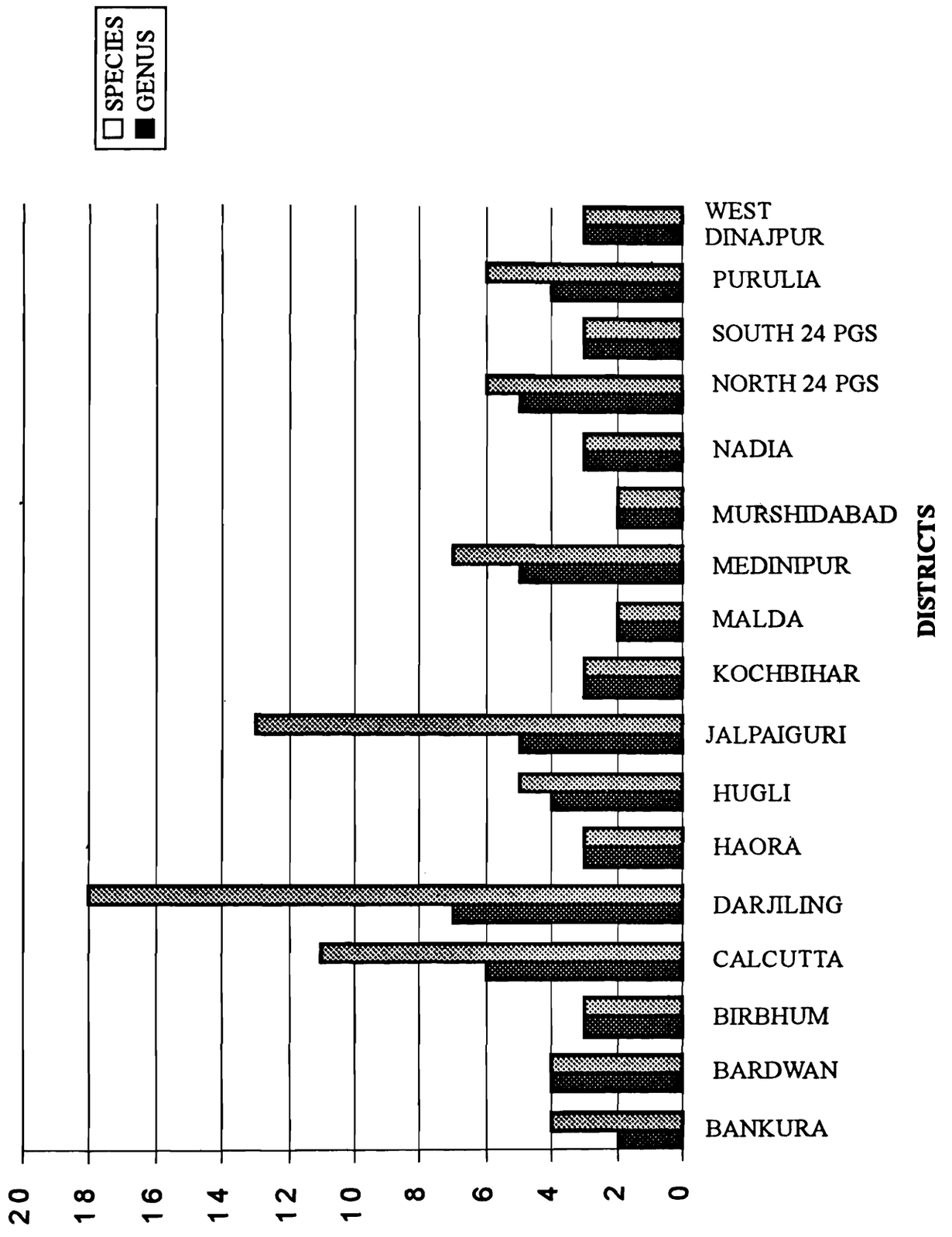


**Fig. 2.** District-wise distribution of ticks in West Bengal.

**Table-II.** Species of tick known from West Bengal with their hosts and distribution.

| Sl. No. | Species | Hosts recorded in West Bengal | Distributed in India and elsewhere |
|---|---|---|---|
| 1 | *Amblyomma helvolum* Koch | *Geomyda grandis, Varanus sp., Naja naja* | India : Andaman & Nicobar Islands, Orissa, West Bengal (Calcutta). Elsewhere : Australia, Indonesia, Malaysia, New Guinea, Philippines, Taiwan, Thailand, Singapore, Vietnam. |
| 2 | *Amblyomma javanense* (Supino) | *Manis pentadactyla, Nicoria tricarinata* | India : Bihar, Gujarat, Karnataka, Maharashtra, Orissa, Uttar Pradesh, West Bengal (Calcutta, Jalpaiguri). Elsewhere : Bangladesh, China, Indonesia, Malaysia, Mayanmar, Pakistan, Philippines, Vietnam. |
| 3 | *Amblyomma supinoi* Neumann | *Testudo elongata, Geomyda spinosa* | India : West Bengal (Jalpaiguri). Elsewhere : Myanmar. |
| 4 | *Amblyomma testudinarium* Koch | Buffalo, tiger | India : Arunachal Pradesh, Assam, Karnataka, Maharashtra, Orissa, Sikkim, West Bengal (North 24-Parganas, Darjiling, Jalpaiguri). Elsewhere : Bangladesh, Indonesia, Japan, Malaysia, Mayanmar, Philippines, Sri Lanka. |
| 5 | *Aponomma gervaisi* (Lucas) | *Naa tripudians, Varanus bengalensis* | India : Assam, Maharashtra, Manipur, Orissa, Uttar Pradesh, West Bengal (Calcutta). Elsewhere : Africa, Indonesia, Nepal, Pakistan, Sri Lanka. |
| 6 | *Aponomma varanensis* (Supino) | *Varanus salvator, Varanus nebulosus, Naia tripudians, Python molurus, Python reticulatus, Zamensis mucosus, Bos frontalis, Ovis nahura* | India : Andaman & Nicobar Islands, Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, West Bengal (Calcutta, Bardhaman). Elsewhere: Bangladesh, Cambodia, Indonesia, Malaysia, Mayanmar, Philippines, Singapore, Sri Lanka, Thailand, Vietnam. |
| 7 | *Boophilus microplus* (Canestrini) | Cattle | India : Andaman & Nicobar Islands, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Madhya Pradesh, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal (all districts). Elsewhere : Africa, Australia, Central America, Formosa, Indonesia, Japan, Mayanmar, New Guinea, Philippines, South America, Sri Lanka. |
| 8 | *Dermacentor auratus* Supino | Deer, Man | India : Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Karnataka, Meghalaya, Orissa, Uttar Pradesh, West Bengal (Calcutta, Darjiling, Jalpaiguri, South 24-Parganas). Elsewhere : Indonesia, Mayanmar, Sri Lanka. |

**Table-II.** *Contd.*

| Sl. No. | Species | Hosts recorded in West Bengal | Distributed in India and elsewhere |
|---|---|---|---|
| 9 | *Haemophysalis aborensis* Warburton | Barking deer, *Parus monticulus, Gallus gallus murghi, Susscrofa cristatus,* vegetation | India : Arunachal Pradesh, Assam, Meghalaya, West Bengal (Darjiling, Jalpaiguri). Elsewhere : Laos, Mayanmar, Nepal, Thailand, Vietnam. |
| 10 | *Haemaphysalis aponommoides* Warburton | Cattle, Man, vegetation | India : Arunachal Pradesh, Sikkim, West Bengal (Calcutta, Darjiling). Elsewhere : China, Nepal, Formosa. |
| 11 | *Haemaphysalis birmaniae* Supino | *Muntiacus muntzak vaginalis, Capricornis sumatraensis thar, Antelope cervicapra* | India : Arunachal Pradesh, Assam, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : Mayanmar, Nepal. |
| 12 | *Haemaphysalis bispinosa* Neumann | Cattle, dog, tiger, vegetation | India : Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Orissa, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal (most of the districts). Elsewhere : Australia, China, New Zealand, Pakistan, Sri Lanka, Thailand. |
| 13 | *Haemaphysalis cornigera shimoga* Trapido and Hoogstraal | Sambar | India : Kerala, Karnataka, Meghalaya, West Bengal (Jalpaiguri). Elsewhere : Sri Lanka. |
| 14 | *Haemaphysalis darjeeling* Hoogstraal and Dhanda | *Capricornis sumatraensis, Susscrofa cristatus, Muntiacus muntzak vaginalis* | India : Assam, Manipur, West Bengal (Darjiling). Elsewhere : Malaysia, Mayanmar, Thailand. |
| 15 | *Haemaphysalis himalaya* Hoogstral | Barking deer | India : Himachal Pradesh, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : Nepal. |
| 16 | *Haemaphysalis hystricis* Supino | Vegetation | India : Arunachal Pradesh, Assam, Uttar Pradesh, West Bengal (Darjiling, Jalpaiguri). Elsewhere : Japan (Okinawa Islands, Ryukyu Islands), Myanmar, Taiwan, Vietnam. |
| 17 | *Haemaphysalis indica* Warburton | Bengal fox, domestic dog, jackle | India : Bihar, Gujarat, Karnataka, Orissa, Uttar Pradesh, West Bengal (Calcutta, Hooghly). Elsewhere : Nepal, Pakistan, Sri Lanka. |
| 18 | *Haemaphysalis montgomeryi Nuttall* | Goat | India : Himachal Pradesh, Jammu and Kashmir, Punjab, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : Nepal, Pakistan. |

**Table-II.** *Contd.*

| Sl. No. | Species | Hosts recorded in West Bengal | Distributed in India and elsewhere |
|---|---|---|---|
| 19 | *Haemaphysalis obesa* Larrousse | Cattle, vegetation | India : Meghalaya, West Bengal (Jalpaiguri). Elsewhere : Malaysia, Thailand, Vietnam. |
| 20 | *Haemaphyalis ramachandrai* Dhanda, Hoogstraal and Bhat | Cattle, vegetation | India : Himachal Pradesh, Sikkim, West Bengal (Darjiling, Jalpaiguri). Elsewhere : Nepal. |
| 21 | *Haemaphysalis spinigera* Neumann | Cattle, vegetation | India : Andaman & Nicobar Islands, Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Kerala, Orissa, Tamil Nadu, West Bengal (Darjiling, Jalpaiguri). Elsewhere : Nepal, Sri Lanka. |
| 22 | *Hyalomma anatolicum anatolicum* Koch | Cattle | India : Andhra Pradesh, Assam, Chandigarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal (most of the districts). Elsewhere : Afganisthan, Border of Mediterranean sea, Canary Islands, East Africa, Pakistan, Portugal, Russia, Southern Europe, West Asia. |
| 23 | *Hyalomma marginatum isaaci* Sharif | Cattle, goat | India : Andhra Pradesh, Arunachal Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal (Bankura, Medinipur, Purulia). Elsewhere : Afganisthan, Nepal, Pakistan, Sri Lanka, West Asia. |
| 24 | *Hyalomma brevipunctata* Sharif | Cheeta, Sambar | India : Andhra Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal (Medinipur). Elsewhere : Pakistan. |
| 25 | *Hyalomma hussaini* Sharif | Cattle | India : Andhra Pradesh, Bihar, Delhi, Goa, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, West Bengal (North 24-Parganas). Elsewhere : Mayanmar, Pakistan. |
| 26 | *Ixodes acutitarsus* (Karsch) | Man | India : Arunachal Pradesh, Assam, Himachal Pradesh, Sikkim, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : Formosa, Japan, Myanmar, Tibet. |

**Table-II.** *Contd.*

| Sl. No. | Species | Hosts recorded in West Bengal | Distributed in India and elsewhere |
|---|---|---|---|
| 27 | *Ixodes granulatus* Supino | *Epimys rufescens* | India : Arunachal Pradesh, Himachal Pradesh, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : Indonesia, Malaysia, Mayanmar. |
| 28 | *Ixodes ovatus* Neumann | Vegetation | India : Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Sikkim, Uttar Pradesh, West Bengal (Darjiling). Elsewhere : China, Formaos, Japan, Mayanmar, Nepal, Taiwan, Thailand. |
| 29 | *Nosomma monstrosum* (Nuttall & Warburton) | Sambar | India : Bihar, Delhi, Goa, Jammu and Kashmir, Maharashtra, Orissa, Karnataka, Punjab, Uttar Pradesh, West Bengal (Medinipur). Elsewhere : Bangladesh, Laos. |
| 30 | *Rhipicephalus haemaphysaloides* Supino | Barking deer, cattle, goat, *Capricornis sumatraensis,* vegetation | India : Arunachal Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Karala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Orissa, Punjab, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal (Darjiling, Jalpaiguri, North 24 Parganas). Elsewhere : China, Indonesia, Myanmar, Sri Lanka, Taiwan, Thailand, Vietnam. |
| 31 | *Rhipicephalus sanguineus* (Latrielle) | Bullock, dog | India : Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal (Calcutta, Medinipur, Purulia). Elsewhere : Africa, America, Asia, Europe. |
| 32 | *Rhipicephalus turanicus* Pomerantzev | *Bandicota bengalensis,* cattle, dog, *Furnumbulus palmarum, Mus musculus, Rattus rattus, Suncus murimus* | India : Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Maharashtra, Tamil Nadu, West Bengal (Calcutta, Hooghly, Nadia, Purulia). Elsewhere : China, Iran, Russia, Western Sudan, Countries bordering the Mediteranen sea. |

## SUMMARY

The sutdy on tick fauna of West Bengal was initiated by Rudow (1870). Later many workers studied the taxonomy of ticks of the state and till date 9 genera and 32 species under the family Ixodidae are known from West Bengal. No argasid tick is known from the state. Ticks have been recorded from all the districts, in which Darjiling occupies highest position in number of species.

The tick species recorded from the state show maximum similarity in species composition with Palaearctic region (25%). *Amblyomma supinoi* s known only from West Bengal.

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*Rec. zool. Surv. India* : 99 (Part 1–4) : 75-79, 2001

# A NEW SPECIES AND A NEW RECORD OF THE GENUS *PROTOGAMASELLUS* KARG (ACARINA : MESOSTIGMATA : ASCIDAE) FROM INDIA

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## INTRODUCTION

Karg (1962) established the genus *Protogamasellus* and designated *Protogamasellus primitivus* as type-species. The genus is cosmopolitan in distribution and around 22 species are known to occur. Recently, Bhattacharyya *et al.* (2000) described three new species from the Indian region. In this work *Protogamasellus rajkotensis* is described as new species while *Protogamasellus bifurcalis* Genis *et al.* is recorded for the first time from India.

Chaetotactic concept of Lindquist and Evans (1965) is used in the following description.

Materials used in this study are deposited in the National Zoological Collection, Zoological Survey of India, Calcutta.

### *Protogamasellus rajkotensis* sp. nov.

*Female* : Anterior dorsal shield (144.9 μ long, 111.15 μ wide) with sixteen pairs of simple setae; apical setae 18.39 μ long; posterior dorsal shield longer (104.4 μ) than wide (91.65 μ), with fifteen pairs of simple setae; transverse line continuous on both shields (Fig. 1); lateral membrane with ten pairs of simple marginal setae; j2 nearly transversely aligned with j1 and z1; setae J1, J2, J3, J4, J5 and Z5 are 26.56 μ, 28.60 μ, 32.69 μ, 36.78 μ, 14.3 μ and 40.86 μ long respectively.

Tritosternum normal in shape with swollen base and slender pilose lacinae (Fig. 2); pre-sternal area sclerotized, deeply emarginate medially; a narrow indistinct strip present connecting two extended sclerotized portions. Sternal shield 81.73 μ long, 76.63 μ wide, slightly concave posteriorly, with two pairs of sternal setae, first pair being situated on anterior sclerotized portion of sternal shield; metasternal setae freely placed on ventral membrene. Genital shield smooth, truncate posteriorly, widening behind paired genital setae. Metapodal plates slender, present transversely nearer to body margin (Fig. 3). Ventri-anal shield lineate anteriorly and conspicuously punctate posteriorly, with three pairs of setae excluding a pair of para- and a post-anal setae; position of three pairs of ventral

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setae and platelets as in fig. 3; ventral membrane lineate around genital and ventri-anal shield. Stigma small, placed at level of coxa IV; peritreme narrow, extending upto between coxae II and III; peritrematal shield encircling coxa IV.

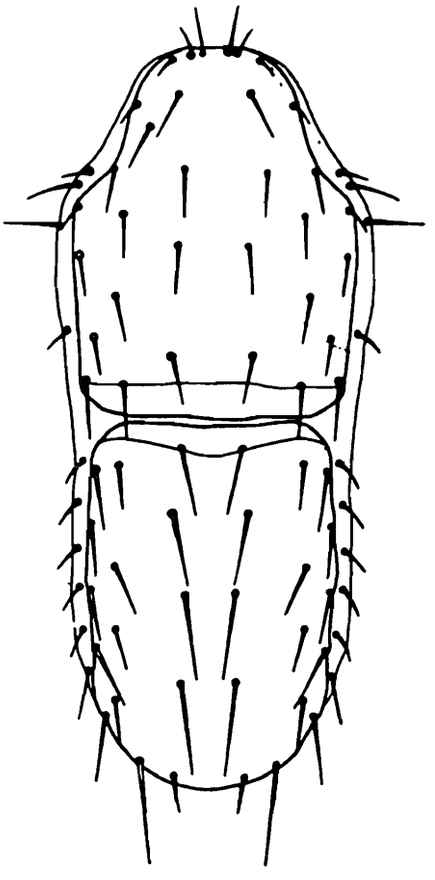

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**Fig. 1.** *Protogamasellus rajkotensis* sp. nov., female. 1. Dorsum.

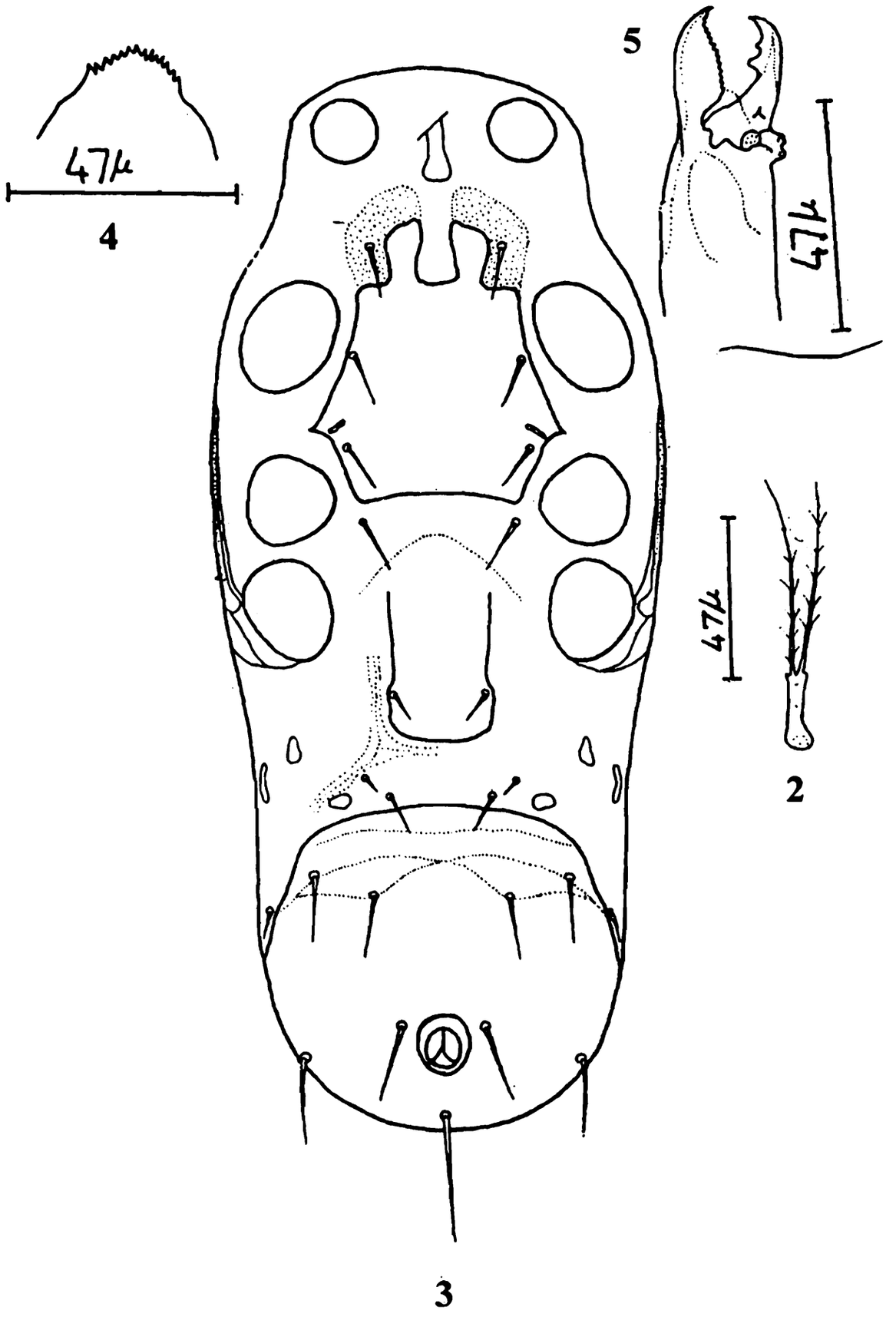
Anterior margin of tectum denticulate, almost round in shape (Fig. 4). Fixed cheliceral digit with a row of teeth on its cutting edge, movable digit bidentate (Fig. 5), distal one larger than proximal one; corniculi slender. Deutosternum with five transverse rows of deutosternal denticles.

Legs I–IV with well-developed claws and pulvilli; length of legs I–IV are 244.2 μ, 173.9 μ, 148 μ and 207 μ respectively; number of setae on femur, genu and tibia of legs I–IV being : femur 12-11-6-6, genua 13-11-8-8, and tibiae 3-10-8-9; legs without any macrosetae.

*Male* : Unknown.

*Material Examined* : Holotype female and four paratype females, Gujarat, Rajkot, Jubilee Garden; ex. soil and grass; 21.ix.1997; A. K. Bhattacharyya coll.

*Differential Diagnosis* : *Protogamasellus rajkotensis* sp. nov. shares its relationship with *P. brevicornis* Genis *et al.*, 1967, in respect of sclerotized pre-sternal area, shape of the genital and ventri-anal shield, number of setae on ventri-anal shield, but the new species is well-distinguished from *brevicornis* in having comparatively long dorsal setae, sixteen pairs of setae on anterior dorsal




**Figs. 2-5.** *Protogamasellus rajkotensis* sp. nov., female. 2. Tritosternum, 3. Venter, 4. Tectum, 5. Chelicera.

shield, free metasternal setae, presence of peritrematal shield, longer para-anal setae, shape of tritosternum, tectum, chelicerae and some other characteristic features.

### *Protogamasellus bifurcalis* Genis *et al.*, 1967

1967. *Protogamasellus bifurcalis* Genis *et al.*, *J. nat. Hist.*, 1 : 345.

*Female* : Anterior dorsal shield 120 μ long, 87 μ wide, with seventeen pairs of setae; posterior dorsal shield 138 μ long, 147 μ wide, with fifteen pairs of setae; lateral membrane with eleven pairs of marginal setae, anterior ones comparatively longer than posterior ones; all setae simple; transverse line across posterior dorsal shield absent between setal bases of J1.

Tritosternum densely plumose; sternal shield 68 μ long, 39 μ wide, with three pairs of setae; first sternal setae longer than second and third ones; posterior margin of sternal shield concave; metasternal setae placed on metasternal platelets; genital shield with paired genital setae. Ventri-anal shield with thirteen pairs of setae, excluding a pair of para- and a post-anal setae with its anterior margin extending beneath genital shield thus possessing Jvl on it; paired metapodal shields small, droplike in shape. Stigma small, placed at anterior level of coxa IV, with its post-stigmatal prolongation not reaching beyond mid-region of coxa IV.

Corniculi slender, with bifurcate tips; ventrally four pairs of stout hypostomatic setae present; capitular groove with seven rows of deutosternal denticles, 3–4 denticles in each row; movable digit of chelicera bidentate, fixed digit multidentate. Margin of tectum strongly denticulate.

Legs I–IV without any spur; tarsus I with macrosetae apically.

*Male* : Unknown.

*Material Examined* : Three females, Gujarat, Vadodora, Zoological Garden; ex. leaf litter; 25.ix.1997; A. K. Bhattacharyya coll.

*Remarks* : The Indian examples of *P. bifurcalis* Genis *et al.* conforms exactly with the well-illustrated description provided by its authors. The species is recorded for the first time from India. Previously the species was known only from its type-locality, Natal, Republic of South Africa.

## ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, Calcutta for providing laboratory and library facilities.

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*Rec. zool. Surv. India* : 99 (Part 1-4) : 81-85, 2001

# DESCRIPTION OF THREE NEW SPECIES OF SPIDERS OF THE GENERA *THOMISUS* WALCKENAER, *OXYPTILA* SIMON AND *XYSTICUS* KOCH (ARANEAE : THOMISIDAE) FROM MADHYA PRADESH, INDIA

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## INTRODUCTION

The interesting spiders of the family Thomisidae are abundant throughout India but not very well known. While studying the spider collection, collected by the second author from different parts of Jabalpur, M. P., we came across three new species of the family Thomisidae which are described here. The type-specimens are deposited in the National Collection, Zoological Survey of India, Calcutta.

The genus *Thomisus* was established by Walckenaer in 1805 with the type-species *Thomisus albus* (Gmelin). Since the establishment of the genus Tikader (1980) reillustrated and redescribed seventeen species in *Fanua* of *India, Spiders* volume.

The genus *Oxyptila* was established by Simon, 1804, with the type-species *Oxyptila brevipes* (Hahn). Since the establishment of the genus, Tikader, 1980, reillustrated and redescribed four species and two new species from different parts of India in *Fauna* of *India, Spiders* volume.

The genus *Xysticus* was established by Koch in 1835, with the type-species *Xysticus critatus* (Clerk). Since the establishment of the genus, Tikader, 1980 reillustrated and redescribed fifteen species and one new species from different parts of India in *Fauna* of *India, Spiders* volume. Gajbe & Gajbe, 1999, described two new species from Madhya Pradesh.

### *Thomisus rajani* sp. nov.

*General* : Cephalothorax and legs yellowish orange, abdomen greenish yellow. Total length 6.60 mm. Carapace 2.90 mm. long, 3.20 mm. wide; abdomen 3.90 mm. long, 4.30 mm wide.

*Cephalothorax* : Wider than long, broadest posteriorly, slightly narrowing in front. Eyes black, ocular area whitish, both rows recurved but posterior row only slightly recurved, three whitish lines below the conical processes converging together in the mid-thoracic region and from the same sport some dark lines running to the lateral sides of the cephalothorax. Sternum heart shaped, pointed

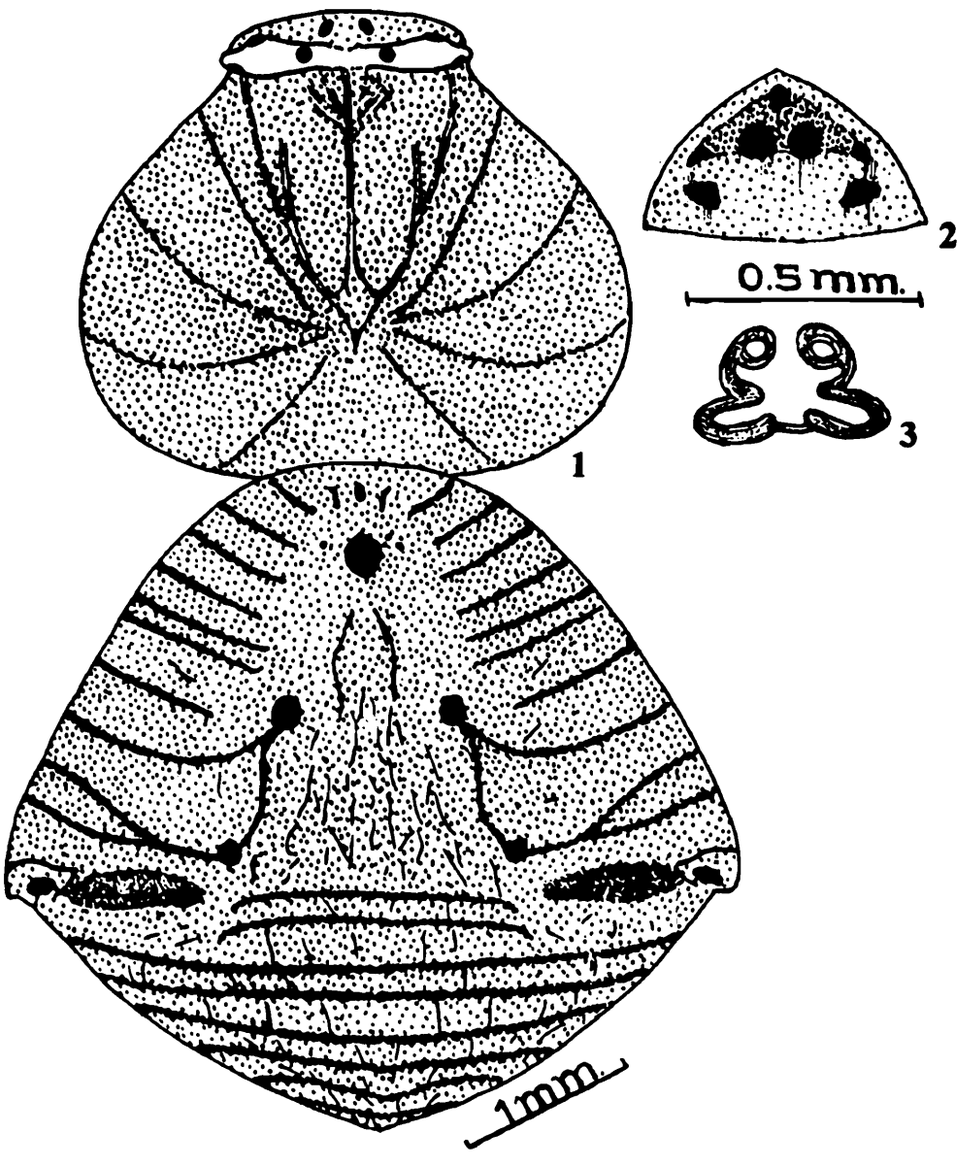
behind, clothed with hairs. Legs long and stout, I and II longer than III and IV, femora I and II with orange spots, femur I with five dorsal spines, tarsi I and II with five pairs of ventral spines.

*Abdomen* : Longer than wide, roughly pentagonal, with a black spot on each tubercle, five greyish spots in the antero-mid-dorsal region, a greyish patch below each tubercle, brown stripes on the antero-lateral sides, posterior region with black markings and conspicuous transverse muscular corrugations as in fig. 1. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

*Type-specimen* : *Holotype* : Female, in spirit, other details as above (Reg. No. 5511/18).

*Type-locality* : Sanjivani Nagar, Jabalpur, M.P., India. Coll. Pawan Gajbe, 12.12.1997.

This species resembles *Thomisus projectus* Tikader but can be distinguished from it as follows : (i) Three whithish lines below the conical processes converging together in the mid-thoracic region but in *T. projectus* such lines are absent. (ii) Femur I with five dorsal spines but in *T. projectus* femur I with three dorsal spines. (iii) Epigyne and internal genitalia also structurally different.




**Figs. 1-3.** *Thomisus rajani* sp. nov.

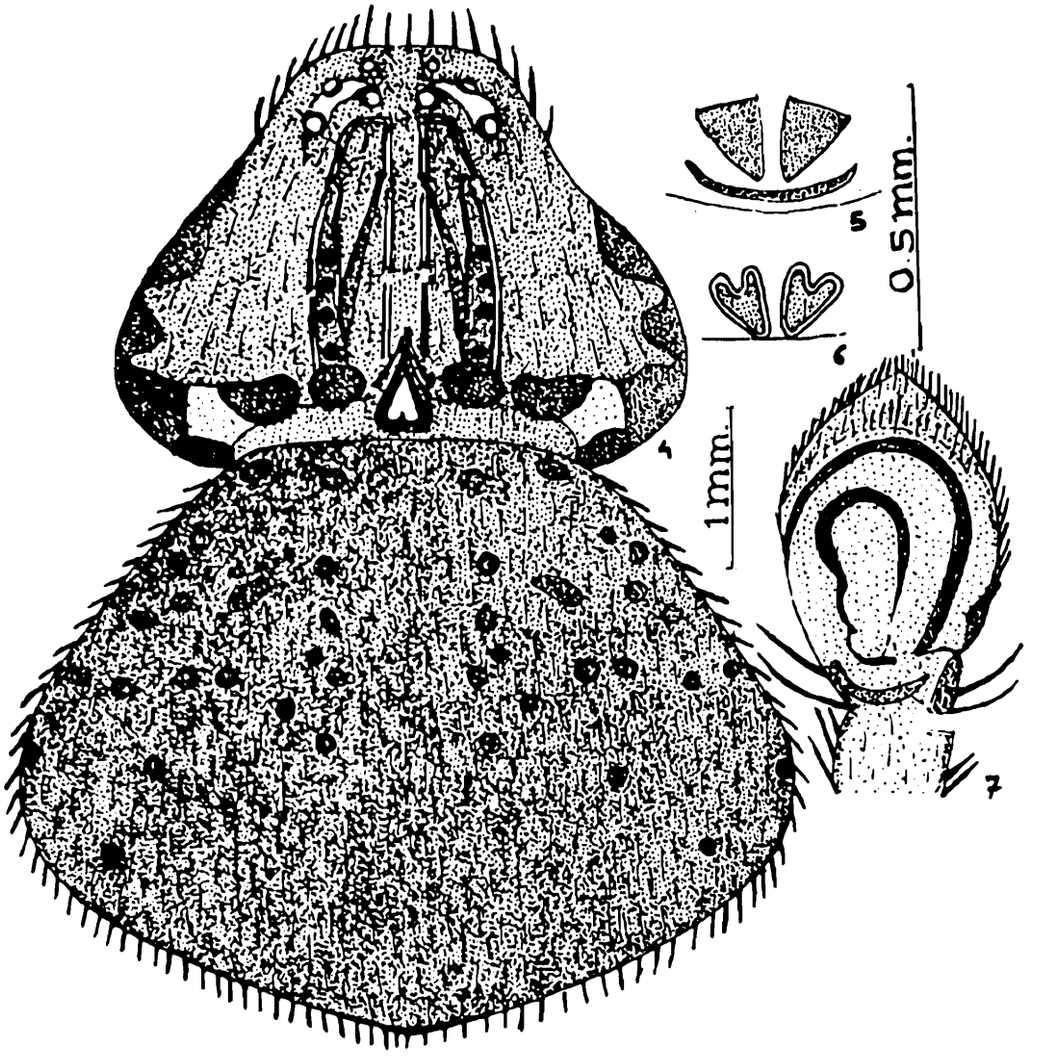
1. Dorsal view of female, legs omitted; 2. Epigyne; 3. Internal genitalia.

## *Oxyptila jabalpurensis* sp. nov.

*General* : Cephalothorax and legs deep brown, abdomen light brown. Total length 6.40 mm. Carapace 2.80 mm. long, 3.60 mm. wide; abdomen 3.90 mm. long, 4.80 mm. wide.

*Cephalothorax* : Wider than long, bearing spatulate hairs on the cephalic region. Anterior laterals and posterior laterals ringed with yellowish tubercles. Ocular quad longer than wide, both rows of eyes recurved but anterior row strongly recurved. Clypeus high, margin bearing nine clavate hairs directed forward but middle one directed upward. Lateral margin of cephalothorax provided with black patches and posterior portion lighter in colour and provided with six black spots. Sternum heart shaped, slightly pointed behind, lighter in colour and provided with eight black spots. Legs I and II robust and longer than III and IV, some black patches on the legs, all legs covered with spatulate hairs and few spines. Male same in colour and size. Male palp as in fig. 7.

*Abdomen* : Ovate, slightly broader than long, broadest behind the middle, densely clothed with spatulate hairs, provided with few black spots as in fig. 4. Ventral side slightly lighter than dorsal. Epigyne as in fig. 5. Internal genitalia as in fig. 6.




**Figs. 4-7.** *Oxyptila jabalpurensis* sp. nov.
4. Dorsal view of female, legs omitted; 5. Epigyne; 6. Internal genitalia; 7. Left male palp, ventral view;

*Type-specimen* : *Holotype* : female, *paratype* one female, *allotype* one male, in spirit, other details as above (Reg. No. 5522/18, 5512/18, 5513/18 respectively).

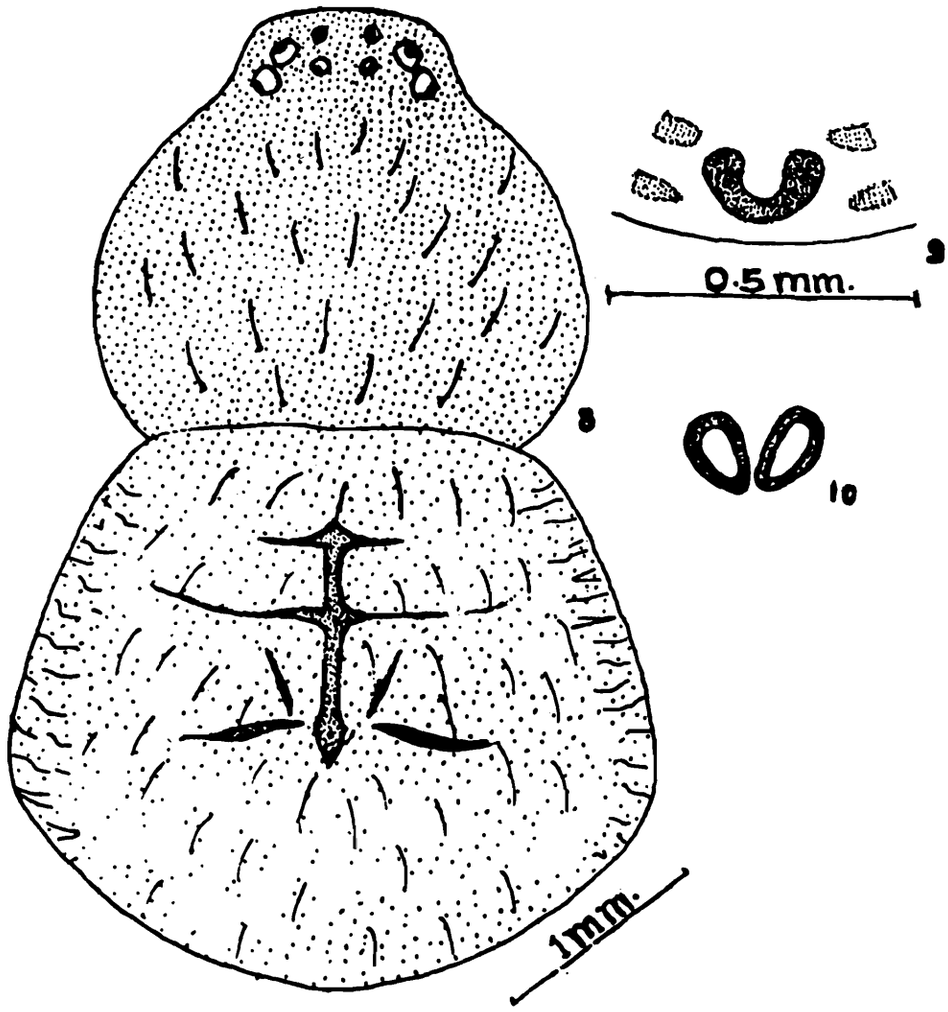
*Type-locality* : Sanjivani Nagar, Jabalpur, M.P., Coll. Pawan Gajbe, 5.10.1997.

This species resembles *Oxyptila amkhasensis* Tikader but can be distinguished from it as follows : (i) Cephalothorax wider than long but in *O. amkhasensis*, cephalothorax longer than wide. (ii) Posterior portion of cephalothorax provided with six black spots but such spots absent in *O. amkhasensis*. (iii) Sternum provided with eight black spots but such spots absent in *O. amkhasensis*. (iv) Epigyne and internal genitalia also structurally different.

***Xysticus tikaderi*** sp. nov.

*General* : Cephalothorax and legs brown, abdomen wiithish brown. Total length 4.60 mm. Carapace 2.00 mm. long, 2.30 mm. wide; abdomen 2.60 mm. long, 3.00 mm. wide.

*Cephalothorax* : Slightly wider than long, narrowing anteriorly, clothed with fine pubescence and spines. Eyes round, ringed with bluish tubercles; lateral eyes close and situated on larger tubercles; posterior median eyes larger than anterior median eyes; both rows of eyes recurved. Clypeus broad,




**Figs. 8-10.** *Xysticus tikaderi* sp. nov.

8. Dorsal view of female, legs omitted; 9. Epigyne; 10. Internal genitalia;

subrectangular, with six spines directed forward. Legs I and II longer than III and IV, clothed with hairs and spines.

*Abdomen* : Slightly wider than long, pentagonal, broadest behind the middle, clothed with stout spines and provided with a conspicuous blackish patch on the dorsum as in fig. 8. Ventral side chalk white. Epigyne as in fig. 9. Internal genitalia as in fig. 10.

*Type-specimen* : *Holotype* : female in spirit, other details as above (Reg. No. 5514/18).

*Type-locality* : Barela, Jabalpur, M.P., India Coll. Pawan Gajbe, 15.9.1997.

This species resembles with *Xysticus hindusthanicus* Basu, but can be distinguished from it as follows : (i) Legs brown but in *X. hindusthanicus*, the legs are black. (ii) A conspicuous blackish patch on the dorsum but in *X. hindusthanicus*, such a patch is absent. (iii) Epigyne and internal genitalia also structurally different.

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*Rec. zool. Surv. India* : 99 (Part 1–4) : 87-93, 2001

# DESCRIPTION OF FOUR NEW SPECIES OF SPIDERS OF THE FAMILIES ULOBORIDAE, PHILODROOMIDAE, GNAPHOSIDAE AND LYCOSIDAE (ARACHNIDA : ARANEAE) FROM MADHYA PRADESH, INDIA

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## INTRODUCTION

While studying the spider collection, collected by the second author from different areas of Jabalpur, M. P., we came across a new species each of the genera *Uloborus* Latreille, *Thanatus* Koch, *Sosticus* Chamberlin and *Lycosa* Latreille which are described here.

The genus *Uloborus* was established by Latreille in 1906 with the type-species *Uloborus walckenaerius* Latreille. Since the establishment of the genus, Tikader (1969, 1970) described two and one species each of the genus *Uloborus*.

The genus *Thanatus* was established by Koch in 1837 with the type-species *Thanatus formicinus* (Clerck). Tikader (1980) and Gajbe & Gajbe (1999) described four and one species respectively of the genus *Thanatus* from different parts of India.

The genus *Sosticus* was established by Chamberlin in 1922 with the type-species *Sosticus insularis* (Banks). Since the establishment of the genus, Gajbe, 1979 & 1992, described four and one species respectively from different parts of India. Tikader, 1982 reillustrated and redescribed all the species in *Fauna* of *India, Spiders* volume with one new species.

The genus *Lycosa* was established by Latreille in the year 1804 with the type-species *Lycosa tarantula* (Rossi). Since the establishment of the genus only 28 species are known from India. Tikader & Malhotra, 1980, reillustrated and redescribed all the species in *Fauna* of *India, Spiders* volume with six new species.

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

### *Uloborus jabalpurensis* sp. nov.

*General* : Cephalothorax, legs and abdomen dirty white. Total length 5.10 mm. Carpace 1.50 mm. long, 1.50 mm. wide; abdomen 3.60 mm long, 1.80 mm. wide.

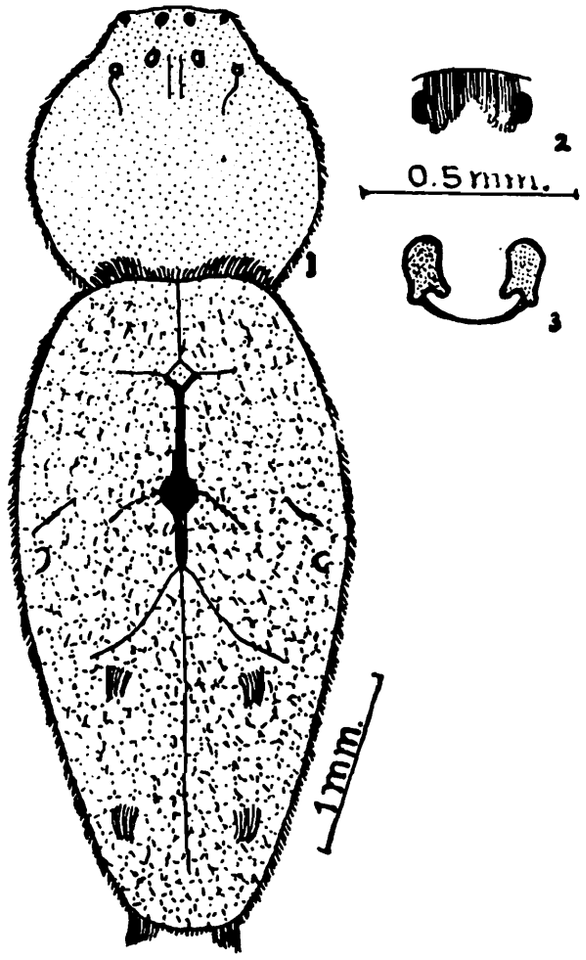
*Cephalothorax* : Nearly as long as wide, narrowing anteriorly, extremely hairy, densely clothed with fine whitish hairs. Eyes on black tubercles; two rows, anterior row straight and posterior row slightly recurved. Anterior medians nearer to each other than adjacent laterals; posterior medians slightly nearer to adjacent laterals than to each other. Sternum longer than wide, triangular, pointed behind, yellowish-white and densely clothed with hairs. Legs moderately long and slender, densely clothed with whitish hairs.

*Abdomen* : Longer than wide, high and broad in front, densely clothed with fine hairs and decorated with fine net-like patterns. Anterior dorsal side of abdomen provided with a hump, mid-dorsal region provided with a conspicuous blackish marking and posterior region provided with six tufts of white hairs as in fig. 1. Ventral side with chalk-white spots. Epigyne as in fig. 2 Internal genitalia as in fig. 3.

*Type-specimen* : *Holotype* : Female, in spirit, other details as above (Reg. No. 5520/18).

*Type-locality* : Pachpedi, Jabalpur, M. P., India, Coll. Pawan Gajbe, 29.8.1998.

This species resembles with *Uloborus danolius* Tikader but differs from it as follows : (i) Cephalothorax without any coloured patches but in *U. danolius*, cephalothorax provided with




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

two conspicuous longitudinal deep brown broad patches. (ii) Abdomen mid-dorsally provided with a conspicuous blackish marking but in *U. danolius*, such a marking is absent. (iii) Epigyne and internal genitalia also structurally different.

***Thanatus ketani*** sp. nov.

*General* : Cephalothorax and legs brownish grey, abdomen darkish brown. Total length 6.70 mm., Carapace 2.60 mm. long, 2.50 mm. wide; abdomen 4.20 mm. long, 2.50 mm. wide.

*Cephalothorax* : Longer than wide, broadest behind, narrow in front, lateral sides provided with conspicuous longitudinal deep brown patches. Eyes black, eight in two rows, both rows recurved but the posterior row longer and more recurved than the anterior row; posterior-lateral eyes larger than others, both rows of eyes form together a crescent shaped area. Ocular quad longer than wide and narrowing in front. Clypeus long, margin of clypeus with seven spines directed forward. Sternum heart shaped, pointed behind, clothed with fine hairs. Legs long and stout, provided with spines and brownish dots. Metatarsus I with twelve strong spines, tarsi I and II with seven spines each.

*Abdomen* : Longer than wide, widest in the middle and the end tapering, clothed with hairs and few spines and brown pigmented dots, mid-dorsally provided with dark brown bands reaching upto the lateral sides as in fig. 4. Ventral side lighter in colour and provided with few brown dots. Epigyne as in fig. 5. Internal genitalia as in fig. 6.

*Type-specimen* : *Holotype* : Female, in spirit, other details as above (Reg. No. 5518/18).

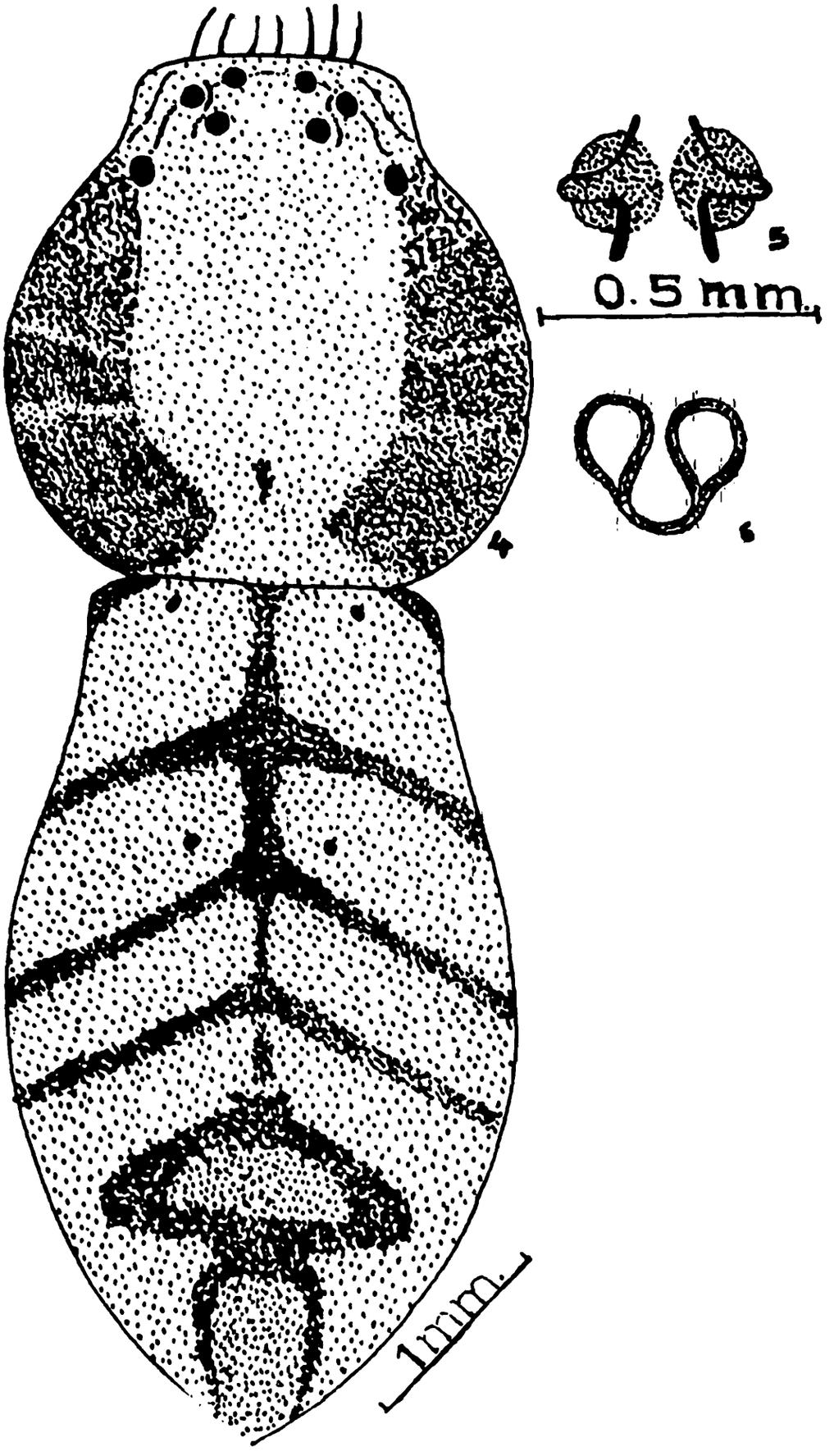
*Type-locality* : Lamhetaghat, Jabalpur, M. P., India, Coll. Pawan Gajbe, 25.7.1998.

This species resembles *Thanatus mandali* Tikader but can be distinguished from it as follows : (i) Abdomen mid-dorsally provided with dark brown bands reaching upto the lateral sides but in *T. mandali* a lens-shaped deep brown patch is present. (ii) Epigyne and internal genitalia also structurally different.

***Sosticus jabalpurensis*** sp. nov.

*General* : Cephalothorax and legs deep brown, abdomen black. Total length 6.50 mm., Carapace 2.50 mm., long 2.10 mm. wide; abdomen 3.90 mm. long, 2.10 mm. wide.

*Cephalothorax* : Longer than wide, oval, convex, clothed with pubescence, posterior middle of cephalothorax provided with an inconspicuous short fovea. Radiating blackish streaks diverge from around short fovea to the lateral sides of cephalothorax as in fig. 7. Eye rows distinctly separated, pearly white except anterior medians, posterior row of eyes slightly longer than the anterior row. Anterior row of eyes slightly recurved, medians closer to the adjacent laterals than to each other. Posterior row of eyes straight, posterior medians irregular in shape and slightly larger than the posterior laterals; the posterior medians and laterals equidistant to each other. Ocular quad longer




Figs. 4-6. *Thanatus ketani* sp. nov.; 4. Dorsal view of female, legs omitted; 5. Epigyne; 6. Internal genitalia.

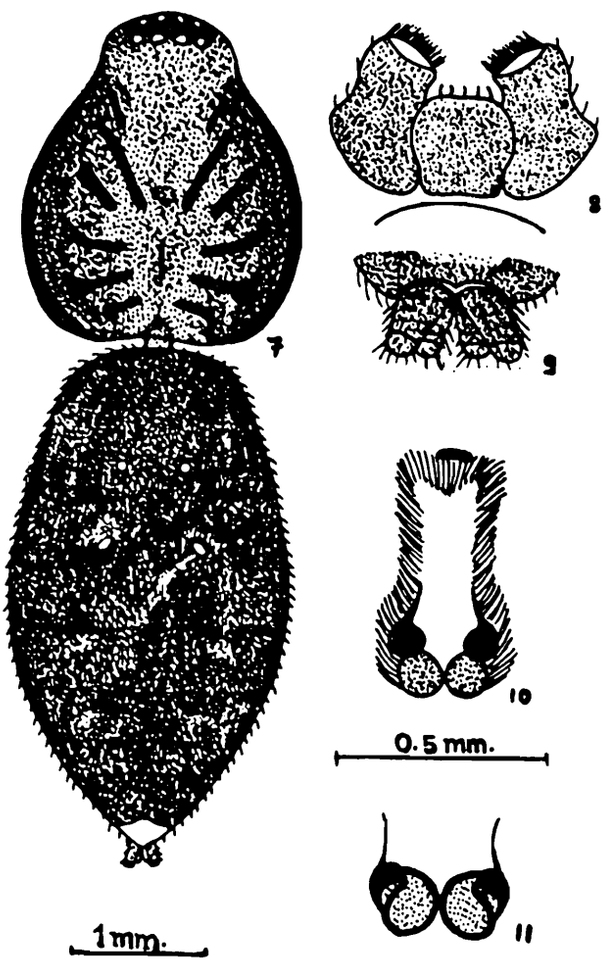
than broad. Sternum heart-shaped, pointed behind, brown in colour and clothed with black hairs. Labium and maxillae as in fig. 8. Chelicerae moderately strong, vertical, margins provided with hairs. Legs relatively long, thin, clothed with hairs and spines. Femora I with two dorsal spines. Tibiae III with three pairs of ventral spines.

*Abdomen* : Longer than wide, nearly elliptical, clothed with thick pubescence. Abdomen dorsally provided with four light brown dots and six dark brown patches, posterior end provided with a chalk white patch as in fig. 7. Epigyne as in fig. 10. Internal genitalia as in fig. 11. Spinnerets prominent, posterior spinnerets longer than others as in fig. 9.

*Type-specimen* : *Holotype* : female, in spirit, other details as above (Reg. No. 5519/18).

*Type-locality* : Tilwaraghat, Jabalpur, M. P., India, Coll. Pawan Gajbe, 22.8.1998.

This species resembles *Sosticus poonaensis* Tikader but can be distinguished from it as follows : (i) Arrangement of blackish streaks on cephalothorax different from *S. poonaensis*. (ii) Abdomen dorsally provided with four light brown dots, six deep brown patches and a chalk white patch at the posterior end but in *S. poonaensis*, five white spots are present. (iii) Epigyne and internal genitalia also structurally different.




**Figs. 7-11.** *Sosticus jabalpurensis* sp. nov.; 7. Dorsal view of female, legs omitted; 8. Labium and maxillae; 9. Spinnerets; 10. Epigyne; 11. Internal genitalia.

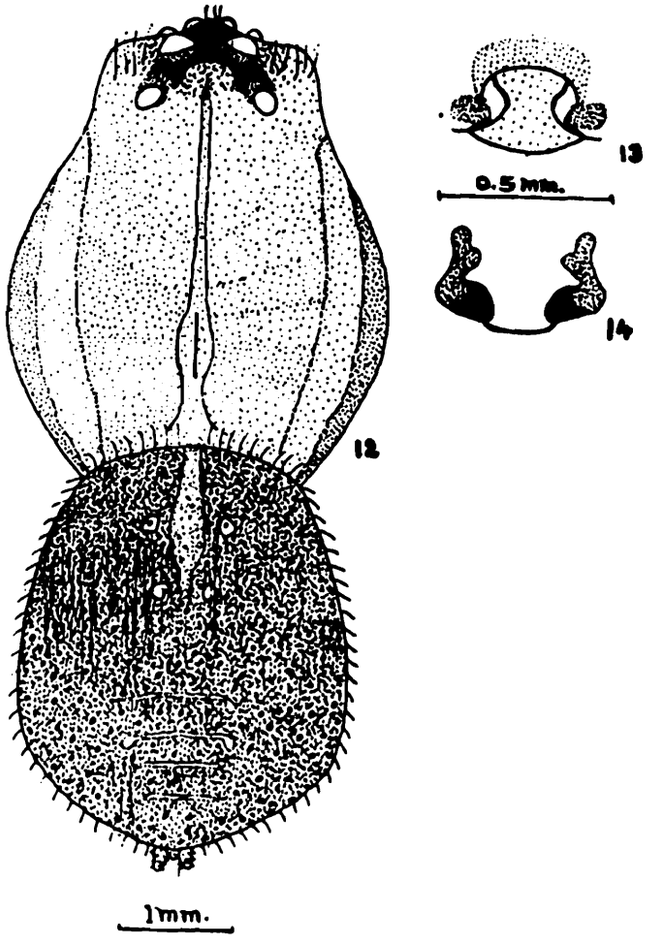
***Lycosa shaktae*** sp. nov.

*General* : Cephalothorax and legs dark brown, abdomen black, Total length 7.70 mm. Carapace 4.10 mm. long, 3.40 mm. wide; abdomen 3.80 mm. long, 2.90 mm. wide.

*Cephalothorax* : Longer than broad, broadest in the middle, narrowing anteriorly, clothed with hairs and few spines; provided with two wide, longitudinal dark patches starting below the ocular area and two dark patches along the lateral margin as in fig. 12. Ocular area black; anterior row of eyes slightly recurved and as long as the second row; anterior medians larger than anterior laterals; posterior medians largest of all eyes and less widely separated than posterior laterals. Sternum brown, heart-shaped, pointed behind, clothed with pubescence and hairs. Labium longer than wide, dark brown with pale distal margin. Maxillae longer than wide, brown, provided with distinct scopulae. Legs long, strong and stout, clothed with hairs and spines.

*Abdomen* : Longer than wide, elliptical, narrowing anteriorly, clothed with thick pubescence and hairs; provided with a spear shaped brown mark on the dorsum and brown dots and lines over the entire dorsal surface as in fig. 12. Ventral side lighter in colour. Epigyne as in fig. 13. Internal genitalia as in fig. 14.

*Type-specimen* : *Holotype* : female, in spirit, other details as above (Reg. No. 5521/18).




**Figs. 12-14.** *Lycosa shaktae* sp. nov.; 12. Dorsal view of female, legs omitted; 13. Epigyne; 14. Inernal genitalia.

*Type-locality* : Pachpedi, Jabalpur, M. P., India, Coll. Pawan Gajbe, 23.10.1997.

This species resembles with *Lycosa tista* Tikader but differs from it as follows : (i) Cephalothorax with two wide, longitudinal dark patches starting below the ocular area and two dark patches along the lateral margins but in *L. tista*, brown bands extending from fovea to the lateral sides. (ii) Epigyne and internal genitalia also structurally different.

## ACKNOWLEDGEMENTS

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# ON THE ICHTHYOFAUNA OF TRIVANDRUM DISTRICT, KERALA, INDIA

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## INTRODUCTION

Trivandrum district with a total area of 2192 Sq. Km. is divided into four main taluks viz. Chirayankil Taluk, Nedumangad Taluk, Trivandrum Taluk and Neyyatinkara Taluk and is drained by three main rivers namely Vamanapuram or Attingal river, Karamana & Neyyar river. Besides, the other major aquatic bodies include the Neyyar Dam, Velikayal, Kadimankulamkayal, Anjuthengukayal and Edava Nadayara Kayal. Trivandrum district was surveyed by the Z.S.I. teams during 1997–1998.

The collections from various water bodies comprised 1274 specimens belonging to 53 species including 36 primary fresh water species and 17 estuarine/marine ones under 25 families and 13 orders. Earlier reports on the Freshwater fishes from Trivandrum include 16 primary Freshwater species. A detailed systematic list is provided for the 36 primary freshwater species collected, which includes the first reference, material examined, length range in SL mm, locality, date of collection, distribution and relevant remarks. Nomenclatural changes followed are based on Menon, 1999.

This is the first consolidated report on the Freshwater fishes of Trivandrum District. Earlier studies on fishes of Travancore are by Pillai, 1929; John, 1936; Hora & Law 1941; Hora & Nair, 1941; and Silas, 1951. Recent addition to the fish fauna of Trivandrum district are by Rema Devi *et al.* 1996 and Raju *et al.* 1999.

## SYSTEMATIC LIST

### Primary Fresh Water Fishes

*Earlier reports, not represented in the present collections.

| | Endemic to India | Endemic to Western Ghats | Common to Srilanka | Of Wider Distribution | New Additions to the Dist. |
|---|---|---|---|---|---|
| Order : ANGUILLIFORMES | | | | | |
| Family : ANGUILLIDAE | | | | | |
| 1 *Anguilla bengalensis bengalensis* (Gray & Hardwicke) | | | + | + | + |
| 2 *Anguilla bicolor bicolor* McCl. | | | + | + | + |

*List Contd.*

| | Endemic to India | Endemic to Western Ghats | Common to Srilanka | Of Wider Distribution | New Additions to the Dist. |
|---|---|---|---|---|---|
| Order : CYPRINIFORMES | | | | | |
| Family : CYPRINIDAE | | | | | |
| Subfamily : RASBORINAE | | | | | |
| 3 *Amblypharyngodon melettinus* (Val.) | | | + | | + |
| 4 *Barilius bakeri* Day | + | + | | | + |
| *5 *Barilius gatensis* (Val.) | + | + | | | |
| 6 *Danio malabaricus* (Jerdon) | | | + | | |
| 7 *Horadandia atukorali* Deraniyagala | | | + | | + |
| 8 *Rasbora daniconius* (Ham.) | | | + | + | |
| Subfamily : CYPRININAE | | | | | |
| *9 *Barbodes sarana subnasutus* (Val.) | + | | | | |
| 10 *Catla catla* (Ham.) | | | + | + | + |
| 11 *Horalabiosa joshuai* Silas | + | + | | | + |
| *12 *Hypselobarbus kurali* Menon and Rema Devi | + | + | | | |
| *13 *Hypselobarbus lithopidos* (Day) | + | + | | | |
| 14 *Puntius amphibius* (Val.) | | | + | | |
| *15 *Puntius arulius* (Jerdon) | + | + | | | |
| *16 *Puntius chola* (Ham.) | | | + | + | |
| *17 *Puntius conchonius* (Ham.) | | | | + | |
| 18 *Puntius filamentosus* (Val.) | | | + | | |
| 19 *Puntius melanampyx* (Day) | + | | | | |
| *20 *Puntius parrah* (Day) | + | | | | |
| 21 *Puntius vittatus* Day | | | + | + | + |
| 22 *Tor khudree* (Sykes) | | | + | | |

*List Contd.*

| | Endemic to India | Endemic to Western Ghats | Common to Srilanka | Of Wider Distribution | New Additions to the Dist. |
|---|---|---|---|---|---|
| **Subfamily : GARRINAE** | | | | | |
| *23 *Garra gotyla stenorhynchus* (Jerdon) | + | + | | | |
| *24 *Garra mcClellandi* (Jerdon) | + | + | | | |
| 25 *Garra mullya* (Sykes) | + | | | | |
| **Family : COBITIDAE** | | | | | |
| 26 *Lepidocephalus thermalis* (Val.) | | | + | | + |
| **Family : BALITORIDAE** | | | | | |
| **Subfamily : NOEMACHEILINAE** | | | | | |
| 27 *Noemacheilus triangularis* Day | + | + | | | |
| **Subfamily : BALITORINAE** | | | | | |
| 28 *Bhavania australis* (Jerdon) | + | + | | | |
| **Order : SILURIFORMES** | | | | | |
| **Family : BAGRIDAE** | | | | | |
| *29 *Batasio travancoria* Hora & Law | + | + | | | |
| 30 *Mystus bleekeri* Day | | | | + | |
| *31 *Mystus gulio* (Ham.) | | | + | + | |
| *32 *Mystus malabaricus* (Jerdon) | + | + | | | |
| *33 *Pseudobagrus chryseus* Day | + | + | | | |
| **Family : CLARIIDAE** | | | | | |
| *34 *Clarias batrachus* (Linn.) | | | + | + | |
| **Family : HETEROPNEUSTIDAE** | | | | | |
| 35 *Heteropneustes fossilis* (Bloch) | | | + | + | + |
| **Order : CYPRINODONTIFORMES** | | | | | |
| **Family : BELONIDAE** | | | | | |
| 36 *Xenentodon cancila* (Ham.) | | | | + | + |
| **Family : APLOCHEILIDAE** | | | | | |
| 37 *Aplocheilus blocki* (Arnold) | + | | | | + |
| 38 *Aplocheilus lineatus* (Val.) | + | | | | |

*List Contd.*

| | Endemic to India | Endemic to Western Ghats | Common to Srilanka | Of Wider Distribution | New Additions to the Dist. |
|---|---|---|---|---|---|
| Order : SYNGNATHIFORMES | | | | | |
| Family : SYNGNATHIDAE | | | | | |
| 39 *Microphis cuncalus* (Ham.) | | | | + | + |
| Order : SYNBRANCHIFORMES | | | | | |
| Family : SYNBRANCHIDAE | | | | | |
| 40 *Ophisternon bengalense* McClelland | | | + | + | + |
| Order : PERCIFORMES | | | | | |
| Family : AMBASSIDAE | | | | | |
| 41 *Parambassis thomassi* (Day) | + | + | | | |
| Family : CICHLIDAE | | | | | |
| 42 *Etroplus maculatus* (Bloch) | | | + | | |
| 43 *Etroplus suratensis* (Bloch) | | | + | | |
| 44 *Oreochromis mossambica* (Peters) | | | | + | |
| Family : GOBIIDAE | | | | | |
| 45 *Glossogobius giuris* (Ham.) | | | | + | + |
| *46 *Sicyopterus griseus* Day | | | + | | |
| Family : ANABANTIDAE | | | | | |
| 47 *Anabas testudineus* (Bloch) | | | + | + | + |
| Family : BELONTIDAE | | | | | |
| 48 *Pseudosphromenus cupanus* (Val.) | | | + | + | + |
| 49 *Pseudosphromenus dayi* Kohler | + | + | | | + |
| Order : CHANNIFORMES | | | | | |
| Family : CHANNIDAE | | | | | |
| 50 *Channa orientalis* (Bloch & Schn.) | | | + | + | + |
| 51 *Channa punctatus* (Bloch) | | | + | + | |
| Order : MASTACEMBELIFORMES | | | | | |
| Family : MASTACEMBELIDAE | | | | | |
| 52 *Macrognathus guentheri* (Day) | + | + | | | + |

Order : ANGUILLIFORMES

Family : ANGUILLIDAE

1. ***Anguilla bengalensis bengalensis*** (Gray & Hardwicke)

1834. *Muraena bengalensis* Gray & Hardwicke, *Illust. Indian Zool.*, : pl. 95, fig. 5 (Type locality : Ganges River)

*Material* : 3 exs., 52–54 mm TL., F.5577, Poikhat, 3.4.98.

*Distribution* : Freshwaters and seas of Pakistan, India, Sri Lanka, the Andamans; Myanmar and the East Indies.

2. ***Anguilla bicolor bicolor*** McClelland

1844. *Anguilla bicolor* McClelland, *Calcutta, J. nat. Hist.*, **5** (8) : 178, pl. 6, fig 1. (Type locality : India)

*Material* : 1 ex., 62.5 mm TL., F.5526, Poikat, 3.4.98

*Distribution* : India and Srilanka and most countries bordering the Bay of Bengal.

Order : CYPRNIFORMES

Family : CYPRINIDAE

Subfamily : RASBORINAE

3. ***Amblypharyngodon melettinus*** (Valenciennes)

1844. *Leuciscus melettinus* Valenciennes, *Hist. nat. Poiss.*, **17** : 304, pl. 501 (Type locality : Bombay).

*Material* : 5 exs., 50–56 mm SL., F.5467 & 5497, Venganoor, 20.12.97; 22 exs., 63–80 mm SL., F.5464, Pongulam, 21.12.97; 6 exs., 85–96 mm SL., F.5551, Anchuthengu, 2.4.98.

*Distribution* : India : Western Ghats and Tamil Nadu; Srilanka.

*Remarks* : *A. chakaiensis* Babu and Nair (1978) is considered a synonym of *A. melettinus* (Menon 1999).

4. ***Barilius bakeri*** Day

1865. *Barilius bakeri* Day, *Proc. Zool. Soc. Lond.* : 305 (Type locality : Mundakayam, Kerala).

*Material* : 3 exs., 24–37 mm SL., F.5493, Tropical Botanical Garden, 17.12.97; 76 exs., 15–70 mm SL., F.5534, Kallar reservoir site, 27.3.98; 2 exs., 65–68 mm SL., F.5542, Mottamood river, Ponmudi, 30.3.98; 1 ex., 65 mm SL., F.5515, Poikat, Poika, 3.4.98.

*Distribution* : India : Western Ghats of Kerala.

5. ***Danio malabaricus*** (Jerdon)

1849. *Perilampus malabaricus* Jerdon, *Madras J. Lit & Sci.*, **15** : 325 (Type locality : Malabar).

*Material* : 1 ex., 48 mm SL., F.5465, Pongulam, 21.12.97; 153 exs., 60–115 mm SL., F.5533, Kallar river site, 27.3.98; 2 exs., 29–77 mm SL., F.5566, Golden Valley, 28.3.98; 1 ex., 28 mm SL.,

F.5547, way to Ponmudi, Chankiri, 29.3.98; 40 exs., 13–55 mm SL., F.5541, Mottamood river, Ponmudi, 30.3.98; 1 ex., 69 mm SL., F.5550, Anchuthengu, 2.4.98; 1 ex., 64 mm SL., F.5516, Poikat, Poika, 3.4.98.

*Distribution* : India : Peninsular India; from headwaters of Krishna river in Maharashtra to Kerala; Srilanka.

### 6. ***Horadandia atukorall*** Deraniyagala

1943. *Horadandia atukorali* Deraniyagala, *J. Ceylon Br. roy. Asisat. Soc.* **35** (96) : 158 fig 1 (Type locality : Attidiya Colombo; Ceylon).

*Material* : 19 exs., 15–20 mm SL., F.5568, Neyyar Dam Site, 29.3.98; 6 exs., 13–18.5 mm SL., F.5518, Poikat, Poika, 3.4.98.

*Distribution* : India : Kerala, Tamilnadu : Madras & Pondicherry; Sri Lanka. In Kerala it is known from Kottayam district. From Trivandrum district this forms the first report.

### 7. ***Rasbora daniconius*** (Hamilton)

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

*Material* : 3 exs., 49–55 mm SL., F.5774, Karamana 18.12.97; 6 exs., 44–59 mm SL., F.5490, Kallar, 24.12.97; 6 exs., 14–25 mm SL., F.5535, Kallar river site, 27.3.98; 27 exs., 17–64 mm SL., F.5543, Mottamood river; Ponmudi, 30.3.98; 14 exs., 33–56 mm SL., F.5517, Poikat, Poika; 3.4.98.

*Distribution* : Pakistan, India, Nepal, Srilanka, Bangladesh, Myanmar and Thailand.

## Subfamily : CYPRININAE

### 8. ***Catla catla*** (Hamilton)

1822. *Cyprinus catla* Hamilton, *Fishes of Ganges* : 287, 318, pl. 13, fig. 81 (Type locality : rivers and tanks of Bengal).

*Material* : 1 ex., 130 mm SL., F.5498, Venganoor, 20.12.97; 1 ex., 116 mm SL., F.5476, Pongulam, 21.12.97.

*Distribution* : Pakistan : Indus plain and adjoining hills; India : Northern India; Bangladesh; Nepal and Myanmar. This species has been transplanted into some of the rivers of Peninsular India, notably river Cauvery, and in more recent times into Srilanka and China.

This has been introduced for fishery purpose.

### 9. ***Horalabiosa joshuai*** Silas

1953. *Horalabiosa joshuai* Silas, *Rec. Indian Mus.*, **51** (1) : 30, text fig. & pl. 5 (Type locality : Singampatty, Tirunelveli dist., Tamil Nadu).

*Material* : 7 exs., 12–21 mm SL., F.5549, way to Chankiri, 29.3.98.

*Distribution* : India : Tirunelveli district, Tamil Nadu and Kerala : Silent valley and Trivandrum District.

*Remarks* : This species was first reported by Silas (1952) from upper reaches of Tambraparni river, Tirunelveli dist.. Subsequently this species was collected from Silent Valley. The present collection of juveniles have been tentatively identified as *H. Joshuai*. This is ths first report of this species from this part of Kerala.

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

1842. *Capoeta amphibia* Valenciennes, *Hist. nat. Poiss.*, **16** : 282, pl. 478 (Type locality : Bombay).

*Material* : 1 ex., 37 mm SL., F.5776, Karamana, 18.12.97; 5 exs., 47–60 mm SL., F.5491, Kallar, 24.12.97; 5 exs., 70–95 mm SL., F.5552, Anchuthengu, 2.4.98.

*Distribution* : Peninsular India as high as Orissa, Madhya Pradesh and Rajasthan; Srilanka.

### 11. *Puntius filamentosus* (Valenciennes)

1844. *Leuciscus filamentosus* Valenciennes, *Hist. nat. Poiss.*, **17** : 96, pl. 492 (Type locality : Alleppey, Kerala State).

*Material* : 6 exs., 38–100 mm SL., F.5480, Vellaiyanikayal, 19.12.97; 2 exs., 79–107 mm SL., F.5468, Venganoor, 20.12.97; 4 exs., 45–75 mm SL., F.5484, Pongulam, 21.12.97; 3 exs., 87–90 mm SL., F.5494, Thiruvallam, 22.12.97; 1 ex., 55 mm SL., F.5537, Kallar river site, 27.3.98; 2 exs., 65–87 mm SL., F.5553, Anchuthengu, 2.4.98; 1 ex., 70 mm SL., F.5520, Poikat, Poika, 3.4.98; 1 ex., 100 mm SL., F.5556, Vellaiyanikayal, 5.4.98.

*Distribution* : India : Goa, Karnataka, Kerala, Andhra Pradesh and Tamil Nadu; Sri Lanka.

### 12. *Puntius melanampyx* (Day)

1865. *Labeo melanampyx* Day, *Proc. Zool. Soc.* Lond : 298 (Type locality : Mundakayam, Kerala).

*Material* : 13 exs., 14–39 mm SL., F.5538, Kallar river site, 27.3.98; 10 exs., 14–44 mm SL., F.5544, Mottamood river, Ponmudi, 30.3.98.

*Distribution* : Peninsular India : Western Ghats : Goa, South Kanara through Travancore hills to Nagerkoil; also Nilgiris, and Cauvery drainage.

### 13. *Puntius vittatus* Day

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

*Material* : 2 exs., 24–39 mm SL., F.5485, Pongulam, 21.12.97; 2 exs., 21–25 mm SL., F.5570, Vamanapuram river, 1.4.98; 264 exs., 17–35 mm SL., F.5519, Poikat, Poika, 3.4.98.

*Distribution* : Pakistan; India : Goa, Karnataka, Kerala, Tamil Nadu, Kutch, Bihar and Rajasthan; Sri Lanka.

### 14. *Tor khudree* (Sykes)

1839. *Barbus khudree* Sykes, *Trans. Zool. Soc. Lond.*, **2** : 357 (Type locality : Mulla Mutha river near Poona, Maharashtra).

*Material* : 3 exs., 45–50 mm SL., F.5536, Kallar river site, 27.3.98.

*Distribution* : India : rivers of Peninsular India and Deccan; Sri Lanka.

## Subfamily : GARRINAE

### 15. *Garra mullya* (Sykes)

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

*Material* : 8 exs., 27–64 mm SL., F.5548, way to Chankiri, 29.3.98; 1 ex., 88 mm SL, F.5564, Vamanapuram, 1.4.98.

*Distribution* : India : throughout the Peninsula.

## Family : COBITIDAE

### 16. *Lepidocephalus thermalis* (Valenciennes)

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

*Material* : 5 exs., 36–44 mm SL., F.5492, Kallar, 24.12.97.

*Distribution* : Peninsular India and Sri Lanka.

## Family : BALITORIDAE

## Subfamily : NOEMACHEILINAE

### 17. *Noemacheilus triangularis* Day

1865. *Nemacheilus triangularis* Day, *Proc. Zool. Soc. Lond.* : 295 (Type locality : Mundakayam, Travancore).

*Material* : 7 exs., 19–50 mm SL., F.5539, Kallar river site, 27.3.98; 2 exs., 13–24 mm SL., F.5545, Mottamood river, Ponmudi, 30.3.98; 1 ex., 38 mm SL., F.5521, Poikat, Poika, 3.4.98.

*Distribution* : Peninsular India : Western Ghats : Kerala and Tamil Nadu.

## Subfamily : BALITORINAE

### 18. *Bhavania australis* (Jerdon)

1849. *Platycara australis* Jerdon, *Madras J. Lit. & Sci.*, **15** : 333 (Type locality : Walliar, Nilgiris).

*Material* : 1 ex, 56 mm SL., F.5532, Kallar river, 27.3.98.

*Distribution* : India : extreme south of western Ghats (Karnataka, Nilgiris and Tirunelveli District in Tamil Nadu and Kerala).

Order : SILURIFORMES

Family : BAGRIDAE

19. ***Mystus bleekeri*** Day

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

*Material* : 8 exs., 22–28 mm SL., F.5546, Mottamood river, Ponmudi, 30.3.98; 1 ex., 35 mm SL., F.5522, Poikat, Poika, 3.4.98.

*Distribution* : Pakistan, India : Throughout India, Bangladesh.

*Remarks* : The Southern most limit of the species was till recently known to be the headwaters of Mahanadi. Subsequently this species has been reported from Neyyar river, Trivandrum Dist. by Raju et. (1999).

Family : HETEROPNEUSTIDAE

20. ***Heteropneustes fossilis*** (Bloch)

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

*Material* : 2 exs., 62–63 mm SL., F.5523, Poikat, Poika, 3.4.98.

*Distribution* : Pakistan : Indus basin; India including the Andaman Islands; Nepal; Bangladesh; Srilanka; Myanmar; Thailand and Laos.

Order : CYPRINODONTIFORMES

Family : BELONIDAE

21. ***Xenentodon cancila*** (Hamilton)

1822. *Esox cancila* Hamilton, *Fishes of Ganges* : 213, 380, pl. 27, fig. 70 (Type locality : Gangetic provinces).

*Material* : 1 ex., 155 mm SL., F.5502, Venganoor, 20.12.97; 1 ex., 165 mm SL., F.5477, Pongulam, 21.12.97.

*Distribution* : Pakistan; India; Bangladesh; Sri Lanka; Myanmar and Thailand.

Family : APLOCHEILIDAE

22. ***Aplocheilus blocki*** (Arnold)

1911. *Haplocheilus panchax* var. *blockii* Arnold, *Wochenschr. Aquarien and Terrarienkunde*, **8** : 672 (Type locality :Cochin, Kerala).

*Material* : 1 ex., 24 mm SL., F.5572, Vamanapuram, 1.4.98; 34 exs., 17–23 mm SL., F.5525, Poikat, Poika, 3.4.98.

*Distribution* : India : Tamil Nadu, Kerala, Kutch (Gujarat); and Sri Lanka.

### 23. *Aplocheilus lineatus* (Valenciennes)

1845. *Panchax lineatus* Valenciennes, *Hist. nat. Poiss.*, **18** : 381 (Type locality : Bombay).

*Material* : 3 exs., 34–35 mm SL., F.5571, Vamanapuram, 1.4.98; 63 exs., 23–46 mm SL., F.5524, Poikat, Poika, 3.4.98.

*Distribution* : India : Widely distributed in Peninsular India.

## Order : SYNGNATHIFORMES

## Family : SYNGNATHIDAE

### 24. *Microphis cuncalus* (Hamilton)

1821. *Syngnathus cuncalus* Hamilton, *Fishes of Ganges* : 12, 362. (Type locality : estuaries near Calcutta).

*Material* : 2 exs., 91 & 92 mm SL., F.5576, Vamanapuram, 1.4.98.

*Distribution* : India : West Bengal, Orissa, Tamil Nadu, Maharashtra, Goa and Kerala; Bangladesh and Sri Lanka.

## Order : SYNBRANCHIFORMES

## Family : SYNBRANCHIDAE

### 25. *Ophisternon bengalense* McClelland

1845. *Ophisternon bengalense* McClelland, *Calcutta J. nat. Hist.*, **5** (18) : 197, 220, pl, 11, fig. 1 (Type locality : Hooghly river, West Bengal).

*Material* : 1 ex., 143 mm., F.5563, Anchuthengu, 2.4.98.

*Distribution* : Sri Lanka, Indo-Malayan Region and the Philippines.

## Order : PERCIFORMES

## Family : AMBASSIDAE

### 26. *Parambassis thomassi* (Day)

1870. *Ambassis thomassi* Day, *Proc. Zool. Soc. Lond.*, : 369 (Type locality : Coast of Canara).

*Material* : 5 exs., 16–45 mm SL., F.5481, Vellaiyanikayal, 19.12.97; 2 exs., 72–73 mm SL., F.5469 & F.5501, Venganoor, 20.12.97; 13 exs., 22–45 mm SL., F.5466 and F.5486, Pongulam, 21.12.97; 1 ex., 29 mm SL., F.5473, Thiruvallam, 22.12.97; 4 exs., 19–25 mm SL., F.5560, Vellaiyanikayal, 5.4.98.

*Distribution* : India : Western Ghats of Kerala and Karnataka.

Family : CICHLIDAE

27. ***Etroplus maculatus*** (Bloch)

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

*Material* : 3 exs., 47–48 mm SL., F.5775, Karamana, 18.12.97; 15 exs., 23–80 mm SL., F.5482 & F.5488, Vellaiyanikayal, 19.12.97; 6 exs., 36–65 mm SL., F.5470 & F.5499, Venganoor, 20.12.97; 8 exs., 55–65 mm SL., F.5478, Pongulam, 21.12.97; 2 exs., 24–26 mm SL., F.5573, Vamanapuram, 1.4.98; 1 ex., 58 mm SL., F.5561, Anchuthengu, 2.4.98; 21 exs., 45–64 mm SL., F.5557, Vellaiyanikayal, 5.4.98.

*Distribution* : India : Tamil Nadu, Kerala and South Karnataka; Sri Lanka.

28. ***Etroplus suratensis*** (Bloch)

1785. *Chaetodon suratensis* Bloch, *Syst. Ichth.* : pl. 217 (Type locality : Surat, Gujarat).

*Material* : 2 exs., 46–56 mm SL., F.5489, Vellaiyanikayal, 19.12.97; 2 exs., 51 & 60 mm SL., F.5471 & F.5500, Venganoor, 20.12.97; 2 exs., 68–90 mm SL., F.5479, Pongulam, 21.12.97; 2 exs., 73–96 mm SL., F.5496, Thiruvallam, 22.12.97; 2 exs., 88 & 100 mm SL., F.5474, Anchuthengu, 23.12.97; 2 exs., 90–120 mm SL., F.5562, Anchuthengu, 2.4.98; 3 exs., 50–120 mm SL., F.5558, Vellaiyanikayal, 5.4.98.

*Distribution* : Peninsular India; Sri Lanka.

29. ***Oreochromis mossambica*** (Peters)

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

*Material* : 2 exs., 125–130 mm SL., F.5475, Anchuthengu, 23.12.97; 17 exs., 17–30 mm SL., F.5569, Neyyar Dam site, 24.3.98.

*Distribution* : East Africa; an introduced species in India, Pakistan and Sri Lanka.

Family : GOBIIDAE

30. ***Glossogobius giuris*** (Hamilton)

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

*Material* : 1 ex., 34 mm SL., F.5487, Pongulam, 21.12.97; 1 ex., 24 mm SL., F.5540, Kallar river site, 27.3.98; 2 exs., 23–32 mm SL., F.5574, Vamanapuram, 1.4.98.

*Distribution* : Indo-West Pacific.

Family ANABANTIDAE

31. ***Anabas testudineus*** (Bloch)

1795. *Anthias testudineus* Bloch, *Naturges. Ausland. Fische, (6)* : 121, pl. 322 (Type locality : Java)

*Material* : 3 exs., 65–68 mm SL., F.5527, Poikat, Poika, 3.4.98.

*Distribution* : Pakistan; India; Bangladesh; Sri Lanka; Myanmar; Malay archipelago; Singapore and the Philippines.

Family : BELONTIDAE

32. ***Pseudosphromenus cupanus*** (Valenciennes)

1831. *Polycanthus cupanus* Valenciennes, *Hist. nat. Poiss.*, **7** : 357 (Type locality : Ariancoupan river at Pondicherry).

*Material* : 133 exs., 19–65 mm SL., F.5528, Poikat, Poika, 3.4.98.

*Distribution* : Eastern India, Sri Lanka, Western Myanmar, Malay Peninsula and Sumatra.

33. ***Pseudosphromenus dayi*** Köhler

1909. *Polycanthus cupanus dayi* Kohler, *Blat. Aquar. Terrar.*, **20** : 331 (Type locality : Not given, Probably Kerala).

*Material* : 14 exs., 22–23 mm SL., F.5529, Poikat, Poika, 3.4.98.

*Distribution* : India : Kerala.

*Remarks* : Talwar (1991) treated this species a synonym of *P. cupanus* though he remarked, that it is considered a distinct species in aquarium literature. Jayaram (1999) did not consider this a distinct species for lack of sufficient data, while Kottelet (1994) and Menon (1999) retained its separate identity. Because of differences in the number of branched rays and the colour pattern, *P. cupanus* and *P. dayi* are considered here distinct species. A detailed note on this species is being published elsewhere.

Order : CHANNIFORMES

Family : CHANNIDAE

34. ***Channa orientalis*** Bloch and Schneider

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

*Material* : 1 ex., 85 mm SL., F.5567, Golden Valley, 28.3.98; 2 exs., 57–82 mm SL., F.5539, Poikat, Poika, 3.4.98; 6 exs., 40–62 mm SL., F.5565, way to Kulathupuzha, 6.4.98.

*Distribution* : Afghanistan; Iran; Pakistan; India; Nepal; Sri Lanka; Bangladesh; Mayanmar and East Indies.

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

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

*Material* : 1 ex., 210 mm SL., F.5504, Anchuthengu, 23.12.97.

*Distribution* : Afghanisatan; Pakistan; India; Sri Lanka; Nepal; Bangladesh; Myanmar and Yunnan.

Order : MASTACEMBELIFORMES

Family : MASTACEMBELIDAE

36. ***Macrognathus malabaricus*** (Jerdon)

1849. *Mastacembelus malabaricus* Jerdon, *Madras J. Lit. Sci.*, **15** : 147 (Type locality : Malabar).

*Material* : 1 ex., 114 mm SL., F.5531, Poikat, Poika, 3.4.98.

*Distribution* : India : Kerala.

*Remarks* : Menon (1999) considered *Mastacembelus guentheri* Day a synonym of this species.

**Besides, the following species were also collected during the surveys, estuarine/ marine species**

Order : RAJIFORMES

Family : DASYATIDAE

1. *Dasyatis zugei* (Muller & Henle)

Order : CLUPEIFORMES

Family : CLUPEIDAE

2. *Dayella malabarica* (Day)

Order : MYCTOPHIFORMES

Family : SYNODIDAE

3. *Saurida thumbil* (Bloch)

Order : CYPRINODONTIFORMES

Family : BELONIDAE

4. *Tylosurus crocodilus* (Peron & LeSueur)

Order : SYNGNATHIFORMES

Family : SYNGNATHIDAE

5. *Fistularia petimba* Linn.

Order : PERCIFORMES
Family : AMBASSIDAE

6. *Ambassis commersoni* Cuvier

Family : SILLAGINIDAE

7. *Sillago vincenti* Mc Kay

Family : CARANGIDAE

8. *Caranx sexfasciatus* Quaoy and Gaimard

9. *Trachynotus baillonii* (Lacepede)

Family : LEIOGNATHIDAE

10. *Leiognathus brevis* (Val.)

Family : MUGILIDAE

11. *Liza subviridis* (Val.)

12. *Mugil cephalus* (Linne)

Family : GOBIIDAE

13. *Awaous gutum* (Ham.)

Family : ELEOTRIDAE

14. *Eleotris fusca* (Schneider)

Order : PLEURONECTIFORMES
Family : BOTHIDAE

15. *Pseudorhombus triocellatus* (Bloch)

Order : TETRAODONTIFORMES
Family : TETRAODONTIDAE

16. *Lagocephalus lunaris* (Bloch & Schneider)

17. *Diodon holocanthus* Linne.

## DISCUSSION

The present paper records the distribution of 69 species, in the inland waters of Trivandrum District. This includes 52 primary freshwater species and one exotic one. Of these 16 are based on earlier reports and are not represented in the present collections. The present study revealed the distribution of 20 more species in the state. It is interesting to observe that the ichthyofauna of this

state alone comprise 22 species endemic to India including 15 Western Ghat endemics, four of which viz. *Barilius bakeri, Batasio travancoria, Pseudosphromenus dayi and Macrognathus guentheri,* are confined to Kerala State.

While drawing the relationship of the Travancore fauna with other Zoogeographical realms, Hora (1941), listed 9 species (12%) of the 76 reported by him, as common to Ceylon. From the present collection it is observed that 24 species (52%) of the primary freshwater species of this district alone are common to Sri Lanka and 20% exclusive to India and Sri Lanka revealing a close affinity of the ichthyofauna of Sri Lanka and the Southern Western Ghats as is the case with the herpetofauna (Cherian et. al., 2000). This is further strengthened by the collection of *Horadandia atukorali* Deraniyagala (thought till recently to be endemic to Sri Lanka), from this state, and is now found to be fairly widespread in Southern India especially Tamil Nadu and Kerala. Of special Ichthyological significance is the collection of *Pseudosphromenus dayi* considered a colour variant in aquarium literature or a Juvenile of *P. cupanus* and considered its synonym by Talwar and Jhingran (1991) and Jayaram (1999). However, it is considered here a distinct species (Menon, 1999) owing to the differences in the colour and the number of branched rays in the dorsal fin.

## SUMMARY

Studies on a small collection of inland fishes from Trivandrum district, Kerala has revealed the presence of 52 Primary freshwater species, including 16 species reported earlier. In this paper 20 species are reported for the first time from this district, including several of Ichthyological significance. The present status of some of these species is also discussed.

## ACKNOWLEDGEMENTS

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# FAUNAL DIVERSITY OF WETLANDS IN THE INDIAN BOTANICAL GARDEN, HAORA, WEST BENGAL

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## INTRODUCTION

The Indian Botanical Garden (IBG), Haora, located at the northern flank of river Hugli, is characterised by a unique aquaterrestrial environment having highly heterogenous vegetation. The aquatic environment of this garden complex comprises of a number of small ponds and a mosaic of interconnected lakes of varying dimensions. These lakes are linked with the river Hugli by a sluice mechanism on the south-eastern side. The net area of the garden is 110 ha while the lakes, twenty five in number, encompass one-ninth of the garden area. These lakes and ponds provide suitable living conditions to a wide variety of introduced tropical and subtropical plants of exotic and indigenous origin. These wetlands of IBG, being the source of sustenance for a national living repository of valuable and rare plant species, have been proposed by Shri Raja Mani, the then secretary to the Department of Environment, Ministry of Environment & Forests, Government of India, to bring under collaborative investigation on floral and faunal diversity by the Botanical Survey of India, Haora and the Zoological Survey of India, Calcutta, and hence the present study.

With the above mentioned objective in view, four ponds (located in sectors 8, 9, 11 and 12) and four lakes *viz.*, Dhobi, Prain, Leram and King Lakes were selected for detailed studies on their faunal diversity.

## PHYSIOGRAPHY OF THE STUDY AREA

Indian Botanical Garden at Sibpur, Haora district, West Bengal, is located within physiographic subdivision known as 'mature delta' in the lower Ganga Plain. Bio-climatically the area of the garden is lying within the humid tropic region and is endowed with soil of variable sand and clay content (Singh *et al.*, 1990). The coarse sand ranges from 0.1% to 0.34% and the fine sand and silt components make the major part of the soils. The range values of sand, silt and clay contents were recorded respectively as 25.7–36.8%, 33.8–42.7% and 26.9–30.7% in the river side area and 39.3–61.0%, 24.2–35.8% and 13.9–23.9% in the far off stretch of the garden (Singh *et al.*, 1990). The river front

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showed higher clay contents (average 28.7%) as these parts, even in 1970 were subjected to occasional flush floods due to high tides during monsoons (Singh and Ghosh, 1985). Like-wise, $p^H$ values are relatively higher in the river side area (5.8–6.7) than the far off stretch (4.1–5.2) indicating that the soils are feebly acidic to highly acidic in reaction towards the far off sides. In general the river side is rich in clay content, moisture content (17.6%) as well as organic carbon (0.87%) and water holding capacity (62.0%).

Climatic condition is seasonally variable. The mean minimum and mean maximum aerial temperatures vary between 19°C (in winter) and 30°C (in summer). The average rainfall of the area is about 150 cm. Humidity ranges normally between 35–95%. Monsoon months (July–September) are wet and always with higher humidity. Premonsoon period (Summer, March-June) is predominantly dry and warm with occasional rains, while the postmonsoon period (Winter, November-February) is also dry but cold with low temperature and negligible precipitation.

Both the pond and lake water quality parameters showed variations due to heavy rain during monsoon and for the access of river water to the lake system. Some hydrological parameters studied and/or reported from these wetland systems (Singh and Ghosh, 1988) are summarized in Table 1.

**Table 1.** Range values of some hydrological parameters from ponds and lakes of Indian Botanical Garden, Sibpur.

| Hydrological parameters | Range values of water quality in | |
|---|---|---|
| | Ponds | Lakes |
| Water depth (m) | 0.8–2.5 | 1.5–3.5 |
| Water temperature (°C) | 27–34 | 27.5–32.0 |
| $p^H$ | 7.0–8.5 | 6.5–8.5 |
| Electrical conductivity (μ mhos/cm) | – | 840–5080 |
| D. O (mg/L) | 4.5–11.0 | 4.0–6.0 |
| Transparency (cm) | 60–95 | 80–130 |
| Residual carbonate (m.c./l) | – | 0.02–0.6 |

**Note :** Mean annual Ec, $p^H$ and residual carbonates of the lake waters are incorporated from Singh and Ghosh (1988).

In ponds and also in some lakes aquatic vegetation occurs in abundance. The vegetation includes plant communities categorized as free-floating, rooted submerged, semi-emergent and amphibious form and herein reported from both ponds and lakes by Singh and Ghosh (1988) as follows (Table 2).

**Table 2.** Aquatic vegetation profile of ponds and lakes of Indian Botanical Garden, Sibpur.

| Vegetation communities | Plant species observed from | |
|---|---|---|
| | Ponds | Lakes |
| **Free floating :** | | |
| Algae | + | + |
| Macrophyte | | |
| 1. *Azolla pinnata* | + | + |
| 2. *Eichhornia crassipes* | + | + |
| 3. *Lemna minor* | + | + |
| 4. *Pistia stratiotes* | + | + |
| 5. *Salvinia auriculata* | + | + |
| **Rooted submerged :** | | |
| 6. *Hydrilla verticillata* | + | + |
| 7. *Otellia alismoides* | – | + |
| 8. *Vallisneria spiralis* | + | + |
| **Semi-emergent :** | | |
| 9. *Ceratophyllum demersum* | + | + |
| 10. *Ludwigia adscendens* | + | + |
| 11. *Ludwigia perenis* | + | + |
| 12. *Nelumbo nucifera* | + | – |
| 13. *Nymphoides cristata* | + | + |
| 14. *Nymphaea nouchali* | + | + |
| 15. *Nymphaea stellata* | + | + |
| 16. *Victoria amazonica* | + | – |
| **Amphibious :** | | |
| 17. *Alternanthera philoxeroides* | + | + |
| 18. *Alternanthera sessilis* | + | + |
| 19. *Marsilea quadrifolia* | + | + |
| 20. *Cyperus* spp. | + | + |
| 21. *Polygonum* spp. | + | + |
| 22. *Scirpus* spp. | + | + |

**Note :** Out of 22 species of macrophytes observed 19 species occurred both in lakes and ponds. *Otellia alismoides* was recorded from only lakes and *Nelumbo nucifera* and *Victoria amazonica* occurred only in ponds. The free floating algae was composed of solitary, colonial and filamentous species like *Euglena, Volvox, Microcystis, Spirogyra*, etc. which were common to both lakes and ponds.

Both the ponds and lakes harbour plant communities of variable density. In general, free floating community (*Lemna, Pistia*) was higher in pond system than the lakes which were dominated by rooted submerged plants (*Hydrilla-Vallisneria*). The dominant vegetative features of the four ponds and four lakes surveyed were as follows :

| | | |
|---|---|---|
| A. **Ponds** : | | |
| 1. Pond ($P_1$ in Sector 12) | : | Mainly free floating forms dominated by *Pistia stratiotes*. |
| 2. Pond ($P_2$ in Sector 11) | : | Mixed vegetation, mainly emergent forms, dominated by lotus (*Nelumbo nucifera*). |
| 3. Pond ($P_3$ in Sector 9) | : | Mainly *Lemna* dominated free floating forms with some marginal vegetation. |
| 4. Pond ($P_4$ in Sector 8) | : | Mixed rooted submerged and semi-emergent vegetation with exotic *Victoria amazonica* introduced. |
| B. **Lakes** : | | |
| 5. Dhobi Lake ($L_1$ in Sector 24) | : | Scattered free floating forms with moderate mixed vegetation dominated by *Vallisneria spiralis* and low fish culture. |
| 6. Prain Lake ($L_2$ in Sector 22) | : | Used for semi-intensive fish culture and almost without any vegetation. |
| 7. Leram Lake ($L_3$ in Sector 2) | : | Scattered free floating (*Pistia*), submerged (*Vallisneria*) and marginal vegetation with moderate fish culture. |
| 8. King Lake ($L_4$ in Sector 14–18) | : | With a wide arrary of mixed vegetation communities and no fish culture. |

## MATERIALS AND METHODS

Field observations and survey works were carried out from four ponds and four lakes (Fig. 1) as mentioned above during 1994–95. Three surveys, each of four days duration, were conducted during premonsoon, monsoon and postmonsoon periods. Data on some environmental (Temperature, humidity, vegetation and soil condition) and hydrological parameters (Temperature, $p^H$, electrical conductivity, D.O., turbidity and residual carbonate) were observed and/or gathered from published papers on the subject. Collections were made using a drag net and a plankton net as well as by hand

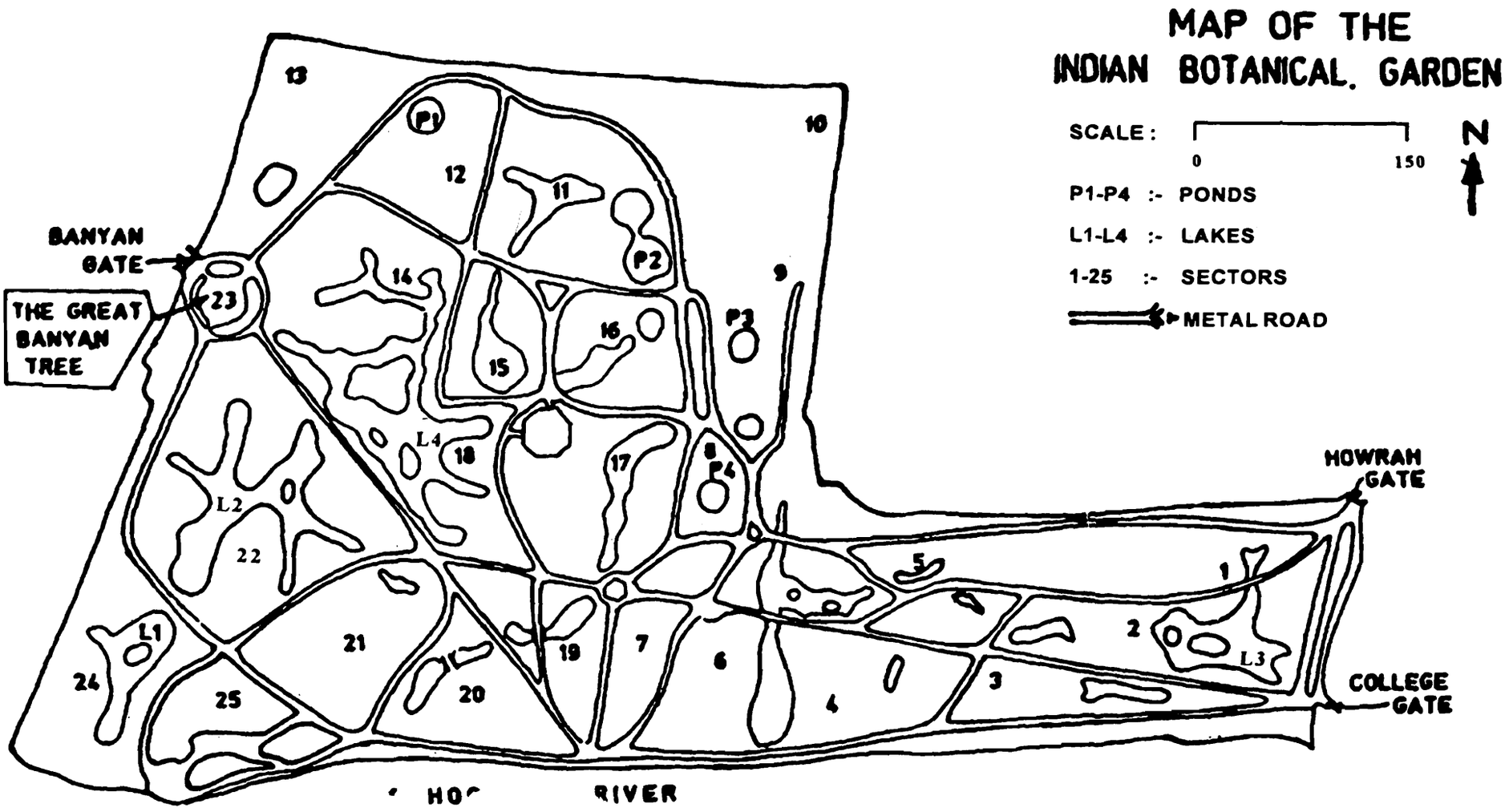


**Fig. 1.** Plan of the Indian Botanical Garden showing study ponds ($P_1 - P_4$) and lakes ($L_1 - L_4$).

picking. Larger animals, namely, mammals, birds, reptiles and amphibians (and culturable fishes) were observed in the field. Further information on culturable fishes and higher vertebrates were also gathered from local knowledgeable persons as well as fishermen.

## FAUNAL DIVERSITY

Of the three categories of wetland fauna viz., (i) aquatic, (ii) wetland dependent (for food e.g. king fishers) and (iii) wetland associates (for shelter e.g. reed dwellers) as defined by Nandi *et al* (1993), only the first two categories of fauna were found during present study. Mention may be made that there was no reed marsh in the garden and hence reed dwelling wetland associates were virtually absent. Besides, some important occasional visitors such as dryland dwelling vertebrates, common and/or characteristic to the biodiversity of the Indian Botanical Garden, are only incorporated but not indicated in the tables. The inventory of the species of vertebrates including fishes, collected observed and/or informed, are herein listed showing their presence (+) or absence (–) from the pond or lake systems as a whole but both macroinvertebrates and zooplankton species are listed/shown separately from each of the ponds and lakes.

## A. VERTEBRATE COMPONENTS

**Mammals :**

Only the Bandicoot Rat, *Bandicota indica* (Bochstein), a wetland dependent species feeding on aquatic molluscs, *Pila globosa*, can be definitely reported as scarcely available (wetland fauna) around ponds and lakes of IBG. The Smooth Indian Otter, *Lutra perspicillata*, an important wetland dependent species, was reported to occur in IBG even in early 1990s; but their presence in and around the garden complex could not be traced. The occurrence of Marsh Mongoose, *Herpestes palustris* Ghosh from Botanical Garden during 1960 (Agarwal *et al.*, 1992) also could not be reascertained. However, some mammals like Small Indian Mongoose, Small Indian Civet, Indian Flying Fox, Indian Pygmy Pipistrelle, Five Stripped Squirrel, Lesser Bandicoot Rat, House Rat and House Shrew could be observed in the area as dryland associates.

**Birds :**

Eighteen species of water birds, waders and wetland dependent fish feeding kingfishers, belonging to 8 families have been recorded from pond and lakes (Table 3). They are all resident and commonly occur in the Gangetic plains of lower West Bengal. While all the 18 species have been observed from lakes but 6 species *viz.*, *Egretta alba* (Linnaeus), *Dendrocygna javanica* (Horsfield), *Nettapus coromandelianus* (Gmelin), *Rostratula bengalensis* (Linnaeus). *Tringa hypoleucos* Linnaeus could not be sighted in ponds. This may be due to their preference for larger waterbodies available in the garden complex.

**Table 3.** List of birds recorded in wetlands of Indian Botanical Garden.

| Family and species | Recorded from | |
|---|---|---|
| | Ponds | Lakes |
| Family PODICIPETIDAE | | |
| *Podiceps ruficollis* (Pallas) | + | + |
| Family PHALACROCORACIDAE | | |
| *Phalacrocorax niger* (Viellot) | + | + |
| Family ARDEIDAE | | |
| *Ardeola grayii* (Sykes) | + | + |
| *Bubulcus ibis* (Linnaeus) | + | + |
| *Egretta alba* (Linnaeus) | – | + |
| *Egretta garzetta* (Linnaeus) | + | + |
| *Nycticorax nycticorax* (Linnaeus) | + | + |
| Family ANATIDAE | | |
| *Dendrocygna javanica* (Horsfield) | – | + |
| *Nettapus coromandelianus* (Gmelin) | – | + |
| Family RALLIDAE | | |
| *Amaurornis phoenicurus* (Pennant) | + | + |
| *Gallinula chloropus* (Linnaeus) | + | + |
| Family JACANIDAE | | |
| *Metopodius indicus* (Latham) | + | + |
| Family ROSTRATULIDAE | | |
| *Rostratula bengalensis* (Linnaeus) | – | + |
| Family CHARADRIIDAE | | |
| *Tringa totanus* (Linnaeus) | – | + |
| Family CHARADRIIDAE | | |
| *Tringa hypoleucos* (Linnaeus) | – | + |
| Family ALCEDINIDAE | | |
| *Ceryle rudis* (Linnaeus) | + | + |
| *Alcedo atthis* (Linnaeus) | + | + |
| *Halcyon smyrnensis* (Linnaeus) | + | + |

**Reptiles :**

Five species of reptiles *viz.*, a pond turtle, *Lissemys punctata* (Bonaterre), two varanid lizards, *Varanus bengalensis* (Daudin) and *Varanus flavescens* (Gray) and two colubrid snakes, *Enhydris enhydris* (Schneider) and *Xenochrophis piscator* (Schneider) were found to be associated with ponds and lakes of IBG. They are scarcely found except *Xenochrophis piscator* which is more or less common in lakes. While three species of wetland fauna comprising of a turtle, *Kachuga tecta* (Gray) Water Monitor, *Varanus salvator* Laurenti and a colubrid water snake, *Cerberus rhynchops* (Schneider) occurring earlier about 130 years ago from IBG, reported by Ahmed and Dasgupta (1992) based on the registered specimens present in the National Zoological Collection (NZC), could not be observed during the present survey work. However, a number of dryland lizards *viz.*, *Hemidactylus* spp., *Calotes versicolor* (Daudin) and *Mabuya* sp. and snakes *viz.*, *Ptyas mucosus* (Linnaeus), *Amphiesma stolata* (Linnaeus) and *Lycodon aulicus* (Linnaeus) were observed from the garden area. But an important elapid snake *viz.*, King cobra, *Ophiophagus hannah* (Cantor) inhabiting IBG during 1880s (*vide* Ahmed and Dasgupta, 1992) appears to be exterminated from this garden complex.

**Amphibians :**

Six species (two common and four scarce) of amphibians belonging to three families *viz.*, Bufonidae (*Bufo melanostictus* Schneider), Microhylidae (*Microhyla ornata* Dumeril and Bibron) and Ranidae (*Rana cyanophlyctis* Schneider, *Rana hexadactyla* Lesson, *Rana limnocharis* Wiegmann and *Rana tigerina* Daudin) have been recorded either in the ponds and lakes or in the moist shady places on the banks of these wetlands. Both *Microhyla ornata* and *Rana cyanophlyctis* were common in occurrence in the garden complex. *Rana hexadactyla* was encountered in King lake. However, it may be mentioned that Anderson (1871), Bhaduri (1945, 1947) and Sarkar (1948) have reported three rare species *viz.*, *Uperodon globulosum* (Gunther), *Rana erythrea* (Schlegel) and *Rana crassa* in addition to some common ones. A thorough search of the various moist microhabitat may reveal the present status of these rare species in IBG.

**Fishes :**

A total of 44 species of fishes belonging to 19 families were recorded from the wetlands of IBG (Table 4). All the 44 species have been recorded from lake system, while only 31 species have been listed from pond system (Table 4). Both weed fishes and air-breathing species predominate in the ponds while the lakes, being brought under pisciculture, are dominated by culturable varieties of cyprinid fishes. The lakes are also widely inhabited by a freshwater gar fish, *Xenentodon cancila* (Hamilton).

Both Prain Lake and Leram Lake are more or less intensively used for fishery purpose. The culturable varities include mostly cyprinid fishes along with cichlid species (Tilapias). Both major carps *viz.*, *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* and exotic carps like *Cyprinus carpio*, *Ctenopharyngodon idella* and *Hypophthalamichthys molitrix* are liberated in lakes for culture while the Tilapias *viz.*, *Oreochromis mossambica* and *Oreochromis nilotica* are grown naturally in the lake system. In the unculturable ponds weed fishes belonging to the genera *Puntius*, *Chanda*, *Esomus*, *Colisa* and *Badis* predominate over air-breathing fishes like murrels (*Channa* spp.), climbing perches (*Anabas testudineus*) and cat fishes (*Clarias batrachus* and *Heteropneustes fossilis*).

**Table 4.** List of fishes occurring in wetlands of Indian Botanical Garden.

| Family and species | Occurrence in | |
|---|---|---|
| | Ponds | Lakes |
| Family ANGUILLIDAE | | |
| *Anguilla bengalensis* (Gray & Hardwicke) | – | + |
| Family CYPRINIDAE | | |
| *Labeo rohita* (Hamilton) | + | + |
| *Labeo bata* (Hamilton) | – | + |
| *Catla catla* (Hamilton) | + | + |
| *Cirrhinus mrigala* (Hamilton) | + | + |
| *Ctenopharyngodon idella* (Valenciennes) | – | + |
| *Cyprinus carpio* Linnaeus | – | + |
| *Hypophthalamichthys molitrix* Valenciennes | – | + |
| *Puntius sophore* (Hamilton) | + | + |
| *Puntius ticto* (Hamilton) | + | + |
| *Puntius sarana* (Hamilton) | – | + |
| *Puntius phutunio* (Hamilton) | + | + |
| *Amblypharyagodon mola* (Hamilton) | + | + |
| *Esomus danricus* (Hamilton) | + | + |
| *Salmostoma bacaila* (Hamilton) | – | + |
| *Lepidocephalus guntea* (Hamilton) | + | + |
| Family NOTOPTERIDAE | | |
| *Notopterus notopterus* (Pallas) | + | + |
| Family BAGRIDAE | | |
| *Mystus cavasius* (Hamilton) | + | + |
| *Mystus vittatus* (Bloch) | + | + |
| *Mystus tengra* (Hamilton) | + | + |
| Family SILURIDAE | | |
| *Wallago attu* (Schneider) | – | + |
| Family CLARIIDAE | | |
| *Clarias batrachus* (Linnaeus) | + | + |

**Table 4.** *Contd.*

| Family and species | Occurrence in | |
|---|---|---|
| | Ponds | Lakes |
| Family HETEROPNEUSTIDAE | | |
| *Heteropneustes fossilis* (Bloch) | + | + |
| Family BELONIDAE | | |
| *Xenentodon cancila* (Hamilton) | + | + |
| Family CYPRINODONTIDAE | | |
| *Aplocheilus panchax* (Hamilton) | + | + |
| Family SYMBRANCHIDAE | | |
| *Monopterus cuchia* (Hamilton) | + | + |
| Family CHANNIDAE | | |
| *Channa orientalis* (Schneider) | + | + |
| *Channa punctatus* (Bloch) | + | + |
| *Channa striatus* (Bloch) | + | + |
| *Channa marulius* (Hamilton) | – | + |
| Family CHANDIDAE | | |
| *Chanda nama* (Hamilton) | + | + |
| *Chanda ranga* (Hamilton) | + | + |
| Family MUGILIDAE | | |
| *Mugil tade* (Forsskal) | – | + |
| Family GOBIIDAE | | |
| *Glossogobius giuris* (Hamilton) | + | + |
| *Oligolepis acutipinnis* (C.V.) | – | + |
| Family ANABANTIDAE | | |
| *Anabas testudineus* (Bloch) | + | + |
| Family CICHLIDAE | | |
| *Oreochromis mossambica* Peters | + | + |
| *Oreochromis nilotica* Valenciennes | – | + |
| Family NANDIDAE | | |
| *Nandus nandus* (Hamilton) | – | + |
| *Badis badis* (Hamilton) | + | + |

**Table 4.** *Contd.*

| Family and species | Occurrence in | |
|---|---|---|
| | Ponds | Lakes |
| Family BELONTIDAE | | |
| *Colisa fasciatus* (Schneider) | + | + |
| Family MASTACEMBELIDAE | | |
| *Macrognathus aculeatus* (Bloch) | + | + |
| *Mastacembelus pancalus* (Hamilton) | + | + |
| *Mastacembelus armatus* (Lacepede) | – | + |

## B. INVERTEBRATE COMPONENTS

The collected aquatic invertebrates comprising of macro-invertebrates and zooplankton are reported hereunder from all the four ponds and four lakes (Tables 5 and 6) using abbreviation $P_1$ to $P_4$ for ponds and $L_1$ to $L_4$ for lakes as referred above.

**Macro-invertebrates :**

A total of over 64 species of macro-invertebrates, both aquatic and wetland associated, comprising of decapod crustaceans (6 species), hemipterans (15 species), coleopterans (18 species), arachnids (10 species) and molluscs (9 species) as well as some miscellaneous larval insects (6 species) were recorded from ponds and lakes of the Botanical Garden (Table 5). Among the aquatic macroinvertebrates, only microhemipterans like *Plea* spp. could not be observed from three lakes presumably due to their use in pisciculture. On the other hand some species belonging to the genera *Macrobrachium* (decapod crustaceans), *Diplonychus* and *Ranatra* (hemipterans) are quite common in both ponds and lakes. Most of the species of spiders (arachnids) are found associated with aquatic weeds. Their occurrences are herein reported based on the collected specimens. However, molluscan species are found to occur in low to high densities in ponds and lakes of which Leram lake represents high density of two gastropod *viz.*, *Assiminnea francessiae* and *Indoplanorbis exustus* and one bivalve species such as *Lamellidens marginalis*.

**Zooplankton :**

A total of over 55 species of zooplankton belonging to six different groups *viz.*, Hydrozoa (1 sp.), Copepoda (4 spp.), Ostracoda (5 spp.) Cladocera (38 spp.), Conchostraca (1 sp.) and Rotifera (>3 spp.) have been observed from ponds and lakes of IBG (Table 6). Of the six zooplankton groups, Cladocera has the highest diversity of 38 species belonging to six different families and of the ponds and lakes, King lake represents highest diversity of cladocerans as well as other zooplankton. In general, lakes support greater diversity of species of zooplankton than the ponds. Eleven cladoceran species marked with asterisks (*) in Table 6 were not recorded from various other wetlands of Haora district, West Bengal (Nandi *et al.*, 1999). Larger cladocerans *viz.*, *Daphnia* species could not be recorded from wetlands of IBG. This may be due to high predation pressure by fish and/or insects. However, among ostracods, the occurrence of *Strandesia weberi* is worth mentioning.

**Table 5.** List of macroinvertebrates recorded from wetlands of Indian Botanical Garden.

| Group/Family and species | Recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| **A. Decapod crustaceans :** | | | | | | | | |
| Family PALAEMONIDAE | | | | | | | | |
| *Macrobrachium rosenbergii* (de Man) | – | – | – | + | + | + | + | – |
| *Macrobrachium lamarrei* (H. M. Edwards) | + | + | + | + | + | + | + | + |
| *Macrobrachium dayanum* (H. M. Edwards) | – | – | – | + | + | + | + | + |
| Family ATYIDAE | | | | | | | | |
| *Caridina* sp. | – | – | – | + | + | – | – | + |
| Family GRAPSIDAE | | | | | | | | |
| *Varuna litterata* (Fabricius) | – | – | – | + | + | + | + | – |
| Family POTAMONIDAE | | | | | | | | |
| *Sartoriana spinigera* (Wood Mason) | + | – | – | + | + | – | – | + |
| **B. Hemipteran insects :** | | | | | | | | |
| Family BELOSTOMIDAE | | | | | | | | |
| *Diplonychus annulatus* Fabr. | + | + | + | + | + | + | + | + |
| *Diplonychus* spp. (2 species) | + | + | + | + | + | + | + | + |
| Family GERRIDAE | | | | | | | | |
| *Gerres* spp. (2 species) | + | + | + | + | + | – | – | + |
| Family HYDROMETRIDAE | | | | | | | | |
| *Hydrometra* sp. | – | + | + | + | + | – | + | + |
| Family NEPIDAE | | | | | | | | |
| *Laccotrephes griseus* (Gnerin) | + | – | + | + | + | – | – | + |
| *Ranatra filiformes* Fabr. | + | + | + | + | + | + | + | + |
| *Ranatra sordidula* Dahrn | – | + | – | + | – | – | – | + |
| Family NOTONECTIDAE | | | | | | | | |
| *Anisops* spp. (2 species) | – | – | + | + | + | + | + | + |
| Family PLEIDAE | | | | | | | | |
| *Plea* spp. (2 species) | – | + | + | + | – | – | – | + |

**Table 5.** *Contd.*

| Group/Family and species | Recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| **C. Coleopteran insects :** | | | | | | | | |
| Family DYTSCIDAE | | | | | | | | |
| *Canthydrus laetabilis* (Walker) | – | + | + | – | – | – | – | + |
| *Canthydrus* spp. (2 species) | + | + | + | + | + | – | – | + |
| *Cybister* spp. (2 species) | – | + | + | + | – | – | – | + |
| *Laccophilus* spp. (2 species) | – | + | + | + | + | + | – | + |
| Family HYDROPHILIDAE | | | | | | | | |
| *Amphiops spp.* (2 species) | – | + | + | + | + | + | + | + |
| *Helochares* spp (2 species) | – | + | – | – | – | + | – | – |
| *Regimbertia* spp. (2 species) | + | + | + | – | + | – | – | + |
| *Sternolophus* spp. (2 species) | – | + | + | – | – | – | – | + |
| Family CHRYSOMELIDAE | | | | | | | | |
| Leaf beetles (2 species) | – | – | + | + | + | – | + | – |
| Family CURCULIONIDAE | | | | | | | | |
| Weevils (1 species) | – | – | + | – | + | – | + | – |
| **D. Larval insects :** | | | | | | | | |
| Order ODONATA | | | | | | | | |
| *Ischnura* sp. | + | + | + | + | + | + | + | + |
| *Brachythemis* spp. (2 species) | – | + | + | + | + | – | + | + |
| Order DIPTERA | | | | | | | | |
| Mosquito larvae | + | + | + | + | + | – | + | + |
| Chironomid larvae | + | + | + | + | + | – | – | + |
| Order EPHEMEROPTERA | | | | | | | | |
| Mayfly larvae | – | + | + | – | – | – | – | – |
| **E. Arachnids :** | | | | | | | | |
| Family LYCOSIDAE | | | | | | | | |
| *Evippa shivajii* Tikader & Malhotra | – | – | – | – | – | – | – | + |
| *Pardosa annandalei* (Gravely) | – | + | – | – | – | – | – | – |

**Table 5.** *Contd.*

| Group/Family and species | Recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| *Pardosa pusiota* (Thorell) | – | – | – | – | – | + | – | – |
| *Pardosa birmanica* Simon | – | – | – | – | – | – | + | – |
| *Pardosa* sp. | – | – | + | – | – | – | – | + |
| Family SALTICIDAE | | | | | | | | |
| *Salticus* sp. | – | – | – | – | + | – | – | – |
| Family TETRAGNATHIDAE | | | | | | | | |
| *Tetragnatha* spp. (2 species) | – | – | – | – | – | + | – | – |
| Family ARANEIDAE | | | | | | | | |
| *Larinia* sp. | – | – | – | – | + | + | – | – |
| **F. Molluscs :** | | | | | | | | |
| Family ASSIMINEIDAE | | | | | | | | |
| *Assiminea francessiae* (Gray) | – | – | – | + | + | + | + | + |
| Family THIARIDAE | | | | | | | | |
| *Thiara tuberculata* (Muller) | – | + | – | + | – | + | + | + |
| Family VIVIPARIDAE | | | | | | | | |
| *Bellamya bengalensis* (Lamarck) | + | + | + | + | + | + | + | + |
| Family PILIDAE | | | | | | | | |
| *Pila globosa* (Swainson) | + | + | + | + | + | + | + | + |
| Family BITHYNIIDAE | | | | | | | | |
| *Gabbia orcula* Frauenfeld | – | + | – | + | + | – | + | + |
| Family PLANORBIDAE | | | | | | | | |
| *Indoplanorbis exustus* (Deshayes) | + | + | + | + | + | + | + | + |
| *Gyraulus convexiusculus* (Hutton) | + | + | + | + | + | + | + | + |
| Family LYMNAEIDAE | | | | | | | | |
| *Lymnaea luteola* Lamarck | – | – | + | + | + | + | – | + |
| Family UNIONIDAE | | | | | | | | |
| *Lamellidens marginalis* (Lamarck) | – | – | – | + | + | – | + | + |

**Table 6.** List of zooplankton species recorded from wetlands of Indian Botanical Garden.

| Group/Family and species | Zooplankton species recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| CNIDARIA : HYDROZOA | | | | | | | | |
| Family HYDRIDAE | | | | | | | | |
| *Hydra* sp. | – | + | + | – | – | – | – | – |
| CRUSTACEA : COPEPODA | | | | | | | | |
| Family DIAPTOMIDAE | | | | | | | | |
| Diaptomids (2 spp.) | + | – | – | + | + | + | + | + |
| Family CYCLOPIDAE | | | | | | | | |
| Cyclopids (2 spp.) | + | + | + | + | + | + | + | + |
| Family HARPACTICOIDAE | | | | | | | | |
| Harpacticoids (1 sp.) | – | + | + | – | + | – | – | – |
| Nauplius larvae | – | – | – | + | + | + | + | + |
| CRUSTACEA : OSTRACODA | | | | | | | | |
| Family CYPRIDIDAE | | | | | | | | |
| *Cypretta* sp. | – | – | – | – | – | + | + | – |
| *Cypris subglobosa* Sowerby | – | – | – | – | – | – | – | + |
| *Stenocypris major* (Baird) | – | – | – | – | – | – | + | – |
| *Stenocypris deruputa* Vavra | – | – | – | – | – | – | – | + |
| *Strandesia weberi* | + | + | – | – | – | – | – | – |
| Other ostracods (2 spp.) | – | + | + | – | + | + | – | + |
| CLADOCERA | | | | | | | | |
| Family SIDIDAE | | | | | | | | |
| *Pseudosida bidentata* Herrick | – | – | – | – | – | – | – | + |
| *Latonopsis australis* Sars | – | – | – | – | – | – | – | + |
| *Diaphanosoma excisum* Sars | + | – | – | + | – | + | + | + |
| *Diaphanosoma sarsi* Richard | + | – | – | – | – | + | + | – |

**Table 6.** *Contd.*

| Group/Family and species | Zooplankton species recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| *Diaphanosoma brachyurum* (Lieven)* | – | – | – | + | – | – | – | + |
| *Diaphanosoma aspinosum** | – | + | – | – | – | – | – | – |
| *Diaphanosoma leuchtenbergianum* Fischer* | – | – | – | – | + | – | – | – |
| Family DAPHNIIDAE | | | | | | | | |
| *Simocephalus vetulus* (O. F. Muller) | – | – | – | – | + | + | + | + |
| *Simocephalus exspinosus* (Koch) | – | + | – | – | – | – | + | – |
| *Simocephalus serrulatus* (Koch)* | – | – | – | – | – | + | – | + |
| *Cereodaphnia cornuta* Sars | + | – | + | + | + | + | + | + |
| *Scapholeberis kingi* Sars | – | – | – | + | – | – | – | + |
| Family MOINIDAE | | | | | | | | |
| *Moina micrura* Kurz | – | – | – | + | + | + | + | – |
| *Moina brachiata* (Jurine)* | – | + | – | – | – | – | – | – |
| Family MACROTHRICIDAE | | | | | | | | |
| *Macrothrix spinosa* King | – | + | + | – | + | – | + | + |
| *Macrothrix triserialis* (Brady) | – | + | + | – | – | + | – | – |
| *Ilyocryptus spinifer* Herrick | – | – | – | – | – | – | + | – |
| Family BOSMINIDAE | | | | | | | | |
| *Bosmina longirostris* (O. F. Muller) | – | – | – | – | + | – | – | – |
| Family CHYDORIDAE | | | | | | | | |
| *Pleuroxus similis* Vavra | – | – | – | – | – | – | – | + |
| *Alonella excisum* Fischer | – | – | – | – | – | – | – | + |
| *Chydorus sphaericus* (O. F. Muller)* | – | + | – | – | + | + | + | + |
| *Chydorus barroisi* (Richard) | – | – | – | – | + | + | – | + |
| *Chydorus reticulatus* Daday* | – | – | + | – | + | + | + | + |
| *Chydorus ventricosus* Daday | – | – | – | – | – | – | – | + |
| *Dunhevedia crassa* King | – | – | – | – | + | + | + | – |
| *Pseudochydorus globosus* (Baid)* | – | – | – | – | + | – | – | + |
| *Camptocercus australis* Sars | – | – | – | – | + | + | – | – |

**Table 6.** *Contd.*

| Group/Family and species | Zooplankton species recorded from | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Ponds | | | | Lakes | | | |
| | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $L_1$ | $L_2$ | $L_3$ | $L_4$ |
| *Dadaya macrops* (Daday)* | – | – | – | – | – | + | – | – |
| *Alona karua* (King) | – | + | – | + | + | + | + | + |
| *Alona pulchella* Sars | – | – | – | + | + | – | – | + |
| *Alona verrucosa* Sars | – | – | – | – | + | + | – | + |
| *Alona costata* Sars | – | – | – | – | + | – | + | – |
| *Alona kwangsiensis* Chiang | – | – | – | – | + | – | – | – |
| *Alona davidi* Richard | – | – | – | – | + | + | – | + |
| *Alona rectangula* Sars* | – | – | – | – | + | + | – | + |
| *Kurzia longirostris* (Daday) | – | – | – | – | + | – | – | + |
| *Oxyurella singalensis* (Daday) | – | + | – | – | – | – | + | + |
| *Notalona globulosa* (Daday)* | – | – | – | – | – | – | – | + |
| CRUSTACEA : CONCHOSTRACA | | | | | | | | |
| Family CYCLESTHERIDAE | | | | | | | | |
| *Cyclestheria hislopi* Baird | – | – | – | – | – | – | – | + |
| ROTIFERA | | | | | | | | |
| Family ASPLANCHIDAE | | | | | | | | |
| *Asplancha* sp. | + | + | – | – | – | – | + | + |
| Other rotifers (2 spp.) | – | + | – | – | + | + | + | + |

**Note :** (*) = These species were not observed from various other wetlands of Haora district (Nandi *et al.*, 1999).

## DISCUSSION

The wetland environment of the Indian Botanical Garden was known for its significant diversity in the incidence and abundance of various plant communities in the lakes (Singh and Ghosh, 1988). But, some of these lakes, *viz.*, Prain lake and Leram lake, are increasingly utilized for pisciculture in recent years. As a result, the apparent heterogeneity as noted by Singh and Ghosh (1988) in the bioaquatic environments of these lakes has rapidly been altered with regular anthropogenic interferences. The natural indigenous vegetation grown widely in ponds could not be seen in lakes as they are manually and mechanically cleared for fish cultivation. It influences on the faunal diversity

of these lakes. A comparative account of faunal diversity with reference to macroinvertebrate and zooplankton in relation to plant diversity and usage is summarised in Table 7. It shows that the lakes are in general, more productive than ponds. Among lakes it is revealed that the King lake which is characterised by high plant diversity with no fish culture supports greatest faunal diversity. However, the comparative account of floral and faunal diversity shown in Table 7 clearly indicates the dependency of faunal diversity with that of plants as well as size of the wetland concerned and inversely with anthropogenic/pisciculture activities.

**Table 7.** Comparative floral and faunal diversities of ponds and lakes in IBG.

| | Ponds and lakes | Plant diversity and usage | Faunal diversity (No. of species) | | |
|---|---|---|---|---|---|
| | | | Macroinvertebrate | Zooplankton | Total |
| | A. *Ponds* ( Small size and no fish culture) | | | | |
| 1. | Pond ($P_1$) | Low diversity, *Pistia* dominated | 16 | 7 | 23 |
| 2. | Pond ($P_2$) | High diversity, Lotus dominated | 28 | 15 | 43 |
| 3. | Pond ($P_3$) | Medium diversity, *Lemna* dominated | 23 | 8 | 31 |
| 4. | Pond ($P_4$) | High diversity, *Victoria* introduced | 35 | 10 | 45 |
| | B. *Lakes* | | | | |
| 5. | Dhobi lake ($L_1$) | Medium diversity with low fish culture | 33 | 25 | 58 |
| 6. | Prain lake ($L_2$) | Very low diversity with very high fish culture | 24 | 22 | 46 |
| 7. | Leram lake ($L_3$) | Low diversity with moderate fish culture | 24 | 21 | 45 |
| 8. | King lake ($L_4$) | High diversity with no fish culture | 35 | 33 | 68 |

## SUMMARY

1. Faunal diversity of 4 ponds and 4 lakes in the Indian Botanical Garden dealing with 74 species of vertebrates and over 119 species of invertebrates is reported.
2. It includes 10 major groups representing mammals (1 sp.), birds (18 spp.), reptiles (5 spp.), amphibians (6 spp.), fishes (44 spp.), decapod crustaceans (6 spp.), insects (39 spp.), arachnids (10 spp.), molluscs (9 spp.) and zooplankton (55 spp.).
3. The dependency of faunal diversity with that of plants is dicussed.

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*Rec. zool. Surv. India* : 99 (Part 1–4) : 131-133, 2001

# A NOTE ON THE COLLECTION OF *OSTEOBRAMA BAKERI* (DAY) AND *LABEO DUSSUMIERI* (VALOENCIENNES), TWO RARE CYPRINID FISHES FROM THE PAMBA-MANIMALA RIVER SYSTEMS OF KERALA, SOUTH INDIA.

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## INTRODUCTION

Ichthyofaunal investigation in the Alappuzha district, Kerala State, conducted along with the faunistic survey of the district by the Zoological Survey of India, Calicut Station, revealed the continued occurrence of the two rare fishes namely *Osteobrâma bakeri* (Day) and *Labeo dussumieri* (Valenciennes) (family : Cyprinidae) in the westflowing rivers in southern Kerala, South India. The status of these two fish species are known to be very rare or vulnerable (Menon 1997). The specimens of both these fish species (*O. bakeri*–1 ex., *L. dussumieri*–3 exs.) were obtained from the confluence of the Manimala and Pamba rivers at a locality near Mannar, Alappuzha district.

Day (1878) described *O. bakeri* (formerly referred to the genus *Rohtee* i.e., *Rohtee bakeri* Day) based on the specimens obtained from the type locality 'Kottayam' in Kerala, South India. It is so far reported only from the westflowing rivers in Kerala and, therefore, endemic to this geographic area. Its salient features are elongately trapezoid and laterally compressed body with abdominal edge sharp and trenchant between bases of pelvic and anal fins but rounded in front of pelvic fins; two pairs of small barbels; dorsal fin with a weak and serrated spine, anal fin with 11-14 branched rays and caudal fin deeply forked; lateral line with about 44 scales etc.

The distribution of *O. bakeri* being within a restricted geographical area or habitat, and that too in thin population, its specimens are hardly available in the ichthyofaunal explorations. After Day (op. cit.), John (1936) had reported its occurrence in the Manimala river and, much later, by Jayaram et. al. (1976) from Cardomom Hills in Southern Kerala. Raghunathan (1995), followed by Easa and Shaji (1997) reported its occurrence in the westflowing river Chaliyar in northern Kerala revealing its extended range of distribution. More recently, it has also been recorded from the westflowing Chalakkudy river in Central Kerala by Ajit Kumar et. al. (1999). The collection of O. bakeri (fig. 1) from the confluence of the Manimala and the Pamba rivers in the Alappuzha district, is the next authentic record of this species from southern Kerala after John (op. cit.).

Day (op. cit.) has mentioned 11 branched anal (total 14 including 3 unbranched) rays for the species. Jayaram (op. cit.) has observed a range of 12-14 branched anal rays while discussing the

biometric variations. The specimen collected by us is having 12 branched (total 15 including 3 unbranched) rays. Thus, *O. bakeri* is having a variable count (11-14) of branched anal rays, a feature (range in counts of branched anal rays) generally found among species of the genus (Talwar and Jingran, 1991). The colour of fish in live condition has not been recorded by Day or other workers. The fish in life is pale greenish on the back and silvery on the flanks and belly. The dorsal spine and the principal rays of caudal fin are deep red which become decolourised in preserved specimen, then tallying with the colour as mentioned in the original description. The live specimen of this fish species is easily distinguishable by its characteristic colouration.

*Labeo dussumieri* is considered a vulnerable species whose very sporadic populations or numbers in its geographic habitats are decreasing, though not reduced to a critical level, as evidenced in the sample-netting-catches during periodic ichthyofaunal explorations over the years. It is at present known from the westflowing rivers of Kerala and Sri Lanka, though it has been recorded as far north as Bombay and Gujarat (Menon, *op. cit.*). Its occurrence in Sri Lanka is reported to be common (Pethiyagoda 1991).

*Labeo dussumieri* (Fig. 2) is distinguishable from all other species of the genus *Labeo* by having two pairs of barbels; body with small scales, 53–60 along the lateral line and 5–5$^1/_2$ rows between lateral line and pelvic fin base; scales with dark edges forming distinct longitudinal stripes on body, etc.

The collection of specimens of these two species, obtained through random sampling efforts, from the confluence of the rivers Pamba and Manimala indicates the continued occurrence of these two fish species, possibly in good numbers, in both these westflowing rivers. It can be surmised beyond doubt that the populations of *O. bakeri* and *L. dussumieri* are still thriving in their threshold capacity ensuring the perpetuity of these two fish species in their known geographic habitats in Kerala.

## ACKNOWLEDGEMENT

The authors are grateful to the Director, Zoological Survey of India, Calcutta for facilities and encouragement. Our sincere thanks are due to Dr. (Ms.) K. Rema Devi, Scientist 'C', Southern Regional Station, Chennai, for correcting the manuscript.

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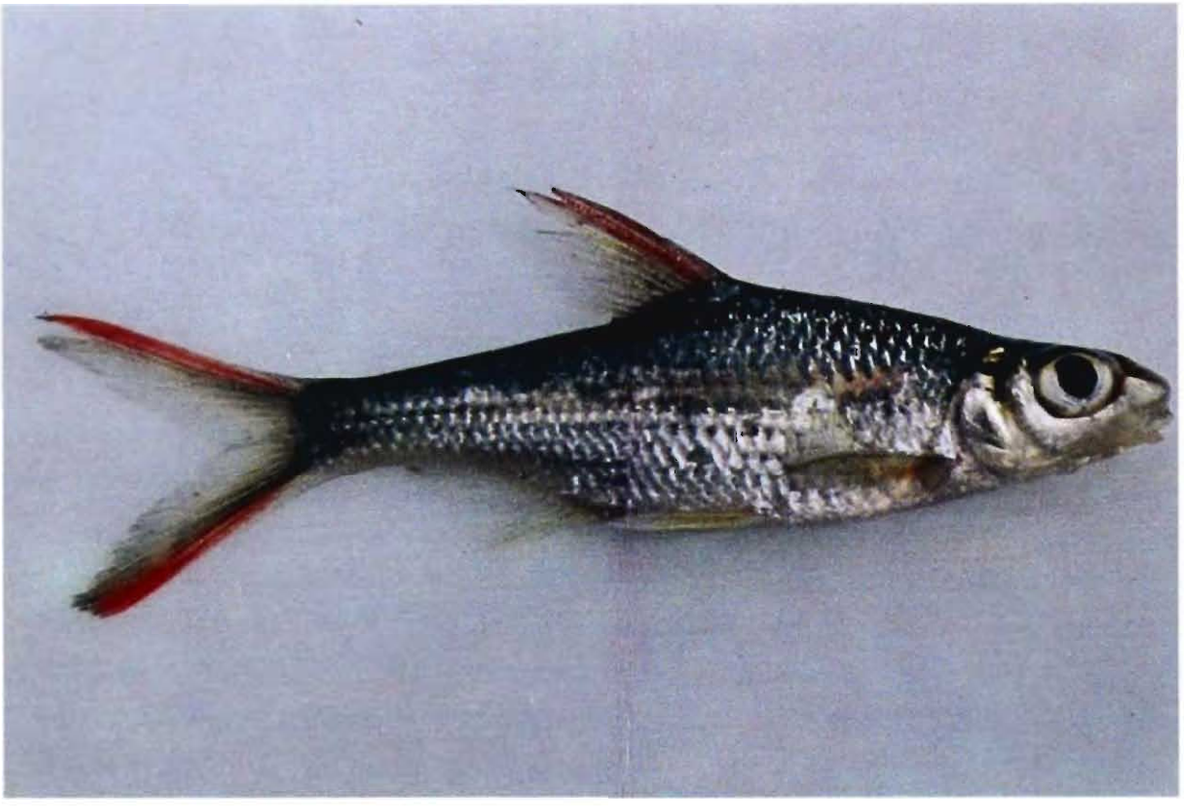
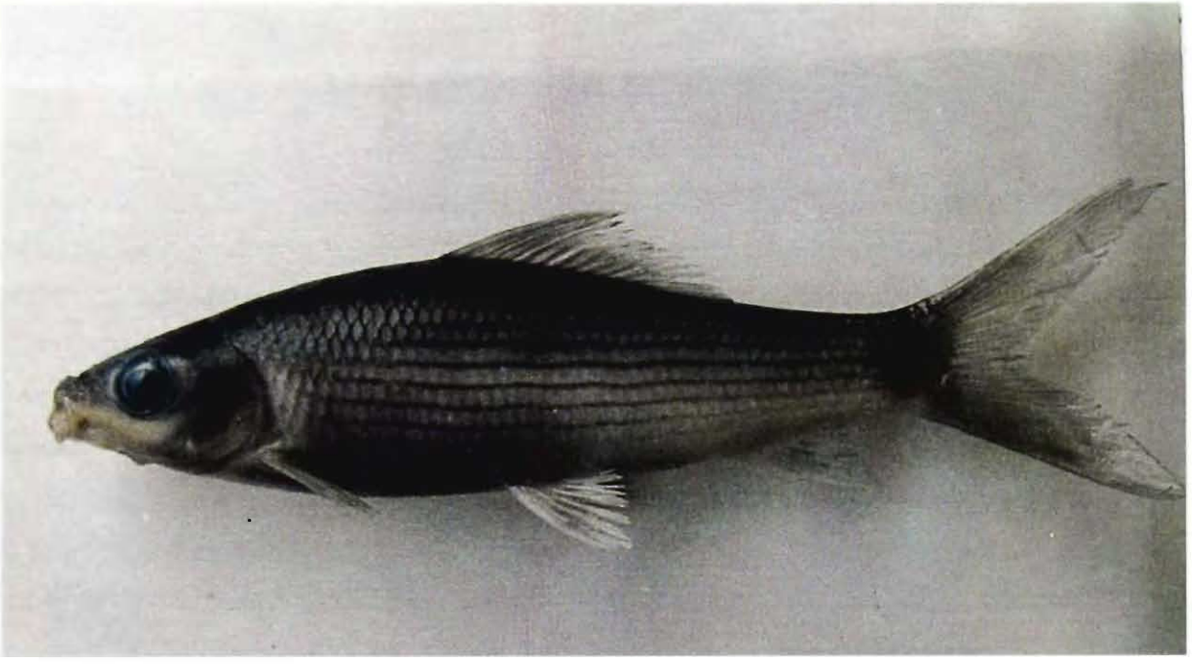
## PLATE 1



**Figs. 1.** *Osteobrama bakeri* (Day).



**Figs. 2.** *Labeo dussumieri* (Val.).

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# WETLAND FAUNAL RESOURCES OF WEST BENGAL-3. BIRBHUM DISTRICT

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## INTRODUCTION

The present study on wetland faunal resources of Birbhum district is the third instalment of the series from West Bengal. The earlier two papers deal with faunal diversity of some wetlands in North and South 24-Parganas districts (Nandi *et al.*, 1993) and Haora and Hugli districts (Nandi *et al.*, 1999). This district has a wide assemblage of aquatic or semi-terrestrial wetland habitats which are usually covered by shallow water. It includes freshwater ponds, beels, barrage, dighies, foodplains, etc. In all, 10 such wetland habitats, both permanent and temporary, have been surveyed during the years 1993 and 1994. Faunal inventories indicating occurrence of the species in the wetlands surveyed are communicated.

A review of literature (Nandi *et al.*, 1993, 1999) shows that there is no specific publication on wetland fauna of Birbhum district. However, Bhattacharya *et al.* (1979), Bhattacharya and Chattopadhyay (1984), Chattopadhyay and Bhattacharya (1986), Saha *et al.* (1992) have made some interesting contributions on Indian Blackback, Spotted Deer and other wildlife of Ballavpur Wildlife Sanctuary for which Ballavpur freshwater wetland within the sanctuary is famous in West Bengal.

## LOCATION AND PHYSIOGRAPHY

### Location

Birbhum district which lies between 23°33' and 24°35' North latitude and 87°10' and 88°2' East longitude, is located in the western part of West Bengal. It extends about 4,545 sq. km. with a population of 25,56,105 inhabitants (1991 census). It is bounded by Santhal Parganas of Bihar State on the North and West, Murshidabad and Barddhaman districts on the East and also by Barddhaman district on the South, demarcated by the river Ajoy.

### Climate

In accordance with the regional variations in the structure of the plains, Birbhum district comes under Rarh plain. The Birbhum plain is characterised by humid and warm climate in the summer and dry and cold condition in winter. The average summer temperature is 30°C and that of winter is 15°C. The annual average rainfall ranges between 130 cm and 140 cm. The rainy season usually lasts from

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the middle of June to the middle of October while hot weather from the middle of March to the middle of June and the cold weather from the middle of October to the middle of March. Cyclones are rare in this district.

**Soil**

The Rarh plain of Birbhum is the land of red soils. They belong to old alluvial type. Pebbles and sand predominate in these soils. The western part shows the presence of laterite soils. Along the river banks the soil is sandy and loamy. In general, the soils of this region contains iron and lime and very small quantity of humus not helpful for agriculture.

**Wetland Profile**

The district is well drained by rivers and rivulets, *viz.*, Mor, Ajai, Hingla, Bakreswar, Brahmani Bansloi, Pagla and Kopa. During dry weather, even the bigger rives like the Mor and Ajai expose their beds as broad expanses of sand with small streams trickling down the centre. But most of these rivers during rainy season grow broader and deeper, occasionally overtopping their banks especially at Rajgaon and Kirnahar areas creating flood plains and beels. Man-made wetlands include ponds and dighies as well as a barrage, *viz.*, Tilpara barage. Besides these wetlands, a hot water spring is located at Bakreswar wherein water temperature ranges 60–70°C. In general, water temperature, $p^H$, Dissolved oxygen of the wetlands surveyed varied from 9–35°C, 6.5–8.5 and 5.0–9.0 respectively.

**Vegetation**

The natural vegetation of Birbhum district is dry deciduous type. Trees, like sal (*Shorea robusta*), mahua (*Bassia latifolia*) and palas grow to the western part. Thorny shrubs, palm and mango trees are present throughout. Wetland plant species include floating hydrophytes, namely, water hyacinth, water lettuce and duck weeds; suspended hydrophytes, like *jhanji* (*Ceratophyllum*) and anchored hydrophytes such as *Patashaola* (*Vallisneria* sp.), *Padma* (*Nelumbo nucifera*), *Paniphal* (*Trapa* sp.) *Panchuli* (*Nymphoides* spp.), *Shapla* (*Nymphaea* spp.), *Hydrilla*, *Ottellia*, *Najas*, etc. Most of these hydrophytes were abundant in Datindighi, about 4 km. west of Dubrajpur, which is said to have been excavated by Khagaditya Raja (O'Malley, 1910). Similar aquatic or palustrine genera are available in wetlands of Ballavpur and Rampurhat along with sedge (*Cyperus* spp.) and emergent amphibious hydrophytes (*Marsilea*, *Aponogeton*, *Enhydra*, *Potamegeton*, *Paspalsum*, *Aeschynomene*, etc., especially in the Nagalhata beel. However, man-made ponds of domestic use were turned into green colour during summer due to algal blooms caused by *Microcystis* sp. and Tilpara barrage was dominated by filamentous algae (*Spirogyra*).

## MATERIALS AND METHODS

During 1993 and 1994, a total of 10 freshwater wetlands (Table 1, Fig. 1) were surveyed for studying the faunal diversity of wetlands in Birbhum district. Of these, only four wetlands, *viz.*,

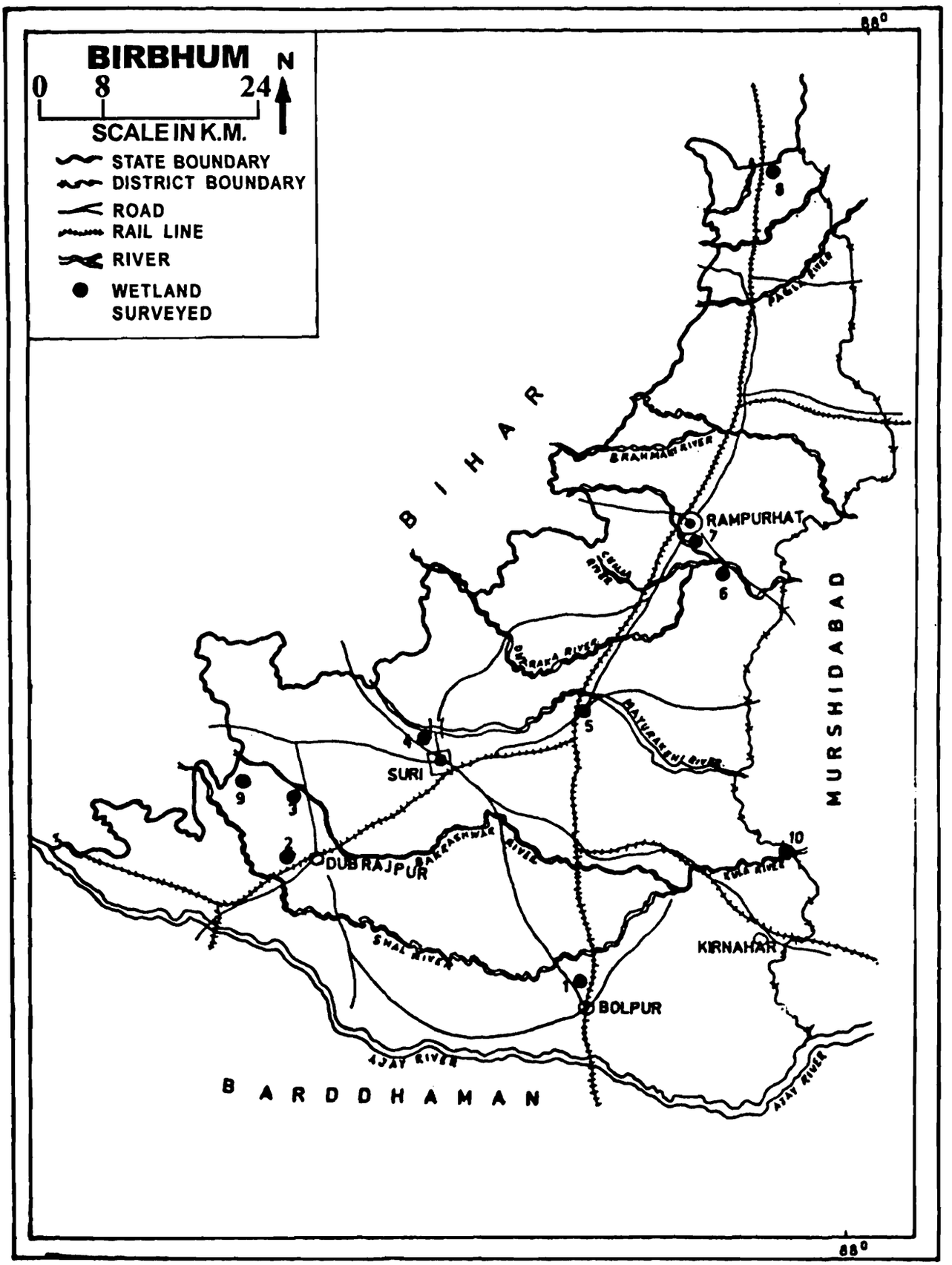


**Fig. 1.** Map of Birbhum district showing the wetlands (1–10) surveyed. 1 = Ballavpur wetland; 2 = Datindighi; 3 = Bakreswar pond; 4 = Tilpara barrage; 5 = Sainthia beel; 6 = Karkaria dighi; 7 = Goldighi; 8 = Gnorsha beel; 9 = Protappur bundh; 10 = Langalhata beel.

**Table 1.** List of wetlands surveyed from Birbhum district.

| Sl. No. | Name of the wetland | Name of the nearest village-town | Approximate area (ha) | Ecological characteristics |
|---|---|---|---|---|
| 1. | Ballavpur wetland (BW) | Bolepur | 202 | Permanent, freshwater ponds – a wildlife reserve and deer park. |
| 2. | Datindighi (DD) | Dubrajpur | 21.6 | Permanent, freshwater macrophyte dominated pond surrounded by agricultural fields. |
| 3. | Bakreswar pond (BP) | Bakreswar | 0.6 | Permanent, freshwater fish pond at the pilgrim site. |
| 4. | Tilpara barrage (TB) | Suri | – | Permanent, freahwater barrage on Mayurakshi river. |
| 5. | Sainthia beel (SB) | Sainthia | 48 | Permanent, uncultivated, freshwater beel with agricultural fields around. |
| 6. | Karkaria dighi (KD) | Tarapith | 6.2 | Permanent, freshwater impoundment in the rural area. |
| 7. | Goldighi (GD) | Rampurhat | 5.0 | Permanent freshwater pond in the urban set up –a recreational park site. |
| 8. | Gnorsha beel (PB) | Rajgram | – | Temporary freshwater flood plain wetland. |
| 9. | Protappur bundh (PB) | Protappur | 7.8 | Permanent, freahwater impoundment in the rural settings. |
| 10. | Langalhata beel (LB) | Kirnahar | 1080 | Temporary, freshwater beel a flooded riverine meadow. |

Ballavpur wetland, Datindighi, Tilpara barrage and Goldighi were surveyed thrice during the course of study. Field observation, water quality analysis and collection of specimens were made from most of these wetlands using a drag net and plankton net as well as hand picking. The collected specimens were identified by these authors and other scientists of this department. Most of the vertebrates and macro-invertebrates were observed, while some were informed during the course of investigation. Their presence (+) or absence (–) from the wetlands during survey was indicated in Tables 2–8. The occurrences of some species marked with asterisks are based on local information from a few wetlands.

## FAUNAL RESOURCE

The species which are habitually found, dependent or associated with wetlands as defined by Nandi *et al.* (1993, 1999, 2001) are reported herein leaving aside terrestrial components and/or 'Occasional visitors'

### A. VERTEBRATES

#### Mammals

Two species of wetland dependent mammals, *viz.*, *Bandicota indica* (Bechstein) from Ballavpur wetland, Datindighi and Goldighi and *Lutra perspicillata* (Geoffroy) from Langalhata beel were encountered in Birbhum district. However, several species belonging to Chiroptera, Carnivora and Rodentia were observed as terrestrial and arboreal components. The Indian Blackbuck, *Antilope cervicapra* Linnaeus and Spotted Deer, *Axis axis* Erxleben are important dryland components of Ballavpur wetland complex.

#### Avifauna

A total of 36 avian species belonging 10 families comprising of water birds, marsh birds and kingfishers have been observed (Table 2). Of these, 25 species were resident and 11 species were migratory birds. The migratory ducks were observed in the Ballavpur wetlands and Tilpara barrage. These two wetlands as well as Nagalhata beel exhibit greater avian diversity in this district. However, Ballavpur wetland, Datindighi and Goldighi were found to be inhabited by some resident anatid birds, *viz.*, *Nettapus coromandelianus* throughout the year. The jheels at Ballavpur sanctuary attract a large number of migratory birds. So far, a total of 65 species of birds were recorded from this area of which 27 species are wetland dependent or associated including 9 species of winter migrants (Haldar *et al.*, 1999), but their population has recently been reduced to a few thousands indicating unsafe refuge to wintering waterfowl. This may be due to gradual disappearance of the fencing structure and the changed situations in the protection status of the wetlands. The occurrence of Comb duck, Brahmini duck and geese in large flocks was reported earlier in Birbhum district (O' Malley, 1910).

**Table 2.** List of resident and migratory birds recorded in wetlands of Birbhum district.

| Family and species | Avifauna occurring in wetlands | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **A. Resident species :** | | | | | | | | | | |
| Family : PODICIPETIDAE | | | | | | | | | | |
| *Podiceps ruficollis* (Pallas) | + | + | – | + | – | – | + | – | – | + |
| Family : PHALACROCORACIDAE | | | | | | | | | | |
| *Phalacrocorax niger* (Vieillot) | + | + | + | + | + | + | + | – | + | + |
| Family : ARDEIDAE | | | | | | | | | | |
| *Ardea alba* (Linnaeus) | + | – | – | – | + | – | – | + | – | + |
| *Ardea grayi* (Sykes) | + | + | + | + | + | + | + | + | + | + |
| *Ardea purpurea* Linnaeus | + | + | – | – | – | – | – | + | – | + |
| *Bubulcus ibis* (Linnaeus) | + | + | – | + | + | + | + | + | + | + |
| *Egretta garzetta* (Linnaeus) | + | + | – | + | + | – | – | + | – | + |
| *Egretta intermedia* (Wagler) | + | – | – | – | + | – | – | + | – | + |
| *Nycticorax nycticorax* (Linnaeus) | + | + | – | – | + | – | + | + | + | + |
| Family : CICONIIDAE | | | | | | | | | | |
| *Anastomus oscitans* (Boddaert)* | – | – | – | + | + | – | – | + | – | + |
| Family : ANATIDAE | | | | | | | | | | |
| *Dendrocygna javanica* (Horsfield) | + | + | – | + | + | – | + | + | – | + |
| *Nettapus coromandelianus* (Gmelin) | + | + | + | – | + | + | + | + | + | + |
| Family : ACCIPITRIDAE | | | | | | | | | | |
| *Haliastur indus* (Boddaert)* | + | – | – | + | – | – | + | + | – | + |
| *Circus aeruginosus* (Linnaeus) | – | – | – | – | – | – | – | + | – | + |
| Family : RALLIDAE | | | | | | | | | | |
| *Amaurornis phoenicurus* (Pennant) | + | + | – | – | + | – | + | – | + | + |
| *Gallinula chloropus* (Linnaeus) | + | + | – | – | + | – | + | – | + | + |
| *Porphyrio porphyrio* (Linnaeus) | – | – | – | – | – | – | – | – | + | – |
| *Fulica atra* (Linnaeus) | – | + | – | + | – | – | – | – | – | – |

**Table 2.** *Contd.*

| Family and species | Avifauna occurring in wetlands | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| Family : JACANIDAE | | | | | | | | | | |
| *Metopidus indicus* (Latham) | + | + | + | – | + | – | + | – | + | + |
| Family : ALCEDINIDAE | | | | | | | | | | |
| *Alcedo athis* (Linnaeus) | + | + | – | + | + | + | + | – | + | + |
| *Ceryle rudis* (Linnaeus) | – | + | – | – | – | – | – | – | + | – |
| *Halcyon smyrnensis* (Linnaeus) | + | + | + | + | + | – | + | + | + | + |
| *Pelargopsis capensis* (Linnaeus) | + | + | – | – | – | – | – | + | – | – |
| Family : CHARADRIIDAE | | | | | | | | | | |
| *Vanellus cinereus* (Blyth) | – | + | – | – | – | – | – | – | – | – |
| *Vanellus indicus* (Boddaert) | + | + | – | – | + | – | + | + | – | + |
| **B. Migratory species :** | | | | | | | | | | |
| Family : ANATIDAE | | | | | | | | | | |
| *Anser anser* (Linnaeus) | + | – | – | + | – | – | – | – | – | – |
| *Anas acuta* Linnaeus | + | – | – | + | – | – | – | – | – | – |
| *Anas crecca* Linnaeus | + | – | – | + | – | – | – | – | – | – |
| *Anas clypeata* Linnaeus | + | – | – | + | – | – | – | – | – | – |
| *Anas poecilorhyncha* Forster | – | – | – | + | – | – | – | – | – | – |
| *Netta rufina* (Pallas) | – | – | – | + | – | – | – | – | – | – |
| *Aythya fuligula* (Linnaeus) | + | – | – | + | – | – | – | – | – | – |
| Family : CHARADRIIDAE | | | | | | | | | | |
| *Tringa nebularia* (Gunner) | + | – | – | + | + | – | – | + | – | – |
| *Tringa ochropus* Linnaeus | – | – | – | + | – | – | – | + | – | – |
| *Tringa hypoleucos* Linnaeus | + | + | – | + | – | – | + | + | – | + |
| *Gallinago stenura* Bonaparte | + | + | – | – | + | – | + | + | + | + |

**Note :** 1. Abbreaviations of the wetlands as in Table 1.

2. The species marked with an asterisk are based on local information from some wetlands.

**Herpetofauna**

Eleven species of herpetofauna, six reptiles and five amphibians belonging to seven families were encountered from wetlands of Birbhum district (Table 3). Of these, two species of snakes *viz.*, *Enhydis enhydris* (Schneider) and *Xenochrophis piscator* (Schneider) and four amphibian species, *viz.*, *Rana cyanophlyctis* Schneider, *R. limnocharis* Wiegman and *R. tigerina* Daudin and *Bufo melanostictus* Schneider were common in occurrence. Chakraborty and Chakraborty (1987) reported hunting of yellow monitor, *Varanus flavescens* by some tribals of Birbhum district.

**Table 3.** List of herpetofauna associated with wetlands of Birbhum district.

| Family and species | Herpetofauna occurring in wetlands | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **A. Reptiles :** | | | | | | | | | | |
| Family : TRIONYCHIDAE | | | | | | | | | | |
| *Lissemys punctata* (Bonaterre)* | + | + | – | – | + | – | – | – | + | + |
| Family : VARANIDAE | | | | | | | | | | |
| *Varanus bengalensis* (Daudin) | + | – | – | + | + | – | – | + | + | + |
| *Varanus falvescens* (Gray) | + | + | – | – | – | – | + | + | – | – |
| Family : COLUBRIDAE | | | | | | | | | | |
| *Enhydris enhydris* (Schneider) | + | + | + | + | + | + | + | + | + | + |
| *Xenochrophis piscator* (Schneider) | + | + | + | + | + | + | + | + | + | + |
| Family : ELAPIDAE | | | | | | | | | | |
| *Naja naja kaouthia* (Lacepede)* | + | + | – | – | + | – | – | + | + | + |
| **B. Amphibians :** | | | | | | | | | | |
| Family : RANIDAE | | | | | | | | | | |
| *Rana cyanophlyctis* Schneider | + | + | + | + | + | + | + | + | + | + |
| *Rana limnocharis* Wiegmann | + | + | + | + | + | + | + | + | + | + |
| *Rana tigerina* Daudin* | + | + | + | + | + | + | + | + | + | + |
| Family : MICROHYLIDAE | | | | | | | | | | |
| *Microhyla ornata* (Dumeril & Bibron) | + | + | + | + | + | – | + | – | – | – |
| Family : BUFONIDAE | | | | | | | | | | |
| *Bufo melanostictus* Schneider* | + | + | + | + | + | + | + | + | + | + |

**Note :** Abbreviations and asterisks as indicated in Table 2.

**Fish fauna**

Forty five species of fishes belonging to 19 families have been recorded from different wetlands of Birbhum district (Table 4). Of these, 41 species were encountered in Nagalhata beel, a flood plain wetland, followed by another, *viz.*, Gnorsha beel (36 species). These two wetlands exhibit greater fish faunal diversity due to overflooding of the adjoining rivers which has resulted in occasional availability of hilsa fish, *Hilsa ilisha* (Hamilton) in these two beels.

**Table 4.** List of fish fauna inhabiting wetlands of Birbhum district.

| Family and species | Fish fauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| Family : ANGUILLIDAE | | | | | | | | | | |
| *Anguilla bengalensis* (Gray & Hardw.) | – | + | – | – | + | + | – | + | + | + |
| Family : CLUPEIDAE | | | | | | | | | | |
| *Hilsa ilisha* (Hamilton)* | – | – | – | – | – | – | – | + | – | + |
| Family : NOTOPTERIDAE | | | | | | | | | | |
| *Notopterus chitala* (Hamilton)* | – | – | – | + | – | – | – | + | – | – |
| *Notopterus notopterus* (Pallas) | – | + | + | – | + | + | + | + | + | + |
| Family : CYPRINIDAE | | | | | | | | | | |
| *Salmostoma bacaila* (Hamilton) | + | + | – | + | – | + | – | + | – | + |
| *Hypophthalmichthys molitrix* (Valenciennes) | – | – | + | – | – | + | + | – | + | – |
| *Amblypharyngodon mola* (Hamilton) | + | + | + | – | + | + | + | + | + | + |
| *Esomus danricus* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Cyprinus carpio* Linnaeus | – | – | – | – | – | + | + | – | – | + |
| *Catla catla* (Hamilton) | + | + | + | + | + | + | + | – | + | + |
| *Labeo rohita* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Labeo bata* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Labeo calbasu* (Hamilton) | + | + | + | – | + | – | + | – | + | + |
| *Cirrhinus mrigala* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Brachydanio rerio* (Hamilton) | – | – | – | + | – | – | – | – | – | + |
| *Puntius sophore* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Puntius sarana* (Hamilton) | – | – | + | + | – | + | + | + | + | + |
| *Puntius ticto* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Puntius phutunio* (Hamilton) | + | + | + | + | + | + | + | – | + | + |

**Table 4.** *Contd.*

| Family and species | Fish fauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| Family : COBITIDAE | | | | | | | | | | |
| *Lepidocephalus guntea* (Hamilton) | + | – | + | + | + | + | + | + | + | + |
| Family : BAGRIDAE | | | | | | | | | | |
| *Aorichthys aor* (Hamilton) | – | – | – | – | – | – | – | + | – | + |
| *Mystus cavasius* (Hamilton) | + | + | – | + | + | + | – | + | – | + |
| *Mystus vittatus* (Bloch) | – | – | + | + | + | + | + | + | + | + |
| *Mystus bleekeri* (Day) | – | – | – | – | – | – | – | + | – | + |
| Family : SILURIDAE | | | | | | | | | | |
| *Ompok pabda* (Hamilton) | – | – | – | + | + | – | – | + | – | + |
| *Wallago attu* (Schneider)* | – | + | – | + | + | – | – | + | + | + |
| Family : CLARIIDAE | | | | | | | | | | |
| *Clarias batrachus* (Linnaeus)* | + | + | + | + | + | + | + | + | + | + |
| Family : HETEROPNEUSTIDAE | | | | | | | | | | |
| *Heteropneustes fossilis* (Bloch)* | + | + | + | + | + | + | + | + | + | + |
| Family : CYPRINODONTIDAE | | | | | | | | | | |
| *Aplocheilus panchax* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| Family : CHANNIDAE | | | | | | | | | | |
| *Channa marulius* Hamilton* | + | + | – | + | + | – | – | + | + | + |
| *Channa striatus* (Bloch)* | + | + | + | + | + | + | + | + | + | + |
| *Channa orientalis* (Schneider) | + | + | + | – | + | – | – | – | – | – |
| *Channa punctatus* (Bloch) | + | + | + | + | + | + | + | + | + | + |
| Family : SYMBRANCHIDAE | | | | | | | | | | |
| *Monopterus cuchia* (Hamilton)* | + | + | – | + | + | – | – | + | + | + |
| Family : CHANDIDAE | | | | | | | | | | |
| *Chanda nama* Hamilton | + | – | – | + | + | + | – | + | + | + |
| *Chanda ranga* Hamilton | + | + | + | + | + | + | + | + | + | + |

**Table 4.** *Contd.*

| Family and species | Fish fauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| Family : NANDIDAE | | | | | | | | | | |
| *Badis badis* (Hamilton) | + | + | + | – | + | + | + | – | + | + |
| Family : CICHLIDAE | | | | | | | | | | |
| *Oreochromis mossambica* (Peters) | + | – | + | + | + | + | + | + | + | + |
| Family : GOBIIDAE | | | | | | | | | | |
| *Glossogobius giuris* (Hamilton) | + | + | + | + | + | + | + | + | + | + |
| *Oligolepis acutipinnis* (C.V.) | – | – | – | – | + | – | – | + | – | + |
| Family : ANABANTIDAE | | | | | | | | | | |
| *Anabas testudineus* (Bloch) | + | + | + | + | + | + | + | + | + | + |
| Family : BELONTIDAE | | | | | | | | | | |
| *Colisa fasciata* (Schneider) | + | + | + | + | + | + | + | + | + | + |
| Family : MASTACEMBELIDAE | | | | | | | | | | |
| *Macrognathus aculeatus* (Bloch) | + | + | + | + | + | + | + | – | + | + |
| *Mastacembelus armatus* (Lacepede) | – | – | – | + | – | – | – | + | – | + |
| *Mastacembelus pancalus* (Hamilton) | + | + | + | + | + | + | + | + | + | + |

**Note :** Abbreviations and asterisks as indicated in Table 2.

A wide variety of cyprinids, as well as 'jeol fish', *viz.*, *Anabas testudineus* (Bloch), *Clarias batrachus* (Linnaeus) and *Heteropneustes fossilis* (Bloch) are extensively grown in ponds, bundhs and dighies in this district. About seven species of major, minor and exotic carps are mostly cultivated in man-made wetlands yielding 200-500 kg/ha/annum under traditional and semi-intensive practices, (Misra, 1987). Although Hora (1943) offered his observations on the fisheries of the improved tanks in Birbhum district, it is found that fish culture in this district, in general, is practised in a very neglected and arbitrary manner as reported by Misra (1987). As a result weed fishes belonging to the genera *Esomus, Puntius, Colisa, Chanda, Badis,* etc., are available in considerable numbers at the periphery of the wetlands.

## B. INVERTEBRATES

### Macroinvertebrates

*Macrocrustaceans :* Four species of prawns and three species of crabs have been identified from freshwater wetlands of Birbhum district (Table 5). A species of prawn, *Macrobranchium lamarrei*

**Table 5.** List of macrocrustaceans identified from wetlands of Birbhum district.

| Family and species | Prawns and crabs occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **MACRURA : Prawns** | | | | | | | | | | |
| Family : PALAEMONIDAE | | | | | | | | | | |
| *Macrobrachium rosenbergii* (de Man) | – | – | – | + | – | – | – | + | – | + |
| *Macrobrachium dayanum* (H. M. Edwards) | + | – | + | + | – | + | + | + | + | + |
| *Macrobrachium lamarrei* (H. M. Edwards) | + | + | + | + | + | + | + | + | + | + |
| Family : ATYIDAE | | | | | | | | | | |
| *Caridina* sp. | + | + | + | – | – | + | + | – | + | + |
| **BRACHYURA : Crabs** | | | | | | | | | | |
| Family : POTAMONIDAE | | | | | | | | | | |
| *Paratelphusa hydrodromus* Herbst | – | – | – | + | + | + | – | – | – | + |
| *Sartoriana spinigera* Wood Mason | + | + | + | – | + | + | + | – | – | + |
| Family : GRAPSIDAE | | | | | | | | | | |
| *Varuna litterata* (Fabricius) | – | – | – | – | – | – | – | + | – | + |

(H. M. Edwards) was common in occurrence in all the wetlands, while a species of crab, *Varuna litterata* (Fabricius) was reported from flood plain wetlands of Gnorsha beel and Nagalhata beel.

*Insects :* A total of over 53 species of entomofauna comprising of hemipterans (25 species), coleopterans (22 species), ephemeropterans (1 species), odonate larvae (3 species) and dipteran larvae (2 species) have been recorded from different wetlands of Birbhum district (Table 6). Among hemipterans, water bug (*Diplonychus* species) and water scorpions (*Ranatra* species) were quite common and among coleopterans *Canthydrus laetibilis* was widely distributed. A single species of ephimeropteran, *viz.*, *Ephemera annandalei* Chopra was recorded from Tilpara barage. However, besides larval odonates, five species adult odonates, *viz.*, *Ceriagrion coromandelianum* (Fabricius) belonging to the family Coenagrionidae and *Crocothemis servilia servilia* (Drury), *Diplacodes trivialis* (Rambur), *Rhyothemis variegata variegata* (Linne) and *Orthetrum sabina sabina* (Drury) of the family Libellulidae were collected from Datindighi and Ballavpur wetlands.

*Molluscs :* In all 13 species belonging to 8 families have been identified (Table 7). Of these, four species, *viz.*, *Bellamya bengalensis* (Lamarck), *Pila globosa* (Swainson), *Indoplanorbis exustus* (Deshayes) and *Gyraulus labiatus* (Benson) were common in occurrence, while species like *Brotia*

**Table 6.** List of entomofauna recorded from freshwater wetlands of Birbhum district.

| Family and species | Entomofauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **A. Hemipteran insects (25 species) :** | | | | | | | | | | |
| Family : BELOSTOMIDAE | | | | | | | | | | |
| *Diplonychus annulatus* (Fabr.) | + | + | – | + | + | + | + | – | + | – |
| *Diplonychus* sp. | + | + | + | + | + | + | + | – | + | + |
| *Lethocercus indicus* (Lep. & Serv.) | – | + | + | – | + | – | – | – | + | – |
| Family : CORIXIDAE | | | | | | | | | | |
| *Corixa* spp. (2 species) | + | + | – | – | + | – | – | – | + | – |
| *Micronecta* spp. (2 species) | + | + | + | + | + | – | + | – | – | – |
| Family : GERRIDAE | | | | | | | | | | |
| *Limogonus nitidus* (Mayr) | + | + | – | – | + | + | + | – | – | – |
| *Limnogonus* spp. (2 species) | + | + | – | + | + | + | + | – | – | – |
| *Rhagadotarsus* sp. | – | – | – | – | – | + | + | – | – | – |
| Family : HYDROMETRIDAE | | | | | | | | | | |
| *Hydrometra* sp. | + | + | – | + | + | – | – | – | – | + |
| Family : NEPIDAE | | | | | | | | | | |
| *Laccotrephes griseus* (Guerin) | – | + | – | – | + | – | – | + | – | – |
| *Laccotrephes* sp. | + | + | + | – | – | – | – | – | + | + |
| *Ranatra filiformis* Fabr. | – | – | + | + | – | – | + | + | – | – |
| *Ranatra sordidula* Dahrn | + | + | + | + | + | + | + | – | + | – |
| *Ranatra* sp. | + | + | – | – | + | + | – | – | + | + |
| Family : NOTONECTIDAE | | | | | | | | | | |
| *Anisops bouvieri* (Krik.) | – | – | + | – | – | – | + | – | – | – |
| *Anisops* spp. (2 spp.) | – | + | + | – | + | + | + | + | – | – |
| Family : MESOVELIIDAE | | | | | | | | | | |
| *Mesovelia vittigera* (Horvath) | – | – | – | + | – | – | – | – | – | – |
| *Mesovolia* spp. (2 spp.) | + | – | – | + | – | – | + | – | – | – |
| Family : PLEIDAE | | | | | | | | | | |
| *Plea* spp. (2 species) | – | + | – | – | + | – | + | – | – | – |

**Table 6.** *Contd.*

| Family and species | Entomofauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **B. Coleopteran insects** (22 species) : | | | | | | | | | | |
| Family : DYTISCIDAE | | | | | | | | | | |
| *Canthydrus laetabilis* (Walker) | + | + | + | + | + | + | + | – | + | – |
| *Canthydrus morsbachi* (Wehnkee) | + | + | + | – | + | – | – | – | – | – |
| *Canthydrus ritsemai* (Regimbert) | + | + | – | + | – | – | – | – | – | – |
| *Canthydrus* sp. | + | – | – | – | – | – | – | – | + | – |
| *Cybister* sp. | – | + | – | – | – | – | – | – | – | – |
| *Clypeodytes* sp. | – | – | – | + | + | – | – | – | – | – |
| *Hydrocoptus fabricii* MacLeay | – | – | – | + | – | – | – | – | – | – |
| *Hydrocoptus subvitulus* Mots. | + | + | – | – | + | – | – | – | – | – |
| *Hydrocoptus* sp. | – | – | + | – | + | – | – | – | – | – |
| *Hydrovatus* sp. | – | + | + | + | + | – | – | – | – | – |
| *Laccophilus* sp. | + | + | + | – | + | + | – | – | + | – |
| *Hyphophorus* sp. | – | + | – | – | – | + | + | – | – | – |
| Family : HYDROPHILLIDAE | | | | | | | | | | |
| *Sternolophus rufipes* (Fabricius) | – | – | – | – | – | – | – | – | + | – |
| *Helochares anchoralis* Sharp | – | – | + | – | – | – | – | – | – | – |
| *Helochares pallons* (MacLeay) | – | – | – | + | – | – | – | – | – | – |
| *Berosus indicus* Mots. | – | + | – | + | – | – | – | – | – | – |
| *Regimbertia attenuata* (Fabricius) | + | + | + | – | + | – | – | – | – | – |
| *Globaria leachi* (Hope) | – | + | – | – | + | – | – | – | + | – |
| *Globaria* sp. | + | + | + | – | + | + | + | – | – | – |
| *Amphiops* sp. | + | + | + | – | – | – | – | – | – | – |
| Family : HALIPLIDAE | | | | | | | | | | |
| *Haliplus* sp. | – | – | – | – | – | + | + | – | – | – |
| Family : GYRINIDAE | | | | | | | | | | |
| *Orectochilus* sp. | – | – | – | + | – | – | – | – | – | – |

**Table 6.** *Contd.*

| Family and species | Entomofauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **C. Miscellaneous insects :** | | | | | | | | | | |
| Odonate larvae (3 spp.) | + | + | + | + | + | + | + | – | + | – |
| Mosquito larvae (>1 sp.) | + | + | + | + | + | + | + | – | + | – |
| Chironomid larvae (>1 sp.) | + | + | – | + | + | + | + | – | + | – |
| Mayfly nymph (1 sp.) (*Ephemera annandalei* Chopra) | – | – | – | + | – | – | – | – | – | – |

**Table 7.** List of molluscan species recorded from wetlands in Birbhum district.

| Family and species | Molluscan fauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| **A. Gastropod molluscs :** | | | | | | | | | | |
| Family : VIVIPARIDAE | | | | | | | | | | |
| *Bellamya bengalensis* (Lamarck) | + | + | + | + | + | + | + | + | + | + |
| Family : PILIDAE | | | | | | | | | | |
| *Pila globosa* (Swainson) | + | + | + | + | + | + | + | + | + | + |
| Family : BITHYNIIDAE | | | | | | | | | | |
| *Gabbia orcula* Frauenfeld | + | + | + | + | – | + | + | – | – | – |
| *Digoniostoma cerameopoma* (Benson) | – | – | + | – | – | – | – | – | – | + |
| Family : THIARIDAE | | | | | | | | | | |
| *Thiara granifera* (Lamarck) | – | – | – | + | – | + | + | – | – | – |
| *Thiara tuberculata* (Muller) | – | – | + | + | – | – | – | + | – | – |
| *Brotia costula* (Rafinesque) | – | – | – | + | – | – | – | – | – | – |
| Family : LYMNAEIDAE | | | | | | | | | | |
| *Lymnaea acuminata* Lamarck | + | – | – | + | – | + | + | – | + | – |
| *Lymnaea luteola* Lamarck | – | – | + | – | + | – | + | – | – | – |

**Table 7.** *Contd.*

| Family and species | Molluscan fauna occurring in | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB | PB | LB |
| Family : PLANORBIDAE | | | | | | | | | | |
| *Indoplanorbis exustus* (Deshayes) | + | + | + | + | + | + | + | – | + | – |
| *Gyraulus labiatus* (Benson) | + | + | + | + | + | + | + | – | + | – |
| **B. Bivalve molluscs :** | | | | | | | | | | |
| Family : UNIONIDAE | | | | | | | | | | |
| *Lamellidens marginalis* (Lamarck) | + | + | + | – | – | + | + | – | + | – |
| Family : CORBICULIDAE | | | | | | | | | | |
| *Corbicula striatella* Desheyes | – | – | – | + | – | – | – | – | – | – |

*costula* (Rafinesque) and *Corbicula striatella* Deshayes were encountered in Tilpara barrage only. The highest molluscan diversity was also observed in Tilpara barrage. *Gyraulus labiatus* is omnipresent in wetlands of Birbhum district with conspicuous absence of *Gyraulus convexiusculus*. Similar observation was recorded earlier by Mitra and Dey (1992).

**Zooplankton**

Fifty three species of zooplankton belonging to Copepoda (6 species), Ostracoda (5 species), Cladocera (35 species), Conchostraca (1 species) and Rotifera (6 species) have been recorded from various wetlands of Birbhum district (Table 8). Of these, cladocerans exhibited greatest diversity representing 35 species belonging to five families. Among cladocerans, *Ceriodaphnia cornuata* occurs in all the wetlands sampled for zooplankton, while *Daphnia similis* occurred only in the flood plain wetland of Gnorsha beel. However, in general, littoral species such as chydorids were dominant over limnetic species since most of these wetlands are used for pisciculture. The scarcity in representation of limnetic cladocerans belonging to the families Daphnidae, Moinidae and Bosminidae is suspected due to the predation pressure by insects and fishes as suggested by Venkataraman and Das (1993) and Venkataraman *et al.*, (2000).

Copepods appear to be the next dominant group in which predaceous cyclops predominate amongst zooplankton population in a number of wetlands surveyed.

## UTILIZATION SCENARIO OF THE WETLANDS

The wetlands of Birbhum district are utilized in various ways, *viz.*, reservoir of water, recreation, waterfowl habitat, religious purposes, etc. The diversified uses of four important wetlands of Bolepur

**Table 8.** List of zooplankton species recorded from wetlands in Birbhum district.

| Family and species | Zooplankton species occurring in | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB |
| CRUSTACEA : COPEPODA | | | | | | | | |
| Family : DIAPTOMIDAE | | | | | | | | |
| *Diaptomids* (3 spp.) | + | – | + | – | + | + | – | – |
| Family : CYCLOPIDAE | | | | | | | | |
| *Mesocyclops* (2 spp.) | + | + | + | – | + | + | – | – |
| Family : HARPACTICOIDAE | | | | | | | | |
| *Harpacticoids* (1 sp.) | – | – | – | – | – | – | – | + |
| Nauplius larvae | – | – | + | – | – | – | – | + |
| CRUSTACEA : OSTRACODA | | | | | | | | |
| Family : CYPRIDAE | | | | | | | | |
| *Cypris subglobosa* Sowerby | + | – | – | – | – | – | – | – |
| *Stenocypris major* (Baird) | – | – | – | + | – | + | – | – |
| Other ostracods (3 spp.) | + | + | – | + | + | + | – | – |
| CRUSTACEA : CLADOCERA | | | | | | | | |
| Family : SIDIDAE | | | | | | | | |
| *Pseudosida bidentata* Herrick | – | + | – | – | – | – | + | – |
| *Latonopsis australis* Sars | + | + | – | + | – | + | + | – |
| *Diaphanosoma excisum* Sars | – | – | – | – | – | + | + | + |
| *Diaphanosoma sarsi* Richard | – | – | – | – | – | + | – | – |
| Family : DAPHNIIDAE | | | | | | | | |
| *Daphnia similis* Claus | – | – | – | – | – | – | – | + |
| *Simocephalus vetulus* (O. F. Mullar) | + | + | + | – | + | + | + | – |
| *Simocephalus exspinosus* (Koch) | – | – | – | – | + | + | + | – |
| *Simocephalus serrulatus* (Koch) | + | + | – | – | – | – | + | – |
| *Cereodaphnia cornuta* Sars | + | + | – | + | + | + | + | + |
| *Scapholeberis kingi* Sars | + | + | – | + | + | + | – | – |

**Table 8.** *Contd.*

| Family and species | Zooplankton species occurring in | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB |
| Family : MOINIDAE | | | | | | | | |
| *Moina micrura* Kurz | – | – | + | – | – | + | + | + |
| Family : MACROTHRICIDAE | | | | | | | | |
| *Macrothrix spinosa* King | + | + | – | + | + | + | + | – |
| *Macrothrix triserialis* (Brady) | + | + | – | + | – | + | – | – |
| *Macrothrix laticornis* (Jurine) | – | – | – | + | – | – | + | – |
| *Ilyocryptus spinifer* Herrick | + | + | – | + | + | + | + | – |
| Family : CHYDORIDAE | | | | | | | | |
| *Pleuroxus similis* Vavra | – | + | – | – | – | – | – | – |
| *Alonella excisa* (Fischer) | + | + | – | + | – | + | – | – |
| *Chydorus sphaericus* (O. F. Muller) | – | + | + | + | + | + | + | – |
| *Chydorus barroisi* (Richard) | + | + | – | + | + | + | + | – |
| *Chydorus reticulatus* Daday | + | + | – | – | + | + | + | – |
| *Chydorus ventricosus* Daday | + | + | – | + | – | + | – | – |
| *Dadaya macrops* (Daday) | + | – | – | – | – | – | – | – |
| *Dunhevedia crassa* King | + | – | – | – | – | + | – | – |
| *Alona karua* (King) | + | – | – | – | – | + | + | – |
| *Alona pulchella* Sars | – | + | – | + | + | + | – | – |
| *Alona verrucosa* Sars | + | + | – | + | – | + | – | – |
| *Alona costata* Sars | + | + | – | – | – | + | – | – |
| *Alona kwangsiensis* Chiang | – | – | – | – | – | – | + | – |
| *Alona davidi* Richard | + | – | – | – | – | – | – | – |
| *Alona rectangula* Sars | – | – | + | – | + | + | + | – |
| *Alona affinis* Leyding | – | – | – | + | – | – | – | – |
| *Kurzia longirostris* (Daday) | – | – | – | – | – | + | – | – |
| *Oxyurella singalensis* (Daday) | + | – | + | – | – | + | + | – |
| *Notalona globulosa* (Daday) | + | – | – | – | + | + | – | – |
| *Leydigia acanthocercoides* (Fischer) | – | – | – | – | + | – | – | – |

**Table 8.** *Contd.*

| Family and species | Zooplankton species occurring in | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | BW | DD | BP | TB | SB | KD | GD | GB |
| CRUSTACEA : CONCHOSTRACA | | | | | | | | |
| Family : CYCLESTHERIDAE | | | | | | | | |
| *Cyclestheria hislopi* Baird | + | + | – | – | – | + | – | – |
| ROTIFERA | | | | | | | | |
| Family : ASPLANCHIDAE | | | | | | | | |
| *Asplancha* sp. | – | – | + | – | – | – | – | + |
| Other rotifers (5 spp.) (*Branchionus, Keratella* and *Filinia* spp.) | – | + | – | + | – | – | – | + |

(Ballavpur wetland), Dubrajpur (Datindighi), Suri (Tilpara barrage) and Rampurhat (Goldighi) are summarised in Table 9.

From Table 9 it is clear that most of the major uses are available from these four wetlands. However, Ballavpur wetland and Tilpara barrage have high value as waterfowl habitat and Goldighi has high recreational as well as reservoir of water value for domestic purposes. On the other hand, Datindighi is an important religious site for the local people. Ghosh *et al.* (1992) reported archaeological domestic mammalian remains from a pond of chalcolithic Kotasur village of this district.

## DISCUSSION

The wetlands of Birbhum district are, in general, small and man-made excepting the natural flood plain wetlands, *viz.*, Gnorsha beel and Nagalhata beel and one artificial wetland, namely, Tilpara barrage. These three wetlands as well as Ballavpur wetlands (202 ha) though qualify for inclusion in the "Directory of Wetlands in India" (Anonymous, 1988), being more than 100 hectares in area, are not listed except Nagalhata beel (23°45' N and 87°45' E; 2000 ha). All the four aforesaid wetlands of Birbhum district represent the freshwater wetlands of the Rarh plain dominated by red soils.

The faunal diversity in freshwater wetlands of Rarh plain represents low diversity of wetland fauna especially avifauna (36 species) when compared with that of Gangetic delta plains *viz.*, (i) Active delta or Coastal plain of North and South 24-Parganas districts (67 species; Nandi *et al.*, 1993) and (ii) Mature delta plain of Haora and Hugli districts (54 species; Nandi *et al.*, 1999). The reed dwelling birds were conspicuously absent from these wetlands of Birbhum district. In overall, the wetland fauna of Birbhum district represent 220 species (94 vertebrates and 126 invertebrates,

**Table 9.** Utilization status of four important wetlands in Birbhum district.

| Types of utilization | Status of utilization | | | |
|---|---|---|---|---|
| | Ballavpur wetland | Datin dighi | Tilpara barrage | Goldighi |
| **A. Wetland use** | | | | |
| 1. Reservoir of water | | | | |
| a. Domestic (Bathing, washing, etc.) | VL | VL | L | VH |
| b. Agricultural | – | L | H | L |
| 2. Waterfowl habitat | H | M | VH | H |
| 3. Fisheries | VL | VL | L | L |
| 4. Tourism | M | L | L | M |
| 5. Nature conservation | M | M | M | H |
| **B. Dryland use** | | | | |
| 6. Gardening and greenery | M | L | VL | H |
| 7. Recreation | M | L | M | H |
| 8. Children's park | – | – | – | M |
| 9. Defaecation/Waste disposal | L | L | L | M |
| 10. Religious site | – | M | – | – |

Abbreviations : VH = Very high; H = High; M = Medium; L = Low; VL = Very low.

while Haora and Hugli districts were represented by 276 and 261 species repectively (Nandi *et al.*, 1999). However, among wetlands of Birbhum district, littoral species collected around knee-dip water showed highest representation of entomofauna in fallow wetlands of Datindighi (33 species) and Sainthia beel (27 species), lowest in floodplain wetlands of Gnorsha beel (4 species) and Langalhata beel (4 species) and moderate in man-made wetlands, *viz.*, Ballavpur wetland (25 species), Goldighi (23 species), Tilpara brrage (24 species), etc. Field observation in these wetlands indicate higher diversity of entomofauna associated with macrophyte diversity of these wetlands. Among zooplankton, five species of Cladocera, *viz.*, *Chydorus reticulatus, Dadaya macrops, Macrothrix laticornis, Notalona globulosa* and *Simocephalus serrulatus* were not recorded from earlier studies in the districts of lower West Bengal (Nandi *et al.*, 1993; 1999). However, these species excepting *Macrothrix laticornis* were encountered in the pond and lake ecosystems of the Indian Botanical Garden suggesting dependency of zooplankton diversity with that of plants/macrophytes (Nandi *et al.*, 2001).

## SUMMARY

1. A faunal inventory of 10 wetlands in Birbhum district dealing with 94 species of vertebrates and 126 species of macroinvertebrate and zooplankton is communicated.
2. The vertebrate species include 2, 36, 6, 5 and 45 species of mammals, birds, reptiles, amphibians and fishes repecteively. The macro-invertebrate fauna include macrocrustaceans (7 species), insects (53 species) and molluscs (13 species) and zooplankton comprise of a total of 53 species.
3. The utilization scenario of four important wetlands of this district is depicted.

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# ECHINODERMATA (OTHER THAN HOLOTHUROIDEA) FROM THE RITCHIE'S ARCHIPELAGO, ANDAMAN ISLANDS

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## INTRODUCTION

Ritchie's Archipelago located East of South Andamans in the Bay of Bengal consists of 13 islands. These are North, Middle and South Button Island National Parks; East or Inglis and Sir Hugh Rose Island Sanctuaries; Outram, John Lawrence and Henry Lawrence Islands of Rani Jhansi Marine National Park and Wilson, Nicholson, Sir William Peel, Havelock and Neil Islands. Mahadevan and Easterson (1983) and Pande *et al.* (1991) gave topographical details of these islands. In spite of several accounts on the echinoderm fauna of the Andaman Islands, there are only a few reports pertaining to Ritchie's Archipelago (see Anon., 1995). Recently there has been a necessity for island-wise faunal inventories for declaration and management of protected areas in the Andaman and Nicobar Islands. Hence the following account reports on the echinoderms other than holothurians of Ritchie's Archipelago. Earlier, Julka and Das (1978), Soota *et al.* (1983), James (1986b) and Sastry (1997) reported the following 12 species from the Ritchie's Archipelago.

ASTEROIDEA

1. *Archaster typicus* Mueller & Troschel (Havelock I)
2. *Culcita novaeguineae* Mueller & Troschel (Havelock I)
3. *Dactylosaster cylindricus* (Lamarck) (Outram I)
4. *Linckia laevigata* Mueller & Troschel (Havelock I)

ECHINOIDEA

5. *Phyllacanthus imperialis* (Lamarck) (Henry Lawrence I)
6. *Prionocidaris verticillata* (Lamarck) (Henry Lawrence I)
7. *Mespilia globulus* (Linnaeus) (Henry Lawrence I)

HOLOTHUROIDEA

8. *Actinopyga mauritiana* (Quoy & Gaimard) (Neil I)
9. *Holothuria pyxis* Selenka (Havelock I)
10. *H. arenicola* Semper (Neil I)

11. *H. impatiens* Forskal (Havelock I)

12. *Stichopus chloronotus* Brandt (Havelock & Neil Is)

During the intensive surveys of the Ritchie's Archipelago over the years by scientists, including the present author, of Zoological Survey of India, several echinoderms had been collected from these islands. The material belonged to 34 species including eight species of Crinoidea, four species of Asteroidea, 17 species of Ophiuroidea and five species of Echinoidea. Of these only the asteroids *Culcita novaeguineae* Mueller and Troschel and *Linckia laevigata* Mueller and Troschel have been reported from Havelock Island of Ritchie's Archipelago as mentioned above. All the other 32 species are new to the echinoderm fauna of the Archipelago. Among the 34 species encountered, the crinoid *Stephanometra indica* (Smith), and the ophiuroids *Macrophiothrix demessa* (Lyman), *Ophiothela danae* Verrill and *Ophiothrix exigua* Lyman are new records from the Andaman Islands while the ophiuroid *Ophiocoma pusilla* (Brock) is new to the fauna of Indian coast. A brief mention of all the 34 species is given below since Clark and Rowe (1971) gave keys for identification, figures, detailed Indo-West Pacific distribution and references to the descriptions and revisions of these species. Other important references are cited in the text. The distribution of all the 44 species in the different islands of the Archipelago is given in Table 1.

Abbreviations: **AD** - Dr. A. Daniel; **ANRS** - Zoological collections of Andaman and Nicobar Regional Station, Port Blair; **BKT** - Dr. B. K. Tikader; **BPH** - Dr. B. P. Haldar; **DRKS** - Dr. D. R. K. Sastry; **DVR** - Dr. D V. Rao; **GCR** - Dr. G. C. Rao; **HL** - Henry Lawrence; **I(s)** - Island(s); **KVS** - Sri K. V. Surya Rao; **Mar. Surv.** - Marine Survey (R.I.M.S.Investigator); **NZC** - National Zoological Collection, Zoological Survey of India, Calcutta; **spec(s)** - specimen(s); **Sta.** Station; **SWP** - Sir William Peel.

## SYSTEMATIC ACCOUNT

Phylum : ECHINODERMATA

Class : CRINOIDEA

Order : COMASTERIDA

Family : COMASTERIDAE

### 1. *Comanthus parvicirrus* (J. Mueller)

*Material examined :* NZC - Havelock I., GCR, 6.4.1974, one spec.

*Distribution :* East Coast of Africa to South Pacific Is. as per Clark and Rowe (1971) while Rowe *et al.* (1986) confirmed the distribution from East Indies to Australia only.

*Remarks :* Clark (1912, 1932) reported the species from Table I. and Port Blair of Andamans and Nancowry I. of Nicobars.

2. ***Comanthus samoanus*** A. H. Clark

*Material examined :* NZC - Havelock I ., GCR, 7.4.1974, one spec.; 21.3.1978, three specs.

*Distribution :* Eastern Arabian Sea to South Pacific Is.

*Remarks :* Clark (1912) reported the species from Invisible Bank of Andamans.

3. ***Comaster multifidus*** (J. Mueller)

*Material examined :* NZC - SWP I., GCR, 7.4.1974, one spec.

*Distribution* : Bay of Bengal to South Pacific Is.

*Remarks* : The species has also been recently collected from the Curlew (B.P) I. of North Andamans (Sastry, in press).

4. ***Comatella nigra*** (P. H. Carpenter)

*Material examined :* NZC - Havelock I., GCR, 8.4.1974, one spec.

*Distribution :* Bay of Bengal to Philippines and North Australia.

*Remarks :* The species was reported from the Mahatma Gandhi Marine National Park of South Andamans by Sastry (1998).

5. ***Comatella stelligera*** (P. H. Carpenter)

*Material examined :* NZC - SWP I., GCR, 7.4.1974, one spec.; Havelock I., GCR, 21.3.1974, one spec.

*Distribution :* Sri Lanka to South Pacific Is.

*Remarks :* The species has also been recently collected from Interview I. of North Andamans (Sastry, in press).

6. ***Oxycomanthus bennetti*** (J. Mueller)

*Material examined :* NZC - SWP I., GCR 7.4.1974, two specs.

*Distribution :* Bay of Bengal to South Pacific Is.

*Remarks :* The species was earlier reported from Table I. of Andamans by Clark (1912) under the genus *Comanthus* and Rowe et al. (1986) transferred the species to their new genus *Oxycomanthus.*

Family : MARIAMETRIDAE

7. ***Lamprometra palmata*** (J. Muller)

*Material examined :* NZC - Havelock I., GCR 21.3.1974, one spec.

*Distribution :* Arabian Sea to Hawaiian Is.

*Remarks :* The species was earlier collected also from Oliver and Egg Is of North Andamans (Sastry, in press).

8. ***Stephanometra indica*** (Smith)

*Material examined :* NZC - Havelock I., GCR, 4.5.1973, two specs.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* The species is newly recorded here from the Andamans.

Class : ASTEROIDEA

Order : VALVATIDA

Family : OREASTERIDAE

9. ***Culcita novaeguineae*** Mueller and Troschel

*Material examined :* ANRS - Havelock I., DRKS, 31.3.1996, one spec.

*Distribution :* Lakshadweep to Hawaiian Is.

*Remarks :* Earlier Julka and Das (1978) reported the species from Havelock I.

Family : OPHIDIASTERIDAE

10. ***Fromia indica*** (Perrier)

*Material examined :* NZC - HL I., Mar. Surv., 31.3.1930, one spec.

*Distribution :* Southern Arabian Sea to South Pacific Is.

*Remarks :* Koehler (1909,1910), Clark (1967) and James (1969) reported the species from the Andamans.

11. ***Linckia laevigata*** (Linnaeus)

*Material examined :* ANRS - Outram I., DVR, 26.2.1994, one spec.; DVR, 1.3.1994, one spec.

*Distribution :* East coast of Africa to (?) Hawaiian Is.

*Remarks :* The species was first reported from the Andamans by Koehler (1910) as *L. miliaris* and later by James (1969).

Family : ASTERINIDAE

12. ***Asterina sarasini*** (de Loriol)

*Material examined :* NZC - Sta. 665. Outram I., Mar. Surv., 5.2.1924, one spec.; Sta. 667. Neil I., Mar. Surv., 8.2.1924, one spec.

*Distribution :* Bay of Bengal.

*Remarks :* Koehler (1910) reported the species from the Andamans under *Palmipes*.

Class : OPHIUROIDEA

Order : OPHIURIDA

Family : OPHIACTIDAE

13. ***Ophiactis modesta*** Brock

*Material examined :* NZC - SWP I ., BPH, 14.5.1978, one spec.

*Distribution :* Bay of Bengal, East Indies , Philippines and South Pacific Is.

*Remarks :* The species was earlier reported by James (1983) from Port Blair.

14. ***Ophiactis savignyi*** Mueller and Troschel

*Material examined :* NZC - Havelock 12.5.1978,one spec.; Neil I., BPH, 5.5.1978, one spec.

*Distribution :* Tropical Atlantic , Indian and Pacific Oceans.

*Remarks :* The species is often associated with various sponges.

Family : OPHIOTHRICIDAE

15. ***Macrophiothrix demessa*** (Lyman)

*Material examined :* NZC - Neil I., BPH, 5.5.1978, one spec.

*Distribution :* East Coast of Africa to North Australia.

*Remarks :* The species is newly recorded from the Andamans. Earlier it was known on Indian Coast only from the Lakshadweep (Sastry, 1991).

16. ***Macrophiothrix longipeda*** (Lamarck)

*Material examined :* NZC - Havelock I., KVS, 19.2.1974, one spec.; ANRS - Nicholson I., DRKS, 2.4.1996, one spec.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* The species inhabits deep crevices and burrows in coral and shingle beds. The disc and two are three arms are firmly hidden in the crevice or burrow. The remaining arms are extended out into the waters to collect suspended food organisms in the mucous secretions and are conveyed in the form of small balls to the mouth.

### 17. ***Macrophiothrix propinqua*** (Lyman)

*Material examined :* NZC - SWP I ., BPH, 14.5.1978, two specs.; Havelock I., BPH, 12.5.1978, four specs.; Neil I., BPH 4.5.1978, one spec .; 5.5.1978, four specs,; 6.5.1978, six specs.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* The species was earlier reported from the Andamans by Koehler (1898) under the genus *Ophiothrix* and Clark (1980) transferred the species to *Macrophiothrix*.

### 18. ***Ophiothela danae*** Verrill

*Material examined :* NZC - Havelock I., BPH, 10.05.1978, 40 specs.

*Distribution :* Arabian Sea to South Pacific Is.

*Remarks :* The species is here reported for the first time from Andamans. It is fissiparous and epizoic on gorgonians.

### 19. ***Ophiothrix exigua*** Lyman

*Material examined :* NZC - Havelock I., BPH, 12.05.1978, four specs.

*Distribution :* Maldives to South Pacific Is.

*Remarks :* The species is newly recorded from the Andamans. Earlier it was reported from the Gulf of Mannar of Indian coast by James (1986a).

### 20. ***Ophiothrix trilineata*** Luetken

*Material examined :* NZC - SWP I., BPH, 14.5.1978, one spec. Havelock I., BPH, 12.05.1978, two specs.; Neil I., BPH, 5.5.1978, four specs.; 6.5.1978, nine specs.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* Earlier Koehler (1898) reported the species from the Andamans.

Family : OPHIOCOMIDAE

21. ***Ophiarthrum pictum*** Muller and Troschel

*Material examined :* NZC - Inglis I., Mar. Surv., 21.4.1919, one spec.; Havelock I., AD, 27.02.1971, one spec.; GCR, 4.5.1974, one spec.; ANRS - Havelock I. DRKS, 5.4.1996, one spec.

*Distribution :* Bay of Bengal to South Pacific Is.

*Remarks :* The species was earlier reported by James (1969, 1971) from the Nicobars and by Sastry (1997) from the Andamans.

22. ***Ophiocoma brevipes*** Peters

*Material examined :* ANRS - Inglis I., DRKS, 3.4.1996, one spec.

*Distribution :* East Coast of Africa to Hawaiian Is.

*Remarks :* James (1969, 1987b) reported the species from the Andamans.

23. ***Ophiocoma dentata*** Mueller and Troschel

*Material examined :* NZC - Inglis I., Mar.Surv., 21.4.1919, three specs.

*Distribution :* East coast of Africa to Hawaiian Is.

*Remarks :* James (1969) reported the species as *O. insularia* var. *variegata* from the Andamans.

24. ***Ophiocoma erinaceus*** Mueller and Troschel

*Material examined :* NZC - Havelock I., GCR, 4.5.1973, one spec.; BPH, 12.05.1978, one spec.; Neil I., GCR, 31.03.1974, one spec.; BPH, 4.5.1978, one spec.; 5.5.1978, five specs.; 6.5.1978, two specs.; ANRS - Inglis I., DRKS, 3.4.1996, one spec.

*Distribution :* East Coast of Africa to Hawaiian Is.

*Remarks :* Koehler (1898) reported the species from the Andamans.

25. ***Ophiocoma pusilla*** (Brock)

*Material examined :* NZC - Neil I., 4.5.1978, one spec.; 5.5.1978, one spec.

*Distribution :* Red Sea, Western Indian Ocean, Andamans, East Indies, South China Sea and South Pacific Is.

*Remarks :* Devaney (1970) relegated *O. latilanxa* Murakami to the synonymy of *O. pusilla* (Brock). The species is new to the fauna of Indian coast.

26. ***Ophiocoma scolopendrina*** (Lamarck)

*Material examined :* NZC - Inglis I., Mar.Surv., 21.4.1919, one spec.; Havelock I., Sta. 662, Mar.Surv., 3.2.1924, two specs.; KVS, 19.2.1974, one spec.; BPH, 11.5.1978, one spec.; Neil I., GCR, 31.3.1974, three specs.; ANRS - Nicholson I., DRKS,2.4.1996, two specs.

*Distribution :* East Coast of Africa to Hawaiian Is.

*Remarks :* James (1969) reported the species from the Andamans.

27. ***Ophiomastix annulosa*** (Lamarck)

*Material examined :* NZC - Inglis I., Mar.Surv., 21.4.1919, two specs.; Neil I., BKT, 9.4.1970, one spec.

*Distribution :* Maldives to South Pacific Is.

*Remarks :* Bell (1887) and Koehler (1898) reported the species from the Andamans.

Family : OPHIURIDAE

28.***Ophioelegans cincta*** (Mueller and Troschel)

*Material examined :* NZC - Neil I., GCR, 31.3.1974, two specs.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* James (1987a) while reporting the species from the Andamans transferred it to a new genus *Ophioelegans*.

29. ***Ophiolepis superba*** H. L. Clark

*Material examined :* NZC - HL I., Station 664, Mar. Surv., 4.2.1924, one spec.

*Distribution :* East coast of Africa to South Pacific Is.

*Remarks :* Bell (1887) reported the species from the Andamans.

Class : ECHINOIDEA

Order : DIADEMATOIDA

Family : DIADEMATIDAE

30. ***Diadema setosum*** (Leske)

*Material examined :* ANRS - Outram I., DVR, 3.3.1994, one spec.

*Distrubtion :* East coast of Africa to South Pacific Is.

*Remarks :* James (1983) reported the species from the Andamans.

31. ***Echinothrix calamaris*** (Pallas)

*Material examined :* ANRS - HL I., DRKS, 4.4.1996, one spec.; Havelock I., DRKS, 5.4.1996, one spec.

*Distribution :* East coast of Africa to Hawaiian Is.

*Remarks :* Clark (1925) and Koehler (1927) reported the species from Andamans.

Order : ECHINOIDA

Family : ECHINOMETRIDAE

32. ***Echinometra mathaei*** (de Blainville)

*Material examined :* ANRS - Inglis I., DRKS, 3.4.1996, one spec.; Outram I., DVR, 2.3.1994, one spec.; HL I., DRKS, 4.4.1996, one spec.; Havelock I., DVR 21.11.1991, one spec.

*Distribution :* East coast of Africa to Hawaiian Is.

*Remarks :* Clark (1925) and Koehler (1927) reported the species from the Andamans. Three colour forms one of olive green spines, one of violet spines and another of black spines with reddish tips are known to occur in the Andaman and Nicobar Islands.

Order : HOLECTYPOIDA

Family : ECHINONEIDAE

33. ***Echinoneus cyclostomus*** Leske

*Materials examined :* ANRS - Havelock I., DVR, 24.2.1994, one spec,

*Distribution :* Tropical Western Atlantic, Indian and West Pacific oceans.

*Remarks :* Bell (1887) reported the species from the Andamans.

Order : SPATANGOIDA

Family : LOVENIIDAE

34. ***Lovenia elongata*** (Gray)

*Material examined :* ANRS - Havelock I., DVR, 24.2.1994, one spec.

*Distribution :* East coast of Africa to Philippines and North Australia.

*Remarks :* The species is new to Andamans. It was collected from the sandy region adjacent to coral reef area.

**Table 1.** Distribution of echinoderms known from the Ritchie's Archipelago in different islands.

| Echinoderm species | Inglis | Rani Jhansi Marine National Park: Outram | Henry Lawrence | Nicholson | Sir William Peel | Havelock | Neil |
|---|---|---|---|---|---|---|---|
| CRINOIDEA | | | | | | | |
| 1. *Comanthus parvicirrus* | | | | | | + | |
| 2. *Comanthus samoanus* | | | | | | + | |
| 3. *Comaster multifidus* | | | | | + | | |
| 4. *Comatella nigra* | | | | | | + | |
| 5. *Comatella stelligera* | | | | | + | + | |
| 6. *Oxycomanthus bennetti* | | | | | + | | |
| 7. *Lamprometra palmata* | | | | | | + | |
| 8. *Stephanometra indica* | | | | | | + | |
| ASTEROIDEA | | | | | | | |
| 9. *Archaster typicus* | | | | | | + | |
| 10. *Culcita novaeguineae* | | | | | | + | |
| 11. *Dactylosaster cylindricus* | | + | | | | | |
| 12. *Fromia indica* | | | + | | | | |
| 13. *Linckia laevigata* | | + | | | | + | |
| 14. *Asterina sarasini* | | + | | | | | + |
| OPHIUROIDEA | | | | | | | |
| 15. *Ophiactis modesta* | | | | | + | | |
| 16. *Ophiactis savignyi* | | | | | | + | + |
| 17. *Macrophiothrix demessa* | | | | | | | + |
| 18. *Macrophiothrix longipeda* | | | | + | | + | |
| 19. *Macrophiothrix propinqua* | | | | | + | + | + |
| 20. *Ophiothela danae* | | | | | | + | |
| 21. *Ophiothrix exigua* | | | | | | + | |
| 22. *Ophiothrix trilineata* | | | | | + | + | + |
| 23. *Ophiarthrum pictum* | + | | | | | + | |
| 24. *Ophiocoma brevipes* | + | | | | | | |
| 25. *Ophiocoma dentata* | + | | | | | | |

**Table 1.** *Contd.*

| Echinoderm species | Inglis | Rani Jhansi Marine National Park: Outram | Henry Lawrence | Nicholson | Sir William Peel | Havelock | Neil |
|---|---|---|---|---|---|---|---|
| 26. *Ophiocoma erinaceus* | + | | | | | + | + |
| 27. *Ophiocoma pusilla* | | | | | | | + |
| 28. *Ophiocoma scolopendrina* | + | | | + | | + | + |
| 29. *Ophiomastix annulosa* | + | | | | | | + |
| 30. *Ophioelegans cincta* | | | | | | | + |
| 31. *Ophiolepis superba* | | | + | | | | |
| ECHINOIDEA | | | | | | | |
| 32. *Phyllacanthus imperialis* | | | + | | | | |
| 33. *Prionocidaris verticillata* | | | + | | | | |
| 34. *Diadema setosum* | | + | | | | | |
| 35. *Echinothrix calamaris* | | | + | | | + | |
| 36. *Mespilia globulus* | | | + | | | | |
| 37. *Echinometra mathaei* | + | + | + | | | + | |
| 38. *Echinoneus cyclostomus* | | | | | | + | |
| 39. *Lovenia elongata* | | | | | | + | |
| HOLOTHUROIDEA | | | | | | | |
| 40. *Actinopyga mauritiana* | | | | | | | + |
| 41. *Holothuria pyxis* | | | | | | + | |
| 42. *Holothuria arenicola* | | | | | | | + |
| 43. *Holothuria impatiens* | | | | | | + | |
| 44. *Stichopus chloronotus* | | | | | | + | + |

**Note** : Many of the common species are likely to occur at other islands also.

## SUMMARY

East of South Andaman Islands in the Bay of Bengal 13 islands constitute Ritchie's Archipelago. The echinoderm fauna of the Archipelago is so far known by four species of Asteroidea, three species of Echinoidea and five species of Holothuroidea. The present study reports eight species of Crinoidea, four species of Asteroidea, 17 species of Ophiuroidea and five species of Echinoidea. Of these the asteroids *Culcita novaeguineae* Mueller and Troschel and *Linckia laevigata* Mueller and Troschel

were reported earlier. Among the others, *Stephanometra indica* (Smith), *Macrophiothrix demessa* (Lyman), *Ophiothela danae* Verrill and *Ophiothrix exigua* Lyman are new to the fauna of Andamans while *Ophiothrix pusilla* (Brock) is new to the fauna of Indian coast. A brief account of all the 34 species is presented along with a list of species reported earlier.

## ACKNOWLEDGEMENTS

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# DIPTERA (INSECTA) FROM SUNDARBAN, WEST BENGAL

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## INTRODUCTION

Sundarban is composed of a group of islands encompassing area from the mouth of the river Hooghly on the West and extends up to the river Meghna in the East covering four districts—North and South 24-Parganas within Indian territory and Khulna and Barisal in Bangladesh. It lies between 21° 0' and 21° 21' N latitudes and 88° 0' and 89° 0' E longitudes occupying an area of 9827 sq. km. of which 4264 sq. km. falls within the jurisdiction of India.

The name Sundarban derives from the 'Sundari' tree which is predominant in the area.

Although Sundarban fauna pertaining to various groups have been dealt with by different workers, that of insects did not receive much attention. As regards dipteran fauna Annandale (1908, 1910), Brunetti (1912, 1923), Christophers (1933) and Barraud (1934) contributed considerably. Since then there is not much work except that of Ray and Choudhury (1986), and Mandal and Nandi (1989).

An attempt is made here to report on the materials collected by the various tour parties of the Zoological Survey of India, Calcutta and Canning together with the published records. The families dealt with here are Tipulidae, Psychodidae, Phlebotomidae, Culicidae, Cecidomyidae, Stratiomyidae, Tabanidae, Syrphidae, Pipunculidae, Empididae, Sepsidae, Phoridae, Muscidae, Calliphoridae and Sarcophagidae.

The distributional records of the species are confined to Indian jurisdiction only. For records beyond India the reader may refer to Delfinado and Hardy (eds) 1973, 1975 and 1977.

## LIST OF TAXA

Suborder : NEMATOCERA

Family : TIPULIDAE

Subfamily : LIMONIINAE

*Limonia (Geranomyia) circipunctata* (Brunetti)

*Limonia (Geranomyia) tridens* (Brunetti)

*Trentopohlia (Trentepohlia) trentepohlii*(Wiedemann)

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MAP OF SUNDERBAN

Family : PHLEBOTOMIDAE

*Phlebotomus (Euphlebotomus) argentipes* Annandale and Brunetti

*Sergentomyia (Parrotomyia) babu* (Annandale)

Family : PSYCHODIDAE

Subfamily : PSYCHODINAE

*Psychoda alternata* Say

*P. nigripennis* Brunetti

Family : CULICIDAE

Subfamily : ANOPHELINAE

*Anopheles (Cellia) subpictus* Grassi

*Anopheles (Cellia) sundaicus* (Rodenwaldt)

Subfamily : CULICINAE

*Aedeomyia catasticka* Knab

*Aedes (Finlaa) niveus* (Ludlow)

*Culex (Culex) vishnui* Theobald

*Culex (Lutzia) fuscanus* Wiedemann

*Mansonia (Mansonioides) annulifera* Theobald

Family : CECIDOMYIIDAE

Subfamily : CECIDOMYINAE

*Stefaniola bengalensis* Mani

Suborder : BRACHYCERA

Family : STRATIOMYIDAE

Subfamily : STRATIOMYINAE

*Odontomyia dorsoangulata* Brunetti

*Oplodontha rubrithorax* (Macquart)

Family : TABANIDAE

Subfamily : CHRYSOPSINAE

*Chrysops dispar* (Fabricius)

Subfamily : TABANINAE

*Haematopota javana* Wiedemann

*Tabanus striatus* Fabricius

Family : SYRPHIDAE

Subfamily : MYLESIINAE

*Mesembrius quadrivittatus* (Wiedemann)

*Syritta indica* (Wiedemann)

*Syritta orientalis* Macquart

*Eristalinus (Eristalinus) obscuritarsis* (de Meijere)

Family : PIPUNCULIDAE

Subfamily : PIPUNCULINAE

*Pipunculus (Eudorylus) biroi* Kertesz

Family : EMPIDIDAE

Subfamily : TACHYDROMIINAE

*Drapetis (Elaphropeza) ferruginea* Brunetti

Family : PHORIDAE

Subfamily : METOPININAE

*Megaselia scalaris* Loew

Suborder : CYCLORRHAPHA

Family : SEPSIDAE

Subfamily : SEPSINAE

*Sepsis indica* Wiedemann

Family : MUSCIDAE

Subfamily : MUSCINAE

*Musca (Musca) domestica* Linnaeus

*Musca (Philaemetomyia) crassirostris* Stein

*Musca (Byomyia) pattoni* Austen

*Musca (Eumusca) seniorwhitei* Patton

*Orthellia indica* (Robineau-Desvoidy)

Subfamily : LIMNOPHORINAE

*Lispe pumila* (Wiedemann)

Subfamily : STOMOXYINAE

*Stomoxys calcitrans* (Linnaus)

*Stomoxys indica* Picard

Family : CALLIPHORIDAE

Subfamily : CHRYSOMYINAE

*Chrysomya megacephala* (Fabricius)

Subfamily : CALLIPHORINAE

*Hemipyrellia pulchra* (Wiedemann)

Family : SARCOPHAGIDAE

Subfamily : SARCOPHAGINAE

*Parasarcophaga (Liopygia) ruficornis* (Fabricius)

*Parasarcophaga (Liosarcophaga)* dux (Thomson)

*Key to the families*

1. Antenna with more than 5 segments which are fused into a solid structure ..... 2

— Antenna either with less than 5 segments (generally 3) or with segments of flagellum fused into a solid structure, usually surmounted by a style or arista ..... 7

2. Thorax with a v-shaped suture on scutum ..... *Tipulidae*

— Thorax without such suture ..... 3

3. Wing with 7 longitudinal veins (excluding branching of any of these veins), wing with scales ..... *Culicidae*

— Wing with less than 7 longitudinal vein, wing without scales ..... 4

4. Wing with the second longitudinal vein always forked ..... 5

— Wing with the second longitudinal vein never forked ..... 6

5. Second longitudinal vein forks at or very little before the middle of wing ..... *Phlebotomidae*

— Second longitudinal vein forks quite near the base of wing ..... *Psychodidae*

6. Costal vein ends at tip of wing ..... *Cecidomyidae*

— Costal vein continues around the whole margin of wing ..... *Chironomidae*

7. Adult without ptilinum or frontal lunule ..... 8

— Adult usually with ptilinum or frontal lunule ..... 13

8. Antennal segment 3 with annulations; leg with 3 distinct pulvilli ..... *Stratiomyidae*

— Antennal segment 3 without annulations ..... 9

9. Basal cells long, atleast one-third the length of wing ..... 10

— Basal cells short ..... 11

10. Vena spuria present between third and fourth longitudinal veins; first posterior cell closed ... ..... *Syrphidae*

— Vena spuria absent; first posterior cell open ..... *Pipunculidae*

11. Venation abnormal, no obvious cross vein present; second and third longitudinal veins united ..... *Phroidae*

— Venation usually normal, at least one cross vein present ..... 12

12. Discal and second basal cells confluent; third longitudinal vein never forked ..... ..... *Dolichopodidae*

— Discal and second basal cells separate; third longitudinal vein often forked ..... ..... *Empididae*

13. Antennal segment 3 without distinct external groove; squama small or vestigeal; space between auxiliary vein and first longitudinal vein not sclerotised ..... *Lonchaedae*

— Antennal segment 2 above with a distinct external groove; squama well developed ..... 14

14. Oral vibrissae present; palpi reduced ..... *Sepsidae*

— Oral vibrissae absent ..... 15

15. Hypopleuron without bristle below spiracle ..... *Muscidae*

— Hypopleuron with a row of strong bristles below spiracle ..... 16

16. Arista of antenna pubescent or with feathering not extending much beyond its middle; notopleurals invariably 3 or 4 ..... *Sarcophagidae*

— Arista feathered to tip; body usually coloured; notopleurals nearly always 2 ..... ..... *Calliphoridae*

## SYSTEMATIC ACCOUNT

### Family : TIPULIDAE

Commonly called "daddy long-leged flies", commonly found in damp shady places in hilly areas.

### Subfamily : LIMONIINAE

*Key to the genera*

1. Antenna of 14 joints; wing with 4 posterior cells, discal cell present ..... *Limonia* Meigen (3 species only)

— Antenna of 16 joints; wing with 3 posterior cells, discal cell absent ..... *Trentepohlia* Bigot (1 species only)

## Genus *Limonia* Meigen

1803. *Limonia* Meigen, *Magazin Insektkde,* 2 : 262. Type-species : *Tipula tripunctata* Fabricius.

## Subgenus *Geranomyia* Haliday

1833. *Geranomyia* Haliday, *Magazin Insektkde,* 2 : 262. Type-species : *Tipula tripunctata* Fabricius.

*Diagnosis :* Proboscis conspicuously prolonged being longer than head and thorax together; wing with three branches of vein M reaching the wing margin, supernumerary cross-vein absent in first anal cell.

### *Key to the species*

1. Thorax yellowish or brownish with a distinct dark brown spot on each side of shoulder and a mark like inverted '3' below it ..... *tridens* Brun.
— Thorax yellow with distinct small black spots ..... 2
2. Thorax with 5 black spots on dorsum ..... *flavicosta* Brun.
— Thorax with a circle of 10 small black spots arranged towards the lateral side of dorsum ..... ..... *circipunctata* Brun.

### 1. *Limonia (Geranomyia) circipunctata* Brunetti

1912. *Geranomyia flavicosta* Brunetti, *Fauna Brit. India Dipt.,* 1 : 390.

*Distribution :* West Bengal (Sundarban), Orissa and Tamil Nadu.

### 2. *Limonia (Geranomyia) flavicosta* Brunetti

1912. *Geranomyia flavicosta* Brunetti, *Fauna Brit. India, Dipt.,* 1 : 389.

*Distribution :* West Bengal (Sundarban).

### 3. *Limonia (Geranomyia) tridens* Brunetti

1912. *Geranomyia tridens* Brunetti, *Fauna Brit. India, Dipt.,* 1 : 391.

*Distribution :* West Bengal (Sunderban).

## Genus *Trentepohlia* Bigot

1854. *Trentepohlia* Bigot, *Annls. Soc. ent. Fr.,* (3) 2 : 473. Type-species : *Limnobia trentepohlii* Wiedeman

## Subgenus *Trentepohlia* Bigot

1854. *Trentepohlia* Bigot, *Annls Soc. ent. Fr.,* (3) 2 : 473. Type-species *Limobia trentepohlii* Wiedemann

*Diagnosis :* Fifth and sixth longitudinal veins ($M_{1+2}$ and $M_{3+4}$) fused for a distance back from margin; first posterior cell open.

### 4. *Trentepohlia (Trentepohlia) trentepohlii* (Wiedemann)

1828. *Limnobia trentepohlii* Wiedemann, *Aussereurop. zweifl. Insekt.*, 1 : 551.

*Diagnosis :* Body wholly yellowish; antenna dusky with scape blackish; thorax shining with a faint median blackish stripe; legs yellow; wings clear with tip blackish, cross veins suffused.

*Distribution :* West Bengal (Sundarban), Assam, Bihar, Kerala and Orissa.

## Family : PHLEBOTOMIDAE

Commonly called sandfly, occurs in dark or shady damp situations. Females suck blood of vertebrates including man causing irritation. Some species of *Phlebotomus* are vectors of Kala-azar and oriental sore.

### *Key to the genera*

1. Cibarial teeth absent or if present usually in the form of spicules, and not arranged as in *Sergentomyia.* Pigment patch nearly always absent. Posterior end of abdominal tergites 2-6 with erect haris, sockets as large as on I. Style of male with 3-5 spines and sometimes with 2 or 3 strong hairs ..... *Phlebotomus* Rondani and Berte (1 species only)

— Ciberial teeth in a posterior transverse row, sometimes with fore teeth which mostly point upward. Pigment patch usually present. Hind ends of abdominal tergites 2-6 with all or nearly all hairs recumbent, sockets much smaller than on I. Style of male with 4 major spines and an accessory seta ..... *Sergentomyia* France and Parrot (1 species only)

### Subgenus *Euphlebotomus* Theodor

1948. *Euphlebotomus* Theodor, *Bull. ent. Res.*, 39 : 98. Type-species : *Euphlebotomus argentipes* Annandale & Brunetti.

### 5. *Phlebotomus (Euphlebotomus) argentipes* Annandale & Brunetti

1908. *Phlebotomus argentipes* Annandale & Brunetti, *Rec. Indian Mus.*, 2 : 101.

*Diagnosis :* Head brownish with concolourous bristly hairs; palpi 5 jointed, second joint more than half the length of the third; thorax covered with thick brownish yellow bristly hairs along with bunches of long bristly hairs; legs very long, femora much shorter than tibiae, metatarsus as long as the remaining tarsal joints combined, wing obtusely pointed at tip, second longitudinal vein ($R_{2+3}$) forks barely before the middle of wing, fifth vein ($Cu_1$) straight and long, sixth vein ($Cu_2$) sinuous; abdomen slender, cylindrical, covered with blackish bristly hairs; male genitalia with long and distinct structures.

*Distribution :* West Bengal (Sundarban), Bihar, Kerala, Maharashtra, Tamil Nadu and Uttar Pradesh.

### Genus *Sergentomyia* France and Parrot

1920. *Sergentomyia* France and Parrot, *Bull. Soc. Path. exot.*, 13 : 699. Type-species : *Phlebotomus minutus* Rondani.

### Subgenus *Parrotomyia* Theodor

1958. *Parrotomyia* Theodor, in Lindner, *Fliegon palaearkt. Reg.*, 9C : 42. Type-species : *Phlebotomus africanus* Newstead.

*Diagnosis :* Spermathecae are round or elliptical smooth capsules. Cibarial teeth in comb-like row, usually of parallel teeth with short points. Pharynx narrow, bulging near hind end, with many, few or no teeth.

#### 6. *Sergentomyia (Parrotomyia) babu* (Annandale)

1910. *Phlebotomus babu* Annandale, *Rec. Indian Mus.*, 4 : 49.

*Diagnosis :* Second joint of antennal scape bears several rows of flat scales, first three palpal joints short, subequal the fourth one nearly as long as the first three together; thorax not so tumid; hind tibia longer than hind femur, the former being more than twice the length of basitarsus; wings narrow, pointed, the second branch of the second vein slightly longer than its anterior branch, and longer than the distance between the two forks of the vein; abdomen short, beset with upright hairs of different lengths.

*Distribution :* West Bengal (Sundarban), Bihar, Kerala, Maharashtra, Orissa, Rajasthan and Tamil Nadu.

## Family : PSYCHODIDAE

Minute moth-like flies, whole body being covered with long coarse hairs, commonly found in damp and shady situations.

### Subfamily : PSYCHODINAE

### Genus *Psychoda* Latreille

1796. *Psychoda* Latreille, *Precis caracteres gen. Ins. :* 152. Type-species : *Tipula phalaenoides* Linnaeus.

*Diagnosis :* Head round, arched, much developed posteriorly; proboscis short; palpi 4 jointed; antennae 15-16 jointed, flagellar joints varying in shape in different species; thorax robust, nearly as broad as long; scutellum small covered with dense pubescence; legs short, robust, tibiae generally longer than femora, shape of wing varies from species to species, always covered with thick hairs; abdomen short, broad, arched, densely pubescent.

*Key to the species*

1. Wing pale grey, wholly unmarked; flagellum of antenna 14-jointed ..... ***nigripennis*** **Brun.**

— Wing with black hairs spots, flagellum of antenna 10-jointed ..... ***alternata*** **Say**

### 7. *Psychoda alternata* Say

1824. *Psychoda alternata* Say, *in Keating, Major Long's second Expedition* (Appendix), 2 : 358.

*Distribution :* West Bengal (Sundarban), Bihar, Himachal Pradesh, Karnataka, Kerala and Uttar Pradesh.

### 8. *Psychoda nigripennis* Brunetti

1908. *Psychoda nigripennis* Brunetti, *Rec. Indian Mus.*, 2 : 376.

*Distribution :* West Bengal (Sundarban), Bihar, Himachal Pradesh, Kerala and Uttar Pradesh.

## Family : CULICIDAE

Commonly called 'mosquitos' has utmost importance being the intermediary hosts of malaria, yellow-fever, filariaisis, dangue etc. *Anopheles culicifacies, A. minimus, A. stephensis, A. fluviatilis* etc. are vectors of malaria. *Aedes aegypti* transmit the virus of dangue; *Culex fatigans* carries the pathogen of elephantiasis. Their larvae may be phytophagus or carnivorous.

*Key to the subfamilies*

1. Wing usually spotted; palpi long and of about same length as the proboscis in female; in male palpi with 2 apical segments swollen and flattened to be shaped as the head of a golf club ... ..... **Anophelinae**

— Wing usually unspotted; palpi not as above ..... **Culicinae**

## Subfamily : ANOPHELINAE

### Genus *Anopheles* Meigen

1818. *Anopheles* Meigen, *Syst. Beschr. europ. Zweifl. insekt.*, 1 : 10, Type-species *Anopheles maculipennis* Meigen.

*Diagnosis :* Palpi of both sexes equal to the length of proboscis, only male with apical two segments club-shaped; posterior edge of scutellum bar-shaped with hairs on it in a continuous series; male with single claw in fore tarsi; in female abdomen with scattered scales on tergites but rare on sternites.

## Subgenus *Cellia* Theobald

1902. *Cellia* Theobald, *J. trop. Med.*, 5 : 183, Type-species : *Anopheles pharoensis* Theobald.

*Diagnosis :* Wing with at least 4 infuscated areas on costa and first longitudinal vein ($R_1$); male coxite with 4 or 5 parabasal spines, internal spines absent.

### *Key to the species*

1. Femora and tibiae speckled; base of femora without any dark colour ..... ..... *sundaicus* (Rodenwaldt)

— Femora and tibiae not speckled; each femur with a dark ring at their base ..... .....*subpictus* Grassi

### 9. *Anopheles (Cellia) subpictus* Grassi

1899. *Anopheles subpictus* Grassi, *Re. R. Accad. Lincei,* 8 : 101.

*Distribution :* West Bengal (Sundarban) and most of the states in India.

### 10. *Anopheles (Cellia) sundaicus* (Rodenwaldt)

1925. *Myzomyia ludlowi var. sundaica* Rodenwaldt, *Geneesk Tijdschr. Ned. India,* 65 : 185.

*Distribution :* West Bengal (Sundarban) and Andaman and Nicobar Islands.

## Subfamily : CULICINAE

### *Key to the genera*

1. Pulvilli present; buccopharyngeal armature present in female ..... ..... *Culex* Linnaeus (2 species only)

— Pulvilli absent; buccopharyngeal armature absent in female .....2

2. Postspiracular bristles absent; all segments of antenna in female and last two segments of male thick and short.....*Aedeomyia* Theobald (1 species only)

— Postspiracular bristles present; antenna of different shape .....3

3. Wing scales unusually broad and many asymmetrical; tergite VIII of female with a row of short tooth-like spines; apical segment of palpi in male minute ..... ..... *Mansonia* Blanchard (2 species only)

— Wing scales not unusually broad; tergite VIII of female without spines; apical segment of palpi in male of moderate length .....*Aedes* Meigen (1 species only)

## Genus *Aedes* Meigen

1818. *Aedes* Meigen, *Syst. Beschr. europ. Zweifl. Insekt.*, 1 : 13. Type-species; *A. cinereus* Meigen.

## Subgenus *Finlaya* Theobald

1903. *Finlaya* Theobald, Monogr. Cul., 3 : 281. Type-species : *Culex kochi.* Donitz.

*Diagnosis :* Species with ornamentation and scales variable; proboscis longer than fore femur; palpi of male half to full length of proboscis, in female less than one-fourth of proboscis; tarsal claws of fore and mid legs toothed; abdomen with sternite VIII large and prominent.

### 11. *Aedes (Finlaya) niveus* (Ludlow)

1903. *Stegomyia niveus* Ludlow, in Theobald, *Monogr. Cul.*, 3 : 139.

*Diagnosis :* In male scales on dorsum of head black with a narrow silvery eye margin, mesonotum with a large snow-white patch in front; in female mesonotum divided into lateral patches; scutellum covered with black scales; wing scales all dark, except for a short line of pale ones.

*Distribution :* West Bengal (Sundarban) and Andaman Islands.

## Genus *Culex* Linnaeus

1758. *Culex* Linnaeus, *Syst. Nat.*, 10 : 602. Type-species : *C. pipiens* Linnaeus.

### *Key to the subgenera*

1. Four or more lower mesepimeral bristles ..... *Lutzia* Theobald

— One or two lower mesepimeral bristles ..... *Culex* Linnaeus

## Subgenus *Culex* Linnaeus

1758. *Culex* Linnaeus, *Syst. Nat.* 10 : 1 : 602. Type-species : *C. pipiens Linn.*

### 12. *Culex (Culex) vishnui* Theobald

1901. *Culex vishnui* Theobald, *Monogr. Cul.*, 1 : 355.

*Diagnosis :* Proboscis dark brown with a pale band nearer to apex; mesonotum usually covered with golden brown or pale brown scales, in cases there may be an admixture of dark-brown and pale-brown forming a pattern; wing dark scaled; fore and mid femora dark brown on anterior surface being devoid of speckling of pale scales, hind femur with pale scalling on outer side, mid and hind tibiae with pale stripes on outer side for its whole length; abdominal tergites dark brown with ochreous basal bands.

*Distribution :* It is one of the common Indian species spreading almost all over the states of India including Sunderban in West Bengal.

### Subgenus *Lutzia* Theobald

1903. *Lutzia* Theobald, *Monogr. Cul.*, 3 : 155. Type-species : *Culex bigoti* Bellardi.

### 13. *Culex (Lutzia) fuscanus* Wiedemann

1820. *Culex fuscanus* Wiedemann. *Dipt. exot.*, 1 : 9.

*Diagnosis :* Proboscis dark brown with wide pale yellow area in middle both dorsally and ventrally; mesonotum with indefinite faint line and spots formed by the admixture of dark brown and lighter scales, two pairs of pale spots present-one pair at level of anterior spiracle and the other pair at wing level; wing with dark scales; fore and mid femora anteriorly sprinkled with pale scales, tibiae predominantly speckled with pale scales; abdominal tergites V-VIII entirely yellow scales or with broad apical bands, II-IV entirely dark or with very narrow apical bands.

*Distribution :* West Bengal (Sundarban), Andaman Islands, Assam and some other states of India.

### Genus *Mansonia* Blanchard

1900. *Panoplites* Theobald, *Rep. Colla. Mosq. Br. Mus.* 5 (Preoccupied Gould 1854). Type-species : *Culex taeniorhyncus* Wiedemann.

### Subgenus *Mansonioides* Theobald

1907. *Mansonioides* Theobald, *Monogr. Cul.*, 4 : 498. Type-species : *M. septemquttata* Theobald.

*Diagnosis :* Palpi of male longer than proboscis; pleura with well developed bristles, 10-12 postspiracular, 9-15 proepimeron, 12-18 upper mesepimeral, 4-9 at lower part of mesepimeron; tergite VIII of female with a number of chitinous hooks or teeth, phallosome with a small tooth at apex, paraprocts with a few teeth at crown and with minute hairs.

### 14. *Mansonia (Mansonioides) annulifera* (Theobald)

1903. *Panoplites annulifera* Theobald, *Monogr. Cal.* 2 : 183.

*Diagnosis :* Yellowish-brown species; in female palpi about one-third length of proboscis and in male three-fourth of proboscis; flagellum of antenna brown with lighter rings, scutum with 2 distinct round white spots on anterior margin and another 2 at wing level together with 3 less distinct spots; wing speackled with yellowish and dark brown asymmetrical scales; legs yellow with about 5 snow-white rings on each femora, tibiae with 4-5 rings of similar colour, knees white; abdomen with varied colour scaling on dorsum, tergite VIII with lateral chitinous hooks.

*Distribution :* West Bengal (Sundarban) and Assam, Bihar, Maharashtra, Madhya Pradesh and Uttar Pradesh.

## Genus *Aedeomyia* Theobald

1901. *Aedeomyia* Theobald, *J. trop. Med.*, 4 : 235. Type-species : *Aedes squamipenna* Lynch.

### 15. *Aedeomyia catasticta* Knab

1909. *Aedeomyia catasticta* Knab, *Ent. News*, 20 : 387.

*Diagnosis :* Palpi less than one-fourth of proboscis; proboscis black with 3 white rings; scutum with a median broad stripe of ochre-yellow scales which spreads posteriorly in the level of wing; legs dark brown, speckled and spotted with yellowish and white scales; abdomen dorsally covered with ochre-yellow scales and patches of white scales laterally.

*Distribution :* West Bengal (Sundarban) and Assam, Bihar, Madhya Pradesh, Maharashtra, Orissa and South India.

## Family : CECIDOMYIIDAE

Commonly called 'gall midges', are minute fragile flies. Larvae have wide range of habits—predaceous on mites, small insects; feed on decomposing organic matters and great majority feed on tissues of leave and stems of plants and form gall almost in all parts of plants.

## Genus *Stefaniola* Kieffer

1898. *Stefaniola* Kieffer, *Synopse des Cecidomyies Kieffer d' Europe et 'd' Algerie* : 55.

*Diagnosis :* Antenna 11 segmented, palpi uniarticulate, characterised by its obliquely truncate ovipostor with a row of hooks dorsally and small head covered by the mesonotum.

### 16. *Stefaniola bengalensis* Mani

1934. Stefaniola bengalensis Mani, *Rec. Indian Mus.*, 36 : 401.

*Diagnosis :* Although the genus possesses only 11 antennal segments the species in question has 20 segments and moderately setose; palpi uniarticulate, with the length two and half times its diameter; claws strongly curved, simple; empodium well developed, longer than claws.

*Distribution :* West Bengal (Sundarban).

## Family : STRATIOMYIDAE

Commonly called "soldier flies" found around garbage, in forest, dense vegetations, grass meadows and on flowers.

## Subfamily : STRATIOMYINAE

### *Key to the genera*

1. Legs generally entirely pale and without distinct femoral bands ..... ..... *Odontomyia* Meigen (1 species only)

— Legs coloured otherwise and with distinct broad black bands on some femora ..... .....*Oplodontha* Rondani (1 species only)

### Genus ***Odontomyia*** Meigen

1803. *Odontomyia* Meigen, *Magazin Insektkde*, 2 : 265. Type-species : *Musca hydroleon* L.

### 17. ***Odontomyia dorsoangulata*** Brunetti

1920. *Odontomyia dorsoangulata* Brunetti, *Fauna Brit. India*, Diptera, 2 : 68.

*Diagnosis :* Vertical triangle black with short yellow hairs; antennae orange, third segment with 4-annulations and a long narrow pointed style; thorax black with golden-yellow or brassy pubescence; scutellum shining apple green or yellow, narrowly black at base; wing clear; legs orange except tips of tarsi brownish; abdomen pale yellowish, varying from greenish-yellow to brownish, tergites 1-5 each with black spot of varying shape and size.

*Distribution :* West Bengal (Sundarban), Bihar, Karnataka and Tamil Nadu.

### Genus ***Oplodontha*** Rondani

1863. *Oplodontha* Rondani, *Dipt. exot.*, : 78. Type-species *Stratiomys viridula* Fabricius.

### 18. ***Oplodontha rubrithorax*** (Macquart)

1838. *Odontomyia rubrithorax* Macquart, *Mem. Soc. Sci. Agric. Lille*, 1838 : 189 (185).

*Diagnosis :* In male eyes with upper faces much longer than lower ones; head with a black tubercle below antennae; thorax dull black with golden or brassy pubescence; scutellum black with golden dusts; legs orange yellow, fore femur with a narrow brown ring in the middle or a streak below middle femur with a brown streak below which sometimes form a ring; wing colourless; abdomen pale greenish or yellowish.

*Distribution :* West Bengal (Sundarban) and Uttar Pradesh.

## Family : TABANIDAE

Commonly called 'horse flies' or 'dear flies' found in forest, vegetations and near cattle sheds; females are blood sucker of mammals.

*Key to the subfamilies*

1. Ocelli well developed; hind tibia with a pair of apical spurs ..... **Chrysopsinae**

— Ocelli rudimentary or absent; hind tibia without apical spur ..... **Tabaninae**

Subfamily : CHRYSOPSINAE

Genus ***Chrysops*** Meigen

1803. *Chryosps* Meigen, *Magazin Insektkde*, 2 : 267. Type-species : *Tabanus caecutiens* Linnaeus.

*Diagnosis :* Slender flies with large angular spots or varigated dark markings on eyes; antenna long, often as long as head and thorax together; wings banded.

19. ***Chrysops dispar*** (Fabricius)

1798. *Tabanus dispar* Fabricius, *Ent. Syst.* Suppl : 567.

*Materials examined :* 1 ♂, West Bengal : Port Canning, VIII. 1907, Coll. N. A.

*Diagnosis :* Abdomen with inverted black v-marking on tergum 2, its arms extending to 3 and sometimes 4 also.

*Distribution :* West Bengal (Sundarban) and also widely distributed in India.

Subfamily : TABANINAE

*Key to the genera*

1. Antennal style quadriangulate; wing clear; tibiae uniformly coloured ..... ..... *Tabanus* Linnaeus (1 species only)

— Antennal style triangulate; wings with pale spots, wavy lines or punctulations; mid and hind tibiae with 2 pale rings ..... *Haematopota* Meigen (1 species only)

Genus ***Haematopota*** Meigen

1803. *Haematopota* Meigen, *Magazin Insektkde*, 2 : 67. Type-species : *Tabanus pluvialis* L.

20. ***Haematopota javana*** Wiedemann

1821. *Haematopota javana* Wiedemann, *Dipt. exot.*, 1 : 100.

*Diagnosis :* Frontal callus yellow; scutum with broad pale band covering subscutelar suture; scutellum distinctly bicoloured, base pale, posterior margin darken; subapical band of wing double; fore coxa usually brown, fore tibia slightly swollen, hind tibia robust.

*Distribution :* West Bengal (Sundarban), Bihar, Mizoram and Tamil Nadu.

## Genus *Tabanus* Linnaeus

1758. *Tabanus* Linnaeus, *Syst. Nat. Ed.*, 10 : 601. Type-species : *Tabanus bovinus* Linnaeus.

### 21. *Tabanus striatus* Fabricius

1787. *Tabanus striatus* Fabricius, *Mantissa Inset.* 2 : 356.

*Material examined :* 2 ♂, West Bengal : Port Canning, 21.iii.1907, Coll. N. A.

*Diagnosis :* Antennae rusty yellow; callus squire; thorax with broad whitish stripes and with a line in the middle; wings hyaline; femur rusty brown, tibiae paler, tarsi blackish; abdomen with 5 dorsal stripes.

*Distribution :* Widely distributed in India including West Bengal (Sundarban).

## Family : SYRPHIDAE

Commonly called 'hover flies' or 'flower flies' are flower visitors and greatly helps in pollination. Larvae feeds on aphids, scale insects and soft bodied insects and few cause myiasis in man.

### Subfamily : MYIESIINAE

*Key to the genera*

1. Hind femur extremely increasated with short rigid spines below; second abdominal segment projected backward, laterally bearing a fringe of hairs ..... *Syritta* St. Farg. et. Serv. (2 species only)

— Hind femur well developed with anterior basal patch of setulae ..... 2

2. Eyes pilose; marginal cell closed ..... *Eristalinus* Rondani (1 species only)

— Eyes bare; marginal cell open at wing margin ..... *Mesembrius* Rondani (1 species only)

## Genus *Eristalinus* Rondani

1845. *Eristalinus* Rondani, *Nouvi Annali Sci. nat. Bologna,* 2 (2) : 453. Type-species : *Musca sepulchralis* Linnaeus.

### Subgenus *Eristalinus* Rondani

*Diagnosis :* Metathoracic spiracular hair patch absent; hind tibia not thickened.

### 22. *Eristalinus (Eristalinus) obscuritarsis* (de Meij.)

1908. *Eristalis obscuritarsis* de Meijere, *Tijdscht. Ent*; 51 : 250.

*Diagnosis :* Abdomen with transverse bands or spots; femora black with pale tips, tarsi black, may be basally pale.

*Distribution :* West Bengal (Sundarban) and from Kashmir down to Kerala.

## Genus *Mesembriaus* Rondani

1857. *Mesembrius* Rondani, *Dipterol. ital. Prodr.*, 2 : 50. Type-species : *Helophilus peregrinus* Loew.

### 23. *Mesembrius quadrivittatus* (Wiedemann)

1819. *Eristalis quadrivittatus* Wiedemann, *Zool. Mag.*, 1 : 26.

*Diagnosis :* Eyes in both sexes with uniformly thick facets; thorax yellow with three longitudinal black stripes; coxae black, femora shining black, hind femur with a distinct comb-like fringe of stiff, black hairs from base to tip, hind tibia suddenly narrowed near tip forming a tooth-like structure; wing pale grey, squama yellow with yellow fringe; abdomen mainly orange with black varied markings on all segments, genitalia shining black.

*Distribution :* West Bengal (Sundarban), Assam, Bihar, Gujarat, Karnataka, Madhya Pradesh, Orissa and Tamil Nadu.

## Genus *Syritta* Lepeletier and Serville

1828. *Syritta* Lepeletier and Serville, *Encyl. meth.* (Ins.), 10(2) : 808. Type-species : *Musca pipiens* L.

### *Key to the species*

1. Hind femur entirely orange or brownish basally up to one-third or even two-thirds, rest black ..... *indica* (Wiedemann)

— Hind femur entirely black or very narrowly pale at extreme tip and base ..... *orientalis* Macquart

### 24. *Syritta indica* (Wiedemann)

1824. *Eumerus indicus* Wiedemann, *Analecta. Ent.*, : 33.

*Distribution :* West Bengal (Sundarban), Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Pondicherry and Uttar Pradesh.

### 25. *Syritta orientalis* Macquart

1824. *Syritta orientalis* Macquart, *Dipt. exot.*, 2 (2) : 76 (136).

*Distribution :* West Bengal (Sundarban), Bihar and Pondicherry.

## Family : PIPUNCULIDAE

Commonly called 'big-headed flies' found hovering on flowers; larvae are endoparasitic on Hemiptera.

## Subfamily : PIPUNCULINAE

### Genus *Pipunculus* Latreille

1802. *Pipunculus* Latreille, *Hist. Nat. Crust. Ins.*, 3 : 463. Type-species : P. *compestris* Latreille.

*Diagnosis :* Head almost globose, eyes very large, antennae moderately long, first segment short, second more or less cup-shaped, third segment back-shaped; thorax subquadrate, pubescent, scutellum with microscopic marginal bristles; auxiliary, first and second longitudinal veins ends well before wing tip; third vein curved upwards and ends at wing tip, fourth vein curves downwards near tip of discal cell and again upwards shaping the first posterior cell very broad in the middle, fifth vein forked; abdomen cylindrical, 5-segmented, curved downwards.

#### 26. *Pipunculus (Eudorylas) biroi* Kertesz

1903. *Pipunculus biroi* Kertesz, *Annls. hist-nat. Mus. natn. hung.*, 1 : 466.

*Diagnosis :* Frons brownish, grey-dusted, with an elongate black streak just below middle and with a white shimmer above antennae; face brightly shining white; first two antennal joints blackish, third yellowish grey with a white shimmer; thorax olive grey; scutellum brownishgrey; wing with brownish stigma, anterior crossvein barely before middle of discal cell; femora dark grey with tips of all and base of hind pair orange, tibiae orange, tarsi orange except their tips blackish; abdomen dark ash-grey.

*Distribution :* West Bengal (Sundarban), Assam, Bihar and Uttar Pradesh.

## Family : EMPIDIDAE

Commonly called 'dance flies' found on flowers, in woods, in the pools and streams and prey upon soft bodied insects.

## Subfamily : TACHYDROMIINAE

### Genus *Drapetis* Meigen

1822. *Drapetis* Meigen, *Syst. Besch.*, 3 : 91. Type-species : *Drapetis exilis* Meigen.

*Diagnosis :* Eyes micropubescent; palpi single jointed; second antennal joint slightly broader at tip, third short, ovate; thorax squarish, roundish at humeral region, dorsum micropubescent; scutellum with two bristles; legs short and strong, fore and hind femora thickened, tibiae with or without spur, hind tibia with a small bump at tip; auxiliary vein indistinct, ending free, discal cell absent, first basal cell much shorter than second; abdomen 8-segmented, short and robust.

### Subgenus *Elaphropeza* Macquart

1827. *Elaphropeza* Macquart, *Inst. Dipt. N. Fr.*, 3 : 86. Type-species : *Tachydromia ephippiata* Fallen.

*Diagnosis :* Third antennal joint elongate, conical; legs slender, fore tibia with short spur; abdomen elongate and relatively less broad.

### 27. *Drapetis (Elaphropeza) ferruginea* Brunetti

1913. *Elaphropeza ferruginae* Brunetti, *Rec. Indian Mus.*, 9 : 43.

*Diagnosis :* Eyes closely contiguous both above and below; antennae with basal joints brownish-yellow, third joint elongate, conical, densely pubescent; thorax wholly brownish-yellow; scutellum blackish; legs wholly brownish-yellow; wing pale yellow; abdomen blackish with pale pubescence.

*Distribution :* West Bengal (Sundarban).

## Family : PHORIDAE

Commonly called 'scuttle flies' are seen on decaying vegetations and animal matters. Larvae also feed on decaying vegetations and animal matters.

### Genus *Megaselia* Rondani

1856. *Megaselia* Rondani, *Dipterol. ital. Prodr.*, 1 : 137. Type-species : *M. crassineura* Rondani.

*Diagnosis :* Frons with two pairs of proclinate bristles on anteromedian projection; wing with the radial vein branched apically; hind tibia bears only apical bristles.

### Subgenus *Megaselia* Rondani

### 28. *Megaselia (Megaselia) scalaris* (Loew)

1866. *Phora scalaris* Loew, *Berl. ent. Z.*, 10 : 53.

*Diagnosis :* Thoracic pleuron creamy; hind femur with dark apical spot; abdominal tergites black with anteromedian yellow areas.

*Distribution :* West Bengal (Sundarban) and widely distributed in many parts of India.

## Family : SEPSIDAE

Ant-like flies, found on herbage, excrement, dung, decaying matters; larvae are coprophagus.

## Subfamily : SEPSINAE

### Genus *Sepsis* Fallen

1810. *Sepsis* Fallen, *Sp. Ent. nov. Dipt. :* 17. Type-species : *Musca cynipsea* Linnaeus.

*Diagnosis :* Thorax and abdomen usually shining; wing with first and second basal cells distinct; abdomen in both the sexes with distinct macrochaetae; epandrial process not bifurcated at tip.

### 29. *Sepsis indica* Wiedemann

1824. *Sepsis indica* Wiedemann, *Analecta Ent.*, : 57.

*Diagnosis :* Frons and face varying from reddish-yellow to nearly black; proboscis yellow; thorax reddish-yellow with a broad black longitudinal stripe, the stripe sometimes reduced, lateral margins with a broad whitish shimmering band across the sternopleuron; scutellum and metanotum reddish yellow; legs reddish yellow, fore femur in male with a peg-like bump in the moddle bearing 3-4 short spines followed by a leaf-shaped appendage, fore tibiae slightly enlarged just below base and again on apical half where it bears a row of stiff short spiny bristles; wing clear; abdomen reddish yellow, 3-4 tergites bears 4 strong spiny bristles; genitalia reddish yellow with 2 strong bristles.

*Distribution :* Widely distributed species in India including Sundarban in West Bengal.

## Family : MUSCIDAE

The commonly called 'house-fly' occur in all zoogeographical regions. Adults are generally saprophagus, but some species have biting habit and carry germs of diseases and some are mechanical carrier of germs.

### *Key to the subfamilies*

1. Pteropleuron hairy on upper embosed part ..... 2
— Pteropleuron bare, hind tibia without a pd seta and with at most a small preapical ..... *Limnophorinae*
2. Proboscis licking type, arista long plumose ..... Muscinae
— Proboscis of blood-sucking type, arista pectinate or with a few rays on underside ..... Stomoxydinae

## Subfamily : MUSCINAE

### *Key to the genera*

1. Thorax and abdomen black or yellow with vittae; prostigmal bristle present ..... *Musca* L. (4 species only)
— Thorax and abdomen metallic blue, green or purple, without dense pollinosity; suprasquamal ridge hairy ..... *Orthellia* Rob, Desv. (1 species only)

### Genus *Musca* L.

1758. *Musca* Linnaeus, *Syst. Nat. Ed.* 10 : 589. Type-species : *Musca domestica* L.

*Key to the subgenera*

1. Mid tibia without an av seta ..... 2
— Mid tibia with an av seta ..... 3
2. Propleural depression hairy ..... *Musca* S. Str
— Propleural depression bare, mid tibia without an au submedian seta ..... *Byomyia* Rob. Desv.
3. Suprasquamosal ridge completely bare ..... *Philaematomyia* Austin
— Suprasquamosal ridge hairy on anterior region ..... *Eumusca* Townsend

Subgenus ***Musca*** Linnaeus

1915. *Promusca* Townsend, *J. Wash. Acad. Sci.*, 5 : 434. Type-species : *Musca domestica* Linnaeus.

30. ***Musca (Musca) domestica*** Linnaeus

1758. *Musca domestica* Linnaeus, *Syst. Nat. Ed.* 10 : 596.

*Material examined :* 2 ♂, 1 ♀ West Bengal, Port Canning, 20.iii.1908, Coll. N. A.

*Diagnosis :* Propleuron hairy in the depression between humeral callus and propleural bristles; ventrobasal scale setulose; suprasquamal ridge bare; fore tibia without a submedian pv bristle; thorax with 4 black vittae; all post dc strong.

*Distribution :* Almost cosmopolitan.

Subgenus ***Philaematomyia*** Austen

1909. *Philaematomyia* Austen, *Ann. Mag. Nat. Hist.*, (8) 3 : 295. Type-species : *P. insignis* Austen

31. ***Musca (Philaematomyia) crassirostris*** Stein

1903. *Musca crassirostris* Stein, *Mitt. Zool. Mus. Berl.*, 2 : 99.

*Material examined :* 2 ♂, West Bengal, Canning, 6.xi.1984, Coll. B. N. Das.

*Diagnosis :* Thorax except for 4 narrow vittae, which remain seperate and abdomen except for the basal part of segment 1, almost eventually covered with dense greyish dust; sides of mesonotum in the supra-alar area, sides of scutellum at base, and a widge-shaped median spot on the abdominal segments fuscous; vein $r_{4+5}$ setulose at base only.

*Distribution :* Widely distributed in oriental region including Sundarban in West Bengal.

Subgenus ***Byomya*** Rob.-Desv.

1830. *Byomya* Rob.-Desv., (Byomya) *Mem. Pres. div. Sav.* Acad. Sci. Inst. Fr., 2 : 392. Type-species : ***B. violacea*** Rob. Desv.

### 32. *Musca (Byomya) pattoni* Austen

1910. *Musca pattoni* Austen, *Ann. Mag. nat. Hist.*, (8) 5 : 115.

*Material examined :* 2 ♂, 2 ♀ West Bengal : Canning, 6.xi.1984, Coll. B. N. Das.

*Diagnosis :* Thorax with 4 conspicuous, well seperated vittai; scutellum with an apical and 2 basal spots—one at base and the other laterally; propleural depression bare, suprasquamal ridge without setulae; fore tibia without a p seta, mid tibia without an av or ad seta; setulae on vein $r_{4+5}$ confined to base generally; abdomen pale ferrugineous, male hypopygium dark.

*Distribution :* Widely distributed in India including Sundarban in West Bengal.

## Subgenus *Eumusca* Townsend

1911. *Eumusca* Townsend, *Proc. ent. Soc. Wash.*, 13 : 170. Type-species : *E. corvina* Fabricius = autumnalis De Geer.

### 33. *Musca (Eumusca) seniorwhitei* Patton

1922. *Musca seniorwhitei* Patton, *Indian J. med. Res.*, 10 : 73.

*Material examined :* 1 ♂, West Bengal, Canning, 6.xi.1984, Coll. B. N. Das.

*Diagnosis :* Thorax with 4 black vittae, inner ones in males reaching upto middle of its length and widened at its end; scutellum with a basal spot laterally and another at apex; suprasquamal ridge with a group of bristles on anterior part; vein $r_{4+5}$ setulose almost upto apex on underside; fore tibia without a pv seta, mid tibia with 1-3 av seta; abdomen with a complete glossy black median vitta which gradually narrowed and reaches to fourth segment.

*Distribution :* West Bengal (Sundarban), Andhra Pradesh and Tamil Nadu.

## Genus *Orthellia* Robineau-Desvoidy

1863. *Orthellia* Robineau-Desvoidy, *Hist. nat. Dipt. env. Paris*, 2 : 837. Type-species : *O. rectinervis* Rob. Desv.

### 34. *Orthellia indica* Robineau-Desvoidy

1830. *Lucilia indica* Robineau-Desvoidy, *Mem. Pres. div. Sav. Acad. Inst. Fr.* : 453.

*Material examined :* 1 ♂, West Bengal, Canning, 6.xi.1984, Coll. B. N. Das.

*Diagnosis :* Bronze green to blueish-green species; occiput metallic green, eyes bare, in male facets highly enlarged on upper parts; second antennal segment and base of third bright reddish; thorax with linear vittae, presutural acrostichal absent, postsutural only one; legs ferrugineous brown, mid tibia with an ad seta; stem vein with one setula, vein m with subangular bend and with slight dip behind it; abdomen without setae.

*Distribution :* Widely distributed in India including Sundarban in West Bengal.

## Subfamily : LIMNOPHORINAE

### Genus *Lispe* Latreille

1796. *Lispe* Latreille, *Precis caract gen. Ins. :* 169. Type-species : *Musca tentaculata* (De Geer).

*Diagnosis :* Palpi spoon shaped; arista long plumose usually upto basal half, prst ac absent; prosternum and hypopleura bare, pteropleura hairy; vein $m_{1+2}$ not upcurved; lower squama tongue-shaped.

#### 35. *Lispa pumila* (Wiedemann)

1824. *Coenosia pumila* Wiedemann, *Analecta Entomol. :* 51.

*Diagnosis :* Body non metallic; third antennal segment black; palpi orange or yellow at least apices; cell R5 not narrow apically; legs orange; dorsocentral bristles strong, presutural dorsocentral 2; abdomen with a pair of rectangular markings on 3-5 tergites.

*Distribution :* West Bengal (Sundarban), Andhra Pradesh, Assam, Bihar and Tamil Nadu.

## Subfamily : STOMOXYINAE

### Genus *Stomoxys* Geoffroy St. Halaire

1762. *Stomoxys* Geoffroy St. Halaire, *Hist. Ins.* 2 : 538. Type-species : *Conops calcitrans* L.

*Diagnosis :* Eyes with its hind margin conspicuously emerginates; antennal arista long pectinate dorsally, bare below; proboscis slender, very long; palpi less than half of proboscis; propleural depression with erect setulose hairs, sternopleuron 0 + 1; hind femur with strong av preapical setae, tibiae without submedian setae; vein $r_{4+5}$ well setulose, R5 widely open at apex; abdomen short, semicircular type.

#### *Key to the species*

1. Setulae at base of $r_{4+5}$ not reaching r-m; vein m strongly upcurved and distinctly sinuous near apex ..... *calcitrans* (Linn.)

— Setulae at base of $r_{4+5}$ crossed r-m; vein m moderately upcurved and barely sinuous near apex ..... *indica* Picard

#### 36. *Stomoxys calcitrans* (Linnaeus)

1758. *Conops calcitrans* Linnaeus, *Syst. nat.*, 10 : 604.

*Material examined :* 1 ♀, West Bengal, Canning, 6.xi.1984, Coll. B. N. Das.

*Distribution :* Widely distributed in India including Sundarban in West Bengal.

### 37. *Stomoxys indica* Picard

1908. *Stomoxys indica* Picard, *Bull. Soc. ent. Fr.*, 1908 : 20.

*Material examined :* 2 ♂, West Bengal, Canning, 6.xi.1984, Coll. B. N. Das.

*Distribution :* West Bengal (Sundarban), Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Kerala and Uttar Pradesh.

## Family : CALLIPHORIDAE

Commonly known as 'blow flies' or 'blue-green bottle flies.' Adults feed on nectar, excrement, decaying plants or animal matters. Larvae parasitic on insects, earthworms, snails etc. Some causes myiasis in man and animals.

*Key to the subfamily*

1. Stem vein of wing setulose on postero-dorsal surface of basal section ..... Chrysomyinae
— Stem vein of wing not setulose on postero-dorsal surface of basal section ..... Calliphorinae

## Subfamily : CHRYSOMYINAE

### Genus *Chrysomya* Rob.-Desv.

1830. *Chrysomya* Robineau-Desvoidy, *Mem. pres. div. Sav. Acad. Sci. Inst. Fr. :* 444. Type-species : Chrysomya marginalis Wied. = C. regalis Rob.-Desv.

*Diagnosis :* Small to medium sized-flies, usually metallic greenish blue in colour; eyes large and bare; prostigmatic bristles present or absent; propleuron and prosternum hairy; suprasquamal ridge usually with anterior parasquamal tuft; subcostal sclerite hairy; tergum 5 with many fine erect bristles on disc.

### 38. *Chrysomya megacephala* (Fabricius)

1794. *Musca megacephala* Fabricius, *Syst. Ent.*, 4 : 317.

Material examined : 3 ♂, 4 ♀, West Bengal, 24 Parganas (South) Canning, 3.iii.1986, Coll. B. N. Das.

*Diagnosis :* Eyes in male with upper facets strongly enlarged and sharply demarcated from small ones in the lower third; prostigmal bristle absent; antennal segment 3 entirely orange; thorax and abdomen greenish-blue with purple lustre; wing hyaline, dark at base, subcostal sclerite covered with brown pubescence and a few short erect hairs, upper squama white, dark margined.

*Distribution :* West Bengal (Sundarban) and most common in other states in India.

## Subfamily : CALLIPHORINAE

### Genus *Hemipyrellia* Townsend

1918. *Hemipyrellia* Townsend, *Insecutor. Insit. menst.*, 6 : 154. Type-species : *Lucilia fernandica* Macq.

### 39. *Hemipyrellia pulchra* (Wiedemann)

1830. *Musca pulchra* Wiedemann, *Aussereurop. Zweifl. insekt.*, 2 : 406.

*Material examined :* 1 ♂, West Bengal, 24 Parganas (South), Canning, 3.iii.1986, Coll. B. N. Das

*Diagnosis :* Eyes in male separated by distance equal to the width of third antennal segment; third antennal segment bright orange; thorax metallic green with purple lustre; legs black; wings hyaline; abdomen greenish to purple.

*Distribution :* West Bengal (Sundarban), Bihar, Orissa, Pondichery, Punjab, Tamil Nadu and Uttar Pradesh.

## Family : SARCOPHAGIDAE

Commonly called 'flesh-flies', found on decaying flesh, excreta; larvae occur in decaying animal or vegetable matters.

## Subfamily : SARCOPHAGINAE

### Genus *Parasarcophaga* Johnston and Tiegs

1921. *Parasarcophaga* Johnston and Tiegs, *Proc. Roy. Soc. Queensland*, 23 : 78. Type-species : *S. omega* J. & T.

*Diagnosis :* Lateral verticals always present in female but may not be in male. Vibrissae bare; arista long plumose up to two-thirds; dorsocentrals 2 anteriorly, numbers variable posteriorly; sternopleurals 1 : 1 : 1 or 1 : 1; third longitudinal vein bristly half way to anterior cross vein; mid femur with a row of stout bristles on apical half ventrally, hind tibia with inner and outer fringe of long hairs.

#### *Key to the subgenera*

1. Lateral plate of paraphallus in the form of rudimentary process, its apical part with 2 lateral process ..... *Liopygia* Enderlein (1 species only)

— Lateral plate of paraphallus with a single pair of lamellate processes, its apical part with no lateral process ..... *Liosarcophaga* Enderlein (1 species only)

### Subgenus *Liopygia* Enderlein

1928. *Liopygia* Enderlein, *Arch. Klass. phyl. Entl.*, 1 (1) : 41. Type-species : *Musca ruficornis* Fabricius.

### 40. *Parasarcophaga (Liopygia) ruficornis* (Fabricius)

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

*Diagnosis :* Antennae and palpi orange; propleuron bare; only pre-scutellar acrostichal present, posterior dorsocentrals 5, anterior 4 very weak; mid femur with comb and a few long basal setae; genital tergites orange.

*Distribution :* Common in most part of India including Sundarban.

### Subgenus *Liosarcophaga* Enderlein

1928. *Liosarcophaga* Enderlein, *Arch. Klass Phyl. Ent.*, 1 (1) : 18; Rohdendorf, 1937. *Fauna USSR : Dipt.*, 19(1) : 205, Type-species : *Cynomyia madeirensis* Schiner.

### 41. *Parasarcophaga (Liosarcophaga) dux* (Thomson)

1868. *Sarcophaga dux* Thomson, *K. Svenska Fregatten Eugenies Resa.* Dipt; 2 : 534.

*Material examined :* 1 ♂, West Bengal : 24-Parganas (South), Canning 3.iii.1986, Coll. B. N. Das.

*Diagnosis :* Lateral verticals wanting; propleura bare, single pre-sutural acrostichal, posterior dorsocentral 5 the anterior 3 weak; mid femur with comb and fringe at base, hind tibia double fringed; apex of paraphallus pointed with a subapical process having bifurcated apex.

*Distribution :* In all parts of India including Sundarban in West Bengal.

## GENERAL REMARKS

The Dipteran fauna of Sundarban is not so diversified as in other parts of the state perhaps due to the absence of varied ecological niches that are available in those parts. The northern part of West Bengal particularly in Darjeeling areas with its mountain ranges and dense forests it is the abode of the varieties of Dipteran fauna.

Of the 15 families dealt with in this communication members of some families are haematophagus, *Anopheles (Cellia) sundaicus* Rod. (Culicidae) and *Phlebotomus argentipes* Annandale and Brunetti (Phlebotomidae) are intermediate carrier of malaria and Kala-azar diseases respectively and *Stomoxys calcitrans* Linn. (Muscidae) is carrier of germs.

Out of the 41 species reported here two species of Tipulidae *Limonia (Geranomyia) flavicosta* Brun. and *Limonia (Geranomyia) tridens* Brun. and one species of Cecidomyidae *Stefaniola bengalensis* Mani are endemic in Sundarban. *Drapetis ferruginea* Brun. (Empididae) is endemic in West Bengal. *Oplodontha rubrithorax* (Macquart) (Stratiomyidae) is confined to West Bengal and Uttar Pradesh. The remaining species have been recorded from many states.

## SUMMARY

The paper deals with 41 species under 31 genera of 19 subfamilies belonging to 15 families of Diptera of which 2 species of Tipulidae *Limonia (Geranomyia) flavicesta* Burn, and *Limonia (Genanomyia) tridens* Brun. and 1 species of Cecidomyiidae *Stefaniola bengalensis* Mani are endemic in Sundarban.

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# AN UPDATED CHECK-LIST OF THE INDIAN TRICHOPTERA ALONG WITH AN ILLUSTRATED KEY TO ITS FAMILIES

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## INTRODUCTION

This paper covers the caddisfly fauna so far recorded from India. The work is based on the literature for which Fisher's catalogue, Schmid's revisionary works and Higler's Checklist deserve the special mention. Higler's Check-list (1992), does not contain a complete list of references and species from Schmid's recent works on Indian caddisflies. Referring the species to their exact type localities turned out to be a most cumbersome job. Due to very scatterred and insufficient information no uniform pattern could be evolved. The species are simply referred to the states in which their type localities fall. In some of the cases very vague terms such as E. Himalaya, Himalaya, W. Himalaya, N. India, India, N. Bengal, C. India, S. India etc. are used, so all these are put in square brackets [ ]. Curly brackets { } are used for those states and areas in which political boundaries have changed with the passage of time. Following Higler (1992) the subsequent locality records, authors and years are enclosed in simple brackets ( ).

At the end a key to the families of adult Indian Trichoptera is provided. Need of such a key was felt as none of the keys available in the literature (Wiggins, 1978; Ross, 1956; Mani, 1974) cover all the families from this region.

After Fisher's catalogue, there has been numerous changes in the taxonomic status of the caddisflies.

**KEY WORDS :** Check-list, Indian, Trichoptera, Family Key

Suborder **ANNULIPALPIA**

Family RHYACOPHILIDAE

The larvae entirely free living; construct a crude shelter of stones only at pupation. The pupa is enclosed in a darkened, separate silk coccon. The habitat is cool running water; larvae are mainly predacious, although some are algivorous. This family is represented by two genera with 176 species from India.

## Genus *Himalopsyche*

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| *Himalopsyche amitabha* Schmid 1966 | Sikkim |
| *Himalopsyche angnorbui* Schmid 1963 | Uttar Pradesh, Sikkim |
| *Himalopsyche bhagirathi* Schmid 1963 | Uttar Pradesh |
| *Himalopsyche biansata* Kimmins 1952 | Sikkim |
| *Himalopsyche digitata* (Martynov 1935) | {West Bengal}<br>West Bengal (Kimmins 1952),<br>Uttar Pradesh, Sikkim<br>Arunachal Pradesh (Schmid 1966) |
| *Himalopsyche dolmasampa* Schmid 1963 | Sikkim<br>Uttar Pradesh (Schmid 1966) |
| *Himalopsyche gyamo* Schmid 1963 | Sikkim |
| *Himalopsyche hierophylax* Schmid 1966 | Uttar Pradesh |
| *Himalopsyche horai* (Martynov 1936) | {Punjab}<br>Uttar Pradesh<br>Arunachal Pradesh (Schmid 1966) |
| *Himalopsyche lanceolata* (Morton 1900) | Meghalaya<br>Manipur (Schmid 1966) |
| *Himalopsyche lepcha* Schmid 1963 | West Bengal<br>Sikkim (Schmid 1966) |
| *Himalopsyche lungma* Schmid 1963 | Uttar Pradesh |
| *Himalopsyche maitreya* Schmid 1963 | Uttar Pradesh |
| *Himalopsyche malenanda* Schmid 1963 | Sikkim<br>Arunachal Pradesh (Schmid 1966) |
| *Himalopsyche phedongensis* Kimmins 1952 | Sikkim |
| *Himalopsyche tibetana* (Martynov 1930) | Uttar Pradesh, Sikkim, Schmid 1966 |
| *Himalopsyche todma* Schmid 1963 | Uttar Pradesh |
| *Himalopsyche yatrawalla* Schmid 1966 | Uttar Pradesh |
| *Himalopsyche yongma* Schmid 1963 | Sikkim |

## Genus *Rhyacophila*

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|---|---|
| *Rhyacophila alticola* Kimmins 1953 | Sikkim (Schmid 1970) |
| *Rhyacophila anatina* Morton 1900 | Meghalaya<br>Meghalaya, Sikkim (Kimmins 1953)<br>Meghalaya (Schmid 1970) |

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|---|---|
| *Rhyacophila ancestralis* Martynov 1935 | {Assam} |
| | Meghalaya (Schmid 1970) |
| *Rhyacophila angden* Schmid 1970 | Sikkim |
| *Rhyacophila assimilis* Kimmins 1953 | Manipur (Schmid 1970) |
| *Rhyacophila aureomaculata* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila aureostigma* Schmid 1970 | Sikkim, W. Bengal |
| *Rhyacophila bhotia* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila bhuchanadhara* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila bicolor* Kimmins 1953 | Manipur |
| *Rhyacophila bidens* Kimmins 1953 | Uttar Pradesh |
| | Sikkim, Arunachal Pradesh, Manipur |
| | Uttar Pradesh (Schmid, 1970) |
| *Rhyacophila chakungpa* Schmid 1970 | Sikkim |
| *Rhyacophila chamolungpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila chandzo* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila changpa* Schmid 1970 | Sikkim |
| *Rhyacophila chayulpa* Schmid 1970 | |
| subsp. *chayulpa* Schmid 1970 | Sikkim |
| subsp. *ringmo* Schmid 1970 | Arunachal Pradesh |
| subsp. *tsetangpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila chematangpa* Schmid 1970 | Sikkim |
| *Rhyacophila chembo* Schmid 1970 | Arunachal Pradesh |
| subsp. *lartsepa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila chenmo* Schmid 1970 | Manipur |
| *Rhyacophila chimdro* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila chomoyuma* Schmid 1970 | Manipur |
| *Rhyacophila choprai* Martynov 1935 | Uttar Pradesh |
| *Rhyacophila chugalungpa* Schmid 1970 | Sikkim |
| *Rhyacophila chulukpa* Schmid 1970 | Sikkim, W. Bengal |
| *Rhyacophila chumikpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila chungse* Schmid 1970 | Manipur, Arunachal Pradesh |
| *Rhyacophila churongpa* Schmid 1970 | Uttar Pradesh |

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| *Rhyacophila curvata* Morton 1900 | Meghalaya, Sikkim (Kimmins 1953), Manipur, Mizoram (Schmid 1970) |
| *Rhyacophila dafla* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila dakshi* Schmid 1970 | West Bengal, Sikkim |
| *Rhyacophila dgaldanpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila dikkaravasini* Schmid 1970 | Tamil Nadu |
| *Rhyacophila dilatata* Martynov 1935 | {Punjab} Uttar pradesh (Schmid, 1970) |
| *Rhyacophila dirangpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila dolingpa* Schmid 1970 | Meghalaya |
| *Rhyacophila dongkyapa* Schmid 1970 | Manpur, Sikkim Arunachal Pradesh |
| *Rhyacophila dongre* Schmid 1970 | Sikkim |
| *Rhyacophila dorje* Schmid 1970 | Tamil Nadu, |
| *Rhyacophila drokpa* | |
| subsp. *drokpa* Schmid 1970 | Arunachal Pradesh, Manipur |
| subsp. *gurla* Schmid 1970 | Uttar Pradesh |
| subsp. *nyenpa* Schmid 1970 | Sikkim |
| *Rhyacophila drosampa* Schmid 1970 | Meghalaya |
| *Rhyacophila drotangpa* Schmid 1970 | Sikkim |
| *Rhyacophila extensa* Martynov 1928 | [North India] (Banks, 1931) |
| *Rhyacophila fletcheri* Kimmins 1952 | Sikkim Arunachal Pradesh (Schmid 1970) |
| *Rhyacophila gelukpa* Schmid 1970 | Sikkim, Arunachal Pradesh |
| *Rhyacophila gyaldzen* Schmid 1970 | Meghalaya, Manipur |
| *Rhyacophila gyamo* Schmid 1970 | Manipur |
| *Rhyacophila gyaspa* Schmid 1970 | West Bengal |
| *Rhyacophila gyelbu* Schmid 1970 | Manipur, Sikkim |
| *Rhyacophila hingstoni* Martynov 1930 | Sikkim |
| *Rhyacophila hobsoni* Martynov 1930 | Uttar Pradesh, Sikkim (Schmid 1970) |
| *Rhyacophila inconspicua* Morton 1900 | Meghalaya |
| *Rhyacophila jayadurga* Schmid 1970 | Tamil Nadu |

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|---|---|
| *Rhyacophila kadampa* Schmid 1970 | Manipur |
| *Rhyacophila kadaphes* Schmid 1959 | Uttar Pradesh (Schmid 1970) |
| *Rhyacophila kagyupa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila kando* Schmid 1970 | Arunachal Pradesh<br>Sikkim, Uttar Pradesh |
| subsp. *rengma* Schmid 1970 | Manipur |
| *Rhyacophila kangjongpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila kanichka* Schmid 1959 | Uttar Pradesh |
| *Rhyacophila karpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila kashongpa* Schmid 1970 | Manipur |
| *Rhyacophila kawachenpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila kedara* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila khamakhya* Schmid 1970 | Tamil Nadu |
| *Rhyacophila khasiorum* Schmid 1970 | Uttar Pradesh, Sikkim<br>Arunachal Pradesh, Meghalaya, Manipur |
| *Rhyacophila khimbarpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila khiympa* Schmid 1970 | Sikkim |
| *Rhyacophila kubra* Schmid 1970 | Sikkim |
| *Rhyacophila kunma* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila kusang* Schmid 1970 | Meghalaya |
| *Rhyacophila kyadongpa* Schmid 1970 | Sikkim |
| *Rhyacophila kyimdongpa* Schmid 1970 | Meghalaya |
| *Rhyacophila kyungpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila langdarma* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila laptsapa* Schmid 1970 | Sikkim |
| *Rhyacophila lepcha* Schmid 1970 | Sikkim |
| *Rhyacophila lhabu* Schmid 1970 | Manipur |
| *Rhyacophila lhadzongpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila lhakpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila lhopa* Schmid 1970 | Tamil Nadu |
| *Rhyacophila lobsang* Schmid 1970 | Tamil Nadu |
| *Rhyacophila lonpo* Schmid 1970 | Arunachal Pradesh |

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| *Rhyacophila maitripa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila manipuri* Schmid 1970 | Manipur |
| *Rhyacophila manlungpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila marpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila milarepa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila mishmica* Schmid 1970 | Meghalaya |
| | Arunachal Pradesh |
| | (Schmid 1970) |
| *Rhyacophila monyupla* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila mortoni* Kimmins 1953 | Meghalaya |
| *Rhyacophila muktepa* Schmid 1970 | Meghalaya, Manipur |
| *Rhyacophila nabochepa* Schmid 1970 | West Bengal, Sikkim, |
| | Arunachal Predesh |
| *Rhyacophila naga* Schmid 1970 | Manipur |
| *Rhyacophila nagongpa* Schmid 1970 | Meghalaya |
| *Rhyacophila nakpo* Schmid 1970 | Manipur |
| *Rhyacophila namgyal* Schmid 1970 | Meghalaya |
| *Rhyacophila narayani* Schmid 1970 | Kerala |
| *Rhyacophila naviculata* Morton 1900 | Mamil Nadu |
| | Tamil Nadu (Schmid 1970) |
| *Rhyacophila netongpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila ngawang* Schmid 1970 | Meghalaya |
| *Rhyacophila ngorpa* Schmid 1970 | West Bengal, Sikkim |
| *Rhyacophila ngulpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila norbu* Schmid 1970 | Meghalaya |
| *Rhyacophila nyamangpa* Schmid 1970 | Sikkim |
| *Rhyacophila nyelungpa* Schmid 1970 | Meghalaya |
| *Rhyacophila nyerongpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila nyerpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila nyukmadongpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila obscura* Schmid 1970 | {Punjab}, Himachal Pradesh (Kimmins 1953), Uttar Pradesh, Sikkim (Schmid 1970) |

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| *Rhyacophila parva* Kimmins 1953 | Meghalaya |
| subsp. *parva* Kimmins 1953 | Meghalaya (Schmid 1970) |
| subsp. *mukpo* Schmind 1970 | Manipur |
| *Rhyacophila paurava* Schmid 1959 | Uttar Pradesh |
| *Rhyacophila pemba* Schmid 1970 | Meghalaya, Manipur |
| *Rhyacophila poba* Schmid 1970 | Sikkim |
| *Rhyacophila polha* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila procliva* Kimmins 1953 | Manipur, Arunachal Pradesh |
| *Rhyacophila putata* Kimmins 1953 | Meghalaya |
| subsp. *temba* Schmid 1970 | Manipur |
| *Rhyacophila rhombica* Martynov 1935 | {West Bengal} |
| *Rhyacophila rongpa* Schmid 1970 | Manipur, Sikkim |
| | Arunachal Pradesh |
| *Rhyacophila sakyapa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila sanglungpa* Schmid 1970 | Sikkim |
| *Rhyacophila scissa* Morton 1900 | Meghalaya |
| | Uttar Pradesh, Sikkim |
| | Arunachal Pradesh |
| | (Schmid 1970) |
| subsp. *niyampa* Schmid 1970 | Manipur |
| *Rhyacophila scissoides* Kimmins 1953 | {Punjab}, Himachal Pradesh |
| | Sikkim, Uttar Pradesh |
| | Arunachal Pradesh, Meghalaya, |
| | Mizoram (Schmid 1970) |
| *Rhyacophila scotina* Kimmins 1953 | Meghalaya (Schmid 1970) |
| *Rhyacophila senggepa* Schmid 1970 | Meghalaya |
| *Rhyacophila shakangpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila sherchokpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila sherpa* Schmid 1970 | Sikkim |
| *Rhyacophila shingripa* Schmid 1970 | Sikkim |
| *Rhyacophila sikungpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila similis* Martynov 1935 | Uttar Pradesh |
| | Uttar Pradesh (Schmid 1970) |

| | |
|---|---|
| *Rhyacophila spinalis* Martynov 1930 | Uttar Pradesh, Sikkim, Arunachal Pradesh |
| *Rhyacophila stenostyla* Martynov 1930 | Uttar Pradesh, Sikkim (Schmid 1970) |
| *Rhyacophila sumdopa* Schmid 1970 | Manipur |
| *Rhyacophila tarkiya* Schmid 1970 | Sikkim |
| *Rhyacophila tashepa* Schmid 1970 | Sikkim |
| *Rhyacophila tashidingpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila tecta* Morton 1900 | {Meghalaya}, Arunachal Pradesh (Schmid 1970) |
| *Rhyacophila tengyelingpa* Schmid 1970 | Sikkim |
| *Rhyacophila tolungpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila trashipa* Schmid 1970 | Manipur |
| *Rhyacophila trulungpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila tsering* Schmid 1970 | Kerala |
| *Rhyacophila tshiringpa* Schmid 1970 | Sikkim |
| *Rhyacophila tshogpa* Schmid 1970 | Sikkim |
| *Rhyacophila tsiudmarpo* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila tsona* Schmid 1970 | Mamipur |
| *Rhyacophila tsongkhapa* Schmid 1970 | Sikkim |
| *Rhyacophila tungkorpa* Schmid 1970 | Sikkim |
| *Rhyacophila tungpa* Schmid 1970 | Uttar Pradesh |
| *Rhyacophila ugyenpa* Schmid 1970 | Meghalaya |
| *Rhyacophila wangpo* Schmid 1970 | West Bengal |
| *Rhyacophila yarhungpa* Schmid 1970 | Arunachal Pradesh |
| *Rhyacophila yigrongpa* Schmid 1970 | Sikkim |
| *Rhyacophila yipung* Schmid 1970 | Manipur |
| *Rhyacophila yishepa* Schmid 1970 | Sikkim |
| *Rhyacophila yonggyapa* Schmid 1970 | Manipur |
| *Rhyacophila yullha* Schmid 1970 | Sikkim |
| *Rhyacophila zhungpa* Schmid 1970 | Arunachal Pradesh<br>Uttar Pradesh |

## Family HYDROBIOSIDAE

Larvae freeliving; construct a crude shelter of stones only at pupation. The pupa is enclosed in a darkened silk cocoon. The habitat is running waters. Larvae are predacious as in Rhyacophilidae, but generally they are more tolerant to higher temperatures. This family is represented by single genus with 9 species from India.

### Genus *Apsilochorema*

| | |
|---|---|
| *Apsilochorema annandalei* Martynov 1935 | Punjab, Himachal Pradesh, Sikkim, Uttar Pradesh Manipur (Schmid 1970) |
| *Apsilochorema dakchinam* Schmid 1970 | Tamil Nadu |
| *Apsilochorema hrasvam* Schmid 1970 | Manipur |
| *Apsilochorema indicum* Ulmer 1905 | {Punjab} |
| *Apsilochorema natibhinnam* Schmid 1970 | Meghalaya |
| *Apsilochorema tanum* Schmid 1970 | Manipur |
| *Apsilochorema tigmatejanam* Schmid 1970 | Uttar Pradesh, Sikkim |
| *Apsilochorema utchtchunam* Schmid 1970 | Manipur |
| *Apsilochorema vaneyam* Schmid 1970 | Arunchal Pradesh Sikkim |

## Family HYDROPTILIDAE

The habitat is running and standing waters, with larvae usually feeding on the cell contents of filamentous algae or diatoms. These insects are known as purse-case makers. The larval case consists of sand, algae, or other plant material, or silk alone. This family is represented by five genera with 47 species from India.

### Genus *Moselyella*

| | |
|---|---|
| *Moselyella violacea* (Morton 1902) | Meghalaya (also Maxwell-Lefroy 1909) (also Martynov 1935) |

### Genus *Orthotrichia*

| | |
|---|---|
| *Orthotrichia avicularis* Kimmins 1951 | Bihar |
| *Orthotrichia extensa* Martynov 1935 | [Central India] |

Genus ***Oxydroptila***

| | |
|---|---|
| *Oxydroptila furcata* Martynov 1935 | [Central India] |

Genus ***Oxyethira***

| | |
|---|---|
| *Oxyethira harpagella* Kimmins 1951 | Meghalaya |
| *Oxyethira ramosa* Martynov 1936 | [Central India] |

Genus ***Stactobia***

| | |
|---|---|
| *Stactobia balin* Schmid 1983 | West Bengal |
| *Stactobia ballur* Schmid 1983 | Meghalaya |
| *Stactobia beor* Schmid 1983 | Arunachal Pradesh, Uttar Pradesh, West Bengal |
| *Stactobia beren* Schmid 1983 | Arunachal Pradesh |
| *Stactobia bifur* Schmid 1983 | Meghalaya |
| *Stactobia bofur* Schmid 1983 | Manipur |
| *Stactobia calin* Schmid 1983 | Arunachal Pradesh, Uttar Pradesh, West Bengal, Sikkim |
| *Stactobia dain* Schmid 1983 | Meghalaya, Mizoram |
| *Stactobia dori* Schmid 1983 | Uttar Pradesh |
| *Stactobia durin* Schmid 1983 | West Bengal |
| *Stactobia dwalin* Schmid 1983 | Uttar Pradesh |
| *Stactobia dwalur* Schmid 1983 | West Bengal |
| *Stactobia froki* Schmid 1983 | Arunachal Pradesh |
| *Stactobia gimli* Schmid 1983 | Uttar Pradesh |
| *Stactobia gloin* Schmid 1983 | Uttar Pradesh |
| *Stactobia glwili* Schmid 1983 | Arunachal Pradesh |
| *Stactobia grolin* Schmid 1983 | Meghalaya |
| *Stactobia huor* Schmid 1983 | Arunachal Pradesh<br>West Bengal |
| *Stactobia hurin* Schmid 1983 | Uttar Pradesh<br>Arunachal Pradesh |
| *Stactobia loki* Schmid 1983 | Uttar Pradesh |
| *Stactobia loni* Schmid 1983 | Meghalaya |
| *Stactobia morettii* Schmid 1959 | Uttar Pradesh (Schmid 1983) |

| | |
|---|---|
| *Stactobia naili* Schmid 1983 | West Bengal |
| *Stactobia nalin* Schmid 1983 | Arunachal Pradesh |
| *Stactobia nielseni* Schmid 1959 | Uttar Pradesh (Schmid 1983) |
| *Stactobia noldi* Schmid 1983 | Uttar Pradesh |
| *Stactobia nori* Schmid 1983 | Uttar Pradesh |
| *Stactobia oin* Schmid 1983 | Uttar Pradesh |
| *Stactobia ori* Schmid 1983 | Sikkim |
| *Stactobia radovanovichi* Schmid 1959 | Uttar Pradesh (Schmid 1983) |
| *Stactobia schmidi* Kimmins 1964 | Uttar Pradesh (Schmid 1983) |
| *Stactobia smoli* Schmid 1983 | Meghalaya |
| *Stactobia snori* Schmid 1983 | West Bengal, Sikkim Arunachal Pradesh |
| *Stactobia snufi* Schmid 1983 | Sikkim |
| *Stactobia teldi* Schmid 1983 | Uttar Pradesh |
| *Stactobia throrin* Schmid 1983 | Uttar Pradesh |
| *Stactobia thrain* Schmid 1983 | Sikkim |
| *Stactobia throhir* Schmid 1983 | Manipur |
| *Stactobia throli* Schmid 1983 | Sikkim |
| *Stactobia thror* Schmid 1983 | Arunachal Pradesh |
| *Stactobia tjederi* Schmid 1983 | Uttar Pradesh (Schmid 1983) |
| *Stactobia tuor* Schmid 1983 | Manipur |

## Family GLOSSOSOMATIDAE

The larval case consists of small rock fragments; The habitat is running waters; larvae eat algae and fine organic particles from the upper surface of rocks. This family is represented by three genera with 22 species from India.

### Genus *Agapetus*

| | |
|---|---|
| *Agapetus kashmirensis* Mimmins 1953 | Jammu & Kashmir |
| *Agapetus sindis* Kimmins 1953 | Jammu & Kashmir |
| *Agapetus triangularis* Martynov 1935 | Uttar Pradesh |

### Genus *Glossosoma*

| | |
|---|---|
| *Glossosoma abhikara* Schmid 1959 | Uttar Pradesh (Schmid 1971) |
| *Glossosoma abhisares* Schmid 1971 | Uttar Pradesh |

| | |
|---|---|
| *Glossosoma ambhi* Schmid 1959 | Uttar Pradesh (Schmid 1971) |
| *Glossosoma atchintitam* Schmid 1971 | Arunachal Pradesh |
| *Glossosoma bahukantakam* Schmid 1971 | Arunachal Pradesh |
| *Glossosoma caudadum fissum* Mart. 1935 | Uttar Pradesh, Himachal Pradesh (Kimmins 1953); U.P., Sikkim, Arunachal Pradesh, Manipur, Schmid (1971) |
| *Glossosoma confluens* Kimmins 1953 | Arunachal Pradesh Manipur (Schmid 1971) |
| *Glossosoma dentatum* McLachlan 1875 | Himachal Pradesh (Martynov 1935), Arunachal Pradesh (Schmid 1971) |
| subsp. *akhandam* Schmid 1971 | Sikkim, Arunachal Pradesh, Manipur, Meghalaya |
| *Glossosoma dirghakantakam* Schmid 1971 | Arunachal Pradesh, Sikkim |
| *Glossosoma heliakreya* Schmid 1959 | Uttar Pradesh (Schmid 1971) |
| *Glossosoma hemantajam* Schmid 1971 | Meghalaya, Manipur |
| *Glossosoma kamarasikam* Schmid 1971 | Sikkim, Arunachal Pradesh |
| *Glossosoma kchinam* Schmid 1971 | Sikkim |
| *Glossosoma krichnarunam* Schmid 1971 | Arunachal Pradesh |
| *Glossosoma moselyi* Kimmins 1953 | Jammu & Kashmir |
| *Glossosoma nigroroseum* Schmid 1971 | Sikkim |
| *Glossosoma vaneyam* Schmid 1971 | Arunachal Pradesh |
| *Glossosoma varjakantakam* Schmid 1971 | Uttar Pradesh, Sikkim Arunachal Pradesh, Manipur, Meghalaya |

## Genus *Synagapetus*

| | |
|---|---|
| *Synagapetus himalayanus* Martynov 1935 | West Bengal |

## Family STENOPSYCHIDAE

Larvae live in stout shelters of stones fastened together with silken meshes on submerged rocks in strong currents of rivers. This family is represented by single genus with 14 species from India.

### Genus *Stenopsyche*

| | |
|---|---|
| *Stenopsyche alamkrita* Schmid 1969 | Arunachal Pradesh |
| *Stenopsyche apiguna* Schmid 1969 | Arunachal Pradesh, Manipur |
| *Stenopsyche benaventi* Navas 1934 | Maharashtra, Bihar (Martynov 1935), West Bengal Bihar, Meghalaya, Manipur, Andhra Pradesh (Schmid 1969) |
| *Stenopsyche dirghajihvi* Schmid 1969 | Arunachal Pradesh, Sikkim |
| *Stenopsyche dvyankopayukta* Schmid 1969 | Meghalaya |
| *Stenopsyche eurycephala* Naves 1935 | Maharashtra |
| (According to Schmid 1969, S. benaventi) | |
| *Stenopsyche furcatula* Martynov 1935 | [Central India] |
| (According to Schmid 1969, probably S. benaventi) | |
| | Madhya Pradesh, Bihar (Schmid 1969) |
| *Stenopsyche griseipennis* McLachlan 1866 | [East India] (Martynov 1935) {Assam} (Mclachlan 1871), Sikkim, {West Bengal} (Betten 1909), {Bengal} (Martynov 1935), Uttar Pradesh, Sikkim, Manipur, Arunachal Pradesh, Meghalaya (Schmid 1969) |
| [non *pallidipennis* (Schmid 1969)] | Sikkim, {Assam} (Kimmins 1958) |
| *Stenopsyche haimavatika* Schmid 1969 | Uttar Pradesh, Sikkim, Meghalaya, Arunachal Pradesh |
| *Stenopsyche himalayana* Martynov 1926 | {Assam}, Jammu & Kashmir (Ulmer 1907) Uttar Pradesh, Sikkim, Meghalaya (Schmid 1969) |
| *Stenopsyche khasia* Kimmins 1958 | Meghalaya |
| *Stenopsyche pallidipennis* Martynov 1926 | {Assam} {Assam} (Martynov 1930) |

| | |
|---|---|
| *Stenopsyche splendida* Martynov 1935 | Maharashtra<br>Andhra Pradesh (Schmid 1969) |
| *Stenopsyche similis* Ulmer 1927 | {West Bengal}<br>Sikkim (Martynov 1930)<br>{Panjab}, {Bengal}<br>(Martynov 1935)<br>Punjab, uttar Pradesh,<br>Arunachal pradesh, Sikkim<br>(Schmid 1969) |

## Family PHILOPOTAMIDAE

Larvae live within elongate, sack like silken nets of exceedingly fine mesh openings on the undersides of rocks or sometimes on vertical rock faces in spring seeps. The habitat is running waters, where algae and fine organic particles filtered by larval nets are swept up by the specialized membranous labrum. This family is represented by seven genera with 66 species from India.

### Genus *Chimarra*

| | |
|---|---|
| *Chimarra aberrans* Martynov 1935 | [India] |
| *Chimarra assamensis* Kimmins 1957 | Meghalaya |
| *Chimarra bicolor* Navas 1932 | Maharashtra |
| *Chimarra crepidata* Kimmins 1957 | Meghalaya |
| *Chimarra digitata* Martynov 1935 | {Punjab}, Uttar Pradesh |
| *Chimarra fusca* Kimmins 1957 | Meghalaya |
| *Chimarra henryi* Kimmins 1957 | Karnataka |
| *Chimarra khasia* Kimmins 1957 | Meghalaya |
| *Chimarra kumaonensis* Martynov 1935 | Uttar Pradesh |
| *Chimarra minuta* Martynov 1935 | {Punjab} |
| *Chimarra pilosella* Navas 1931 | Maharashtra (also Martynov 1935) |
| *Chimarra pulla* Navas 1932 | Maharashtra (also Martynov 1935) |

### Genus *Doloclanes*

| | |
|---|---|
| *Doloclanes acteon* Schmid 1991 | Madras |
| *Doloclanes alcmeon* Schmid 1991 | Madras |
| *Doloclanes anactorion* Schmid 1991 | Madras |
| *Doloclanes dexileon* Schmid 1991 | Assam |
| *Doloclanes dolophion* Schmid 1991 | Uttar Pradesh |

| | |
|---|---|
| *Doloclanes endymion* Schmid 1991 | Assam |
| *Doloclanes hyperion* Schmid 1991 | Assam |
| *Doloclanes ixion* Schmid 1991 | Assam |
| *Doloclanes nyctimon* Schmid 1991 | Assam |
| *Doloclanes timoleon* Schmid 1991 | Assam |

Genus ***Dolomyia***

| | |
|---|---|
| *Dolomyia kalmasa* Schmid 1991 | Assam |

Genus ***Dolophilodes***

| | |
|---|---|
| *Dolophilodes indica* Martynov 1935 | {Punjab} |
| *Dolophilodes tibetana* Kimmins 1955 | Jammu & Kashmir |

Genus ***Dolopsyche***

| | |
|---|---|
| *Dolopsyche kalmasita* Schmid 1991 | Assam |

Genus ***Gunungiella***

| | |
|---|---|
| *Gunungiella achtadachi* Schmid 1968 | Meghalaya |
| *Gunungiella achtami* Schmid 1968 | Meghalaya |
| *Gunungiella achtatrimchi* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella achtavimchi* Schmid 1968 | Andhra Pradesh |
| *Gunungiella bodhidharma* Schmid 1968 | Uttar Pradesh (Schmid 1968) |
| *Gunungiella chodachi* Schmid 1968 | West Bengal |
| *Gunungiella chotrimchi* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella chovimchi* Schmid 1968 | Karnataka |
| *Gunungiella dachami* Schmid 1968 | Kerala |
| *Gunungiella dvadachi* Schmid 1968 | Karnataka |
| *Gunungiella dvatrimchi* Schmid 1968 | Kerala |
| *Gunungiella dvitiya* Schmid 1968 | Uttar Pradesh, Sikkim, Meghalaya, Manipur, Arunachal Pradesh |
| *Gunungiella ekadachi* Schmid 1968 | Kerala |
| *Gunungiella ekatrimchi* Schmid 1968 | Karnataka |
| *Gunungiella ekavimchi* Schmid 1968 | Meghalaya |
| *Gunungiella navadachi* Schmid 1968 | Manipur |
| *Gunungiella navami* Schmid 1968 | Meghalaya, Manipur |

| | |
|---|---|
| *Gunungiella navavimchi* Schmid 1968 | Karnataka |
| *Gunungiella pachtchima* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella pantchadachi* Schmid 1968 | Manipur |
| *Gunungiella pantchami* Schmid 1968 | Meghalaya |
| *Gunungiella pantchatrimchi* Schmid 1968 | Mizoram |
| *Gunungiella prathama* Schmid 1968 | Arunachal Pradesh, Uttar Pradesh, Sikkim |
| *Gunungiella saptami* Schmid 1968 | Meghalaya |
| *Gunungiella saptatrimchi* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella saptavimchi* Schmid 1968 | Tamil Nadu |
| *Gunungiella tchaturdachi* Schmid 1968 | Manipur |
| *Gunungiella tchaturti* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella tchaturtimchi* Schmid 1968 | Kerala |
| *Gunungiella tridachi* Schmid 1968 | Tamil Nadu |
| *Gunungiella tritrimchi* Schmid 1968 | Arunachal Pradesh |
| *Gunungiella tritiya* Schmid 1968 | Manipur |
| *Gunungiella trivimchi* Schmid 1968 | Assam |
| *Gunungiella ulmeri* Schmid 1949 | Arunachal Pradesh (Schmid 1968) |
| *Gunungiella vimchi* Schmid 1968 | Arunachal Pradesh |

Genus ***Wormaldia***

| | |
|---|---|
| *Wormaldia ephestion* Schmid 1991 | Madras |
| *Wormaldia melanion* Schmid 1991 | Sikkim |
| *Wormaldia nigrorosea* Schmid 1991 | Assam |
| *Wormaldia relicta* (Martynov 1935) | {Bengal} |
| *Wormaldia therapion* Schmid 1991 | Assam |

## Family XIPHOCENTRONIDAE

Larvae construct tubes of silk and sand, frequently extending above the water surface on wet substrates. The habitat is small streams. This family is represented by five genera with 46 species from India.

Genus ***Abaria***

| | |
|---|---|
| *Abaria achwatirtha* Schmid 1982 | Tamil Nadu, Kerala, Karnataka |
| *Abaria devavrata* Schmid 1982 | Meghalaya |

| | |
|---|---|
| *Abaria dusyanta* Schmid 1982 | Tamil Nadu, Kerala |
| *Abaria madhavi* Schmid 1982 | Arunachal Pradesh |
| *Abaria margaritifera* Schmid 1982 | Uttar Pradesh, Sikkim, West Bengal, Manipur, Arunachal Pradesh, Meghalaya, Tamil Nadu, Mizoram (Schmid 1982) |
| *Abaria puru* Schmid 1982 | Uttar Pradesh |
| *Abaria richika* Schmid 1982 | Sikkim |
| *Abaria uchinara* Schmid 1982 | Sikkim |
| *Abaria yakcha* Schmid 1982 | Meghalaya |

Genus ***Cnodocentron***

| | |
|---|---|
| *Cnodocentron devayani* Schmid 1982 | Meghalaya |
| *Cnodocentron girika* Schmid 1982 | Arunachal Pradesh |
| *Cnodocentron tchaturbhuja* Schmid 1982 | Sikkim, Arunachal Pradesh |
| *Cnodocentron vrisaparvan* Schmid 1982 | Arunachal Pradesh |

Genus ***Drepanocentron***

| | |
|---|---|
| *Drepanocentron abhimayu* Schmid 1982 | Sikkim |
| *Drepanocentron birghu* Schmid 1982 | Arunachal Pradesh, Meghalaya |
| *Drepanocentron brihadratha* Schmid 1982 | Arunachal Pradesh |
| *Drepanocentron brihaspati* Schmid 1982 | Mizoram |
| *Drepanocentron citrangada* Schmid 1982 | Arunachal Pradesh |
| *Drepanocentron dacharatha* Schmid 1982 | Sikkim |
| *Drepanocentron druhyu* Schmid 1982 | Manipur |
| *Drepanocentron dvaravati* Schmid 1982 | Manipur |
| *Drepanocentron haryachwa* Schmid 1982 | West Bengal |
| *Drepanocentron nahucha* Schmid 1982 | Manipur |
| *Drepanocentron sarmichta* Schmid 1982 | Manipur |
| *Drepanocentron satrajita* Schmid 1982 | Meghalaya |
| *Drepanocentron satyavati* Schmid 1982 | Meghalaya |
| *Drepanocentron turvasi* Schmid 1982 | Manipur |
| *Drepanocentron ugrasena* Schmid 1982 | Manipur |
| *Drepanocentron vicitravirya* Schmid 1982 | Sikkim, Arunachal Pradesh |
| *Drepanocentron yayati* Schmid 1982 | Meghalaya, Manipur, Mizoram |

Genus ***Melanotrichia***

| | |
|---|---|
| *Melanotrichia chichupala* Schmid 1982 | Kerala |
| *Melanotrichia dhanajaya* Schmid 1982 | Meghalaya |
| *Melanotrichia drupada* Schmid 1982 | Manipur |
| *Melanotrichia ikchvaku* Schmid 1982 | Meghalaya |
| *Melanotrichia jamadagni* Schmid 1982 | Manipur |
| *Melanotrichia janamejaya* Schmid 1982 | Meghalaya |
| *Melanotrichia kachika* Schmid 1982 | Manipur |
| *Melanotrichia pachupati* Schmid 1982 | Tamil Nadu, Kerala, Karnataka |
| *Melanotrichia prajapati* Schmid 1982 | Arunachal Pradesh |
| *Melanotrichia radhasuta* Schmid 1982 | Meghalaya |
| *Melanotrichia singularis* Ulmer 1906 | [S. India]<br>Tamil Nadu, Kerala,<br>Karnataka (Schmid 1982) |
| *Melanotrichia uparichara* Schmid 1982 | Meghalaya |
| *Melanotrichia vasudeva* Schmid 1982 | Meghalaya |
| *Melanotrichia vichvamitra* Schmid 1982 | Arunachal Pradesh, Meghalaya and most probably Assam |
| *Melanotrichia yadu* Schmid 1982 | Arunachal Pradesh |

Genus ***Proxiphocentron***

| | |
|---|---|
| *Proxiphocentron prathamajam* Schmid 1982 | Sikkim |

## Family PSYCHOMYIIDAE

Larvae construct fixed meandering tubes of silk, covered with particles of sand and detritus, on rocks or logs. They feed on periphyton and fine organic particles from the substrate. The habitat is mainly cool running waters; some species occur in lakes. This family is represented by seven genera with 79 species from India.

Genus ***Eoneureclipsis***

| | |
|---|---|
| *Eoneureclipsis akrichalakchmi* Schmid 1972 | Manipur |
| *Eoneureclipsis varsikiyja* Schmid 1972 | Arunachal Pradesh |

Genus ***Khandalina***

| | |
|---|---|
| *Khandalina acuta* Navas 1934 | Maharashtra |

Genus ***Lype***

| | |
|---|---|
| *Lype dhumravarna* Schmid 1972 | Manipur, West Bengal, Arunachal Pradesh, Mizoram, Uttar Pradesh |

Genus ***Paduniella***

| | |
|---|---|
| *Paduniella amurensis* Martynov 1934 | [C. India] (Martynov 1935) |
| *Paduniella fissa* Martynov 1935 | Bihar |

Genus ***Psychomyia***

| | |
|---|---|
| *Psychomyia anaktujuh* Malicky 1995 | Uttar Pradesh, Manipur |
| *Psychomyia arefinae* Schmid 1997 | Uttar Pradesh |
| *Psychomyia armitagei* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia asvagosha* Schmid 1961 | Uttar Pradesh, West Bengal, Sikkim |
| *Psychomyia botosaneanui* Schmid 1997 | Assam, Manipur |
| *Psychomyia curriei* Schmid 1997 | Madras |
| *Psychomyia denisi* Schmid 1997 | Assam, Manipur |
| *Psychomyia dugpa* Schmid 1975 | Sikkim, Uttar Pradesh |
| *Psychomyia flinti* Schmid 1997 | Kerala |
| *Psychomyia galli* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia giboni* Schmid 1997 | Mysore |
| *Psychomyia gonzaleizi* Schmid 1997 | Assam |
| *Psychomyia higleri* Schmid 1997 | Uttar Pradesh |
| *Psychomyia holzenthali* Schmid 1997 | Meghalaya |
| *Psychomyia itoae* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia ivanovi* Schmid 1997 | Madras |
| *Psychomyia karkii* Malicky 1994 | Uttar Pradesh, Sikkim, Assam |
| *Psychomyia kumanskii* Schmid 1997 | Assam, Manipur |
| *Psychomyia kumari* Schmid 1997 | Uttar Pradesh |
| *Psychomyia kuranishi* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia levandovae* Schmid 1997 | Assam |
| *Psychomyia lii* Schmid 1997 | Assam |
| *Psychomyia maharaksa* Schmid 1961 | Uttar Pradesh |
| *Psychomyia mahayinna* Schmid 1961 | Uttar Pradesh |
| *Psychomyia malickyi* Schmid 1997 | Uttar Pradesh |

| | |
|---|---|
| *Psychomyia meyi* Schmid 1997 | Kerala |
| *Psychomyia monicae* Schmid 1997 | Assam |
| *Psychomyia moretti* Schmid 1997 | Madras |
| *Psychomyia morsei* Schmid 1997 | Mysore |
| *Psychomyia neboissi* Schmid 1997 | Assam, Manipur |
| *Psychomyia nimmoi* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia nogradiae* Schmid 1997 | Madras |
| *Psychomyia purthi* Martynov 1935 | Mysore, Madya Pradesh |
| *Psychomyia reshi* Schmid 1997 | Madras |
| *Psychomyia schetlerae* Schmid 1997 | Uttar Pradesh |
| *Psychomyia scottae* Schmid 1997 | Sikkim |
| *Psychomyia spurisi* Schmid 1997 | Assam |
| *Psychomyia suni* Schmid 1997 | Assam |
| *Psychomyia sykorai* Schmid 1997 | Madras |
| *Psychomyia tiani* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia tobiasi* Schmid 1997 | West Bengal |
| *Psychomyia tomaszewskii* Schmid 1997 | Madras |
| *Psychomyia unzickeri* Schmid 1997 | Assam, Manipur |
| *Psychomyia vaillanti* Schmid 1997 | Assam |
| *Psychomyia wangi* Schmid 1997 | West Bengal, Sikkim |
| *Psychomyia weaveri* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia wardi* Schmid 1997 | Assam, Manipur |
| *Psychomyia wellsae* Schmid 1997 | Kerala |
| *Psychomyia wigginsi* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia yangae* Schmid 1997 | Assam, Meghalaya |
| *Psychomyia levanidovae* Schmid 1997 | Assam |

Genus ***Psychomyiella***

| | |
|---|---|
| *Psychomyiella pruthii* Martynov 1935 | [C. India] |

Genus ***Tinodes***

| | |
|---|---|
| *Tinodes achtachastra* Schmid 1972 | Sikkim |
| *Tinodes adhrichta* Schmid 1972 | Arunachal Pradesh |
| *Tinodes akanda* Schmid 1972 | Meghalaya |

| | |
|---|---|
| *Tinodes akantaka* Schmid 1972 | Uttar Pradesh |
| *Tinodes alpachastra* Schmid 1972 | Sikkim |
| *Tinodes analoka* Schmid 1972 | Tamil Nadu |
| *Tinodes anibhrita* Schmid 1972 | West Bengal, Meghalaya Arunachal Pradesh |
| *Tinodes aprakrita* Schmid 1972 | Meghalaya, Mizoram |
| *Tinodes arala* Schmid 1972 | Meghalaya |
| *Tinodes atichastra* Schmid 1972 | Sikkim |
| *Tinodes chrinidhara* Schmid 1972 | Arunachal Pradesh |
| *Tinodes dirghachastra* Schmid 1972 | Arunachal Pradesh |
| *Tinodes lavidhara* Schmid 1972 | Manipur |
| *Tinodes natichastra* Schmid 1972 | West Bengal |
| *Tinodes prisatkayukta* Schmid 1972 | Manipur, Uttar Pradesh |
| *Tinodes prithulavi* Schmid 1972 | Uttar Pradesh |
| *Tinodes pullulans* Navas 1932 | Maharashtra, Meghalaya Mizoram Manipur, Karnataka, Madya Pradesh (Schmid 1972) |
| *Tinodes utchringita* Schmid 1972 | Meghalaya |
| *Tinodes utchunalinga* Schmid 1972 | Uttar Pradesh |
| *Tinodes vadichayudha* Schmid 1972 | Tamil Nadu |
| *Tinodes vristchika* Schmid 1972 | Arunachal Pradesh |

## Family DIPSEUDOPSIDAE

Larvae construct branching tubes of silk covered with sand or silt. They often also burrow in soft sediments and feed on fine organic particles and algae filtered from current passing through the tube by meshes of silken threads in a bulbous expansion of the tube. This family is represented by single genus with 11 species from India.

### Genus *Dipseudopsis*

| | |
|---|---|
| *Dipseudopsis bicolorata* Martynov 1935 | Maharashtra |
| *Dipseudopsis bombayana* Martynov 1935 | Maharashtra |
| *Dipseudopsis buddha* Banks 1913 | Bihar |
| *Dipseudopsis doehleri* Ulmer 1929 | Meghalaya |

| | |
|---|---|
| *Dipseudopsis indica* McLachlan 1875 | [India] |
| | [India] (Maxwell-Lefroy 1909) |
| | Orissa, {Bengal} (Martynov 1935) |
| *Dipseudopsis lamellata* Martynov 1935 | {Assam} |
| *Dipseudopsis modesta* Banks 1911 | Bihar |
| *Dipseudopsis onychophora* Navas 1935 | Maharashtra |
| *Dipseudopsis pallida* Martynov 1935 | Bihar |
| *Dipseudopsis recta* Martynov 1935 | Bihar |
| *Dipseudopsis triclavata* Martynov 1935 | Maharashtra, {Assam} |

## Family POLYCENTROPODIDAE

Some larvae construct fixed tubular shelters of silk of cover depressions in rocks with a silken roof, and are largely predacious. The habitat is running or standing waters.This family is represented by three genera with 9 species from India.

### Genus *Hyalopsyche*

| | |
|---|---|
| *Hyalopsyche parsula* Martynov 1935 | {Assam} |
| *Hyalopsyche similis* Martynov 1935 | Bihar, Maharashtra |

### Genus *Nyctiophlax*

| | |
|---|---|
| *Nyctiophlax abruptus* (Bank 1913) | {Bengal} |

### Genus *Plectrocnemia*

| | |
|---|---|
| *Plectrocnemia aurea* Ulmer 1905 | Sikkim |
| | {West Bengal} (Ulmer 1907, |
| | Martynov 1935) |
| *Plectrocnemia banksi* Fischer 1962 | Sikkim (Banks 1920) |
| *Plectrocnemia distincta* Martynov 1935 | [India] |
| *Plectrocnemia navasi* Ulmer 1906 | [India] |
| | Sikkim (Maxwell-Lefroy 1909) |
| *Plectrocnemia obliquofasciata* Martynov 1935 | {Punjab} |
| *Plectrocnemia punjabica* Martynov 1935 | {Punjab} |

## Family HYDROPSYCHIDAE

Larvae construct fixed shelters of plant and rock fragments on rocks or logs, usually in rivers and streams, but occasionally along wave-washed shorelines of lakes. Larvae feed on algae, organic particles, and invertebrates filtered from the water current by a silken net, constructed at the entrance to the shelter. This family is represented by fifteen genera with 60 species from India.

### Genus *Aethaloptera*

| | |
|---|---|
| *Aethaloptera sexpunctata* (Kolenati 1859) | [East India]<br>{S. Bengal} (Betten 1909)<br>Bihar (Martynov 1935) |

### Genus *Amphipsyche*

| | |
|---|---|
| *Amphipsyche apicalis* Banks 1939 | [India] |
| *Amphipsyche bengalensis* Martynov 1935 | {Bengal} |
| *Amphipsyche distincta* Martynov 1935 | [C. India]<br>Karnataka (Banks 1939). |
| *Amphipsyche indica* Martynov 1935 | Bihar, {Bengal}<br>(also Hafiz 1937)<br>[S. India] (Seshadri 1955) |
| *Amphipsyche nirvana* Banks 1913 | Bihar |
| *Amphipsyche proluta* McLachlan 1935 | Mahrashtra (Navas 1934) |
| *Amphipsyche sigmosa* Navas 1935 | Maharashtra |
| *Amphipsyche tricalcarata* Martynov 1935 | Orissa |
| *Amphipsyche vedana* Banks 1913 | Bihar |

### Genus *Amphipsychella*

| | |
|---|---|
| *Amphipsychella extrema* Martynov 1935 | {Bengal} |

### Genus *Arctopsyche*

| | |
|---|---|
| *Arctopsyche arcuata* Schmid 1968 | Arunachal Pradesh |
| *Arctopsyche bicornis* Schmid 1968 | Arunachal Pradesh |
| *Arctopsyche composita* Martynov 1930 | Sikkim, Arunachal Pradesh,<br>Uttar Pradesh, Sikkim<br>(Schmid 1968) |
| *Arctopsyche fissa* Schmid 1968 | Sikkim |
| *Arctopsyche inaequispinosa* Schmid 1968 | Sikkim |

| | |
|---|---|
| *Arctopsyche integra* Schmid 1968 | Arunachal Pradesh, Sikkim |
| *Arctopsyche lobata* Martynov 1930 | {Punjab}, {Bengal}, (Martynov 1935) Uttar Pradesh, Sikkim, Manipur, Arunachal Pradesh (Schmid 1968) |
| *Arctopsyche pluviosa* Navas 1916 | {West Bengal} |
| *Arctopsyche tricornis* Schmid 1968 | Meghalaya |

Genus ***Cheumatopsyche***

| | |
|---|---|
| *Cheumatopsyche chlorogastra* Navas 1932 | Maharashtra |
| *Cheumatopsyche columnata* Martynov 1935 | [C. India] |
| *Cheumatopsyche curvata* Martynov 1935 | [C. India] |
| *Cheumatopsyche lebasi* Navas 1932 | {West Bengal} {Bengal} (Martynov 1935) |
| *Cheumatopsyche processuata* Martynov 1927 | Bihar (Martynov 1935) |
| *Cheumatopsyche stenocyta* Navas 1932 | Maharashtra |
| *Cheumatopsyche suffusa* Naves 1932 | Maharastra |
| *Cheumatopsyche truncata* Martynov 1935 | [C. India], {Assam} Uttar Pradesh |

Genus ***Diplectrona***

| | |
|---|---|
| *Diplectrona brunnea* Betten 1909 | {Assam} |
| *Diplectona indica* Mosely 1931 | Maharashtra |
| *Diplectrona marginata* Betten 1909 | {West Bengal} {Bengal}, {Punjab} |
| *Diplectrona orientalis* Betten 1909 | {West Bengal} |
| *Diplectrona salai* Navas 1932 | Maharashtra |
| *Diplectrona ulmeri* Martynov 1935 | Bihar |

Genus ***Hydatopsyche***

| | |
|---|---|
| *Hydatopsyche spatulata* Maharashtra 1931 | Maharashtra |

Genus ***Hydromanicus***

| | |
|---|---|
| *Hydromanicus truncatus* Betten 1909 | {Bengal} |

Genus ***Hydropsyche***

| | |
|---|---|
| *Hydropsyche asiatica* Ulmer 1905 | Sikkim {West Bengal} (Betten 1909) |
| *Hydropsyche indica* Betten 1909 | {West Bengal} |
| *Hydropsyche lobulata* Martynov 1936 | {Bengal} |
| *Hydropsyche luctuosus* Ulmer 1905 | Sikkim |
| *Hydropsyche pallidipennis* Martynov 1936 | Uttar Pradesh |
| *Hydropsyche sagittata* Martynov 1936 | Bihar |

Genus ***Hydropsychodes***

| | |
|---|---|
| *Hydropsychodes indica* Navas 1932 | (Maharashtra) |

Genus ***Macrostemum***

| | |
|---|---|
| *Macrostemum ethelda* (Banks 1939) | Karnataka |
| *Macrostemum fastosum* (Walker 1852) | Sikkim (Ulmer 1906) {Assam} (Ulmer 1907) {West Bengal} (Betten 1909) {West Bengal} {Assam} Martynov 1935 |
| forma *bifasciatum* Martynov 1935 | {Bengal} |
| forma *fuscum* Martynov 1935 | {Bengal} |
| *Macrostemum fulvescens* (Martynov 1935) | Kerala |
| *Macrostemum indistinctum* (Banks 1911) | {Bengal} |
| *Macrostemum pallidipennis* (Martynov 1935) | Bihar |
| *Macrostemum pseudoneura* (Brauer 1865) | Karnatake (Martynov 1935) |
| *Macrostemum quinquefasciatum* (Mart. 1935) | Uttar Pradesh |

Genus ***Oestropsyche***

| | |
|---|---|
| *Oestropsyche hageni* Banks 1939 | [India] |
| *Oestropsyche vitrina* (Hagen 1859) | Bihar (Martynov 1935) |

Genus ***Parapsyche***

| | |
|---|---|
| *Parapsyche kchina* Schmid 1968 | Arunachal Pradesh |
| *Parapsyche mahati* Schmid 1968 | Sikkim |
| *Parapsyche tchandratchuda* Schmid 1968 | Manipur |
| *Parapsyche variyasi* Schmid 1968 | Arunachal Pradesh |

Genus ***Polymorphanisus***

| | |
|---|---|
| *Polymorphanisus flavipes* Banks 1939 | [India] |
| *Polymorphanisus indicus* Banks 1911 | {Bengal} |

| | |
|---|---|
| *Polymorphanisus nigrcornis* Walker 1852 | [North India] {Assam} (Betten 1909) Tamil Nadu (Martynov 1935) |
| *Polymorphanisus ocularis* Ulmer 1906 | Orissa (Martynov 1935) |
| *Polymorphanisus tumidus* Banks 1939 | [India] |

Genus ***Trichomacronema***

| | |
|---|---|
| *Trichomacronema shanorum* Schmid 1964 | Manipur Uttar Pradesh, (Martynov 1935) |

## Family ECNOMIDAE

Larvae construct fixed meandering tubes of silk, covered with sand or detrital particles, within which they feed on periphyton and fine organic particles from the substrate. The habitats are lakes, ponds, and slow running waters. This family is represented by single genus with 7 species from India.

Genus ***Ecnomus***

| | |
|---|---|
| *Ecnomus costalis* Martynov 1935 | [Central India] |
| *Ecnomus fletcheri* Mosely 1932 | Tamil Nadu |
| *Ecnomus indicus* Martynov 1935 | Bihar |
| *Ecnomus montanus* Mosely 1932 | Jammu & Kashmir, Uttar Pradesh [C. India] (Martinov 1935) |
| *Ecnomus moselyi* Martynov 1935 | Bihar |
| *Ecnomus pusanus* Mosely 1932 | Bihar Maharashtra (Martynov 1935) |
| *Ecnomus tenellus* Ramb 1842 | [India] (Martynov 1935) Maharashtra (Mosely 1932) |

## Suborder : INTEGRIPALPIA

## Family : PHRYGANOPSYCHIDAE

The larval case consists mainly of small pieces of plant debris; very irregular, loosely held together, and flexible. The habitat is marginal pools of streams and springs. This family is represented by single genus with 3 species from India.

Genus ***Phryganopsyche***

| | |
|---|---|
| *Phryganopsyche latipennis elongata* (Kimmins 1950) | Meghalaya |
| *Phryganopsyche latipennis sikkimensis* (Kimmins 1950) | West Bengal |
| *Phryganopsyche latipennis* (Banks 1906) | Sikkim, Manipur<br>Arunachal Pradesh<br>(Schmid 1968) |

(Accroding to Schmid 1968, a very variable species with no subspecies)

Family : PHRYGANEIDAE

The larval case usually consists of leaf or bark pieces, fashioned into a continuous spiral coil or discrete cylindrical sections, joined end to end or arranged irregularly. Pupae in some genera are unusual among Trichoptera in lacking mandibles (adecticous). The habitat is mainly lakes and marshes; some species live in slower parts of streams, a few in temporary pools. This family is represented by three genera with 9 species from India.

Genus ***Eubasilissa***

| | |
|---|---|
| *Eubasilissa alaknanda* Schmid 1962 | Uttar Pradesh |
| *Eubasilissa asiatica* (Betten 1909) | {Assam} (Sibsagar) |
| (According to Schmid 1962 Sibsagar improbable : probably Srinagar (Kashmir) | |
| *Eubasilissa avalokhita* Schmid 1962 | Arunachal Pradesh |
| subsp. *naga* Schmid 1962 | Manipur |
| *Eubasilissa maclachlani* White 1862 | [India]<br>{Assam}, [W. & E. Himalaya]<br>(Betten 1909)<br>{West Bengal} (Martynov 1930)<br>{Punjab} or Uttar Pradesh<br>(Martynov 1936)<br>Uttar Pradesh, Arunachal Pradesh,<br>Sikkim (Schmid 1962) |
| *Eubasilissa chomolhari* Schmid 1962 | Arunachal Pradesh |
| *Eubasilissa regina* McLachlan 1871 | [India] (Ulmer 1907)<br>Uttar Pradesh or<br>{Punjab} (Martynov 1930) |
| *Eubasilissa tibetana* Martynov 1930 | Sikkim (Schmid 1962) |

Genus *Neurocyta*

| | |
|---|---|
| *Neurocyta arenata* Navas 1916 | {West Bengal}, (Sikkim) |

### Genus *Oopterygia*

Oopterygia asiatica Betten 1909 {Assam}

## Family LEPIDOSTOMATIDAE

Larval cases consist of plant or mineral materials variously arranged, frequently of quadrate pieces of leaves or bark forming a four-sided case. The habitat is mainly cool running waters where current is slow; some species are found in the littoral zone of lakes. The larvae feed mainly on plant detritus. This family is represented by sixteen genera with 29 species from India.

### Genus *Adinarthrella*

*Adinarthrella brunnea* Mosely 1941 {Assam}

*Adinarthrella kimsa* Mosely 1941 Sikkim

### Genus *Adinarthrum*

*Adinarthrum kurseum* Mosely 1949 Sikkim, {Assam}

*Adinarthrum moulmina* Mosely 1949 Assam

### Genus *Agoerodes*

*Agoerodes sida* Mosely 1949 Sikkim

### Genus *Anacrunoecia*

*Anacrunoecia assamensis* Mosely 1949 {Assam}

### Genus *Dinarthrella*

*Dinarthrella betteni* Martynov 1936 [E. Himalaya]
{West Bengal} (Betten 1909) (sp.)
{West Bengal} (Mosely 1949)

### Genus *Dinarthrum*

*Dinarthrum ferox* McLachlan 1871 [N. India]
[N. India] (Mosely 1939)

*Dinarthrum margulum* Mosely 1949 Jammu & Kashmir

*Dinarthrum naganum* Mosely 1939 Jammu & Kashmir

*Dinarthrum rema* Mosely 1939 {Punjab}

*Dinarthrum sonomax* Mosely 1939 Jammu & Kashmir

*Dinarthrum destructa* (Ulmer 1906) {West Bengal}
{West Bengal} (Kimmins 1952)

Genus ***Goerodella***

| | |
|---|---|
| *Goerodella tesarum* Mosely 1949 | Uttar Pradesh |

Genus ***Goerodes***

| | |
|---|---|
| *Goerodes fuscatus* (Navas 1932) | Maharashtra<br>[S. India] (Martynov 1936) |
| *Goerodes inaequalis* (Martynov 1936) | [W. Himalayas] |
| *Goerodes khasianus* Mosely 1949 | Meghalaya |
| *Goerodes palnius* Mosely 1949 | Tamil Nadu |

Genus ***Goerodella***

| | |
|---|---|
| *Goerodina dubitans* Mosely 1949 | Meghalaya |
| *Goerodina serrata* Mosely 1949 | Meghalaya |

Genus ***Hypodinarthrum***

| | |
|---|---|
| *Hypodinarthrum parvulum* McLachlan 1875 | Jammu & Kashmir (Mosely 1939) |

Genus ***Indodinarthrum***

| | |
|---|---|
| *Indodinarthrum latum* Martynov 1936 | {West Bengal}, {Punjab} |
| *Indodinarthrum punjabicum* Martynov 1936 | {Punjab} |

Genus ***Kodala***

| | |
|---|---|
| *Kodala lanca* Mosely 1949 | Tamil Nadu |

Genus ***Metadinarthrum***

| | |
|---|---|
| *Metadinarthrum parvulum* McLachlan 1878 | Jammu & Kashmir<br>(also Mosely 1939) |

Genus ***Paraphlegopteryx***

| | |
|---|---|
| *Paraphlegopteryx composita* Mart. 1936 | [E. Himalaya]<br>Uttar Pradesh (Mosely 1949) |
| *Paraphlegopteryx normalis* Mosely 1949 | West Bengal |

Genus ***Indocrunoecia***

| | |
|---|---|
| *Indocrunoecia heterolepidia* Mart. 1936 | West Bengal |

Genus ***Ulmerodes***

| | |
|---|---|
| *Ulmerodes armatus* (Ulmer 1905) | {Assam} |

## Family BRACHYCENTRIDAE

The larval case usually consists of plant materials; it is often four sided, of sand in some genera or largely of silk alone. The habitat is running water; some genera are characteristic of small, cool streams, others of large rivers. This family is represented by two genera with 12 species from India.

### Genus *Brachycentrus*

| | |
|---|---|
| *Brachycentrus kozlovi* Martynov 1909 | Kashmir & Ladakh (Mosely 1938)<br>Sikkim & Uttar Pradesh (Schmid 1961) |

### Genus *Micrasema*

| | |
|---|---|
| *Micrasema abghavyani* Schmid 1992 | Sikkim |
| *Micrasema adhacharam* Schmid 1992 | Assam, Manipur |
| *Micrasema adhiram* Schmid 1992 | Sikkim |
| *Micrasema aparatitam* Schmid 1992 | Assam |
| *Micrasema arsajjanam* Schmid 1992 | Assam |
| *Micrasema avadhiritam* Schmid 1992 | Assam, Meghalaya |
| *Micrasema dabhram* Schmid 1992 | Uttar Pradesh |
| *Micrasema jihmam* Schmid 1992 | Sikkim |
| *Micrasema karunam* Schmid 1992 | Assam, Manipur |
| *Micrasema kripanam* Schmid 1992 | Assam |
| *Micrasema punjaubi* Mosely 1938 | {Punjab} |

## Family : UENOIDAE

The larval case of fine sand or silk alone is very slender. The habitat is rapid streams. Larvae are found mainly on rocks; they are gregarious, and scrap algae and fine organic particles. This family is represented by single genus with 6 species from India.

### Genus *Uenoa*

| | |
|---|---|
| *Uenoa arcuata* Wiggins, Weaver & Unzicker 1985 | Arunachal Pradesh |
| *Uenoa fernandoschmidi* Botosaneanu 1979 | Uttar Pradesh |
| *Uenoa hiberna* Kimmins 1964 | Uttar Pradesh, Sikkim, West Bengal, Meghalaya, Manipur, Arunachal Pradesh (Wiggins et al. 1985) |
| *Uenoa hindustana* (Martynov 1936) | {Punjab} |
| *Uenoa laga* Mosely 1939 | Jammu & Kashmir |
| *Uenoa punja* Mosely 1939 | {Punjab} |

## Family : LIMNEPHILIDAE

The larval case consists of plant or mineral materials, frequently combined, and arranged in many different ways. The habitat is running and standing water, including temporary pools, sometimes even brackish water. This family is represented by 12 genera with 59 species from India.

### Genus *Apatania*

| | |
|---|---|
| *Apatania avyddhagada* Schmid 1968 | Uttar Pradesh |
| *Apatania bhimagada* Schmid 1968 | Arunachal Pradesh |
| *Apatania brevis* Mosely 1936 | Jammu & Kashmir |
| *Apatania devisaraspali* Schmid 1968 | Uttar Pradesh, (Schmid 1968) |
| *Apatania dirghabahu* Schmid 1968 | Sikkim |
| *Apatania extenta* Kimmins 1950 | Arunachal Pradesh |

### Genus *Apataniana*

| | |
|---|---|
| *Apataniana charadija* Schmid 1968 | Uttar Pradesh |

### Genus *Apatelina*

| | |
|---|---|
| *Apatelina incerta* Martynov 1936 | [India] |

(Probably *Moropsyche* according to Schmid 1968)

### Genus *Aplatyphlax*

| | |
|---|---|
| *Aplatyphlax cristatus* Kimmins 1950 | Arunachal Pradesh |
| *Aplatyphlax erectus* Kimmins 1950 | Arunachal Pradesh |
| *Aplatyphlax steeleae* Kimmins 1950 | Arunachal Pradesh |
| *Aplatyphlax eupalinos* Schmid 1991 | Sikkim |
| *Aplatyphlax mishmicus* Kimmins 1950 | Arunachal Pradesh |
| *Aplatyphlax terrestris* Schmid 1991 | Assam |

### Genus *Astenophylina*

| | |
|---|---|
| *Astenophylina kashmira* Mosely 1936 | Jammu & Kashmir |

### Genus *Astratodina*

| | |
|---|---|
| *Astratodina antenor* Schmid 1991 | Sikkim |
| *Astratodina anteros* Schmid 1991 | Uttar Pradesh, Sikkim |

### Genus *Asynarchus*

| | |
|---|---|
| *Asynarchus tibetanus* Schmid 1966 | Sikkim |

Genus ***Limnephilus***

| | |
|---|---|
| *Limnephilus fuscovittatus* Schmid 1966 | Sikkim |
| *Limnephilus tibeticus* Schmid 1966 | Uttar Pradesh |

Genus ***Moropsyche***

| | |
|---|---|
| *Moropsyche avikritanga* Schmid 1968 | Manipur |
| *Moropsyche chandrabuchita* Schmid 1968 | Meghalaya, Manipur |
| *Moropsyche dirghakarni* Schmid 1968 | Meghalaya |
| *Moropsyche gairichringiya* Schmid 1968 | Manipur |
| *Moropsyche girautcharichnu* Schmid 1968 | Arunachal Pradesh |
| *Moropsyche girikchit* Schmid 1968 | Manipur |
| *Moropsyche krichnaruna* Schmid 1968 | Sikkim, Arunachal Pradesh |
| *Moropsyche trikonakarni* Schmid 1968 | Sikkim |
| *Moropsyche urdhvakarni* Schmid 1968 | Manipur |
| *Moropsyche vanegudha* Schmid 1968 | Arunachal Pradesh |

Genus ***Notania***

| | |
|---|---|
| *Notania adhanya* Schmid 1968 | Sikkim |
| *Notania brunnea* Mosely 1950 | Arunachal Pradesh |
| *Notania itarichta* Schmid 1968 | Sikkim |
| *Notania kricha* Schmid 1968 | Arunachal Pradesh |

Genus ***Phylostenax***

| | |
|---|---|
| *Phylostenax himalus* Mosely 1935 | Uttar Pradesh, West Bengal |

Genus ***Pseudostenophylax***

| | |
|---|---|
| *Pseudostenophylax acutifalcatus* Schmid 1991 | Assam Manipur |
| *Pseudostenophylax amphion* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax angulatus* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax angustifalctus* Schmid 1991 | Assam |
| *Pseudostenophylax arwiel* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax bifalcatus* Schmid 1991 | Assam |
| *Pseudostenophylax fimbriatofalcatus* Schmid 1991 | Sikkim |
| *Pseudostenophylax garhwalensis* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax glycerion* Schmid 1991 | Sikkim |

| | |
|---|---|
| *Pseudostenophylax griseolus* Martynov 1930 | Sikkim, (Mosely 1936) |
| *Pseudostenophylax himalayanus* Martynov 1930 | Sikkim |
| *Pseudostenophylax indicus* Navas 1917 | {West Bengal} |
| *Pseudostenophylax ithuriel* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax kashmirensis* (Mosely 1936) | Jammu & Kashmir |
| *Pseudostenophylax latifalcatus* Schmid 1991 | Assam |
| *Pseudostenophylax micraulax* (Mart. 1928) | Jammu & Kashmir |
| *Pseudostenophylax mitchelli* (Mosely 1936) | Jammu & Kashmir |
| *Pseudostenophylax nectarion* Schmid 1991 | Assam, Manipur |
| *Pseudostenophylax ovalis* Schmid 1991 | Uttar Pradesh |
| *Pseudostenophylax pauper* Schmid 1991 | Sikkim |
| *Pseudostenophylax schelpei* (Kimm. 1854) | {Punjab} |
| *Pseudostenophylax secretus* Mart. 1927 | {Punjab}<br>Sikkim (Mosely 1936) |
| *Pseudostenophylax squamolineatus* Schmid 1991 | Assam, Manipur |
| *Pseudostenophylax tenuifalcatus* Schmid 1991 | Sikkim |

## Family : GOERIDAE

The larval case consists of rock fragments, and is curved. The habitat is running water; a few species are confined to water-saturated organic ooze around spring seepage. This family is represented by two genera with 30 species from India.

### Genus *Goera*

| | |
|---|---|
| *Goera arisudana* Schmid 1991 | Assam |
| *Goera dandaka* Schmid 1991 | Uttar Pradesh |
| *Goera dilipa* Schmid 1991 | Assam |
| *Goera janaka* Schmid 1991 | Assam, Manipur |
| *Goera kalimpa* Mosely 1938 | {West Bengal} |
| *Goera kausalya* Schmid 1991 | Sikkim |
| *Goera kursea* Mosely 1938 | {West Bengal} |
| *Goera maithili* Schmid 1991 | Assam |
| *Goera mandna* Mosely 1938 | Uttar Pradesh, Sikkim, Assam |
| *Goera mishmia* Mosely 1938 | Arunachal Pradesh |
| *Goera nigricornis* Navas 1932 | Maharashtra |

| | |
|---|---|
| *Goera poarabhava* Schmid 1991 | Assam, Manipur |
| *Goera paracrita* Schmid 1991 | Uttar Pradesh |
| *Goera parakiya* Schmid 1991 | Kerala |
| *Goera paramahanas* Schmid 1991 | Assam |
| *Goera paramika* Schmid 1991 | Assam |
| *Goera parayatta* Schmid 1991 | Assam |
| *Goera paropadecha* Schmid 1991 | Madras |
| *Goera raghu* Schmid 1991 | Sikkim |
| *Goera rakchasa* Schmid 1991 | Assam, Manipur |
| *Goera relicta* Betten 1909 | [India] |
| *Goera sarayu* Schmid 1991 | Uttar Pradesh |
| *Goera tridens* Mosely 1938 | [India] |
| *Goera vaichravana* Schmid 1991 | Uttar Pradesh |
| *Goera vaidhi* Schmid 1991 | Assam, Manipur |
| *Goera vajnadatta* Schmid 1991 | Assam |
| *Goera valmiki* Schmid 1991 | Assam |
| *Goera vinata* Schmid 1991 | Assam, Manipur |

Genus ***Larcasia***

| | |
|---|---|
| *Larcasia assamica* Schmid 1965 | Manipur |
| *Larcasia elia* Mosely 1939 | Jammu & Kashmir |

## Family : MOLANNIDAE

The larval case consists mainly of sand, occasionally with organic materials, and is straight and cylindrical but with the lateral margins extended as a flange continuous anteriorly as a dorsal hood over the anterior opening. The habitat is sandy deposits in waters of either little or no current. This family is represented by two genera with 8 species from India.

Genus ***Indomolannodes***

| | |
|---|---|
| *Indomolannodes comans* Wiggins 1968 | Meghalaya |
| *Indomolannodes decurvatus* Wiggins 1968 | Manipur |
| *Indomolannodes excavatus* Wiggins 1968 | Manipur |
| *Indomolannodes falcifer* Wiggins 1968 | Meghalaya, Manipur |
| *Indomolannodes incurvatus* Wiggins 1968 | Arunachal Pradesh, Uttar Pradesh |

Genus ***Molanna***

| | |
|---|---|
| *Molanna crinita* Wiggins 1968 | Arunachal Pradesh |
| *Molanna paramoesta* Wiggins 1968 | Madhya Pradesh, Manipur, Meghalaya, Kerala, Tamil Nadu, Karnataka |
| *Molanna saetigera* Wiggins 1968 | Meghalaya |

Family : LEPTOCERIDAE

The larval case consists of rock or plant material, arranged in diverse ways; sometimes they consist entirely of silk. The habitat is mainly standing waters, in rivers mainly in areas of reduced current. This family is represented by thirteen genera with 248 species from India.

Genus ***Adicella***

| | |
|---|---|
| *Adicella acte* Schmid 1994 | Uttar Pradesh |
| *Adicella aglae* Schmid 1994 | Madras |
| *Adicella athys* Schmid 1994 | Assam, Meghalaya |
| *Adicella athys* Schmid 1994 | Assam |
| *Adicella bifasciata* Kimmins 1963 | Tamil Nadu |
| *Adicella biramosa* Martynov 1936 | {Assam} |
| *Adicella castanea* Kimmins 1963 | Meghalaya |
| *Adicella chloe* Schmid 1994 | Assam |
| *Adicella clelia* Schmid 1994 | Madras |
| *Adicella clio* Schmid 1994 | Mysore |
| *Adicella clotho* Schmid 1994 | Madras |
| *Adicella core* Schmid 1994 | Assam |
| *Adicella danae* Schmid 1994 | Madras |
| *Adicella daphne* Schmid 1994 | Assam |
| *Adicella dhruvasena* Schmid 1961 | Uttar Pradesh, Madhya Pradesh |
| *Adicella dicte* Schmid 1994 | Assam, Meghalaya |
| *Adicella dirce* Schmid 1994 | Sikkim |
| *Adicella dryas* Schmid 1994 | Assam |
| *Adicella dryope* Schmid 1994 | Assam, Manipur |
| *Adicella eloa* Schmid 1994 | Sikkim |
| *Adicella enone* Schmid 1994 | Sikkim |

| | |
|---|---|
| *Adicella erato* Schmid 1994 | Assam, Manipur |
| *Adicella eryale* Schmid 1994 | Assam, Meghalaya |
| *Adicella erynome* Schmid 1994 | Assam, Meghalaya |
| *Adicella eryx* Schmid 1994 | Assam |
| *Adicella eunoia* Schmid 1994 | Assam |
| *Adicella euphrosyne* Schmid 1994 | Sikkim |
| *Adicella eurynoe* Schmid 1994 | Assam; Manipur |
| *Adicella eurypyle* Schmid 1994 | Assam, Manipur |
| *Adicella eurythemiste* Schmid 1994 | Assam, Manipur |
| *Adicella eurythene* Schmid 1994 | Assam |
| *Adicella evadne* Schmid 1994 | Assam, Meghalaya |
| *Adicella evohe* Schmid 1994 | Sikkim |
| *Adicella fulva* Kimmins 1963 | Meghalaya |
| *Adicella hebe* Schmid 1994 | Assam |
| *Adicella lais* Schmid 1994 | Assam |
| *Adicella lampito* Schmid 1994 | Assam |
| *Adicella leda* Schmid 1994 | Assam, Meghalaya |
| *Adicella leto* Schmid 1994 | Assam |
| *Adicella maculata* Kimmins 1963 | Meghalaya |
| *Adicella myrtho* Schmid 1994 | Sikkim |
| *Adicella niobe* Schmid 1994 | Uttar Pradesh |
| *Adicella nyse* Schmid 1994 | Sikkim |
| *Adicella phoebe* Schmid 1994 | Assam |
| *Adicella phryne* Schmid 1994 | Assam, Meghalaya |
| *Adicella thais* Schmid 1994 | Assam |
| *Adicella thalie* Schmid 1994 | Assam |

Genus ***Ceraclea***

| | |
|---|---|
| *Ceraclea distinguenda* (Martynov 1936) | Madhya Pradesh |
| *Ceraclea marginata* (Banks 1911) | Bihar |
| *Ceraclea martynovi* (Forsslund 1940) | Madhya Pradesh |

Genus ***Leptocerus***

| | |
|---|---|
| *Leptocerus agunachila* Schmid 1987 | Arunachal Pradesh |
| *Leptocerus akhunta* Schmid 1987 | Arunachal Pradesh |

| | |
|---|---|
| *Leptocerus ankuchagraha* Schmid 1987 | Arunachal Pradesh |
| *Leptocerus aprachasta* Schmid 1987 | Manipur |
| *Leptocerus atidvaya* Schmid 1987 | Arunachal Pradesh |
| *Leptocerus atiraskrita* Schmid 1987 | Karnataka |
| *Leptocerus atyudatta* Schmid 1987 | Manipur |
| *Leptocerus bahuchaka* Schmid 1987 | Meghalaya, Manipur |
| *Leptocerus bosei* Kimmins 1963 | Madhya Pradesh |
| *Leptocerus chaktika* Schmid 1987 | Meghalaya |
| *Leptocerus chatadalaja* Schmid 1987 | Karnataka, Maharashtra |
| *Leptocerus cherrensis* Kimmins 1963 | Meghalaya (also Schmid 1987) |
| *Leptocerus chyamavadata* Schmid 1987 | Meghalaya |
| *Leptocerus datrayukta* Schmid 1987 | Meghalaya |
| *Leptocerus kchapavarna* Schmid 1987 | Karnataka |
| *Leptocerus mahadbhuta* Schmid 1987 | Mizoram |
| *Leptocerus mahasena* (Schmid 1958) | Karnataka, Madhya Pradesh (Schmid 1987) |
| *Leptocerus mahawansa* (Schmis 1958) | Kerala, Karnataka (Schmid 1987) |
| *Leptocerus manichyana* Schmid 1987 | Manipur |
| *Leptocerus mechakita* Schmid 1987 | Meghalaya |
| *Leptocerus mechavrichana* Schmid 1987 | Kerala |
| *Leptocerus posticus* (Banks 1911) | Maharashtra, {Bengal} Orissa (as *Setodes inlensis* Mart.) Kerala, Andhra Pradesh, Tamil Nadu, Karnataka (Schmid 1987) |
| *Leptocerus prithudhara* Schmid 1987 | Meghalaya |
| *Leptocerus sadbhuta* Schmid 1987 | Meghalaya, Manipur |
| *Leptocerus sakantaka* Schmid 1987 | Karnataka |
| *Leptocerus samchita* Schmid 1987 | Kerala, Karnataka, Tamil Nadu |
| *Leptocerus samnata* Schmid 1987 | Meghalaya |
| *Leptocerus sarchtika* Schmid 1987 | Manipur |
| *Leptocerus sudhara* Schmid 1987 | Kerala, Karnataka |
| *Leptocerus sukhabddha* Schmid 1987 | Kerala, Karnataka |
| *Leptocerus ukchatara* Schmid 1987 | Uttar Pradesh |
| *Leptocerus vakrita* Schmid 1987 | Manipur |

Genus ***Mystacides***

| | |
|---|---|
| *Mystacides khasica* Kimmins 1963 | Meghalaya |

Genus ***Oecetis***

| | |
|---|---|
| *Oecetis angulata* Kimmins 1963 | Meghalaya |
| *Oecetis assamensis* Kimmins 1963 | Meghalaya |
| *Oecetis bengalica* Martynov 1936 | Bihar |
| *Oecetis biramosa* Martynov 1936 | Orissa |
| *Oecetis cristata* Kimmins 1963 | Bihar |
| *Oecetis fimbriata* Navas 1935 | Maharashtra |
| *Oecetis fletcheri* Kimmins 1963 | Meghalaya |
| *Oecetis insignis* (Banks 1911) | Maharashtra |
| *Oecetis multispinosa* Kimmins 1963 | Meghalaya |
| *Oecetis nerviciliata* (Schmid 1958) | Tamil Nadu (Kimmins 1963) |
| *Oecetis pretiosa* (Banks 1913) | Bihar |
| *Oecetis punctulata* Navas 1932 | Maharashtra |
| *Oecetis rectangula* Kimmins 1963 | Meghalaya |
| *Oecetis rufescens* Navas 1932 | Maharashtra |
| *Oecetis scutulata* Martynov 1936 | Madhya Pradesh |
| *Oecetis submaculosa* Kimmins 1963 | Uttar Pradesh |
| *Oecetis villosa* Kimmins 1963 | Meghalaya |

Genus ***Parasetodes***

| | |
|---|---|
| *Parasetodes maculata* (Banks 1911) | Bihar |

Genus ***Poecilopsyche***

| | |
|---|---|
| *Poecilopsyche arjuna* Schmid 1968 | Meghalaya |
| *Poecilopsyche bagha* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche bimasena* Schmid 1968 | Sikkim |
| *Poecilopsyche dhristadyumna* Schmid 1968 | Manipur |
| *Poecilopsyche dhritarashtra* Schmid 1968 | Meghalaya |
| *Poecilopsyche draupadi* Schmid 1968 | West Bengal |
| *Poecilopsyche duhchasana* Schmid 1968 | Manipur |
| *Poecilopsyche durhyodhana* Schmid 1968 | Manipur |
| *Poecilopsyche nakula* Schmid 1968 | Arunachal Pradesh |

| | |
|---|---|
| *Poecilopsyche nasatya* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche pandava* Schmid 1968 | Sikkim |
| *Poecilopsyche pandu* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche sahadeva* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche suyodhana* Schmid 1968 | Sikkim |
| *Poecilopsyche vayu* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche vidura* Schmid 1968 | Arunachal Pradesh |
| *Poecilopsyche yudhishthira* Schmid 1968 | Arunachal Pradesh |

Genus *Setodellina*

| | |
|---|---|
| *Setodellina angustipennis* Martynov 1936 | Karnataka |
| *Setodellina mahadeva* (Banks. 1913) | Karnataka |
| *Setodellina tenuis* Martynov 1936 | Madhya Pradesh |

Genus *Setodes*

| | |
|---|---|
| *Setodes abhichobhita* Schmid 1987 | Uttar Pradesh |
| *Setodes abhiramika* Schmid 1987 | Karnataka |
| *Setodes abhirupa* Schmid 1987 | Uttar Pradesh |
| *Setodes abhrayita* Schmid 1987 | Karnataka |
| *Setodes acchidra* Schmid 1987 | Karnataka, Tamil Nadu |
| *Setodes adusita* Schmid 1987 | Meghalaya |
| *Setodes agarhita* Schmid 1987 | Manipur |
| *Setodes akalanka* Schmid 1987 | Arunachal Pradesh, Sikkim |
| *Setodes akilbicha* Schmid 1987 | Tamil Nadu |
| *Setodes akunchita* Schmid 1987 | Tamil Nadu, Kerala |
| *Setodes akutila* Schmid 1987 | Karnataka |
| *Setodes akutsita* Schmid 1987 | Mizoram |
| *Setodes alampata* Schmid 1987 | Meghalaya |
| *Setodes alukcha* Schmid 1987 | Uttar Pradesh |
| *Setodes antardhana* Schmid 1987 | Arunachal Pradesh |
| *Setodes aparimeya* Schmid 1987 | Arunachal Pradesh, Sikkim |
| *Setodes apinchanga* Schmid 1987 | Meghalaya, Manipur |
| *Setodes apitayati* Schmid 1987 | Arunachal Pradesh |

| | |
|---|---|
| *Setodes argentiferus* McLachlan 1871 | [N. W. India]<br>Bihar (Martynov 1936)<br>Meghalaya, Manipur |
| *Setodes asadjarama* Schmid 1987 | Tamil Nadu |
| *Setodes asammuaddha* Schmid 1987 | Kerala, Karnataka |
| *Setodes atiguna* Schmid 1987 | Meghalaya |
| *Setodes atiloma* Schmid 1987 | Karnataka |
| *Setodes atipunya* Schmid 1987 | Karnataka |
| *Setodes atisubhaga* Schmid 1987 | Manipur |
| *Setodes atitejas* Schmid 1987 | Mizoram |
| *Setodes atymanjula* Schmid 1987 | Tamil Nadu |
| *Setodes atyutkata* Schmid 1987 | Uttar Pradesh |
| *Setodes bhimachringa* Schmid 1987 | Maharashtra, Kerala, Karnataka |
| *Setodes bimaculatus* Martynov 1936 | Bihar |
| *Setodes chandrakita* Schmid 1987 | Arunachal Pradesh |
| *Setodes chandravarna* Schmid 1987 | Meghalaya, Manipur |
| *Setodes chubhamyu* Schmid 1987 | Tamil Nadu, Kerala |
| *Setodes dantavarna* Schmid 1987 | Maharashtra, Kerala<br>Tamil Nadu, Karnataka |
| *Setodes dhanavriddha* Schmid 1987 | Arunachal Pradesh, Uttar Pradesh<br>Sikkim |
| *Setodes dhanika* Schmid 1987 | Uttar Pradesh |
| *Setodes divyarupa* Schmid 1987 | Arunachal Pradesh |
| *Setodes ekachringa* Schmid 1987 | Karnataka |
| *Setodes ekapita* Schmid 1987 | Kerala |
| *Setodes fluvialis* Kimmins 1963 | Uttar Pradesh, Maharashtra, Kerala,<br>Karnataka (Schmid 1987) |
| *Setodes furcatus* Navas 1932 | Maharashtra |
| *Setodes gaurichachringa* Schmid 1987 | Kerala |
| *Setodes gherni* Schmid 1987 | Arunachal Pradesh |
| *Setodes gutika* Schmid 1987 | Arunachal Pradesh |
| *Setodes gutivriddha* Schmid 1987 | Manipur |
| *Setodes himaruna* Schmid 1987 | Karnataka |
| *Setodes jatisampanna* Schmid 1987 | Kerala |

| | |
|---|---|
| *Setodes kadrava* Schmid 1987 | Meghalaya, Manipur, Mizoram, Uttar Pradesh |
| *Setodes kalyand* Schmid 1987 | Karnataka |
| *Setodes kantyamrita* Schmid 1987 | Meghalaya |
| *Setodes kapchajalaja* Schmid 1987 | Kerala, Karnataka |
| *Setodes khechara* Schmid 1987 | Manipur |
| *Setodes kumara* Schmid 1987 | Mizoram |
| *Setodes lineatus* Banks 1913 | Bihar, Meghalaya, Manipur, Madhya Pradesh, Karnataka (Schmid 1987) |
| *Setodes madhuvarna* Schmid 1987 | Kerala, Karnataka, Tamil Nadu |
| *Setodes mahabichu* Schmid 1987 | Maghalaya, Manipur, Mizoram |
| *Setodes manimekhala* Schmid 1987 | Meghalaya, Manipur |
| *Setodes manivriddha* Schmid 1987 | Arunachal Pradesh |
| *Setodes mauktikavriddha* Schmid 1987 | Meghalaya |
| *Setodes meghavarna* Schmid 1987 | Karnataka |
| *Setodes monicae* Schmid 1987 | Karnataka |
| *Setodes nagarjouna nagarjouna* Schmid 1987 | Uttar Pradesh (Schmid 1987) |
| subsp. *assamicus* Schmid 1987 | Meghalaya |
| *Setodes navanita* Schmid 1987 | Meghalaya |
| *Setodes nirmala* Schmid 1987 | Manipur |
| *Setodes nyuna* Schmid 1987 | Karnataka |
| *Setodes pandara* Schmid 1987 | Uttar Pradesh |
| *Setodes paribhuchita* Schmid 1987 | Meghalaya |
| *Setodes parichkrita* Schmid 1987 | Manipur |
| *Setodes parilaghu* Schmid 1987 | Manipur |
| *Setodes parisamchuddha* Schmid 1987 | Maharashtra, Karnataka, Tamil Nadu |
| *Setodes prabhatajalaja* Schmid 1987 | Tamil Nadu |
| *Setodeś pratachandradynti* Schmid 1987 | Tamil Nadu |

| | |
|---|---|
| *Setodes priyadarcha* Schmid 1987 | Uttar Pradesh |
| *Setodes puchkaraja* Schmid 1987 | Meghalaya |
| *Setodes puruchringa* Schmid 1987 | Meghalaya |
| *Setodes sachrika* Schmid 1987 | Mizoram, Manipur |
| *Setodes samphulla* Schmid 1987 | Tamil Nadu |
| *Setodes samprabhinna* Schmid 1987 | Tamil Nadu |
| *Setodes sarvapunya* Schmid 1987 | Kerala |
| *Setodes satichaya* Schmid 1987 | Uttar Pradesh |
| *Setodes savibhrama* Schmid 1987 | Meghalaya, Manipur |
| *Setodes sternalis* Martynov | Madhya Pradesh |
| *Setodes subhachita* Schmid 1987 | Kerala |
| *Setodes sucharu* Schmid 1987 | Meghalaya |
| *Setodes supattra* Schmid 1987 | Karnataka |
| *Setodes tchaturdanta* Schmid 1987 | Sikkim |
| *Setodes tejasvin* Schmid 1987 | Maharashtra, Madhya Pradesh |
| *Setodes tenuifalcatus* Martynov | Madhya Pradesh, Maharashtra, Bihar (Schmid 1987) |
| *Setodes tilakita* Schmid 1987 | Uttar Pradesh |
| *Setodes tridanta* Schmid 1987 | Meghalaya |
| *Setodes trikantayudha* Schmid 1987 | Karnataka, Kerala |
| *Setodes uchita* Schmid 1987 | Meghalaya |
| *Setodes uddharcha* Schmid 1987 | Manipur |
| *Setodes udghona* Schmid 1987 | Manipur |
| *Setodes unispinus* Martynov 1936 | Bihar |
| *Setodes uttamavarna* Schmid 1987 | Kerala, Tamil Nadu |
| *Setodes vichitrita* Schmid 1987 | Tamil Nadu |
| *Setodes viridellus* Navas 1932 | Maharashtra |
| Setodes *vitanka* Schmid 1987 | Karnataka |
| *Setodes vratachakora* Schmid 1987 | Kerala, Tamil Nadu, Karnataka |
| *Setodes yatharupa* Schmid 1987 | Sikkim |

Genus ***Tagalopsyche***

| | |
|---|---|
| *Tagalopsyche flectcheri* kimmins 1963 | Tamil Nadu |

Genus ***Triaenodes***

| | |
|---|---|
| *Triaenodes eximius* Schmid, 1994 | Mysore |
| *Triaenodes fastasio* Schmid, 1994 | Uttar Pardesh |

| | |
|---|---|
| *Triaenodes fortunio* Schmid, 1994 | Assam, Meghalaya |
| *Triaenodes gracillimus* (martynov 1935) | Meghalaya (Schmid 1968) |
| *Triaenodes indicus* Martynov 1936 | [S. India] |
| *Triaenodes internus* McLachlan 1875 | Jammu & Kashmir (Kimmins 1963) |
| *Triaenodes trivulcio* Schmid, 1994 | Assam, Manipur |

Genus ***Trichosetodes***

| | |
|---|---|
| *Trichosetodes angustipennis* (Mart, 1936) | Madhya Pradesh |
| *Trichosetodes atibhadrata* Schmid 1987 | Manipur |
| *Trichosetodes atichayana* Schmid 1987 | Meghalaya, Manipur |
| *Trichosetodes atidhanin* Schmid 1987 | Uttar Pradesh, West Bengal, Sikkim |
| *Trichosetodes atiharin* Schmid 1987 | Maharashtra |
| *Trichosetodes atiramaniya* Schmid 1987 | Meghalaya |
| *Trichosetodes atirupa* Schmid 1987 | Meghalaya |
| *Trichosetodes atisudhara* Schmid 1987 | Meghalaya, Manipur Mizoram |
| *Trichosetodes atisukchma* Schmid 1987 | Madhya Pradesh |
| *Trichosetodes atisukha* Schmid 1987 | Meghalaya |
| *Trichosetodes compositus* Martynov 1936 | Bihar Widespread In India (Schmid 1987) |
| *Trichosetodes damchtragada* Schmid 1987 | Kerala, Karnataka |
| *Trichosetodes karapatradhara* Schmid 1987 | Karnataka, Tamil Nadu, Maharashtra |

Genus ***Triplectides***

| | |
|---|---|
| *Triplectides gilolensis* (Mc Lachlan 1866) | [India] (Betten 1909) |
| *Triplectides indicus* (Walker 1852) | {N. Bengal} |
| *Triplectides magnus* (Walker 1852) | {West Bengal}, (Ulmer 1906) {West Bengal}, Bihar, Orissa (Martynov 1936) |
| *Triplectides viviparus* (Wood-Manson 1890) | {West Bengal} |

## Family CALAMOCERATIDAE

The larval cases usually consist of leaf or bark pieces, or of twigs, hollowed out by larvae. The habitat is streams, where the current is reduced, coastal lakes, and swamps. This family is represented by two genera with 7 species from India.

Genus *Anisocentropus*

| | |
|---|---|
| *Anisocentropus kempi* Sartynov 1936 | Maharashtra |
| *Anisocentropus salsum* (Betten 1909) | {Assam} |
| | West Bengal |
| | (Martynov 1936) |

Genus *Ganonema*

| | |
|---|---|
| *Ganonema brevipenne* Ulmer 1906 | [India] (Banks 1931) |
| *Ganonema flexuosus* Martynov 1936 | Maharashtra |
| *Ganonema fusicpenne* (Albarda 1881) | {Assam} (Ulmer 1906) |
| | {Punjab} or Uttar Pradesh |
| | (Betten 1909) [India] |
| | (serveral localities) |
| | (Martyynov 1936) |
| *Ganonema longipenne* Martynov 1930 | {Assam} |
| *Ganonema simuatus* Martynov 1936 | Orissa |

Family LIMNOCENTROPODIDAE

The larval case consists mainly of rock fragments, with a few plant pieces, frequently also with silken denticles added, and is unusual in the long silken stalk fastening the anterior edge of the case to the substrate. The habitat is strong currents of rapid streams. This family is represented by single genus with 5 species from India.

Genus *Limnocentropus*

| | |
|---|---|
| *Limnocentropus fletcheri* Mosely 1935 | Sikkim |
| *Limnocentropus himalayanus* Martynov 1930 | Sikkim |
| *Limnocentropus insolitus* Ulmer 1907 | {West Bengal} (Ulmer 1926) |
| | Sikkim (Martynov 1930) |
| *Limnocentropus mergatus* Kimmmins 1950 | Sikkim |
| *Limnocentropus rectus* Mosely 1950 | Meghalaya |

Family ODONTOCERIDAE

The larval case consists of fine rock fragments. The habitat is running waters. Larvae usually burrow in loose sediments; they are omnivorous. This family is represented by single genus with 3 species from India.

Genus ***Psilotreta***

| | |
|---|---|
| *Psilotreta assamensis* Parker & Wiggins 1987 | Sikkim, Arunachal Pradesh |
| *Psilotreta schmidi* Parker & Wiggins 1987 | Sikkim |
| *Psilotreta* sp. larva | Arunachal Pradesh (in Parker & Wiggins 1987) |

Family HELICOPSYCHIDAE

The larval cases consist of sand grains, fastened with silk to form a helix, resembling the shells of snails. The habitat is running water, ranging from cool to warm streams about 34°C where few other insects live, and the littoral zone of lakes. This family is represented by two genera with 29 species from India.

Genus ***Cochliophylax***

| | |
|---|---|
| *Cochliophylax antinoe* Schmid 1993 | Assam |
| *Cochliophylax arsinoe* Schmid 1993 | Assam, Manipur |
| *Cochliophylax astynome* Schmid 1993 | Sikkim |
| *Cochliophylax chrysothoe* Schmid 1993 | Assam |
| *Cochliophylax euryboe* Schmid 1993 | Assam |
| *Cochliophylax harmothoe* Schmid 1993 | Assam |
| *Cochliophylax hippothoe* Schmid 1993 | Sikkim |
| *Cochliophylax itonoe* Schmid 1993 | Assam, Manipur |
| *Cochliophylax laothoe* Schmid 1993 | Assam |
| *Cochliophylax phoebe* Schmid 1993 | Assam, Manipur |
| *Cochliophylax xenothoe* Schmid 1993 | Uttar Padesh |

Genus ***Helicopsyche***

| | |
|---|---|
| *Helicopsyche calliope* Schmid 1993 | Assam, Manipur |
| *Helicopsyche callirrhoe* Schmid 1993 | Assam, Meghalaya |
| *Helicopsyche chionadoce* Schmid 1993 | Madras |
| *Helicopsyche cymodoce* Schmid 1993 | Assam |
| *Helicopsyche demodoce* Schmid 1993 | Assam |
| *Helicopsyche erigone* Schmid 1993 | Assam, Meghalaya |
| *Helicopsyche erynoe* Schmid 1993 | Assam |
| *Helicopsyche erythronoe* Schmid 1993 | Manipur |
| *Helicopsyche eurycrene* Schmid 1993 | Madras |

| | |
|---|---|
| *Helicopsyche leucothoe* Schmid 1993 | Manipur |
| *Helicopsyche maculata* Schmid 1993 | Madras |
| *Helicopsyche martynovi* Mosely 1939 | Tamil Nadu |
| *Helicopsyche myrrhine* Schmid 1993 | Mysore |
| *Helicopsyche onodoce* Schmid 1993 | Assam, Manipur |
| *Helicopsyche philodoce* Schmid 1993 | Madras |
| *Helicopsyche thedoce* Schmid 1993 | Assam |
| *Helicopsyche thyonoe* Schmid 1993 | Assam |
| *Helicopsyche* sp. case | Sikkim McLachlan 1875 |

**Key to the Families from India**

1. Small insects, usually 5 mm or less in length, mesoscutum lacking setal warts, mesoscutellar setal warts transverse and meeting mesally to from an angulate ridge (Fig. 1); hind wing narrow and apically acute (Fig. 25); often with a posterior fringe of long setae, the longest approximately the width of hind wing ..... *Hydroptilidae*

1' Insects usually more than 5 mm long; mesoscutum frequently with setal warts (Fig. 2) mesoscutellar setal warts usually rounded or elongate (Fig. 3,4); hind wing usually broader and rounded apically (Fig. 26); posterior fringe when present of relatively short setae ..... 2

2.(1') Ocelli present ..... 3

2' Ocelli absent ..... 12

3.(2') Maxillary palp 5 segmented, terminal segment flexible, usually at least twice as long as the preceding segment (Fig. 37) ..... 4

3' Maxillary palp 3, 4 or 5 segmented, terminal segment similar to others in structure, sub equal to the preceding segment (Fig. 38) ..... 5

4.(3) Middle leg flat, ocelli close and well developed (Fig. 19) ..... *Stenopsychidae*

4'. Middle leg not flat; ocelli widely separated and reduced (Fig. 20) ..... *Philopotamidae*

5.(3') Maxillary palp 5 segmented, 2nd segment short, often rounded and approximately of the same length as the first segment (Fig. 38) ..... 6

5' Maxillary palp 3, 4 or 5 segmented, 2nd segment slender and longer than first ..... 8

6.(5) Maxillary palp with 2nd segment rounded or globose (Fig. 38) ..... 7

6'. Maxillary palp with 2nd segment not globose, but of same cylindrical shape like first (Fig. 41) ..... *Hydrobiosidae*

7.(6) Foretibia with a preapical spur (Fig. 27) ..... *Rhyacophilidae*

7' Foretibia lacking a preapical spur (Fig. 28) ..... *Glossosomatidae*

8.(5') Middle tibia with 2 prepical spurs (Fig. 29) ..... 9

8'. Middle tibia with 1 or no prepical spur ..... 11

9.(8) Mesoscutellum with a pair of elongate or rounded setal warts (Fig. 14) ..... 10

9'. Mesoscutellum with setae scattered over much of the area (Fig. 15) ..... *Phyryganeidae*

10.(9) Mesoscutum with a pair of elongate setal warts (Fig. 14) ..... *Phryganopsychidae*

10' Mesoscutum with 2 pairs of ovoid setal warts (Fig. 16) ..... *Limnocentropodidae*

11.(8')Anterior edge of hind wing with a row of stout, hooked setae (Fig. 26) ..... *Uenoidae*

11' Anterior edge of hind wing lacking row of stout hooked setae, although straight or slightly curved normal setae present ..... *Limnephilidae*

12.(2') Maxillary palp with 5 or more segments (both sexes) ..... 13

12' Maxillary palp with less than 3 segments (males only) ..... 21

13.(12) Terminal segment of maxillary palp similar to others and usually of approximately the same length as preceeding segment (Fig. 39) or some segments with long setae ..... 14

13' Terminal segment of maxillary palp flexible, with numberous cross-striae and different in structure from the preceding segment, usually at least twice as long as the preceding segment (Fig. 43) ..... 24

14.(13) Mesoscutal setae arising in diffuse area over almost the entire length of mesoscutum (Fig. 5) ..... 15

14'. Mesoscutal setae largely confined to pair of small discrete warts (Fig. 6) ..... 17

15.(14) Antennae with scape almost twice as long as pedicel; dorsum of head usually with posteromesal ridge (Fig. 21) ..... *Calamoceratidae*

15' Antennae with scape atleast 3 times longer than pedicel; dorsum of head lacking posteromesal ridge (Fig. 22) ..... 16

16.(15') Antennae much longer than body; middle tibia lacking preapical spurs (Fig. 30) ..... *Leptoceridae*

16'. Antennae short, if longer than body; middle tibia with 2 preapical spurs (Fig. 31) ..... *Molannidae*

17.(14) Dorsum of head with posterior setal warts very large, extending from mesal margin of eye to mid-dorsal line and anteriorly to middle of head, (Fig. 23); antenna never longer than fore wing ..... *Helicopsychidae*

17' Dorsum of head with posterior setal wart small; antennae $1^1/_2$ times longer than fore wing ..... 18

18.(17') Mesoscutellum with 1 mesal setal wart (Fig. 7) ..... 19

18' Mesoscutellum with a pair of setal warts (Fig. 8), although sometimes touching along the middorsal line (Fig. 12) ..... 20

19.(18) Mesoscutellum almost entirely covered by a single setal wart, setal wart, setae arising over most of wart (Fig. 7) ..... *Odontoceridae*

19' Mesoscutellum with setal wart narrower, setae largely confined to preiphery (Fig. 10) ..... ..... *Goeridae*

20.(18') Middle tibia with 1 or 2 preapical spurs arising at a point which is at about one-third distance from tip of tibia (Fig. 32) or without preapical spur; abdomen with openings of glands on venter V in a pair of rounded sclerotized lobes (Fig. 18) ..... *Brachycentridae*

20'. Middle tibia with 2 preapical spurs arising from approx. midpoint of tibia (Fig. 33); abdomen with glands on venter V not apparent ..... *Lepidostomatidae*

21.(12') Dorsum of head with posterior setal warts very large, extending from mesal margin of eye to middorsal line and anteriorly to middle of head (Fig. 23) antennae never longer than fore wing ..... *Helicopsychidae*

21' Dorsum of head with posterior setal wart smaller than above; or antennae $1^{1/2}$ times longer than fore wing ..... 22

22.(21') Mesoscutellum with one mesal setal wart (Fig. 10) ..... *Goeridae*

22'. Mesoscutellum with a pair of setal warts, although sometimes touching along the middorsal line (Fig. 12) ..... 23

23.(22') Middle tibia with 1 or 2 preapical suprs arising at a point about one-third distance from tip of tibia (Fig. 32) or without preapical spurs; abdomen with openings of glands on venter V in a pair of rounded sclerotized lobes (Fig. 18) ..... *Brachycentridae*

23' Middle tibia with 2 preapical spurs arising from approximately midpoint of tibia (Fig. 33). abdomen with glands on venter V not apparent ..... *Lepidostomatidae*

24.(13') Pronotum large and collar-like, with a deep median fissure ..... *Dipseudopsidae*

24' Pronotum not collar like and without deep median fissure ..... 25

25.(24) Mesoscutum lacking setal warts or setae (Fig. 11) ..... *Hydropsychidae*

25' Mesocutum with wetal warts (Fig. 12) ..... 26

26.(25') Mescoscutal setal warts quadrate and appressed along the median line over a large area approximately the size of entire mesoscutellum (Fig. 13) ..... *Xiphocentronidae*

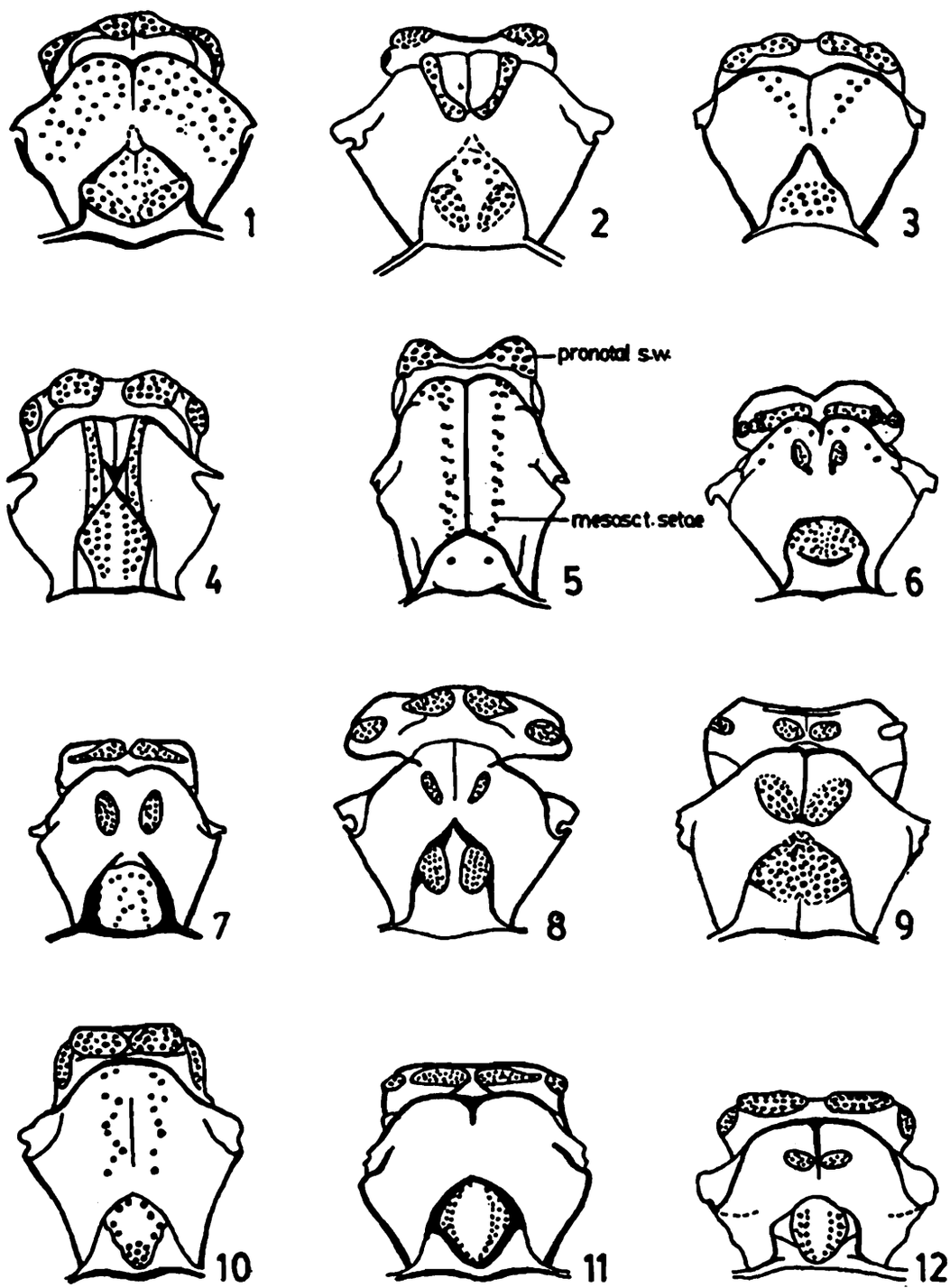
26'. Mesoscutal setal warts circular, sometimes touching at the median line, but much smaller than the mesocutellum (Fig. 14) ..... 27

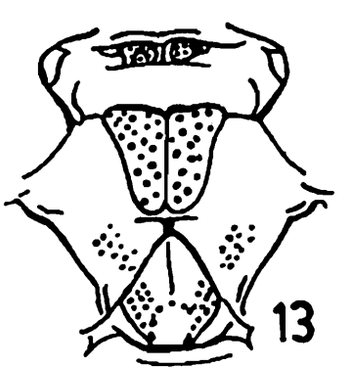
27.(26') Length of basitarsus less than twice the length of longer apical spur (Fig. 34) ..... 28

27' Length of basitarsus at least twice the length of longer apical spur (Fig. 35) ..... ..... *Psychomyiidae*

28.(27) Fore wing with $R_1$ not branched; mesoscutellum with single rounded mesal setal wart ..... ..... *Polycentropodidae*

28. Fore wing with $R_1$ branched; mesoseutellum with pair of rounded setal warts *Ecnomidae*

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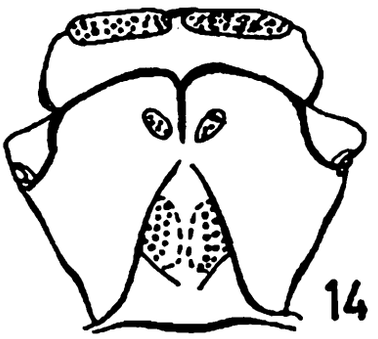
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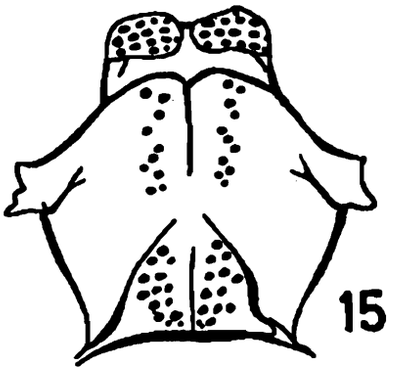
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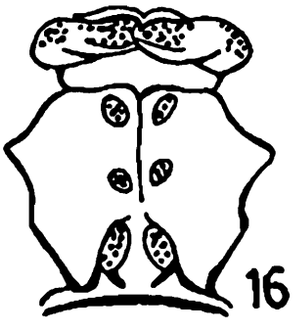
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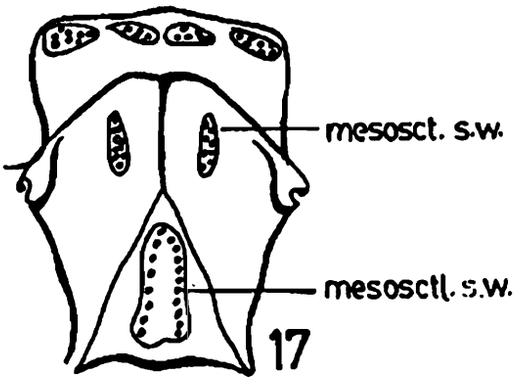

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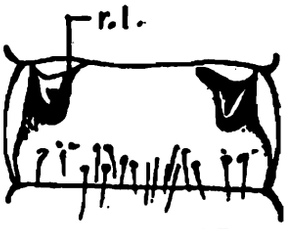

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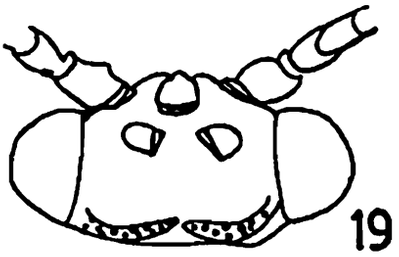
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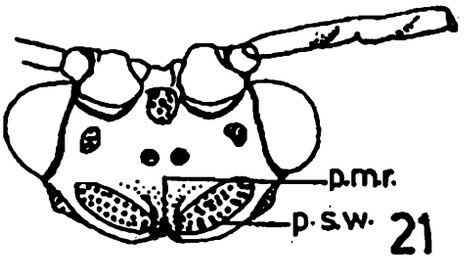

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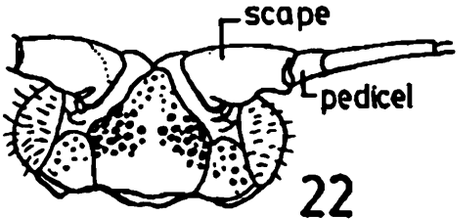

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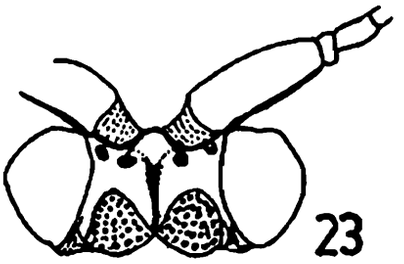
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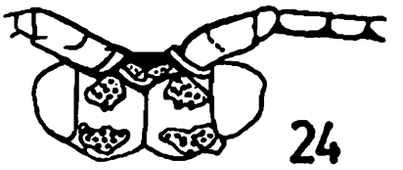
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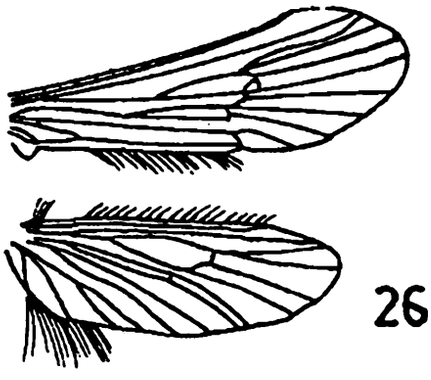
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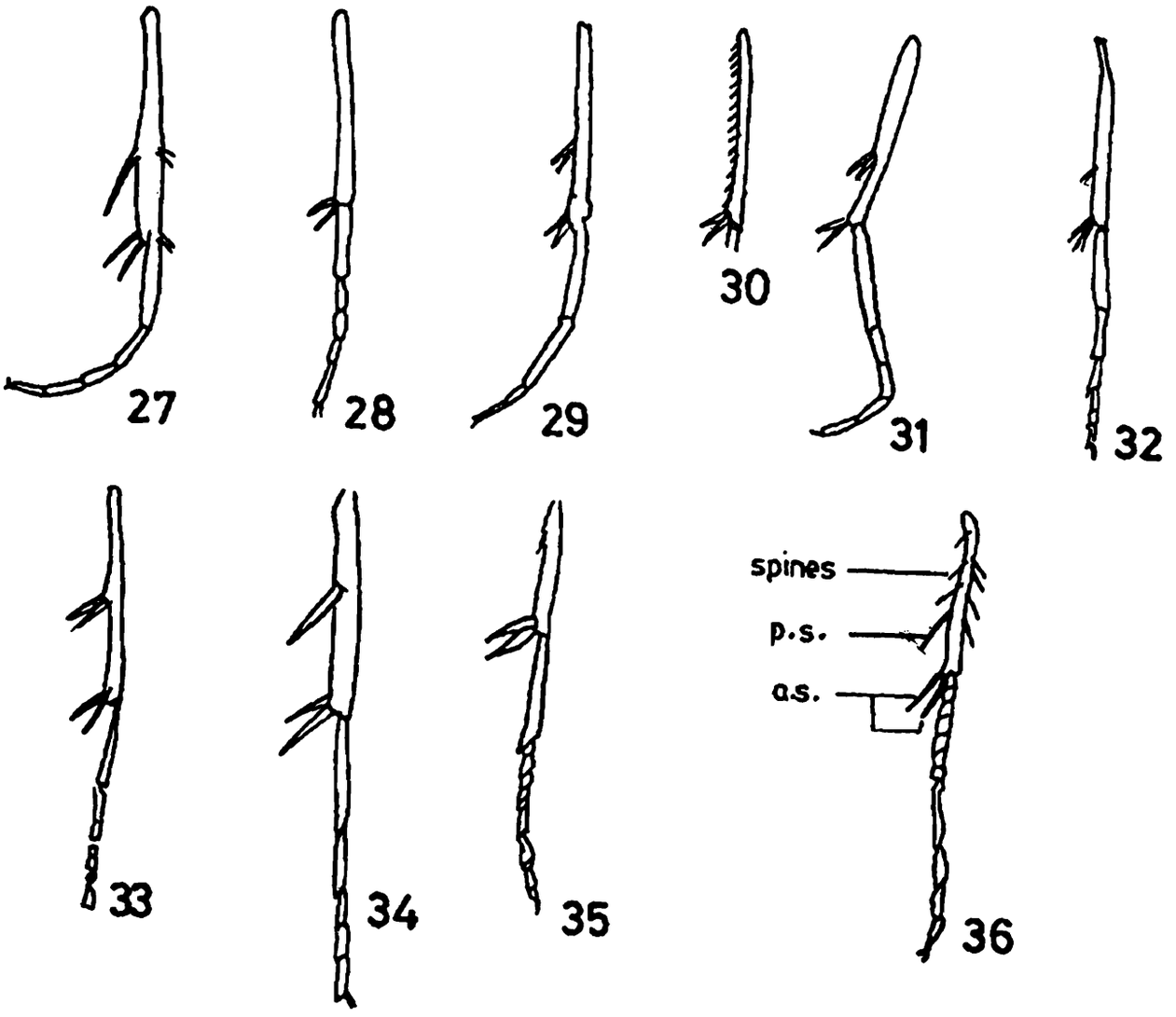
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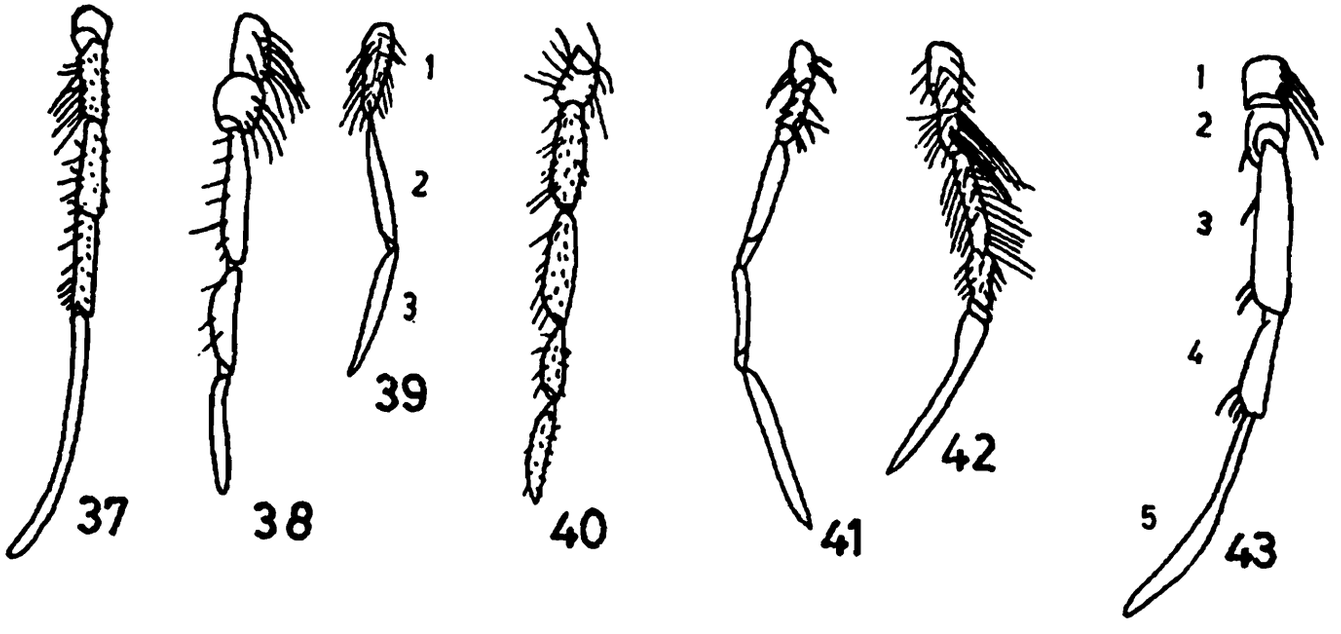
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## EXPLANATION TO FIGURES

**Figures 1-17. Dorsal view of typical pro- and mesonotum of adults of**

1. Hydroptilidae
2. Glossosomatidae
3. Rhyacophilidae
4. Hydrobiosidae
5. Leptoceridae
6. Helicopsychidae
7. Odontoceridae
8. Brachycentridae
9. Lepidostomatidae
10. Limnephilidae
11. Hydropsychidae
12. Polycentropodidae
13. Xiphocentronidae
14. Phryganopsychidae
15. Phryganeidae
16. Limnocentropodidae
17. Uenoidae
18. Ventral view of abdominal segment V of Brachycentridae adult.

**Figures 19-24 : Dorsal view of the typical head of adult of**

19. Stenopsychidae
20. Philopotamidae
21. Calamoceratidae
22. Leptoceridae
23. Helicopsychidae
24. Odontoceridae

**Figures 25-26 : Dorsal view of the wings of**

25. Hydroptilidae
26. Uenoidae
27. Tibia and tarsus of foreleg of Rhyacophilidae
28. Tibia and tarsus of foreleg of Glossosomatidae
29. Middle tibia and tarsus of Phryganeidae
30. Middle tibia of Leptoceridae
31. Middle tibia and tarsus of Molannidae
32. Middle tibia and tarsus of Brachycentridae
33. Middle tibia and tarsus of Lepidostomatidae
34. Foretibia and tarsus of Polycentropodidae
35. Foretibia and tarsus of Psychomyiidae
36. Middle tibia and tarsus of Linnephilidae

**Figures 37-43 : Maxillary palp of**

37. Philopotamidae
38. Glossosomatidae
39. Limnephilidae male
40. Limnephilidae female
41. Hydrobiosidae
42. Odontoceridae
43. Polycentropodidae

## ABBREVIATIONS

1. Pronotal s.w. — Pronotal setal wart
2. Mesosct. setae — mesoscutal setae
3. mesosct. s.w. — mesoscutal setal wart

| | | | |
|---|---|---|---|
| 4. | mesosctl. s.w. | — | mesoscutellar setal wart |
| 5. | r.l. | — | rounded lobe |
| 6. | p.m.r. | — | posteromesal ridge |
| 7. | p.s.w. | — | posterior setal wart |
| 8. | p.s. | — | preapical spur |
| 9. | a.s. | — | apical spurs. |

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