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Dr. J. R. B. ALFRED

Director

Zoological Survey of India

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These specimens will be registered and their data will be computerised. *They are further requested to deposit their type collection positively of ZSI and use the Registration number in their publication of the new taxon.*

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



Rec. zool. Surv. India : 106(Part-2) : 1-11, 2006

ON SOME INTERESTING CHALCIDOID PARASITOIDS ASSOCIATED WITH *EPHEDRA FOLIATA* BOISS ex C.A. MEYER IN INDIA

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INTRODUCTION

Ephedra foliata Boiss. ex C.A. Meyer (Ephedraceae) is a climber species distributed in Sindh, Baluchistan, Kurram Valley, North-West Frontier Province (N.W.F.P.), Pakistan, and Punjab plains to 800 m in Salt range, Rajasthan, Afghanistan, Arabia and Aden (Stapf, 1889; Sahni, 1990; Price, 1996). Ecologically it acts as a soil builder, economically important source of browse for camel, sheep, goat and an important source of pseudoephedrine (Khanna *et al.*, 1976). Five species of Chalcidoids were collected from the seeds of *Ephedra foliata* from its wild locality in Samod near Jaipur in Rajasthan. They are Eurytomidae : *Eurytoma ephedrae* Narendran & Prabha Sharma sp. nov. and *Eurytoma foliatae* Narendran & Rita Singh sp. nov., Torymidae : *Pseudotorymus ephedrae* Narendran & Prabha Sharma sp. nov. and *Idiomacromerus* sp. and Eupelmidae : *Eupelmus urozonus* Dalman. The new species are described and others commented hereunder. The holotypes of the new species are deposited in the Department of Zoology, University of Calicut (DZUC) but eventually will be transferred to Western Ghat Regional Station of Zoological Survey of India, Kozhikode (ZSIK).

1. *Eurytoma ephedrae* Narendran & Prabha Sharma sp. nov. (Figs. 1-5)

Holotype : Female : Length 1.9 mm.

Colour : Black except following : antenna brown with base and apex of scape paler; apices of femora, bases and apices of tibiae pale brownish yellow; tarsi pale brownish yellow, wings hyaline with veins pale white.

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Sculpture : Face, dorsum of mesosoma, mesepisternum, metapleuron and lateral areas of propodeum covered with contiguous setigerous punctures, interstices microreticulate (except lower face smooth); gena, lateral panel of pronotum and mesepimeron microreticulate; femoral depression and fore coxa reticulate; tegula reticulate; hind coxa cross reticulate on dorsal half. Propodeum with a broad shallow microreticulate area, sides with irregular setigerous pits; metasoma glabrous on dorsal side, microreticulate on lower sides.

Head : Posterior margin of gena well carinate and with a groove in front of it; pre-and post-orbital carinae and malar groove indistinct, scrobal basin carinate laterally, scrobe not reaching front ocellus; distance between front ocellus and scrobe more than diameter of front ocellus; median raised ridge extending from interantennal projection to apex of clypeus; face with radiating carinae from mid point of clypeal apex which forms slightly depressed triangle; ratio of lateral ocellus : OOL : POL as 7 : 6 : 24. Antenna with scape not reaching front ocellus; ratio of scape (minus radicle) : pedicel : 2 anelli together : F1 : F2 : F3 : F4 : F5 : clava as 24 : 12 : 2.5 : 10 : 10 : 11 : 10 : 12.5 : 25.

Mesosoma : Fore coxa not distinctly depressed ventrally in basal half for reception of lower head, not carinate, mesopleuron/mesepisternum in ventral view with semicircular carinae meeting medially and protruding forwards between fore coxae; sculptural area (mesosternal shelf) flat, wider than mesocoxal diameter; prepectus triangular with a median curved pit; fore wing 2.25x as long as its maximum width, speculum closed below; ratio of marginal vein : postmarginal : stigmal as 8 : 13 : 10.

Metasoma : Gaster sessile, distinctly longer than mesosoma but distinctly shorter than head plus mesosoma; ratio of gastral tergites (T1–T7) and ovipositor sheath as 13 : 8 : 10 : 28 : 3 : 7 : 10 : 10.

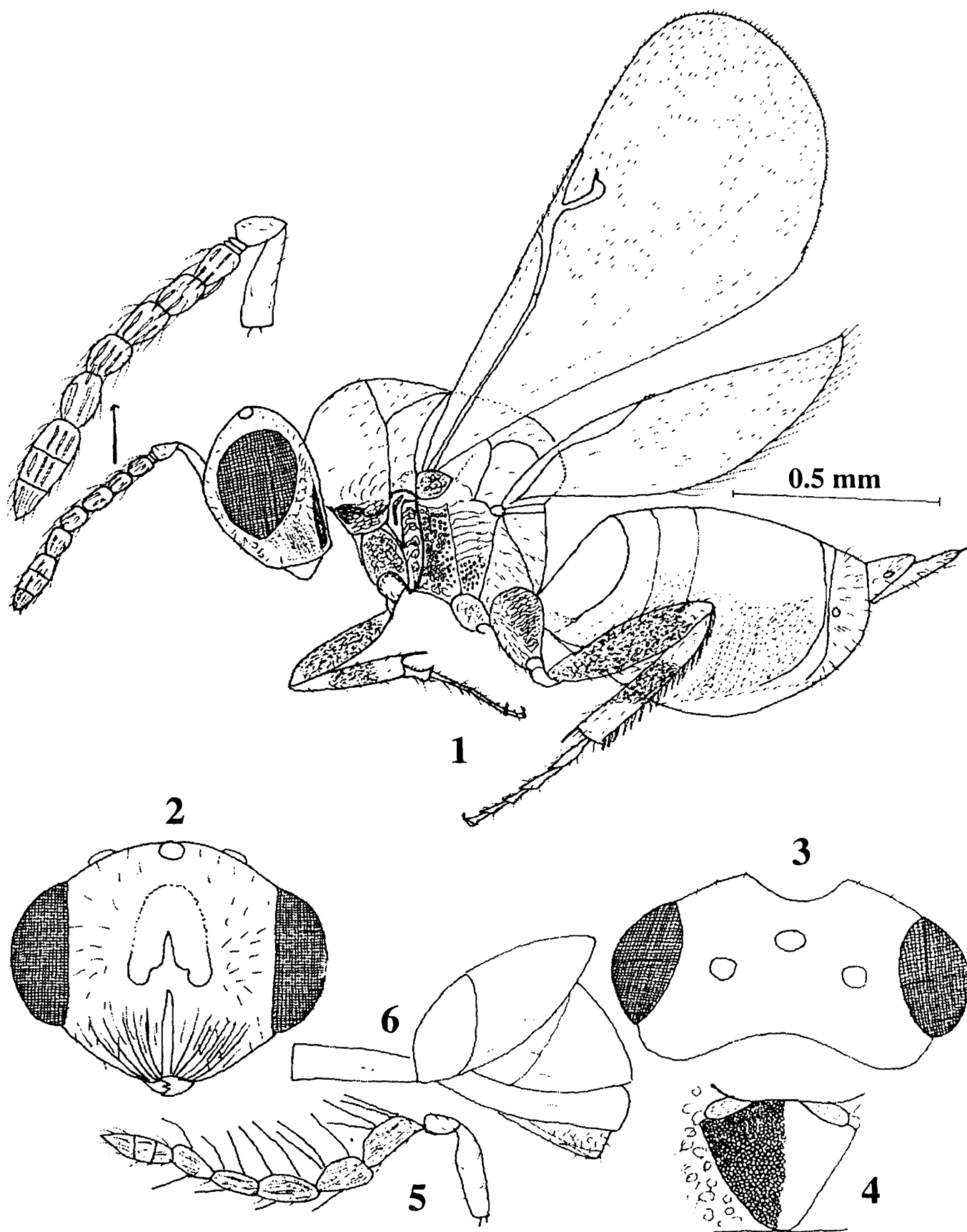
Male : Length 1.52–1.6 mm. Similar to female except antennal segment pedicellate (Fig. 5); ratio of antennal segments : scape : pedicel : anelli : funicular segments : clava as 22 : 8 : 2 : 16 : 13 : 14 : 11 : 11 : 17. Gastral petiole in lateral view subcylindrical, dorsal length 2x its greatest thickness, slightly longer than metacoxa, without carinae, mostly smooth with weak reticulations.

Material examined : Holotype : Female : INDIA, Rajasthan, Jaipur, Samod (27°12'N 75°49'E), reared from seeds of *Ephedra foliata* Boiss ex C.A. Meyer, May 2005, Rita Singh & Prabha Sharma (Reg. No. MoEF 4784); Paratypes : 1 Female and 4 males of the same collection data of holotype (Reg. Nos. MoEF 4785-4788 & 4794).

Etymology : The species is named after the host plant genus *Ephedra*.

Distribution : Jaipur (Samod), India.

Discussion : This new species comes near *Eurytoma setitibia* Gahan and *Eurytoma apara* Narendran (Gahan, 1919 and Narendran, 1994) in general appearance. It differs from *E. setitibia* in having : (1) Face with radiating carinae (without such radiating carinae in *E. setitibia*);



Figs. 1-6. : *Eurytoma ephedrae* Narendran & Prabha Sharma sp. nov.; Figs. 1-4 Female : 1. Body profile; 2. Head front view; 3. Head dorsal view; 4. Propodeum. Figs. 5-6 Male : 5. Antenna; 6. Gaster.

- (2) Mesosternal shelf distinctly developed (mesosternal shelf not distinctly developed in *E. setitibia*);
 (3) Hind tibia with more than 10-15 strong setae on dorsal margin (in *E. setitibia* hind tibia with only 3 stout setae on dorsal margin).

This new species differs from *E. apara* in having : (1) Hind tibia with 10–15 strong setae on dorsal margin (in *E. apara* not such stout setae in dorsal margin of hind tibia); (2) F2 to F5 not strongly wider than long (in *E. apara* F2 to F5 strongly wider than long); (3) Propodeum without a median furrow containing pits (in *E. apara* propodeum with a median furrow containing pits) and (4) Marginal vein shorter than postmarginal (in *E. apara* marginal vein longer than postmarginal).

This new species does not fit to the description of any of the Oriental species of *Eurytoma* listed by Noyes (2005).

2. *Eurytoma foliatae* Narendran & Rita Singh sp. nov.
 (Figs. 7-10)

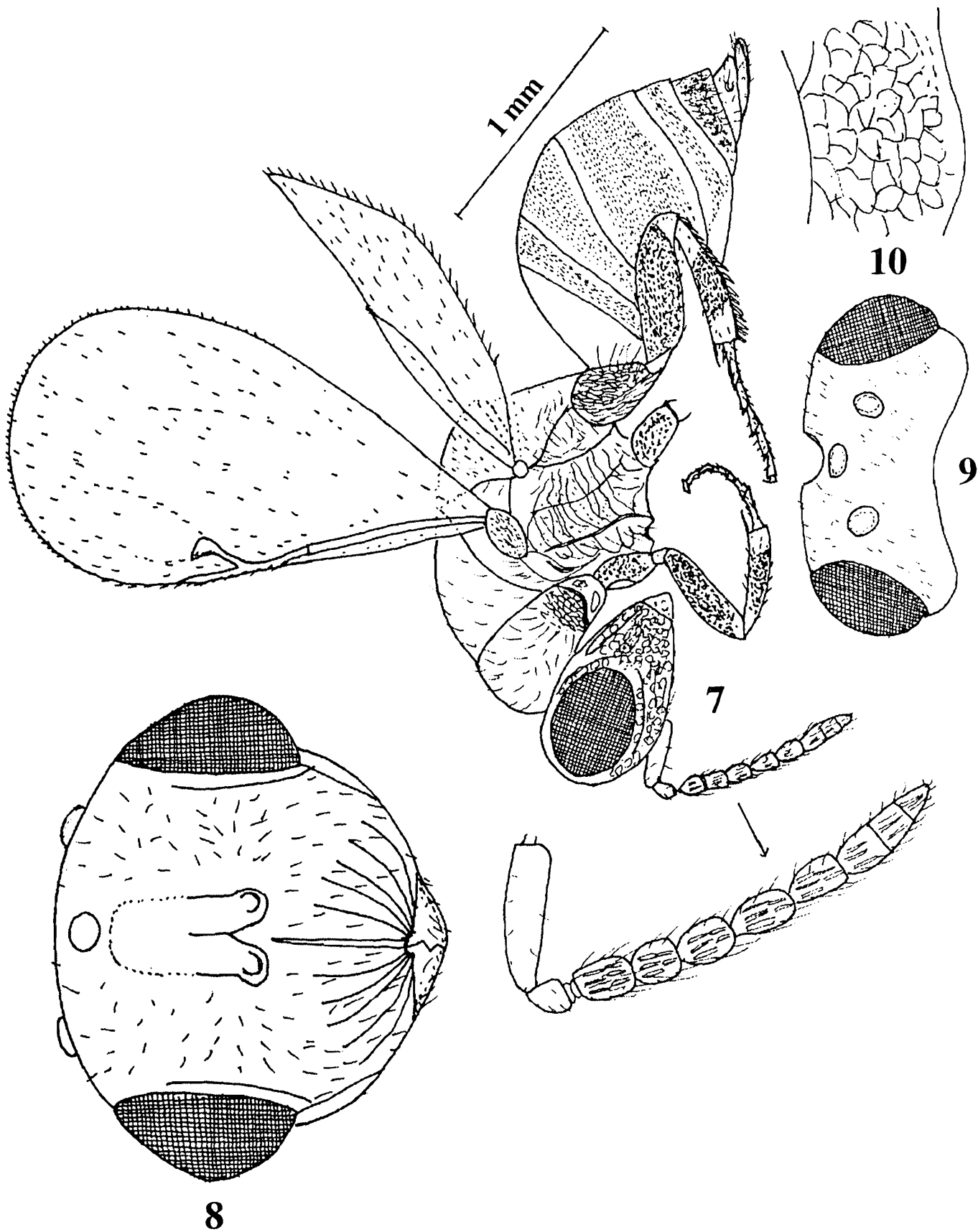
Holotype : Female : Length 3.1 mm.

Colour : Black except following : eye grey with reflecting yellow and brown patches; ocelli brownish red; antenna brown with scape and pedicel (ventral and apical parts) paler; apices of femora, bases and apices of tibiae pale yellow with median part of tibiae brown; tarsi pale yellow. Wings hyaline and veins and pilosity white.

Sculpture : Frons, vertex, dorsum of mesosoma, mesepisternum, metapleuron with deep setigerous pits, with interstices microreticulate (except lower face smooth); lateral panel of pronotum microreticulate; tegula cross reticulate; coxae reticulate, reticulations confined to dorsal half in hind coxa; propodeum (Fig. 10) with irregular pits in a shallow area; metasoma finely microreticulate (Fig. 7).

Head : Posterior margin of gena well carinate and with a deep groove in front; pre- and post-orbital carinae distinct; malar groove indistinct, scrobal basin carinate laterally, almost reaching front ocellus; median raised ridge extending from base of interantennal projection to apex of clypeus; submedian carinae diverging from mid point of clypeal apex which forms a distinct semicircular notch; ratio lateral ocellus : OOL : POL as 6 : 7 : 18. Antenna with scape not reaching front ocellus; ratio scape (minus radicle) : pedicel : 2 anelli together : Fl : F2 : F3 : F4 : F5 : clava as 36 : 9 : 2 : 12 : 10 : 12 : 14 : 12 : 25.

Mesosoma : Fore coxa depressed ventrally in basal half for reception of lower part of head, depression strongly carinate along outer edge, medially and longitudinally grooved; mesopleuron and mesepisternum with semicircular carinae meeting medially and protruding forward between



Figs. 7-10. : *Eurytoma foliatae* Narendran & Rita Singh sp. nov.; Female : 7. Body profile; 8. Head front view; 9. Head dorsal view; 10. Propodeum.

fore coxae; mesosternal shelf flat, wider than mesocoxal diameter; prepectus subtriangular, smooth, shiny with a pit on ventral side; fore wing length 1.76x its maximum width; speculum weakly closed below by cubital line of setae; ratio of marginal : postmarginal : stigmal vein as 9:13:10.

Metasoma : Gaster sessile, petiole indistinct, a little longer than mesosoma but distinctly shorter than head plus mesosoma; ovipositor sheath slightly tilted upwards. Ratio of gastral tergites (T1–T7) : ovipositor sheath as 17:9:18:20:8:9:6:4.

Male : Unknown.

Distribution : Jaipur (Samod), Rajasthan.

Material examined : Holotype : Female : INDIA, Rajasthan, emerged from seeds of *Ephedra foliata* Boiss. ex C.A. Meyer, May 2005, Rita Singh & Prabha Sharma (Reg. No. MoEF 4789) (ZSIK). Paratype : 1 Female of the same collection data of holotype (Reg. No. MoEF 4790).

Etymology : The species is named after the host plant *Ephedra foliata*.

Discussion : This new species comes near *Eurytoma agalica* Narendran in general appearance but differs from it in having (1) Pedicel shorter than F1 (pedicel as long as F1 in *E. agalica*); (2) Gaster shorter than combined length of head plus mesosoma (gaster longer than head plus mesosoma in *E. agalica*); (3) Hind tibia with more than 10–15 stout spines on dorsal margin (no stout spines on dorsal margin of hind tibia in *E. agalica*).

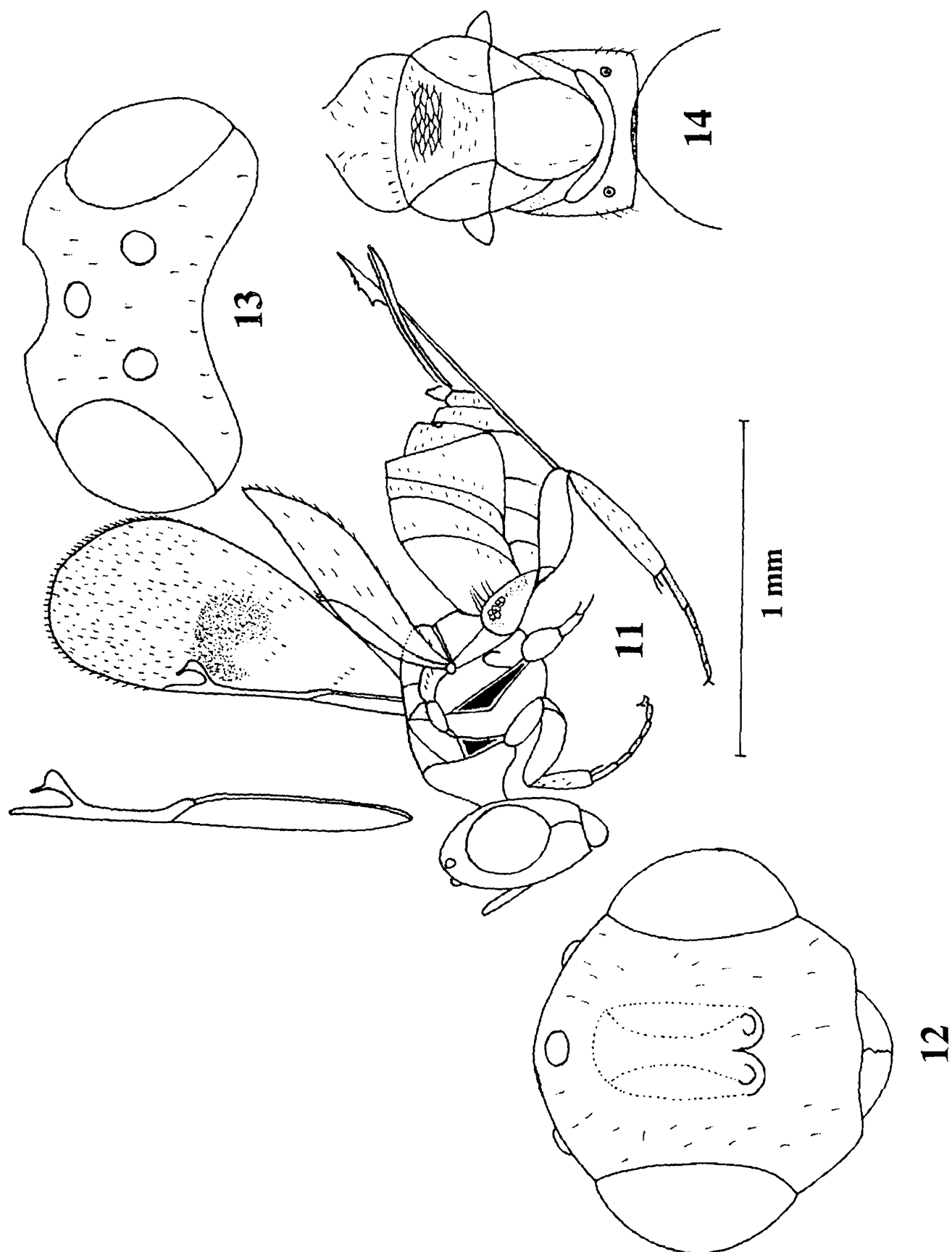
3. *Idiomacromerus* sp.

(Figs. 11-14)

Female : Length excluding ovipositor 1.75 mm; ovipositor 0.5 mm.

Colour : Head and mesosoma dark metallic green, dorsally mesosoma slightly coppery and with brown tints; gaster brown on dorsal part, sides darker; ovipositor dark brown; scape testaceous ventrally, dark brown dorsally, pedicel and flagellum brown. Legs dark brown with inner sides of femora and tibiae pale brown; tarsi pale yellow; tegula pale yellow with a brown margin; forewing with a large brown patch extending from marginal and stigmal veins to about two-third distance across wing.

Sculpture : Head, mesosoma dorsally with distinct raised reticulations; mesepisternum and mesepimeron mostly smooth and shiny; metapleuron weakly reticulate; coxae weakly reticulate. Propodeum smooth medially and weakly reticulate on sides; gaster mostly smooth with weak reticulations.



Figs. 11-14. : *Idiomacromerus* sp.; Female : 11. Body profile; 12. Head front view; 13. Head dorsal view; 14. Mesosoma dorsal view.

Head : In dorsal view (Fig. 13) 2.15x breadth of mesoscutum; 2.67x as broad as its median dorsal length; POL 3x OOL. Head in front view 1.1x as broad as high, malar space in side view 0.375x height of eye; torulus with ventral edge slightly above level of lower ocular margin; scrobe moderately deep; occiput without carina. Antenna with scape not reaching front ocellus, separated by the diameter of latter; pedicel almost to as long as first four flagellar segments, with many short hairs; flagellum clavate with 3 anelli and five funicular segments; clava about 2x as long as broad apically rounded without a process or spicule.

Mesosoma : In dorsal view 1.7x as long as broad; pronotum with dorsal surface rounded in to anterior face; mesonotum dorsally with inconspicuous short, white pilosity. Notauli complete but not deep; scutellum length subequal to its width; propodeum medially 2x as long as dorsellum, its anterior margin with an elongated fovea on either side. Hind leg with dorsal surface of coxa pilose on dorsal margin on basal half; femur 2.83x as long as broad; tibia with 2 distinct apical spurs, outer one longer than inner one. Forewing (Fig. 11) basal cell with 1–3 hairs (excluding hairs on cubital veins); speculum partially open below. Ratio of costal cell : marginal vein : postmarginal vein : stigmal vein as 43 : 19 : 12 : 5; marginal plus postmarginal vein occupying 0.36x wing length.

Gaster : (Fig. 11) (excluding ovipositor) distinctly shorter than head plus mesosoma; T1 and T2 with posterior margin weakly incised medially; ovipositor sheath 0.68x as long as rest of gaster, 1.12x length of metatibia.

Male : Unknown.

Distribution : Jaipur (Samod), Rajasthan.

Material examined : 1 Female : INDIA, Rajasthan, Jaipur, Samod (27°12' N 75°49' E), from seeds of *Ephedra foliata* Boiss. ex C.A. Meyer, Rita Singh & Prabha Sharma, May 2005, (ZSIK) (Reg. No. MoEF 4791).

Remarks : This new species is not given a name here since the single specimen is not in good condition to designate as a holotype. The genus *Idiomacromerus* reported here is the first record of the genus from Indian subcontinent.

Discussion : This new species comes very near *Idiomacromerus silybi* Askew (Askew *et al.*, 2004) but differs from it in having : (1) 3 anelli (or 1 anellus with 2 anelliform funicular segments) (In *I. silybi* antenna with 2 anelli), (2) mesoscutum 1.7x as long as broad (In *I. silybi* mesoscutum 1.55x as long as broad). (3) ovipositor sheath 1.12x as long as metatibia (In *I. silybi* ovipositor sheath 1.4x as long as hind tibia; (4) marginal vein 1.58x postmarginal vein (In *I. silybi* marginal vein 3.09x postmarginal vein); (5) forewing with a brown patch extending from marginal and stigmal veins to about two-thirds across the wing (In *I. silybi* no submedian brown patch present) and in several other features.

4. *Pseudotorymus ephedrae* Narendran & Prabha Sharma sp. nov.

(Figs. 15-16)

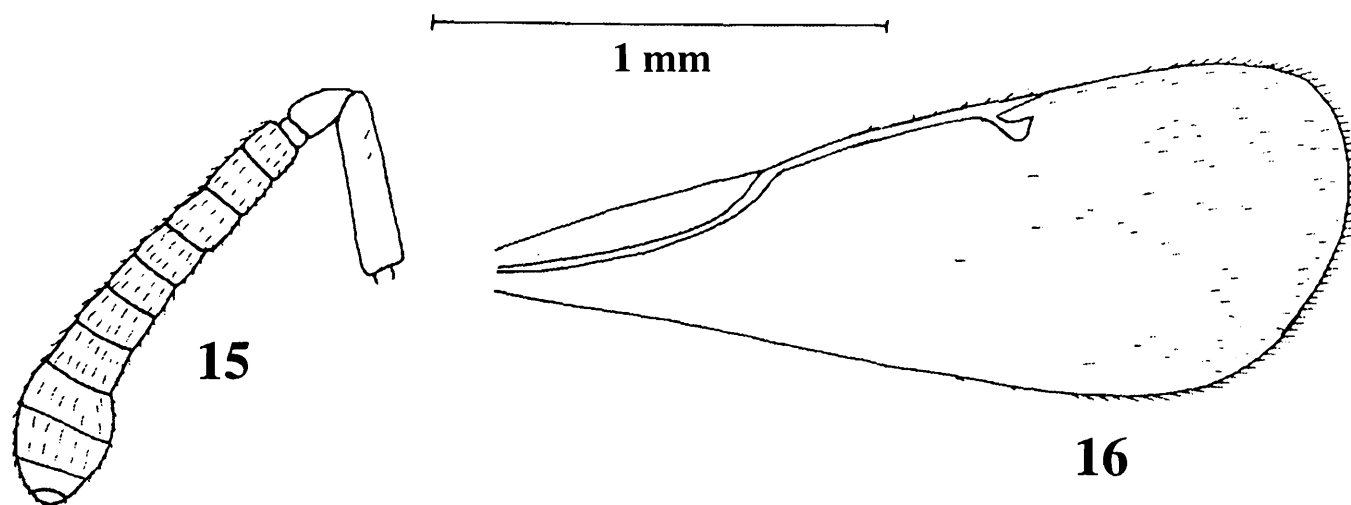
Holotype : Female : Length excluding ovipositor sheath 2 mm; ovipositor sheath 1.82 mm.

Colour : Black with metallic greenish blue reflections; eyes and ocelli brown; antenna pale brown with scape and ventral half of pedicel pale yellow; all tibiae and tarsi (except brown fifth tarsal segment) pale yellow, ovipositor pale yellow. Wings hyaline, veins pale yellow with stigmal veins brown; pubescence on body silvery.

Sculpture : Head and dorsum of mesosoma with raised reticulations; episternum reticulate; epimeron reticulate on anterior lower marginal area, remaining part smooth and shiny, metapleuron reticulate; fore and mid coxae weakly reticulate; hind coxa strongly reticulate on dorsal half; all femora reticulate. Propodeum smooth in middle, reticulate on sides; gaster weakly reticulate on sides.

Head : Width subequal to width of mesoscutum; width in anterior view 1.13x its length; POL 3x OOL, malar space 0.3x eye height in side view, torulus with ventral edge slightly above level of lower ocular margin; scrobe moderately deep. Antenna with scape almost reaching front ocellus; scape a little less than 4x as long as wide (15 : 4); pedicel as long as wide; F1 a little more than 1.3x as wide as its length; F2 length subequal to its width; F3 slightly wider than long; F4 to F7 wider than long; clava 1.25x as long as broad without a process or spicule at apex.

Mesosoma : In dorsal view a little more than 1.27x as long as its width; pronotum and mesoscutum with short white pilosity; notauli complete but not deep; scutellum length subequal to its width; propodeum medially about 2x as long as dorsellum, its anterior margin with a row of small carinulae; a weak median carina present. Hind coxa with two or three setae, posterior margin, ventral half pilose, hind femur 2.5x as long as broad. Fore wing length a little more than 2.3x its



Figs. 15-16. : *Pseudotorymus ephedrae* Narendran and Prabha sp. nov.; Female : 15. Antenna; 16. Fore leg.

maximum width; speculum open below; ratio of costal cell : marginal vein : postmarginal vein : stigmal vein as 37 : 31 : 6.5 : 5; marginal plus postmarginal occupying about 0.35x wing length.

Gaster : Excluding ovipositor as long as head plus mesosoma; T1 and T2 with posterior margin incised medially; ovipositor sheath about as long as rest of gaster, 3.1x length of metatibia.

Male : Unknown.

Distribution : Jaipur (Samod), Rajasthan.

Material examined : Holotype : Female : INDIA, Rajasthan, Jaipur, Samod (27°12' N 75°49' E), from seeds of *Ephedra foliata* Boiss. ex C.A. Meyer, Rita Singh & Prabha Sharma, May 2005 (ZSIK) (Reg. No. MoEF 4792).

Discussion : This new species comes near *Pseudotorymus amuthae* Narendran in the key to species of Indian subcontinent by Narendran (1994) but differs from it in having : (1) Scape a little shorter than 4x length of F1 (In *P. amuthae* scape a little longer than 4x length of F1); (2) ovipositor sheath 2x as long as gaster (in *P. amuthae* ovipositor sheath 1.1x larger than gaster; (3) clava 1.25x as long as wide (in *P. amuthae* clava 2x as long as wide); (4) clava 2.25x as long as preceding segment (in *P. amuthae* clava a little more than 3x as long as preceding segment; (5) Inhabitant of *Ephedra foliata* (Ephedraceae) seeds (*P. amuthae* inhabitant of *Jasminum sambac* (L.) Ait, (Oleaceae).

5. *Eupelmus urozonus* Dalman

1820. *Eupelmus urozonus* Dalman, *K. avenska Vet. Akad. Handl.*, **41** : 378 (? NRS).

Disgnosis : Body dark metallic green with blue and bronze tinge; legs brown or pale brown with base and apex of hind femur pale and middle region darker; ovipositor sheath medially pale yellow and apex dark; ovipositor sheath shorter than hind tibia; MV 4x as long as PMV.

Host : Parasitic on many species of Diptera and Hymenoptera associated with plant galls (Narendran & Anil, 1995) and probably seeds also.

Distribution : West Europe, Africa, Australia, Former USSR, India (Gujarat, North Bengal, Tamil Nadu) (Narendran & Anil, 1995). Here it is recorded for the first time from Delhi.

Material examined : 1 Female, INDIA, Delhi (28°40' N 77°14' E), Reared from seeds of *Ephedra foliata*, Coll. Prabha Sharma, May 2005 (ZSIK) (Reg. No. MoEF 4793).

SUMMARY

Four new species viz., *Eurytoma ephedrae* Narendran & Prabha Sharma, *E. foliatae* Narendran & Rita Singh, *Pseudotorymus ephedrae* Narendran & Prabha Sharma, *Idiomacromerus* sp. (unnamed)

and a known species *Eupelmus urozonus* Dalman are reared from the seeds of *Ephedra foliata* Boiss. ex C.A. Meyer. The new species are described and the known species are commented.

ACKNOWLEDGMENTS

While the first author (T.C.N.) of the paper thanks the University of Calicut, the second (PS) and third (RS) authors acknowledge Ministry of Environment & Forests for providing financial assistance (AICOPTAX – No. J-22018/54/2000 – CSC (BC) and Ms. P. Radha for her constant selfless support.

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MOTHS OF KANGER VALLEY NATIONAL PARK (BASTAR, CHHATTISGARH)

KAILASH CHANDRA AND D.K. NEMA

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

INTRODUCTION

Kanger Valley National Park (KVNP) is located between 18°45'00" to 18°56'30" N latitudes and 81°51'30" to 82°10'00" E longitudes. The total area of KVNP is 200 sq. km which is situated at 27 km from Bastar and the eastern part of the southern half of the Bastar district in Kanger valley. The park was notified in the year 1982 by Govt. of Madhya Pradesh. This valley possesses one of the last pockets of virgin forests in the southern Chhattisgarh. The park is significant floristically. The moist peninsular "Sal Forests" and the "South Indian Tropical Moist Deciduous Forests" are seen in their original forms here. The national park also possesses unique fauna, which is having the affinities with the peninsular fauna.

LIST OF MOTHS OF KANGER VALLEY NATIONAL PARK, CHHATTISGARH

Order LEPIDOPTERA

Suborder HETEROCERA

I. Family PYRALIDAE

1. *Maruca testulalis* (Guen'ee)
2. *Nausinoe geometralis* (Guen'ee)
3. *Nausinoe neptis* Cramer
4. *Sameodes cancellalis* (Zeller)

II. Family SPHINGIDAE

5. *Hippotion boerhaviae* (Fab.)

III. Family NOCTUIDAE

6. *Agrotis* sp.
7. *Episparis varialis* Walker
8. *Helicoverpa armigera* (Hubner)
9. *Hyblaea puera* (Cramer)
10. *Ophiusa triphaenoides* Walker
11. *Prodenia litura* (Fabricius)
12. *Trigonodes hyppasia* Carmer

IV. Family LYMANTRIDAE

13. *Lymantria* sp.
14. *Orvasca subnotata* Walker
15. *Perina nuda* (Fabricius)

V. Family HYPSIDAE

16. *Asota caricae* (Fabricius)

VI. Family ARCTIIDAE

17. *Creatonotus gangis* (Linnaeus)
18. *Cyana puella* Drury
19. *Oeinistis altica* Linnaeus
20. *Phissama transiens* (Walker)
21. *Utethesia puchelloides* Hampson
22. *Nyctemera lacticinia* Cramer

VII. Family GEOMETRIDAE

23. *Aporandria specularia* Guen'ee
24. *Hyposidra talaca* (Walker)
25. *Macaria fasciata* Fabricius
26. *Pingasa ruginaria* Guen'ee

Order LEPIDOPTERA

Suborder HETEROCERA

I. Family PYRALIDAE

1. *Maruca testulalis* (Geyer)

1832. *Crochiphora testulalis* Geyer, *Hubn. Sammal. Exot. Schmitt.*, 4(4) : 12.

1896. *Maruca testulalis* Hampson, *Fauna Brit. India*, Moths, 4 : 393.

Material examined : Bastar, KVNP, Kanger, 17.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 26–30 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni, Umaria). *Elsewhere* : Australian and Oriental Regions, Neotropical and Ethiopian Regions and Japan.

2. *Nausinoe geometralis* (Guen'ee)

1854. *Lepyrodes geometralis* Guen'ee, *Delt. & Pyral.* : 278.

1896. *Lepyrodes geometralis*, Hampson, *Fauna Brit. India*, Moths, 4 : 368.

1939. *Nausinoe geometralis*, Klima, *Lep. Cat.* : 94.

1980. *Nausinoe geometralis*, Mandal & Bhattacharya, *Rec. zool. Surv. India*, 77(1-4) : 328.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 22 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Chhindwara). *Elsewhere* : West Africa, China, Formosa, Sri Lanka, Myanmar, Malayan Java and Australia.

3. *Nausinoe neptis* (Cramer)

1779. *Phalaena (Noctua) neptis* Cramer, *Pap. Exot.*, iii, pl. : 264.

1896. *Lepyrodes neptis*, Hampson, *Fauna Brit. India*, Moths, 4 : 368.

1939. *Nausinoe neptis*, Klima, *Lep. Cat.* : 94.

1980. *Nausinoe neptis*, Mandal & Bhattacharya, *Rec. zool. Surv. India*, 77(1-4) : 328.

Material examined : Bastar, KVNP, Machkot, 22.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : 32 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni). *Elsewhere* : Sri Lanka, Myanmar, Malayan subregion and Australia.

4. *Sameodes cancellalis* (Zeller)

1852. *Botrys cancellalis* Zeller, K. Vet. A. K. Handl. P. : 34.

1896. *Sameodes cancellalis*, Hampson, *Fauna Brit. India*, Moths, 4 : 375.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : 22 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Hoshangabad, Seoni). *Elsewhere* : Sri Lanka, Africa, Australia, Myanmar, Fiji and Java.

II. Family SPHINGIDAE

5. *Hippotion boerhaviae* (Fabricius)

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

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

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

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 50–58 mm.

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

III. Family NOCTUIDAE

6. *Agrotis* sp.

1816. *Agrotis* Ochs. *Eur. Schmett.*, iv : 66.

1818. *Peridroma*, Hubner, *Verz* : 227.

1896. *Agrotis*, Hampson, *Fauna Brit. India*, Moths, 2 : 180.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 32 mm.

Distribution : Universally distributed including Chhattisgarh (Bastar).

7. *Episparis varialis* Walker

1858. *Episparis varialis* Walker, *Cat. Lep. Het. B. M.*, xvi : 7.

1888. *Episparis varialis*, Cotes & Swinhoe, *Cat. Moths of India* : 435.

1894. *Episparis varialis*, Hampson, *Fauna Brit. India*, Moths, 2 : 543.

Material examined : Bastar, KVNP, Machkot, 25.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : 60 mm.

Distribution : India : Peninsular India including Chhattisgarh (Bastar) and Madhya Pradesh (Indore, Seoni and Umaria) and Andaman. *Elsewhere* : Sri Lanka.

8. *Helicoverpa armigera* (Hubner)

1804. *Noctua armigera* Hubner, *Noct.*, ii : 180.

1896. *Heliothis armigera*, Hampson, *Fauna Brit. India*, Moths, 2 : 174-175.

1989. *Helicoverpa armigera*, Holloway, *The Moths of Borneo, Malayan Nature Journal*, 42(2 & 3) : 75.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 31–41 mm.

Distribution : India : Universally distributed including Chhattisgarh (Bastar) and Madhya Pradesh (Jabalpur, Shivpuri).

9. *Hyblaea puera* Cramer

1779-83. *Hyblaea puera* Cramer, *Pap. Exot.*, : 103.

1894. *Hyblaea puera*, Hampson, *Fauna Brit. India*, Moths. 2 : 371.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 32–40 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni). *Elsewhere* : Myanmar, Borneo, China, Malacca, Australia and Sri Lanka.

10. *Ophiura triphaenoides* Walker

1858. *Ophiura triphaenoides* Walker, *Cat. Lep. Het. B. M.*, xiv : 1358.

1888. *Minucia triphaenoides*, Cotes & Swinhoe, *Cat. Moths of India* : 400.

1894. *Ophiura triphaenoides*, Hampson, *Fauna Brit. India*, Moths, 2 : 504.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 60 mm.

Distribution : India : Chhattisgarh (Bastar) and Madhya Pradesh (Indore), Jharkhand, Maharashtra and Sikkim.

11. *Prodenia litura* (Fabricius)

1775. *Noctua litura* Fabricius, *Syst. Ent.* : 601.

1991. *Prodenia litura*, Mandal and Maulik, *Fauna of Orissa, Zool. Surv. India*, 3 : 212.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 36–40 mm.

Distribution : India : Chhattisgarh (Bastar) and Madhya Pradesh (Hoshangabad), West Bengal, Sikkim, Orissa, Tripura, Himachal Pradesh, Uttar Pradesh, Punjab, Maharashtra, Karnataka, Tamil Nadu and Kerala. *Elsewhere* : Nepal, Southern Myanmar, Sri Lanka, Singapore, Borneo, Java and Taiwan of Oriental and also Austral-Papuan, Ethiopian, Palaearctic and Hawaiian Regions.

12. *Trigonodes hyppasia* Cramer

1779. *Trigonodes hyppasia* Cramer, *Pap. Exot.*, **3** : 250.

1854. *Trigonodes hyppasia*, Hampson, *Fauna Brit. India*, Moths, **2** : 527.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : 46 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni, Umaria).

IV. Family LYMANTRIDAE

13. *Lymantria* sp.

1818. *Lymantria* Hubner, *Verz.* : 160.

1892. *Lymantria*, Hampson, *Fauna Brit. India*, Moths, **1** : 145.

Material examined : Bastar, KVNP, Machkot, 25.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 40 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni). *Elsewhere* : Sri Lanka, Myanmar, Java, Amboina and Celebes.

14. *Orvasca subnotata* Walker

1865. *Orvasca subnotata* Walker, *List lipid. Insects Colln Br. Mus.*, **32** : 502.

1999. *Orvasca subnotata*, Holloway, *Malayan Nature Journal*, **53**(1 & 2) : 54.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 32 mm.

Distribution : India : Chhattisgarh (Bastar) and Madhya Pradesh (Bhopal). *Elsewhere* : Oriental tropics to Borneo and Sumatra.

15. *Perina nuda* (Fabricius)

1787. *Bombyx nuda* Fabricius, *Mant. Ins.*, **2** : 117.

1892. *Perina nuda*, Hampson, *Fauna Brit. India*, Moths, **1** : 486.

1897. *Perina nuda*, Mandal & Maulik, *Fauna of West Bengal*, Zool. Surv. India, **7** : 670.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 38 mm. Female : 50 mm.

Distribution : India : Chhattisgarh (Bastar) and Madhya Pradesh (Indore, Mandla), Maharashtra, West Bengal and Assam. *Elsewhere* : China, Hong Kong, Japan, Nepal, Taiwan and Sri Lanka.

V. Family HYPSIDAE**16. *Asota caricae* (Fabricius)**

1792. *Noctua caricae* Fabricius, *Syst. Ent.*, **3** 2 : 27.

1892. *Hypsa alciphron*, Hampson, *Fauna Brit. India*, Moths, **1** : 502.

1982. *Asota caricae*, Barlow, *An introduction to the Moths of South East Asia* : 77.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 62–67 mm. Female : 72–76 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Seoni, Umariya). *Elsewhere* : Myanmar, Sri Lanka, Penang, Java, Amboina, Ceram, New Guinea, New Hebrides, Solomons and New Ireland.

VI. Family ARCTIIDAE**17. *Cretonotus gangis* (Linnaeus)**

1764. *Phalaena gangis* Linnaeus, *Amoen. Acad.*, **6** : 410.

1991. *Cretonotus gangis*, Mandal & Ghosh, *Fauna of Tripura*, *Rec. zool. Surv. India*, **88**(3 & 4) : 313-314.

Material examined : Bastar, KVNP, Machkot, 20.3.2004 (1 ex.), Coll. D. K. Harshey & Party.

Wing expanse : 39 mm.

Distribution : India : Chhattisgarh (Bastar), Madhya Pradesh (Indore, Hoshangabad, Chhindwara and Umariya), West Bengal, Maharashtra, Gujarat, Andhra Pradesh, Kerala, Tamil Nadu, Assam, Meghalaya, Arunachal Pradesh and Tripura. *Elsewhere* : Myanmar, Sri Lanka, Western Malaysia, Java, Australia, China, Pakistan and Nepal.

18. *Cyana puella* Drury

1773. *Cyana puella* Drury, III. *Exot. Ins.*, ii : 3.

1894. *Cyana puella*., Hampson, *Fauna Brit. India*, Moths, 2 : 57.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 28 mm.; Female : 36 mm.

Distribution : India : Chhattisgarh (Bastar), Madhya Pradesh (Seoni, Umaria), Maharashtra and S. India. *Elsewhere* : Nepal, Sri Lanka and Java.

19. *Utetheisa pulchelloides* Hampson

1907. *Utetheisa pulchelloides* Hampson, *Ann. Mag. nat. Hist.*, (7)19 : 239.

1939. *Utetheisa pulchelloides* Hampson, Jordan, *Novit. Zool.*, 41 : 281-3.

1988. *Utetheisa pulchelloides* Holloway, *The Moth of Borneo*, 6 : 56.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 40–46 mm.; Female : 45 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar) and Madhya Pradesh (Indore, Seoni). *Elsewhere* : Europe, Africa, Sri Lanka, Philippines, Malay Archipelago, New Guinea and Australia.

20. *Oeonistis altica* Linnaeus

1768. *Phalaena (Noctua) altica* Linnaeus, *Her in Chinam* : 10, 11.

1894. *Philagria entella*, Hampson, *Fauna Brit. India*, Moths, 2 : 71.

2001. *Oeonistis altica*, Holloway, *Malayan Nature Journal*, 55(3 & 4) : 293.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 42 mm.; Female : 46 mm.

Distribution : India : Chhattisgarh (Bastar), Madhya Pradesh (Balaghat, Hoshangabad) and S. India. *Elsewhere* : Sri Lanka, Myanmar, Borneo, New Hebrides, China, Taiwan, Vietnam and Philippines.

21. *Phissama transiens* (Walker)

1855. *Spilosoma transiens* Walker, *List lep. Insects Brit Mus.*, 3 : 675.

1894. *Phissama transiens*, Hampson, *Fauna Brit. India* Moths, 2 : 29-30.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : Male : 38–48 mm.; Female : 48–55 mm.

Distribution : India : Chhattisgarh (Bastar), Madhya Pradesh (Mandla, Hoshangabad), West Bengal, Assam, Arunachal Pradesh and Sikkim. *Elsewhere* : China, Indonesia and Philippines.

22. *Nyctemera lacticinia* Cramer

1775. *Phalaena (Geometra) lacticinia*, Cramer, *Uitl. Kapellen*. 2 : 47.

1894. *Nyctemera lacticinia*, Hampson, *Fauna Brit. India* Moths, 2 : 47.

1957. *Nyctemera lacticinia* Cramer, *Roepke* : 164.

1988. *Nyctemera lacticinia*, Holloway, *The Moths of Borneo, The Malayan Nature Society* 6 : 65.

Material examined : Bastar, KVNP, Machkot, 20.3.2004, (1 ex.), Coll. D.K. Harshey and Party.

Wing expanse : Male : 42 mm.; Female : 48 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar). *Elsewhere* : China, Sri Lanka and Myanmar.

VII. Family GEOMETRIDAE

23. *Aporandria specularia* Guen'ee

1857. *Aporandria specularia* Guen'ee, *Histoire. Natural. Des. Insectes*, Lepidopteres : 342.

1895. *Aporandria specularia*, Hampson, *Fauna Brit. India*, Moths, 3 : 495.

Material examined : Bastar, KVNP, Kangerdhara, 20.3.2004, (1 ex.), Coll. D.K. Harshey and Party.

Wing expanse : Male : 54 mm.; Female : 60 mm.

Distribution : India : Chhattisgarh (Bastar), Madhya Pradesh (Seoni), Assam, Kerala and Tamil Nadu. *Elsewhere* : Sri Lanka and Sumatra.

24. *Hyposidra talaca* (Walker)

1860. *Lagyra talaca* Walker, *Cat. Lep. Het. Brit. Mus.*, 20 : 59.

1895. *Hyposidra talaca*, Hampson, *Fauna Brit. India*, Moths, 3 : 213.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey and Party.

Wing expanse : Male : 44 mm.; Female : 54–60 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar), Madhya Pradesh (Hoshangabad) and Andamans. *Elsewhere* : Myanmar, Java, Sri Lanka, Borneo, Celebes, and Philippines.

25. *Macaria fasciata* Fabricius

1775. *Macaria fasciata* Fabricius, *Syst. Ent.*, : 629.

1895. *Macaria fasciata*, Hampson, *Fauna Brit. India*, Moths, **3** : 202-203.

Material examined : Bastar, KVNP, Kotamsar, 18.3.2004, (2 exs.), Coll. D.K. Harshey & Party.

Wing expanse : 42 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar), Madhya Pradesh (Hoshangabad, Seoni), and Andamans. *Elsewhere* : Myanmar and Sri Lanka.

26. *Pingasa ruginaria* Guen'ee

1857. *Hypochroma ruginaria*, Gurn'ee, *Hist. nat. Insectes, Spec. gen. Lep.*, **9** : 278.

1895. *Pseudoterpna ruginaria*, Hampson, *Fauna Brit. India*, Moths, **3** : 472.

1996. *Pingasa ruginaria*, Holloway, *The Malayan Nature Journal*, Malaysian Nature Society, **49**(3 & 4) : 206.

Material examined : Bastar, KVNP, Machkot, 22.3.2004, (1 ex.), Coll. D.K. Harshey & Party.

Wing expanse : 46 mm.

Distribution : India : Throughout India including Chhattisgarh (Bastar). *Elsewhere* : West Africa, Kilima-njaro, Natal, Formosa and Borneo.

SUMMARY

During the extensive survey of Kanger Valley National Park by the scientific team of Zoological Survey of India, Jabalpur from 10.3.2003 to 29.3.2003, 26 species of moths belonging to 25 genera under 7 families are identified. This is the first study on the Moths of KNVP and all these species are reported for the first time from the park.

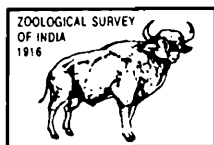
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Rec. zool. Surv. India : 106(Part-2) : 25-34, 2006

STUDIES ON THE IMPACT OF FOUR EDAPHIC FACTORS ON THE DENSITY, SEASONAL ABUNDANCE AND DIVERSITY OF ACARINE FAUNA IN THE SOILS OF A TEA ESTATE IN DARJEELING

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INTRODUCTION

Investigation on the taxonomy and ecology of acarine community in the tea garden soils, undisturbed forest floors of Darjeeling district were made from time to time by workers like Choudhuri and Pande (1979, 1981 and 1982), Chakraborti and Mandal (1981), Mandal and Kundu (1985, 1986 and 1988), Ghosh and Roy (2004). But the ecological studies so far made with respect to acarine community in tea garden soils were not comprehensive enough to come to any definite conclusion. To bridge the gap in existing knowledge an attempt has been made in this study to analyse the density, seasonal abundance and diversity of acarine fauna in two sampling plots of Happy Valley Tea Estate at Darjeeling in relation to four important soil factors.

SAMPLING SITES

Soil samples for this investigation were collected from two sampling plots ('A' and 'B') in Happy Valley Tea Estate, situated very close to Lebong cart Road and was within the jurisdiction of Darjeeling town in West Bengal, India. The plot-'A' was at an approximate altitude of 2010m, while the plot-'B' was at an altitude of 1970m and 500m away from the plot-'A'. Each of the plot has an area of 16 sq.m (4 m × 4 m). Both the plots contained chiefly tea plants, *Camellia sinensis* (Ternstroemiaceae) approximately 90 cm high and 1m apart from the corresponding plant in either direction. In addition, few mosses, grasses, ferns, herbs and shrubs like *Panicum palmifolium*

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(Gramineae), *Berberis insignis* (Berberidaceae), *Polygonum runcinatum* (Polygonaceae), *Geranium nepalense*, (Geraniaceae), *Anaphalis contorta* (Compositae) etc. were also present either in plot-‘A’ or in plot-‘B’ The plot-‘B’ also contained few shade trees like *Cryptomeria japonica* (Taxodiaceae) which was absent in plot-‘A’ A thin litter layer formed of dead and decaying fallen leaves, twigs etc. was found to prevail on the surface soil of both the plots which were occasionally removed during clearing operation.

Soils of the sampling plots were moderately dark grey (plot-‘A’) or lightly dark grey in colour (plot-‘B’), sandy loam in texture and acidic in reaction. The characteristics of the sampling plots have been presented in Table-1. Both the plots experienced anthropogenic effects during leaf plucking, trimming, cleaning and manuring etc. from time to time.

Table 1 : Characteristics of the Sampling sites.

Sampling Site	Location	Plot	Altitude (approx.)	Soil Characteristics				
				Colour	Sand	Silt	Clay	Texture
Happy Valley Tea Estate	Darjeeling	A	2010 m	Moderately dark grey	60.2	21.2	18.6	Sandy loam
		B	1970 m	Lightly dark grey	62.1	20.7	17.2	Sandy loam

MATERIALS AND METHODS

In each plot soil samples were collected at monthly interval over a period of 3-years (Jan.1999 to Dec. 2001). Samples were collected from the surface upto a depth of 10 cm by a steel borer as employed by Dhillon and Gibson (1962) and the cores were extracted by Tullgren funnel as modified by Macfadyen (1953). The collected samples were brought to the laboratory in polythene bags in such a way that the faunal components remain undamaged. Each sample had a volume of 250 cubic centimeter (5 sq. cm × 10 cm). Altogether 72 samples were collected from 2 sampling plots of the tea garden. Soil temperature was recorded by a soil thermometer and soil moisture was determined by an Infra Red Moisture Balance (Model-A). The pH of the soil sample was determined by an electric digital pH meter and the organic matter content was estimated by rapid titration method of Walkley and Black (1934).

RESULTS

The acarine fauna extracted from soil samples of the sampling plots included 11 genera of which 7 belonged to cryptostigmatids and 4 to mesostigmatids. No specimens of either prostigmatids or astigmatids were obtained. In both the plots cryptotigmatids outnumbered the mesostigmatids in

Table 2 : Monthly variation of Mean values of Edaphic factors with S.E. of 2 plots of Happy Valley Tea Estate, Darjeeling during 1999–2001.

Soil Factors	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp (°C)	9.29 ±0.48	10.49 ±0.52	11.65 ±0.47	14.09 ±0.99	17.48 ±0.89	18.96 ±0.71	19.67 ±0.87	20.27 ±0.53	16.99 ±0.76	15.57 ±0.89	12.19 ±0.69	10.11 ±0.69
Moisture (%)	20.43 ±1.45	16.00 ±0.95	12.66 ±1.73	10.55 ±1.26	28.40 ±2.34	34.52 ±0.90	36.98 ±1.17	37.29 ±1.54	28.20 ±2.14	24.50 ±1.84	22.37 ±1.52	18.96 ±1.40
pH	4.91 ±0.07	4.97 ±0.05	4.96 ±0.05	4.93 ±0.05	4.95 ±0.08	4.95 ±0.10	5.00 ±0.08	4.98 ±0.09	4.92 ±0.06	4.94 ±0.05	4.91 ±0.03	4.95 ±0.04
Org. Matter (%)	8.81 ±0.22	8.90 ±0.39	8.30 ±0.67	7.75 ±0.30	7.70 ±0.90	6.80 ±0.71	6.50 ±0.53	6.30 ±0.64	7.03 ±0.51	7.54 ±0.51	7.92 ±0.16	8.21 ±0.21

Table 3 : Showing the species Diversity and Relative Abundance of two plots of Happy Valley Tea Estate, Darjeeling.

Site	Plot	Taxa/Specimens	Ni	Shannon-Wiener's Index (H')	R.A. (%)
H A P P Y V A L L E Y T E A E S T A T E	A	1. <i>Scheloribates rectus</i> Hammer, 1958	308		35.44
		2. <i>Scheloribates luminosus</i> Hammer, 1961	146		16.80
		3. <i>Brachioppia cajamarcensis</i> Hammer, 1961	115		13.23
		4. <i>Galumna</i> Heyden, 1826	75		8.63
		5. <i>Nothrus</i> Koch, 1836	38	1.94	4.37
		6. <i>Tectocepheus</i> Berlese, 1913	33		3.79
		7. <i>Rostrozetes</i> Sellnick, 1925	28		3.22
		8. <i>Gymnolaelaps</i> Berlese, 1916	67		7.71
		9. <i>Macrocheles glaber</i> Muller 1860	30		3.45
		10. <i>Trichouropoda</i> Koch, 1839 Berlese, 1916	29		3.33
			N = 869		
	B	1. <i>Scheloribates luminosus</i> Hammer, 1961	404		41.06
		2. <i>Brachioppia cajamarcensis</i> Hammer, 1961	188		20.47
		3. <i>Galumna</i> Heyden, 1826	94		10.23
		4. <i>Nothrus</i> Koch, 1836	34		3.70
		5. <i>Tectocepheus</i> Berlese, 1913	30	1.78	3.26
		6. <i>Xylobates</i> Jacot, 1929	47		5.12
		7. <i>Gymnolaelaps</i> Berlese, 1916	69		7.51
		8. <i>Macrocheles glaber</i> Muller, 1860	21		2.28
		9. <i>Trichouropoda</i> Koch, 1839 Berlese, 1916	26		2.83
		10. <i>Parasitus assamensis</i> Bhattacharyya, 1972	32		3.48
			N = 945		
Total Collection = 1814					

Table 4 : Showing the relationship between the acarine fauna with different edaphic factors at Happy Valley Tea Estate, Darjeeling during 1999–2001.

Site	Parameters	'r'-value of acarina	Remarks	Regression Equation $Y = a + bx$
Happy Valley Tea Estate	Temperature (°C)	−0.933	****	$Y = 21.65 - 0.27x_1$
	Moisture (%)	−0.875	****	$Y = 39.17 - 0.59 x_2$
	pH	−0.250	NS	$Y = 4.96 - 5.17 x_3$
	Organic Matter (%)	0.949	****	$Y = 6.12 + 0.06 x_4$

**** Significant at 0.1% level.

N. S. Not significant.

Y = Acarina

 x_1 = Temperature (°C) x_2 = Moisture (%) x_3 = pH x_4 = Organic Matter (%)

numerical abundance (Table-5). Of the 11 genera encountered, the genera like *Scheloribates*, *Brachioppia*, *Galumna*, *Nothrus*, *Tectocepheus*, *Macrochles*, *Gymnolaelaps* and *Trichouropoda* were common in both the plots while the remaining three genera like *Xylobates*, *Rostrozetes* and *Parasitus* were present either in plot-'A' or Plot-'B' (Table-5). The genus *Scheloribates* occupied the top most position in degree of dominance being followed by *Brachioppia*, *Galumna*, *Gymnolaelaps* and *Nothrus* and constituted 47.30%, 16.70%, 9.32% and 7.50% respectively of the total population. The other forms were numerically low and represented a minor fraction of total population. The acarine fauna in plot B appeared to be relatively higher in number (Table-5). The total population exhibited an irregular trend of fluctuation being maximum in February and minimum in July. The population curve exhibited a trend of increase from September reaching its peak in February followed by a steady decline and reached the minimum level in July (Fig.-1). This trend of fluctuation seems to be chiefly influenced by the fluctuation in abundance of population of *Scheloribates*, *Brachioppia* and *Galumna* (Table-5).

The edaphological factors exhibited some variations during the period of study (Table-2). The lowest soil temperature (9.29°C) was recorded in January and the highest (20.27°C) in August. Soil moisture showed a fairly wide range of variation, the concentration being lowest in April (10.55%) and the highest in August (37.29%). The pH of all the samples were acidic and did not exhibit wide range of variation and varied between 4.91 to 5.00. The concentration of organic matter reached its highest level (8.90%) in February while the lowest value (6.30%) was recorded in August. Mean values of soil factors of different months have been shown in Table-2.

DISCUSSION

The trend of fluctuation as observed in this study was more or less similar to that reported by Choudhuri and Pande (1981 and 1982) Ghosh and Roy (2004) in the undisturbed forest floors and

Table 5 : Monthly population of acarine fauna in two plots of Happy Valley Tea Estate, Darjeeling during the year 1999–2001.

Site	Plot	Species/Taxa	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
H A P P Y V A L L E Y T E A E S T A T E	A	1. <i>Scheloribates rectus</i>	38	49	43	31	17	13	12	10	15	19	26	35
		2. <i>Scheloribates luminosus</i>	23	26	21	21	7	4	2	1	5	9	14	13
		3. <i>Brachioppia cajamarcensis</i>	14	21	24	16	5	4	–	4	4	3	9	11
		4. <i>Galumna</i> sp.	11	12	14	7	4	–	3	4	4	7	4	5
		5. <i>Nothrus</i> sp.	6	1	5	2	–	5	2	1	2	4	3	7
		6. <i>Tectocephus</i> sp.	4	7	–	4	3	–	1	3	2	3	3	3
		7. <i>Rostrozetes</i> sp.	1	5	1	3	5	–	–	2	2	1	4	4
		8. <i>Gymnolaelaps</i> sp.	12	7	9	3	6	1	3	2	5	6	3	10
		9. <i>Macrocheles glaber</i>	4	3	1	3	–	2	2	2	2	4	3	4
		10. <i>Trichouropoda</i> sp.	6	3	2	2	1	1	–	3	–	4	4	3
	B	1. <i>Scheloribates luminosus</i>	56	64	51	42	25	13	14	13	17	24	39	46
		2. <i>Brachioppia cajamarcensis</i>	25	28	30	20	15	8	4	5	5	11	16	21
		3. <i>Galumna</i> sp.	12	15	17	7	8	2	2	3	3	8	2	15
		4. <i>Nothrus</i> sp.	3	5	2	7	1	3	1	1	2	2	4	3
		5. <i>Tectocephus</i> sp.	2	4	5	–	3	–	2	1	1	3	2	7
		6. <i>Xylobates</i> sp.	7	8	4	7	1	3	2	1	4	3	5	2
		7. <i>Gymnolaelaps</i> sp.	14	7	10	7	5	1	2	2	3	7	4	7
		8. <i>Macrocheles glaber</i>	3	3	4	–	1	–	1	3	1	2	1	2
		9. <i>Trichouropoda</i> sp.	4	4	4	2	1	–	1	2	2	2	2	2
		10. <i>Parasitus assamensis</i>	3	8	1	2	1	3	1	1	3	2	4	3
			248	280	248	186	109	63	55	64	82	124	152	203

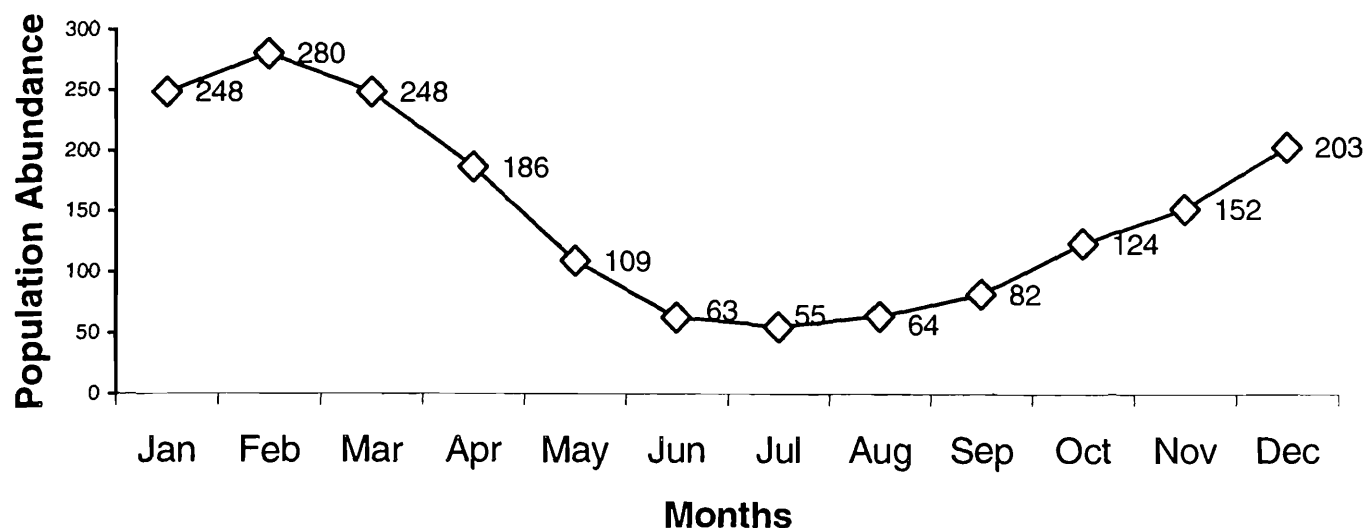


Fig. 1.: Seasonal fluctuation of acarine fauna in Happy Valley Tea Estate, Darjeeling during the year 1999-2001.

tea garden soils of Darjeeling. The numerical dominance of *Scheloribates*, *Brachioppia* and *Galumna* clearly indicate their adaptability and wide tolerance ranges. It is also evident from the data presented in Table-5 that cryptostigmatids in both the plots outnumbered mesostigmatids in numerical abundance as well as in species diversity and this is in conformity with the observation of Choudhuri and Pande (1982), Ghosh and Roy (2004). From December to April moisture content of soil was relatively low, temperature moderate and concentration of organic matter was fairly high and these in turn supported a relatively higher population. In the monsoon months high level of soil moisture, relatively higher surface temperature and low concentration of organic matter led to a decline in population. The pH on the other hand exhibited a narrow variation and possibly did not have a significant impact on population fluctuation. The pH values recorded were well within the tolerance range of most of the species as have been reported by Choudhuri and Banerjee (1977), Sanyal (1994), Sanyal *et al.* (1999), Ghosh and Roy (2004) in different ecosystems of West Bengal. The relatively lean population during monsoon months might be due to heavy down pour during the period which might have led to a surface erosion to some extent in sloppy areas leading thereby to a decline in surface dwelling acarines (Ghosh and Roy, 2004).

It was interesting to note that among the four soil factors studied only organic matter showed positive correlation with population, while the remaining three showed negative correlation (Table-4). Therefore, samples extracted during post winter or pre monsoon months supported a population which was numerically high since concentration of organic matter during that period was fairly high and the other factors were at the optimum level. The quantitative increase of acarine population with increased concentration of organic matter has also been reported by Choudhuri and Banerjee (1977), Choudhuri and Pande (1982), Banerjee and Sanyal (1991),

Sanyal *et al.* (1999), Ghosh and Roy (2004) in different areas of study in West Bengal. Negative correlation of temperature, moisture and pH with population is further substantiated by a lean population in monsoon months when all those factors were relatively high. Similar results with respect to temperature and moisture have also been reported by Choudhuri and Pande (1982), Sarkar (1991), Sanyal and Sarkar (1993), Ghosh (1995), Ghosh and Roy (2004).

The divesity indices as determined by Shannon-Wiener method showed a little variation between the values of plot-‘A’ and plot-‘B’ of Happy Valley Tea Estate (Table-3). This is substantiated by the occurrence of same number of species (10 in each plot) in both the plots. The plots being located in the same tea garden with little altitudinal variation and having similar soil and climatic condition perhaps did not exhibit any appreciable difference in diversity index value.

SUMMARY

In this investigation an attempt has been made to analyse the density, seasonal abundance and diversity of acarine community in two sampling plots (A and B) of a tea garden in Darjeeling town of Himalayan West Bengal, India in relation to four edaphic factors. The study continued for three consecutive years (Jan, 1999 to Dec, 2001) revealed the presence of 11 genera of which seven belonged to cryptostigmatids and four to mesostigmatids. Among them eight genera were extracted from both the plots. Genera like *Scheloribates*, *Brachioppia*, and *Galumna* common to both the sites occupied the first, second and third position in numerical abundance representing 47.30%, 16.70% and 9.32% of total population respectively. The rest of the genera were extracted either from plot A or plot B or from both the plots. The cryptostigmatids in both the sites outnumbered mesostigmatids in numerical abundance. The population encountered from the sites under study exhibited an irregular trend of fluctuation being maximum in February and minimum in July. Of the four soil factors analysed, only the organic matter showed significant positive correlation with acarine population, while the other factors like temperature, moisture and pH were negatively correlated. The plots being located in the same tea garden with little altitudinal variation and having more or less similar soil and climatic condition did not exhibit any appreciable difference in diversity index value.

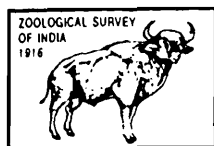
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ROTIFER COMMUNITIES (ROTIFERA : EUROTATORIA) OF RICE-FIELD ECOSYSTEMS OF MEGHALAYA : COMPOSITION AND DISTRIBUTION

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INTRODUCTION

Rice fields exhibit a rich mosaic of ecotones, changing in time and space seasonally and rapidly and are characterized by complex limnology not mirrored by any natural aquatic habitat (Fernando, 1995). In addition, they combine unique features of aquatic and semi-aquatic environs during different growth phases of paddy cultivation and are known to be biologically diverse biotopes colonized by a wide spectrum of aquatic organisms (Fernando *et al.*, 1979; Fernando, 1993) in general and micro-invertebrate communities in particular. The later, in turn, are invariably characterized by greater rotifer richness.

A review of the Indian literature reveals general lack of attention on micro-faunal diversity of Phylum Rotifera in rice-fields of this country (Sharma, 1998a). Sharma and Sharma (1999, 2005), however, remarked on occurrence of rotifers in these ecosystems and commented on importance of extensive faunal investigations in these interesting environs. The present study, an attempt to fill up the stated lacuna, provides a detailed account of the rotifer taxocoenosis of the rice-field ecosystems of Meghalaya based on collections examined from different parts of this state. Seventy-four species of Eurotatoria are documented in this account. Various rare and interesting species are briefly diagnosed and illustrated. Remarks are made on nature and composition of the examined rotifer fauna and on distribution of interesting elements.

MATERIALS AND METHODS

The present observations are based on plankton samples collected, during 2001–2003 and also those collected earlier (during 1988–1990) for the “State Fauna of Meghalaya : Zooplankton Survey”

from rice-fields located in different districts of Meghalaya state (Fig. 1, a-b). The material examined for this systematic survey included the samples deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong and those in the holdings of the Eastern Regional Station, Zoological Survey of India, Shillong.

The examined samples are collected, during the period of paddy-cultivation (May/June-October), with a nylobolt plankton net (No. 25) and preserved in 5% formalin. Various samples are screened, the rotifer taxa are isolated, and permanently mounted individually in Polyvinyl alcohol-lectophenol mixture. The drawings are made with a Leitz-Dialux phase contrast stereoscopic microscope using a drawing tube attachment and measurements are indicated in micrometers (μm).

The rotifer taxa are identified following the works of Kutikova (1970), Koste (1978), Sharma (1983, 1998b), Segers (1995) and Sharma & Sharma (1999, 2000). The recent system of nomenclature of Rotifera proposed by Segers (2002) is followed in this account. The distribution of the recorded taxa refers to their reports from Meghalaya and India and that from elsewhere refers to the global distribution.

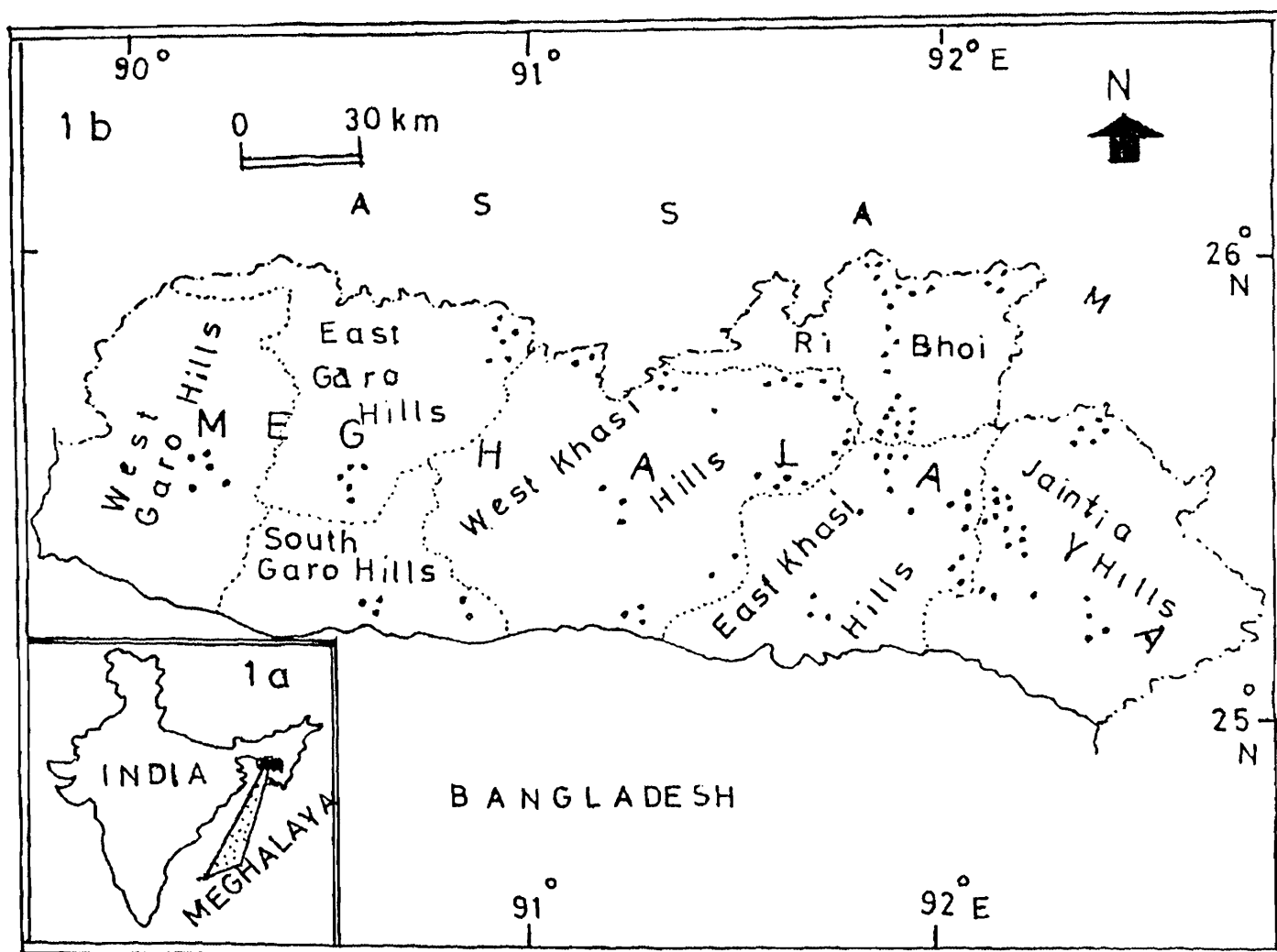


Fig. 1(a-b). : (a) Map of India indicating the state of Meghalaya; (b) Map of Meghalaya showing the sampling sites.

SYSTEMATIC LIST OF ROTIFERA RECORDED FROM RICE-FIELDS

Phylum ROTIFERA

Class EUROTATORIA

Subclass MONOGONONTA

Order PLOIMIDA

Family BRACHIONIDAE

<i>Brachionus angularis</i> Gosse, 1851	C
<i>Brachionus bidentatus</i> Anderson, 1889	Pt
<i>Brachionus falcatus</i> Zacharias, 1898	Pt
<i>Brachionus dichotomus reductus</i> Koste & Shiel, 1980	A
<i>Brachionus quadridentatus</i> (Hermann, 1783)	C
<i>Keratella cochlearis</i> Gosse, 1851	C
<i>Keratella tropica</i> (Apstein, 1907)	C
<i>Platylabus quadricornis</i> (Ehrenberg, 1832)	C
<i>Platylabus patulus</i> (O.F. Müller, 1786)	C
<i>Platylabus patulus macracanthus</i> (Daday, 1905)	N

Family EUCHLANIDAE

<i>Euchlanis dilatata</i> Ehrenberg, 1832	C
<i>Dipleuchlanis propatula</i> (Gosse, 1886)	C
<i>Manfredium eudactylota</i> (Gosse, 1886)	C

Family MYTILINIDAE

<i>Lophocharis salpina</i> (Ehrenberg, 1834)	C, NRM
<i>M. ventralis</i> (Ehrenberg, 1832)	C

Family TRICHOTRIIDAE

<i>Macrochaetus longipes</i> (Myers, 1934)	C, NRM
<i>Macrochaetus sericus</i> (Thorpe, 1893)	Pt
<i>Trichotria tetractis</i> (Ehrenberg, 1830)	C

Family LEPADELLIDAE

<i>Colurella adriatica</i> Ehrenberg, 1831	C, NRM
<i>Colurella sulcata</i> (Stenroos, 1898)	C
<i>Colurella uncinata</i> (O.F. Müller, 1773)	C
<i>Lepadella acuminata</i> (Ehrenberg, 1834)	C

<i>Lepadella apsicora</i> Myers, 1934	C
<i>Lepadella apsida</i> Haring, 1916	C
<i>Lepadella costatoides</i> Segers, 1993	Pt
<i>Lepadella discoidea</i> Segers, 1993	Pa, NRM
<i>Lepadella ehrenbergi</i> (Perty, 1850)	C
<i>Lepadella eurysterna</i> Myers, 1942	C, NRNE
<i>Lepadella heterostyla</i> (Murray, 1913)	C
<i>Lepadella ovalis</i> (O.F. Müller, 1786)	C
<i>Lepadella patella</i> (O.F. Müller, 1773)	C
<i>Lepadella rhomboides</i> (Gosse, 1886)	C
<i>Lepadella triptera</i> Ehrenberg, 1830	C

Family LECANIDAE

<i>Lecane aculeata</i> (Jakubski, 1912)	T
<i>Lecane arcula</i> Haring, 1914	T, NRM
<i>Lecane bulla</i> (Gosse, 1851)	C
<i>Lecane closterocerca</i> (Schmarda, 1898)	C
<i>Lecane curvicornis</i> (Murray, 1913)	T
<i>Lecane doryssa</i> Haring, 1914	T
<i>Lecane furcata</i> (Murray, 1913)	C
<i>Lecane hamata</i> (Stokes, 1896)	C
<i>Lecane hornemanni</i> (Ehrenberg, 1834)	T
<i>Lecane inermis</i> (Bryce, 1892)	C
<i>Lecane jaintiaensis</i> Sharma, 1987	END
<i>Lecane lateralis</i> Sharma, 1978	Pa, NRM
<i>Lecane leontina</i> (Turner, 1892)	T
<i>Lecane ludwigii</i> (Eckstein, 1883)	C
<i>Lecane luna</i> (O.F. Müller, 1776)	C
<i>Lecane lunaris</i> (Ehrenberg, 1832)	C
<i>Lecane monostyla</i> (Daday, 1897)	T, NRM
<i>Lecane ohioensis</i> (Herrick, 1885)	T, NRM
<i>Lecane papuana</i> (Murray, 1913)	T
<i>Lecane ploenensis</i> (Voigt, 1902)	C
<i>Lecane quadridentata</i> (Ehrenberg, 1832)	C
<i>Lecane signifera</i> (Jennings, 1896)	T
<i>Lecane unguitata</i> (Fadeev, 1925)	Pa
<i>Lecane ungulata</i> (Gosse, 1887)	C

Family NOTOMMATIDAE

<i>Monommata longiseta</i> (O.F. Müller, 1786)	C
<i>Monommata maculata</i> Myers, 1930	C, NRM

Family SCARIDIIDAE

<i>Scaridium longicaudum</i> (O.F. Müller, 1786)	C
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Family TRICHOCERCIDAE

<i>Trichocerca cylindrica</i> (Imhof, 1891)	Pa
<i>Trichocerca jenningsi</i> Voigt, 1957	C
<i>Trichocerca longiseta</i> (Schränk, 1802)	C
<i>Trichocerca rattus</i> (O.F. Müller, 1786)	T
<i>Trichocerca similis</i> (Wierzejski, 1893)	C

Family ASPLANCHNIDAE

<i>Asplanchna priodonta</i> Gosse, 1850	C
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Family SYNCHAETIDAE

<i>Pleosoma lenticulare</i> Herrick, 1855	C
<i>Polyarthra vulgaris</i> Carlin, 1943	C

Order GNESIoTROCHA

Family FILINIIDAE

<i>Filinia longiseta</i> (Ehrenberg, 1834)	C
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Family TESTUDINELLIDAE

<i>Testudinella emarginula</i> (Stenroos, 1898)	C
<i>Testudinella parva</i> (Ternetz, 1892)	C
<i>Testudinella patina</i> (Hermann, 1783)	C
<i>Testudinella tridentata</i> Smirnov, 1931	C, NRM

Subclass BDELLOIDEA

Family PHILODINIDAE

<i>Philodina citrina</i> (Ehrenberg, 1832)	C
<i>Rotaria neptunia</i> (Ehrenberg, 1832)	C

END – Endemic, C – Cosmopolitan, A – Australasian, Pa – Palaeotropical, T – Tropicopolitan, N – Neotropical, NRNE – New record from N. E. India, NRM – New record from Meghalaya.

SYSTEMATIC NOTES ON RARE AND INTERESTING TAXA

The examined collections revealed a number of rare and interesting elements. These taxa are briefly diagnosed below, with notes on their distribution :

Brachionus dichotomus reductus Koste & Shiel, 1980

(Fig. 2)

Diagnosis : Lorica firm, stippled, dorso-ventrally compressed and with maximum width in its posterior region. Anterior occipital margin with distinct median spines of variable length. Posterior spines moderately long and divergent.

Distribution : Meghalaya : reported earlier by Sharma and Sharma (1999). India : Meghalaya, Tripura and Assam. *Elsewhere* : Australasian, with records from Australia and Thailand.

Lophocharis salpina (Ehrenberg, 1834)

(Fig. 3)

Diagnosis : Lorica long, triangular in cross-section and anterior margin of lorica strongly serrated. Dorsal keel of lorica distinct and with transverse folds.

Distribution : Meghalaya : New record. India : Assam. *Elsewhere* : Cosmopolitan.

Colurella adriatica Ehrenberg, 1831

(Figs. 4 & 5)

Diagnosis : Lorica long and slender; length height ratio low. Posterior end of lorica with curved spines. Toes long.

Distribution : Meghalaya : New record. India : Assam. *Elsewhere* : Cosmopolitan.

Macrochaetus longipes (Myers, 1934)

(Fig. 6)

Diagnosis : Lorica serrated and characterized by 12 long spines. Specimens identical with those illustrated by Sharma (2005).

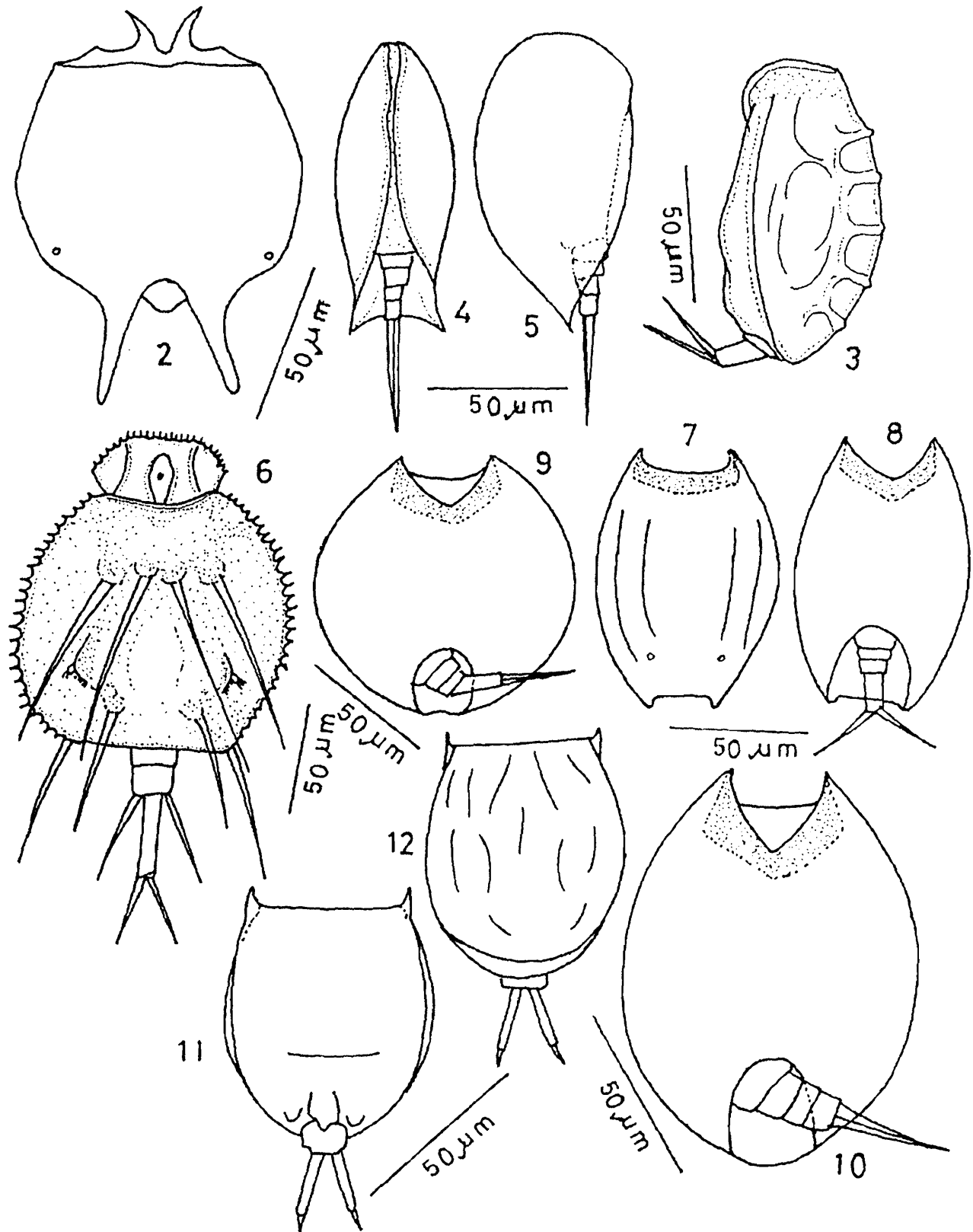
Distribution : Meghalaya : New record. India : Assam. *Elsewhere* : Cosmopolitan.

Lepadella costatoides Segers, 1993

(Figs. 7 & 8)

Diagnosis : Dorsal surface of lorica with three pairs of longitudinal ridges. Postero-lateral projections symmetrical. The specimens collected from a paddy-field near Thadlaskein are identical with the details given by Segers (1993).

Distribution : India : Meghalaya, recorded by Sharma (2004). *Elsewhere* : Pantropical.



Figs. 2-13. : 2. *Brachionus dichotomus reductus* Shiel & Koste, ventral view; 3. *Lophocharis salpina* (Ehrenberg), lateral view; 4. & 5. *Colurella adriatica* Ehrenberg, ventral and lateral views; 6. *Macrochaetus longipes* (Myers), dorsal view; 7. & 8. *Lepadella costatoides* Segers, dorsal and ventral views; 9. *L. discoidea* Segers, ventral view; 10. *L. eurysterna* Myers, ventral view; 11. & 12. *Lecane arcula* Harring, dorsal and ventral views.

***Lepadella discoidea* Segers, 1993**

(Fig. 9)

Diagnosis : Lorica circular in outline and compressed dorso-ventrally; dorsum arched. Foot three segmented; distal foot-segment longest. Toes long.

Distribution : Meghalaya : new record. India : Delhi and Assam. *Elsewhere* : Palaeotropical.

***Lepadella eurysterna* Myers, 1942**

(Fig. 10)

Diagnosis : Differentiated from closely related *L. patella* by characteristic shape of posterior margin of its foot-opening. Toes elongated.

Distribution : N.E. India : new record. India : reported so far only from Delhi. *Elsewhere* : Cosmopolitan.

***Lecane arcula* Harring, 1914**

(Figs. 11 & 12)

Diagnosis : Differentiated from closely related *L. aculeata* by its relatively shorter and less elongated antero-lateral occipital spines.

Distribution : Meghalaya : new record. India : Assam. *Elsewhere* : Tropicopolitan.

***Lecane doryssa* Harring, 1914**

(Figs. 13 & 14)

Diagnosis : Lorica flexible and with fewer surface markings. Anterior occipital margins nearly straight and coincident; dorsal plate broader than ventral plate. Posterior segment large. Toes slender and with thin, pointed and undifferentiated claws.

Distribution : Meghalaya : recorded earlier by Sharma (1987). India : Meghalaya. *Elsewhere* : Tropicopolitan.

***Lecane jaintiaensis* Sharma, 1987**

(Figs. 15 & 16)

Diagnosis : Lorica elongate-oval, with coincident anterior margins and small triangular cusps at external angles. Ventral plate slightly narrow than dorsal plate. Posterior segment broad. Second foot-segment rectangular and projecting a little beyond lorica. Toes long, swollen at their bases, almost parallel-sided and terminating into acutely pointed tips.

Distribution : Meghalaya : described (Sharma, 1987) from a rice field at Nartiang, Jaintia Hills district and known so far only from its type locality. India : an endemic species.

***Lecane lateralis* Sharma, 1978**

(Figs. 17 & 18)

Diagnosis : Lorica ovate, anterior dorsal margin concave and anterior ventral margin with a shallow sinus flanked by undulating sides. Dorsal plate smaller than ventral plate. Ventral plate with postero-lateral extensions. Toes long, parallel-sided along $\frac{3}{4}$ of their lengths, then tapering and terminating into stout claws; each claw with one basal spicule.

Distribution : Meghalaya : new record. India : Tripura, Orissa and West Bengal. *Elsewhere* : Palaeotropical.

***Lecane monostyla* (Daday, 1897)**

(Fig. 19)

Characters : Lorica small, oval, with straight and coincident anterior margins; dorsal plate with characteristic lateral spine-like processes, ventral plate with very small spines at anterior external angles. Toe parallel-sided for $\frac{3}{4}$ of its length and then tapering to an acute point.

Distribution : Meghalaya : new record. India : Tripura and Assam. *Elsewhere* : Cosmopolitan.

***Lecane ohioensis* (Herrick, 1885)**

(Fig. 20)

Characters : Lorica oval and with stout spines at anterior external margins; ventral plate narrower than dorsal plate. Posterior segment broad and with a spade-shaped process. Toes long, parallel-sided and with short, pointed tips.

Distribution : Meghalaya : new record. India : West Bengal and Tripura. *Elsewhere* : Tropicopolitan.

***Monommata maculata* Myers, 1930**

(Fig. 21)

Characters : Body long, slender and integument striated. Foot two-segmented. Toes long and unequal. Trophi characteristic.

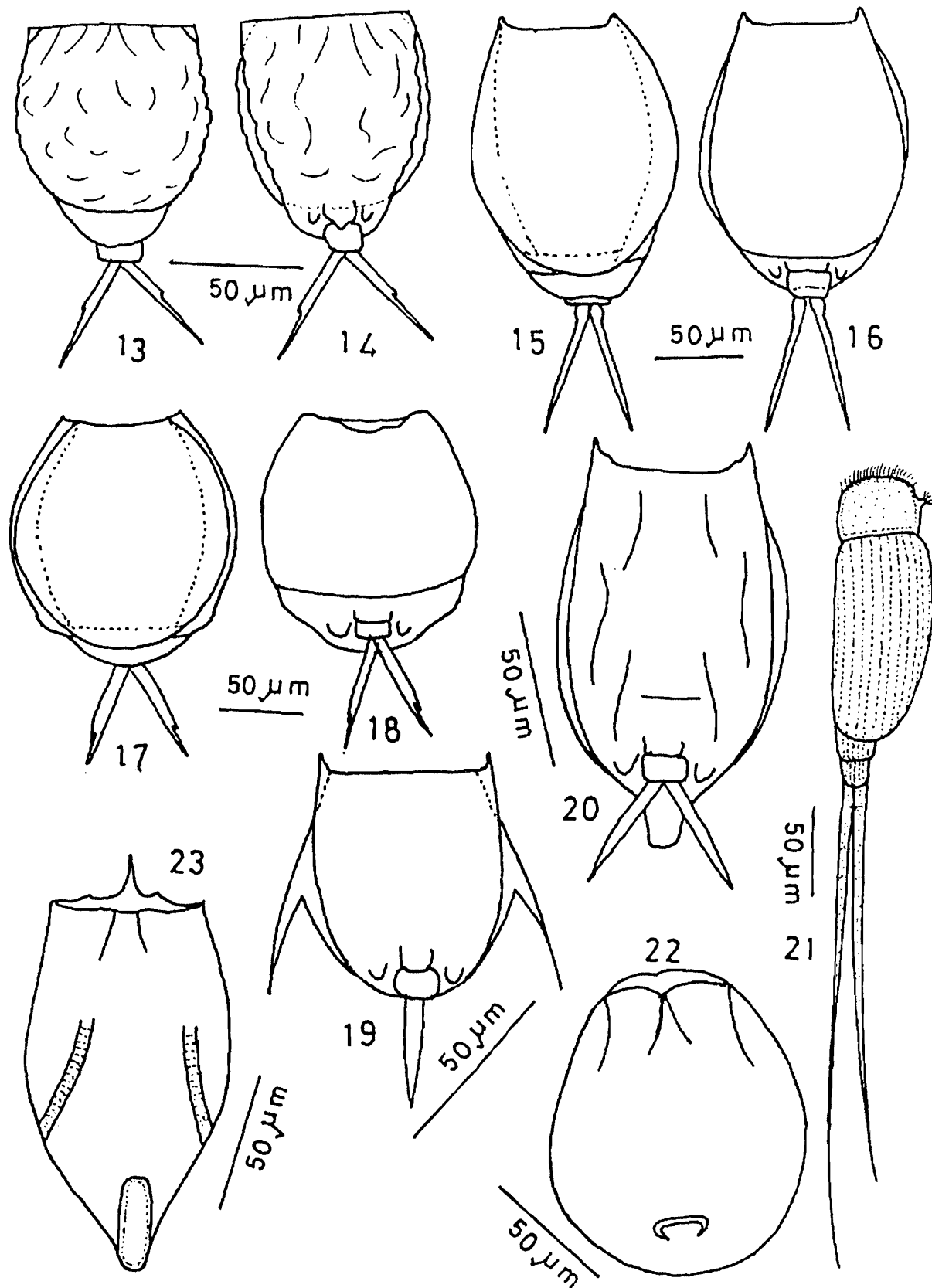
Distribution : Meghalaya : new record. India : Assam. *Elsewhere* : Cosmopolitan.

***Testudinella parva* (Ternetz, 1892)**

(Fig. 22)

Characters : Lorica pear-shaped and with maximum width in the posterior region. Lateral antennae located behind the middle region of lorica. Foot-opening elliptical and located at a short distance from posterior margin of lorica.

Distribution : Meghalaya : recorded earlier by Sharma and Sharma (1999). India : Meghalaya, Assam, Orissa and West Bengal. *Elsewhere* : Cosmopolitan.



Figs. 13-23. : 13. & 14. *Lecane doryssa* Haring, dorsal and ventral views; 15. & 16. *L. jaintiaensis* Sharma, dorsal and ventral views; 17. & 18. *L. lateralis* Sharma, dorsal and ventral views; 19. *L. monostyla* (Daday), ventral view; 20. *L. ohioensis* (Herrick), ventral view; 21. *Monommata maculata* Myers, lateral view; 22. *Testudinella parva* (Ternetz), ventral view; 23. *T. tridentata* Smirnov, ventral view.

***Testudinella tridentata* Smirnov, 1931**

(Fig. 23)

Diagnosis : Lorica vase-shaped, compressed, with maximum width behind its middle and then tapering gradually to a posterior lobate projection. Anterior dorsal margin with long median spine. Foot-opening elongated, located at posterior ventral end of lorica.

Distribution : Meghalaya : new record. India : Tripura and Assam. *Elsewhere* : Cosmopolitan.

REMARKS

Seventy-four species of Eurotatoria documented presently from rice fields of Meghalaya indicate fairly rich and diversified taxocoenosis. This salient feature reflects a greater environmental heterogeneity of the sampled habitats which, in turn, is attributed to their unique and complex limnological nature (Fernando, 1995), water level fluctuations, plantation and growth of paddy, and growth of aquatic weeds. Interestingly, the recorded richness represents the highest qualitative diversity of freshwater rotifers known till date from rice fields of any part of the Indian subcontinent and of the Oriental region and is followed by earlier reports (Fernando, 1980, 1995) of 71 and 51 species from rice fields of Sri Lanka and Thailand, respectively. The rich nature of the rotifer taxocoenosis is also supported by greater higher diversity of this phylum (30 genera and 17 families) which, in turn, certainly compares well with the reports of 39 genera and 20 families from N. E. India (Sharma and Sharma, 2005). Qualitative dominance of Rotifera over other groups of micro-invertebrates noticed in all the collections examined from rice fields of Meghalaya concurred with the trends noted in these biotopes from other parts of the world (Fernando, 1995).

Biogeographically interesting elements constitute a notable fraction (8.1%) of the listed species; these include the endemic *Lecane jaintiaensis*, the Australasian *Brachionus dichotomus reductus* and four palaeotropical species namely *Lepadella discoidea*, *Lecane lateralis*, *L. unguitata* and *Trichocerca cylindrica*. Among these, the endemic lecanid deserves special mention because of its rare occurrence in the Indian fauna and is so far known exclusively from its “type-locality” *i.e.*, a paddy field located in Nartiang, Jaintia Hills district of Meghalaya state. The second species represents one of the four Australasian elements recorded from India and is so far documented only from N. E. region (Sharma and Sharma, 2005). Further, this brachionid serves an interesting example to assign special affinity of the rotifer faunas of Meghalaya and N. E. India with that of S. E. Asia and tropical Australia (Sanoamuang *et al.*, 1995; Sanoamuang, 1998; Sharma, 2004, 2005). Segers (2001) commented on occurrence of *reductus* vicariant of *B. dichotomus* outside Australia, hypothesized recent expansion of these populations to Southeast Asia and hinted at a possible Australian origin of this taxon. The restricted occurrence of this brachionid in N. E. region (Sharma, 2005) lends additional support to Segers’s hypothesis. Among the members of the last category, *Lepadella discoidea* has been described (Segers, 1993) from Africa while *Lecane lateralis*,

originally described from West Bengal (Sharma, 1978), is now known to be apparently widely distributed in sub(tropical) parts of the Old and New world.

Ten species namely *Lophocharis salpina*, *Macrochaetus longipes*, *Colurella adriatica*, *Lepadella discoidea*, *Lecane arcua*, *L. lateralis*, *L. monostyla*, *L. ohioensis*, *Monommata maculata* and *Testudinella tridentata* comprise new records to the rotifer fauna of the state of Meghalaya while *Lepadella eurysterna* is a new addition to the N. E. Indian Rotifera. Besides, several other species namely *Lepadella costatoides*, *Lecane arcua*, *L. furcata*, *Pleosoma lenticulare*, *Testudinella emarginula* and *T. parva* are elements of regional distributional importance. The present study raises overall rotifer richness from Meghalaya to 126 species which, in turn, represents the second largest diversity known from any state of India and follows the report of 148 species from West Bengal (Sharma, 1998b). Further, the presently documented species form an important component of the rotifer faunas of Meghalaya (58.7%) and that N. E. India (39.1%). Of the reported species, *Brachionus dichotomus reductus*, *Lecane monostyla* and *Testudinella tridentata* are till now known to occur only in N. E. India, *Lepadella costatoides* and *Lecane doryssa* are restricted to Meghalaya while five species viz., *Lophocharis salpina*, *Colurella adriatica*, *Macrochaetus longipes*, *Lecane arcua* and *Monommata maculata* so far occur only in Assam and Meghalaya.

The rotifer communities of rice fields of Meghalaya exhibit predominance of cosmopolitan species (71.6%); their overall contribution is higher than noticed earlier in the faunas of Meghalaya (Sharma and Sharma, 1999) and N. E. India (Sharma and Sharma, 2005), respectively. On the other hand, Tropicopolitan (14.9%) species are well represented while the present study indicates relatively fewer Pantropical elements (5.4%). The stated pattern, however, deviates than the observed richness of Pantropical > Tropicopolitan species in the faunas of Meghalaya and N. E. region. Lecanidae (23 species) > Lepadellidae (15 species) > Brachionidae (9 species) together constitute a significant component (63.3%) of the documented species. This stated pattern differs notably from that of Meghalaya and N. E. region Rotifera because of occurrence of distinctly fewer species of the last family in the examined collections.

Two genera namely *Lecane* (23 species) > *Lepadella* (12 species) depict distinctly higher diversity and are followed by *Brachionus* (5 species) = *Trichocerca* (5 species) > *Testudinella* (4 species). Qualitative predominance (31.1%) of 'tropic-centered' genus *Lecane* compares well with the reports of Segers *et al.*, (1993), Sanoamuang (1998), Sharma & Sharma (1997, 2001, 2005) and Sharma (2005). This salient feature imparts a general tropical character to the examined taxocoenosis and also concurs with the composition of tropical rotifer communities (Green, 1972; Pejler, 1977; Fernando, 1980; Dussart *et al.*, 1984; Segers, 1996, 2001; Sharma, 1998b). On the other hand, the relative paucity of the brachionids in general and that species of *Brachionus*, another important 'tropic-centered' genus in particular is a noteworthy feature of the present observations. The latter aspect is attributed to lack of typical limnetic conditions in shallow ephemeral rice fields

and also to general acidic to nearly neutral nature of waters of these biotopes (Sharma, personal communication).

Highest richness of upto 35 species/sample in subtropical rice-fields of Khasi (East and West) and Jaintia Hills districts of Meghalaya observed currently, with predominance of *Lecane* > *Lepadella* endorsed earlier results of Sharma (1987) and Sharma and Sharma (1987, 2005). On the contrary, the samples from Garo Hills region indicated relatively lower richness with maximum upto 22–25 species/sample. Though the present study did not make any systematic attempt to trace temporal changes in species richness during the whole paddy season (May/June–October), the analyzed collections indicate fewer pioneer *Lecane* species following ploughing and application of organic fertilizer (cow dung) during May/early June and the community heterogeneity increased with paddy plantation and its subsequent growth and peak richness was invariably observed in the samples collected during August–September. Such a generalization also concurred with the richness pattern reported by Fernando (1995).

The shallow nature of the sampled rice fields and the growth of paddy and some aquatic weeds apparently resulted in predominance of periphytic species in the studied collections, showed occurrence of very few facultative planktonic taxa and complete lack of any typical planktonic element. *Plationus patulus*, *Trichotria tetractis*, *Lepadella patella*, *L. ovalis*, *Lecane bulla*, *L. leontina*, *L. luna*, *L. lunaris*, *L. quadridentata* and *Testudinella patina* exhibited relatively common occurrence. The list of presently documented taxa, though fairly exhaustive as per the examined materials, may still provide scope for its up-dating based particularly on regular fortnightly/monthly collections from these interesting ecotones.

SUMMARY

Seventy-four species of Eurotatoria, belonging to 30 genera and 17 families, documented presently from sub-tropical rice fields of Meghalaya represent the richest species and higher diversity of Rotifera known till date from these habitats from any part of the Indian subcontinent. *Lepadella eurysterna* represents a new record from N. E. India while ten species are new records to the rotifer fauna of Meghalaya. Biogeographically interesting elements constitute a notable fraction (8.1%) of the listed species; these include the endemic *Lecane jaintiaensis*, one Australasian element and four palaeotropical species. Besides, this study indicates several elements of regional distributional importance including three species known to be so far restricted to N. E. India, two to Meghalaya and five recorded only from Meghalaya and Assam. Cosmopolitan species (71.6%) distinctly dominate Tropicopolitan (14.9%) > Pantropical (5.4%) species. The rotifer taxocenosis depicts general tropical nature characterized by richness of 'tropic-centered' genus *Lecane*, qualitative importance of Lecanidae > Lepadellidae, predominance of the littoral-periphytic elements and lack of typical planktonic taxa, paucity of *Brachionus* spp., and records highest richness of upto 35 species/sample.

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**DESCRIPTION OF *ARGIOPE LOBATA* PALLAS
(ARANEAE : ARANEIDAE) FROM NALLAMALAI REGION,
EASTERN GHATS, ANDHRA PRADESH, INDIA**

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Argiope lobata Pallas

(Figs. 1-6)

1772. *Argiope lobata*, Pallas, *Spc. Zool. Ipt.*, **9** : 46.

1900. *Argiope lobata*, Pocock : *Fauna Brit. India Arachnida* : 221.

General : Female cephalothorax yellowish brown with few radiating dark patches on mid lateral portion, palps yellowish, legs lighter on trochanter and femur, except femur I, but darker on distal digits, tibiae IV with a yellow round spot at the proximal joint on ventral side. Abdomen light yellow with few darker marking and sigillae, lobed, ending blunt.

Measurements (mm) : Total length 19 mm; Cephalothorax 5 mm long, 4.75 mm wide; Abdomen 14 mm long, 10 mm wide.

Cephalothorax : Longer than wide, Cephalic region slightly raised, eyes in two rows, anterior row almost straight with anterior lateral pairs smaller than median pair as well as posterior lateral pair, posterior row recurved, both pairs almost of same size and encircled with black ring, ocular quadrangle longer than wide. Thoracic portion with a median shallow depression with elongated fovea chelicerae with elongated basal segment, moderate to weak boss noticeable on external basal portion, few spines present at the inner basal portion, elongated and distally covered with few spines and hair, fang furrow distinct with aboral margin with four distinct teeth, 2nd being longer oral margin with 3 teeth, almost of equal size, fang not much curved but sharply pointed; palps

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with spines on coxae, trochanter but femora with one spine each on distal inner portion, patellae with out spine but tibiae and tarsi with many robust spines. Legs formula 2143, I & II coxae and trochanters with few minute spines below, femora, patellae, tibiae and tarsus with many long and pointed spines, III & IV coxae, trochanters with short ventral spines; femora III with 4 to 5 spines, IV with a row of many ventral spines; patellae, tibiae and tarsi with many strong spines, all legs covered with small, delicate pubescence; sternum heart shaped, pointed posteriorly, yellow medially but 2–3 black patches laterally, labium almost as long as wide, narrow mid-anteriorly, maxillae broad, with brown ridge anteriorly.

Abdomen : Longer than wide, 3 pairs of prominent and 3 pairs of rudimentary lateral lobes, smooth, with 6 pairs of darker sigillae, blunt on posterior end; ventrally with middle blackish patch, middle lateral yellowish patches posteriorly encircle the spinnerets; epigyne with a anterior median scape forming a median septum and joining to posterior short basal septum; internal genitalia with a pair of rounded spermathecae, each with a short duct, opening posteriorly (Fig. 4).

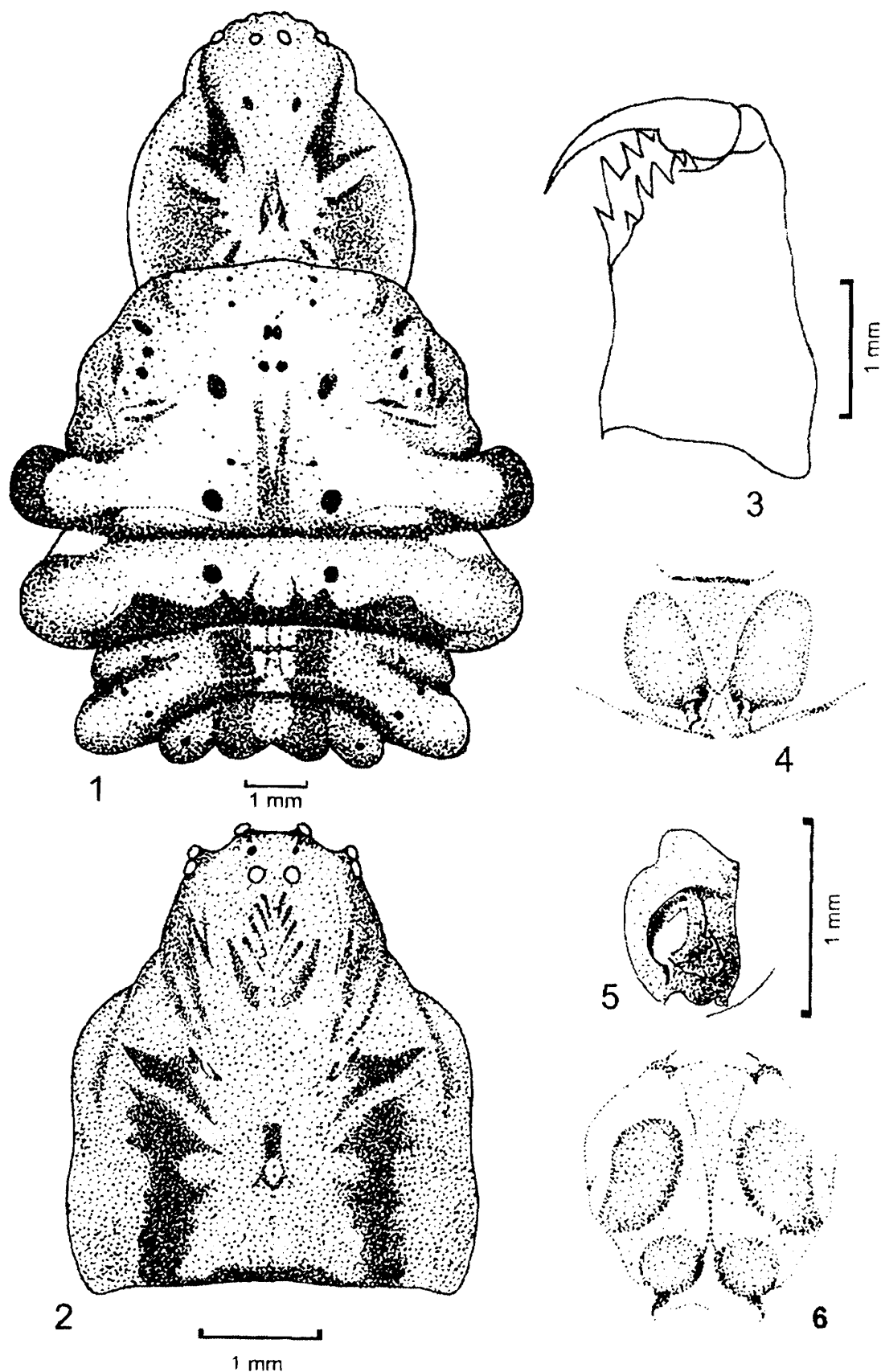
Material examined : 2 ♀ ♀; Rollapadu Wildlife Sanctuary, NSTR, Kurnool Dist., Andhra Pradesh, India, Coll. K. Thulsi Rao & S.M. Maqsood Javed, 4.4.2003.

Distribution : Bellary, Karnataka (Pocock), Daghra Karoor (Simon).

Remarks : Pocock (1900) in his keys to *Argiope* species mentioned that unspined 3rd and 4th coxae and trochanters which seems to be misleading. Further Tikader (1982) has not dealt with the species described as *Argiope lobata* (Pallas) though it was known from India; this probably may be due to the unavailability of type specimens. The description and illustrations presented by Tikader (1982) in his fauna of Indian spider 2(1) : Araneidae Figs. 215–218 for *Argiope arcuata* Simon shows definitely that *Argiope lobata* Pallas is a different species from that of *Argiope arcuata* Simon. Author do not agree with Levy for synonymous placement of *Argiope lobata* Pallas to *Argiope arcuata* Simon, on basis of above remarks. Complete re-description and illustrations have been presented including internal genitalia which show considerable difference to that of *Argiope arcuata* Simon.

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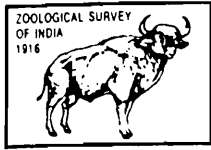


Figs. 1-6 : *Argiope lobata*, Pallas; 1. Female dorsal view (legs omitted). 2. Carapace, dorsal view. 3. Chelicera inner view showing arrangements of teeth. 4. Internal genitalia, dorsal view. 5. Epigyne, lateral view. 6. Epigyne, ventral view.

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ROTATORIAN FAUNA OF KASU BRAHMANANDA REDDY NATIONAL PARK, HYDERABAD

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INTRODUCTION

Rotifers (also called Rotatoria) are sessile, microscopic (40 microns to 250 microns in size), pseudococclomate, free swimming, cosmopolitan organisms. 95% of the rotatorians occur in freshwater and the rest are found in sea. Most of the species of this group have got world wide distribution. In India 330 species of Rotifera have been reported out of which 91 species are from Andhra Pradesh (Dhanapathi, 2000). Rotifer studies in India were started by Anderson (1889) and later carried out by Dhanapathi (1974, 1975, 1976), Edmondson and Hutchinson (1934), Nasar (1968), Patil (1978, 1988, 2001), Sharma (1978, 1979) *etc.* This paper has gained significance due to its maiden effort to study the Rotifer fauna of ponds of a national park in India. The study has yielded 8 species (*Brachionus calyciflorus* with 3 varieties) of Rotifera belonging to 5 genera spread over 4 families in two orders.

STUDY AREA

Kasu Brahmananda Reddy National park with an area of 142.5 hectares is situated in the hill rocks of prestigious Jubilee hills, in the heart of the city between Cyberabad and Hyderabad (17°35' N and 78°25' E). It is named after the demise of former Chief Minister of Andhra Pradesh, Shri Kasu Brahmananda Reddy and this park had been declared as National Park in the year, 1994. It houses 3 small ponds with an area of 0.5 to 1 hectare, one of which is comparatively big (one hectare) and perennial one.

MATERIAL AND METHODS

During the course of fortnightly surveys to the park during 2002-2003, in connection with the Inventorisation of Faunal Resources of National Parks assigned to Freshwater Biological Station

(FBS), Zoological Survey of India (ZSI), Hyderabad, the authors have collected qualitative plankton samples, from undisturbed subsurface regions of all the ponds, with bolting silk conical net (No. 25) and preserved with 5% formaldehyde solution. Rotatorian fauna was identified with the aid of standard literature viz., Battish (1992), Dhanapathi (2000), Sharma (1978, 1979, 1980). The results of the study is given here and measurements of the specimens are given in microns.

SYSTEMATIC ACCOUNT

Phylum ROTIFERA

Class MONOGONONTA

Order PLOIMIDA

Family BRACHIONIDAE

Brachionus calyciflorus f. borgerti (Apstein, 1907)

This species can be identified from other *Brachionus* genera with its Median occipital spines slightly longer than laterals and posterior spines reduced or absent.

Measurements : Lorica length : 230, width 196, median occipital spines 54, lateral spine 50.

Status : Common.

Distribution : India, China and Japan.

Source : Dhanapathi (1977).

Brachionus calyciflorus var. dorcas Gosse, 1851

This species had earlier been reported by Dhanapathi (1974) from Hussainsagar, Hyderabad and can be identified by median occipital spines much longer than laterals and posterior spines absent.

Measurements : Lorica length : 230, maximum width 175, anterior median spines 98, anterior lateral spine 52.

Status : Very Common.

Distribution : Europe, India, China and Japan.

Source : Dhanapathi (1974).

Brachionus calyciflorus var. hymani Dhanapathi, 1974

This species had earlier been reported by Dhanapathi (1974) from Vizianagaram and Rao and Chandra Mohan (1983) from Visakhapatnam of Andhra Pradesh and can be identified by the median spines slightly longer than laterals and posterior spines flanking the foot opening.

Measurements : Lorica length 225, maximum width 198, anterior median spine 50, anterior lateral spine 42, posterior lateral spine 25.

Status : Common.

Distribution : India.

Source : Dhanapathi (1974).

***Brachionus diversicornis* Daday, 1883**

This species can be identified by lorica with four occipital spines of which the laterals longer than medians; right posterior spine longer than the left.

Measurements : Lorica length 178, maximum width 120, anterior lateral spine 38, right posterior spine 62, left posterior spine 10.

Status : Uncommon.

Distribution : Cosmopolitan.

Source : Nasar (1968).

***Brachionus durgae* Dhanapathi, 1974**

This species can be identified by lorica with anterior margin with six saw like spines of equal length and 'V shaped sinus; ventral margin with projections having truncated edges.

Measurements : Lorica length : 235, maximum width 218, occipital spines 12.

Status : Common.

Distribution : India, Japan, Africa, S. America.

Source : Dhanapathi, 1974.

***Brachionus falcatus* Zacharias, 1898**

This species can be identified with six anterior dorsal unequal spines, the medians long and curved ventrally at the end; posterior spines very long and bent inwards.

Measurements : Lorica length : 110, maximum width 100, anterior intermediate spine 68, posterior spines 75.

Status : Very Common.

Distribution : Cosmopolitan.

Source : Brehm (1950).

***Keratella tropica* (Apstein, 1907)**

This species can be identified from other *Keratella* species by the presence of right posterior spine.

Measurements : Lorica length : 135, maximum width 51, Posterior right spine 68, posterior left spine 13.

Status : Very Common.

Distribution : Asia, Africa, Australia, North and South America.

Source : Edmondson & Hutchinson (1934).

Family MYTILINIDAE***Mytilina ventralis* Ehrenberg, 1832**

Body cylindrical and laterally compressed; anterior end of lorica strippled and with curved spines; posterior ventral spines longer than the posterior dorsal spine.

Measurements : Lorica length : 195, posterior dorsal spine 40, posterior ventral spine 53.

Status : Uncommon.

Distribution : Cosmopolitan.

Source : Anderson (1889).

Family LECANIDAE***Lecane (Monostyla) bulla* (Gosse, 1851)**

Lorica elongate and ovate, anterior dorsal margin with 'V' shaped sinus and ventral margin with deep rounded sinus; toe long, slightly enlarged in the middle and ending in acute claw.

Measurements : Lorica length : 108, maximum width 85, toe 48, claw 5.

Status : Uncommon.

Distribution : Cosmopolitan.

Source : Anderson (1889).

Order GNESIOTROCHA**Family TESTUDINELLIDAE*****Testudinella patina* (Hermann, 1783)**

This species can be identified by stripped lorica and anterior dorsal margin in bow shape; foot opening circular and at 1/3 of distance from posterior end.

Measurements : Lorica length : 165, Maximum width 163.

Status : Common.

Distribution : Cosmopolitan.

Source : Anderson (1889).

SUMMARY

A study had been undertaken on the Rotifer fauna from the plankton samples collected from the water ponds of Kasu Brahmananda Reddy National Park, Hyderabad. The results shows the presence of 8 species (*Brachionus calyciflorus* with 3 varieties) of Rotifera belonging to 5 genera spread over 4 families in two orders.

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LIFE CYCLE OF *TETRANYCHUS NEOCALEDONICUS* ANDRE ON *RHIZOPHORA MUCRONATA* LAMK, UNDER LABORATORY CONDITION AT CONTROLLED TEMPERATURE

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INTRODUCTION

Sundarbans Biosphere Reserve (SBR) is very rich with mangrove vegetation. During the present study, *Tetranychus neocaledonicus* Andre was found infesting mangrove as well as agri-horticultural vegetation. Infestation of this mite may cause serious yield loss. Unfortunately, no study has been made in India to work out its biology and duration of different developmental stages on mangrove plants. Hence an attempt has been made in this study to work out the duration of different developmental stages, longevity, fecundity, sex-ratio, etc on a mangrove plant viz. *Rhizophora mucronata* Lamk. The results thereof are presented in this paper.

MATERIAL AND METHODS

The life cycle of an important phytophagous mite, *Tetranychus neocaledonicus* Andre was studied on a mangrove plant *Rhizophora mucronata* Lamk. at controlled temperature ($30 \pm 1^\circ\text{C}$) in the laboratory. The leaf-disc technique was followed (Lal, 1977). The excised leaf of *Rhizophora mucronata* was kept on wet cotton swab in a Petridish of 5 cm diameter.

The cotton swab was always kept supersaturated with water to prevent escape of mites. The excised leaf of *Rhizophora* was kept on cotton swab ventral surface upward. About ten females collected from field were released on the leaf kept on the wet cotton swab and the females were allowed to lay eggs. Next morning the eggs were counted, marked and after that the females were removed leaving only the eggs. The eggs were kept as such till they hatched into larvae. After hatching, each larva was transferred on individual Petridish and for each stage at least 10 replications

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were maintained enabling the data to analyse statistically. Observations were recorded at 12 hourly intervals till they attained adulthood.

Whenever, the eggs hatched, the larvae were removed and kept on a separate excised leaf on Petridish and all those were maintained individually till attaining adulthood. All the Petridishes were kept in BOD incubator where desired temperature i.e., 30°C was maintained. During the life study period the drying or decaying excised leaves were replaced with fresh ones and the mites were transferred carefully on the fresh excised leaf.

For studying sex ratio, some females were released on excised leaves kept on wet cotton swabs in petridishes and were allowed to lay eggs. After laying of sufficient eggs, all the females were removed on the following day and the total number of eggs obtained was counted. The eggs hatched into larvae and those gradually developed into adults passing through different stages. Thereafter, among the total adults obtained, the total number of females and males were counted and ratio of males and females were computed on the basis of total number of eggs with which the experiment was started.

During experimentation when mortality was noticed in any of the Petridishes, data from the said dish recorded earlier was discarded and was not considered for completion of the duration of different stages.

The duration of different stages like incubation, larval, protonymphal, deutonymphal, adult, egg to adult, preoviposition, oviposition, postoviposition, fecundity and longevity were recorded. The data so collected were subjected to statistical analysis.

RESULTS AND DISCUSSION

Mating : The adults of both male and female became sexually mature immediately after emergence. Males emerged earlier than females. It was found that more than one male tried to impregnate a single female but once the female allowed the male to impregnate her, she did not allow others in doing so even at later stage.

Incubation : The eggs were round, about 50 microns in diameter and laid in groups of (5–8 eggs/day) on the under surface of the leaf.

The mean incubation period was 3.33 ± 0.23 days having minimum of 3 days and maximum of 4 days. The percentage of hatching was 76.65 ± 0.41 . The incubation period as reported by other workers were 4.20 days in *Tetranychus ludeni* feeding on okra (Puttaswamy and ChannaBasavanna, 1981), and 4.60 ± 0.89 days in *Tetranychus ludeni* at 33°C (Singh *et al.*, 1989).

Larva Stage : The larva was light reddish in colour having three pairs of legs and move very slowly. The mean larval period was 3.25 ± 0.22 days with the minimum of 3 days and maximum

of 4 days. The earlier workers like Mallik and ChannaBasavanna (1981) reported the period as 32.5 hours in case of *Tetranychus ludeni*, 1.0–2.5 days in *T. neocaledonicus* (Manjunath & Puttaswamy, 1989).

Protonymph Stage : This stage can be easily distinguished for the larval stage because of having 4 pairs of legs and the body colour was also deeper than the previous stage. It was more active than larval stage. The mean protonymphal period was 3.80 ± 0.17 days having minimum of 3 days and maximum of 4 days. The earlier workers like Mallik and ChannaBasavanna (1983) in case of *Tetranychus ludeni* reported this period as 34.5 hours while Puttaswamy and ChannaBasavanna (1982) in case of *Tetranychus ludeni* reported this period as 2.27 days, feeding on okra leaves and 2.22 days in case of *T. neocaledonicus*. The female protonymph before moulting to the next stage passed through a short quiescent stage while male protonymphs directly moulted into adults.

Deutonymph Stage : Deutonymphs are larger in size, reddish orange in colour and were more active than the previous stage. The duration of this stage was 3.60 ± 0.15 days, Mallik & ChannaBasabanna (1983) reported this period around 2 days in case of *Tetranychus ludeni* and Manjunath and Puttaswami (1989) reported this period as 1.83 ± 0.19 days in case of *Tetranychus neocaledonicus*.

Egg to Adult Period : The mean egg to adult period was 13.50 ± 0.15 days with the minimum of 6.00 days and maximum of 7.00 days. The percentage of mortality was found to be 16.66. This duration appeared to be on the much higher side as compared to 222 hours in *Tetranychus ludeni* (Mallik and ChannaBasavanna, 1983), 10.16 ± 0.74 days at 29°C in case of *Tetranychus ludeni* (Singh *et al.*, 1989).

Pre-oviposition Period : The mean pre-oviposition period was 2.50 ± 0.15 days. The observations as reported by other workers were 0.98 days in *Tetranychus ludeni* feeding on brinjal leaves (Puttaswamy and ChannaBasavanna, 1981) and 1.83 ± 0.19 days in case of *Tetranychus neocaledonicus* (Mallik & ChannaBasavanna, 1983).

Oviposition Period : The mean oviposition period was 4.70 ± 0.14 days. The observations reported by other workers were 10.85 days in *Tetranychus ludeni* feeding on brinjal leaves (Puttaswamy and ChannaBasavanna, 1981). Manjunath and Puttaswamy (1989) reported this period 13.27 ± 3.2 days in case of *Tetranychus neocaledonicus*.

Postoviposition Period : The mean postoviposition period in the present study was 6.20 ± 0.23 days. The observations reported by other workers were 2.30 days in *Tetranychus ludeni* feeding on brinjal leaves (Puttaswamy and ChannaBasavanna, 1981), 1.88 ± 0.47 days in case of *Tetranychus neocaledonicus* (Manjunath and Puttaswamy 1989).

Adult Longevity : The average adult longevity in female was found to be 13.20 ± 0.23 days with the minimum of 12 days and maximum of 14 days. The earlier workers like Puttaswamy and ChannaBasavanna (1982) in case of *Tetranychus ludeni* reported this period as 27.98 ± 4.50 days. Singh *et al.*, (1989) in case of *Tetranychus ludeni* reported this period to be 5.60 to 5.40 days. Manjunath & Puttaswamy (1989), in case of *Tetranychus neocaledonicus* reported this period to be 22.80 ± 0.47 days. Therefore the present observation was less in conformity with the other observations.

Fecundity : The average fecundity was 39.80 ± 0.85 eggs. The earlier workers like Puttaswamy and ChannaBasavanna (1982) reported the fecundity as 149.40 eggs in case of *Tetranychus ludeni*, Manjunath & Puttaswamy (1989), on *Tetranychus neocaledonicus* reported this period to be 75.83 ± 22.40 eggs. Therefore the fecundity in the present observation was much less than the earlier observations.

Sex Ratio : The Male : Female sex ratio was found to be 1 : 1.65. So, the sex ratio appeared to be slightly female biased.

Life cycle of *Tetranychus neocaledonicus* Andre on *Rhizophora mucronata* Under Laboratory condition at control temperature ($30^{\circ}\text{C} \pm 1^{\circ}\text{C}$) :

Stage	Range	Average (n = 10)	Duration
Egg	3–4 days	3.33 days	3.33 ± 0.23 days
Larva	3–4 days	3.25 days	3.25 ± 0.22 days
Protonymph	3–4 days	3.8 days	3.8 ± 0.17 days
Deutonymph	3–4 days	3.6 days	3.6 ± 0.15 days
Egg to Adult	13–14 days	13.5 days	13.5 ± 0.15 days
Pre-oviposition	2–3 days	2.5 days	2.5 ± 0.15 days
Oviposition	4–5 days	4.7 days	4.7 ± 0.14 days
Post-Oviposition	5–7 days	6.2 days	6.2 ± 0.23 days
Fecundity	37–43 eggs	39.8 eggs	39.8 ± 0.85 eggs
Adult Longevity	12–14 days	13.2 days	13.2 ± 0.23 days
% of Hatching :	75–80%	76.65%	$76.65 \pm 0.41\%$
% of Mortality :	16.66%		
Sex Ratio (M : F)	1 : 1.65		
n = Number of observations			

SUMMARY

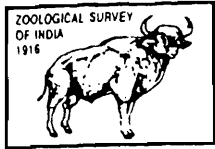
The present paper reports the duration of different developmental stages of *Tetranychus neocaledonicus* Andre along with fecundity, longevity and sex ratio. The life cycle (egg to adult) took 13.5 ± 0.15 days. The fecundity, longevity and Male : Female sex ratio were 39.8 ± 0.85 eggs, 13.2 ± 0.23 days and 1 : 1.65, respectively.

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DIVERSITY OF ROTIFERS OF TAMILNADU

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INTRODUCTION

Rotifers, commonly known as 'wheel animalcules' are one of the major constituents of freshwater zooplankton. These animals could be readily recognized by their small size (0.4 mm to 3.0 mm) and by the presence of ciliated wheel like rotating structure at the anterior end. They are regarded as one of the valuable indicator organisms in biological monitoring studies.

Though this group attracted the attention of scientists worldwide (Jennings, 1900; Yamamata, 1960; Sudzuki, 1964, 1967; Chengalnath and Fernando, 1973; Dumont and De Ridder, 1987; De Peggi, 1990; Sharma and Michael, 1980; Sharma, 1991; Dhanapathi, 2000), the studies on Indian Rotifera are scanty (Sharma, 1998). In Tamilnadu the studies are very limited when compared to other states of India. Edmondson and Hutchinson (1934) reported 8 species of rotifers belonging to 5 genera including *Keratella quadrata* (O.F. Muller) from Ootacamund, Nilgiris, forms the first report of rotifers from Tamilnadu. Subsequently Hauer (1937) recorded 3 species of 3 genera and a form of *Brachionus angularis* from Almati and Sholavaram lakes of the then Madras Presidency, now in Tamilnadu. This was followed by the report of Ahlstrom (1940) who has dealt with a new variety, *Keratella quadrata edmondsoni* from Ootacamund which was later, made as a new combination, *Keratella edmondsoni* (Nayar, 1965). Later Brehm (1951) described a species *Brachionus donneri* from Almati reservoirs of Madras and Donner (1953) referred to the collections of Brehm and described *Trichocerca (Diurella) ruttneri*. During the development of fishery ponds in Kodaikanal, Chacko (1951) recorded 5 species of rotifers, though the validity of those species is yet to be ascertained. The decade between 1961–1970 registered more works on taxonomy from Tamilnadu. Pasha (1961) reported the occurrence of 6 Lecanid rotifers from freshwater tanks and the Cooum river of Madras. Hutchinson (1964) resurrected *Filinia pejleri* from the figure reported earlier by Edmondson and Hutchinson (1934). Michael (1966) described a colonial rotifer, *Conochilus madurai*, while Wycliffe and Michael (1968) dealt with a new species, *Pseudoembata acutipoda*, an epizoic bdelloid from the gill chambers of *Caridina* sp. In addition Rajendran (1971)

described *Conochilus arboreus*, a new species from Madurai. Michael (1973) provided an important contribution by reporting 12 species of rotifers belonging to 4 genera and 4 families, along with the key to the genera, a treatise for Tamilnadu rotifer workers.

Sampath *et al.*, (1974) inventorised 45 species of rotifers under 32 genera from the Tamilnadu part of river Cauvery and studied their role as biological indicators. Kannan and Govindasamy (1991) reported 45 species of brackish water rotifers from Portonovo, Tamilnadu. Sampathkumar (1991) reported the distribution of 7 species of *Brachionus* rotifers from the fishponds and later (1992) he has reported 8 species of rotifers belonging to 7 genera and 7 families from the fishponds of Tuticorin. Patil (2000) dealt with 7 species of rotifers under 5 genera and 4 families from the Tamilnadu part of Nilgiri Biosphere Reserve. Daisy (2001) documented 93 species belonging to 16 families under 41 genera from Tirunelveli district and Sivakumar and Altaff (2001) inventorised 26 species under 13 genera from Dharmapuri district. Francis *et al.*, (2003) reported the rotifer diversity of fishponds manured with livestock wastes by recording 33 species belonging to 12 genera under 7 families. Besides, there are many studies on plankton ecology, which comprised part of rotifer taxonomy and ecology (Prabavathy and Sreenivasan, 1977; Raghunathan, 1985, 1990; Mary bai, 1993; Shahul Hameed *et al.*, 1995).

In the present study an inventory of the rotifers of Tamilnadu has been made and the list contains 158 species belonging to 53 genera under 22 families and 3 orders. The systematic list of the same has been given below.

SYSTEMATIC LIST

Phylum ROTIFERA

Subclass EUROTATORIA, Bartos

Superorder MONOGONONTA, Wesenberg-Lund

Order PLOIMIDA Delage

Family BRACHIONIDAE Wesenberg-Lund

1. *Anuraeopsis fissa* (Gosse)
2. *Brachionus angularis* (Gosse)
3. *Brachionus angularis angularis* Gosse
4. *Brachionus angularis bidens* Plate
5. *Brachionus angularis v. chelonis* Ahlstrom
6. *Brachionus bidentatus* Anderson
7. *Brachionus budapestinensis* (Daday)
8. *Brachionus calyciflorus* Pallas
9. *Brachionus calyciflorus f. ampiceros* Ehrenberg

10. *Brachionus calyciflorus f. borgerti* Apstein
11. *Brachionus calyciflorus f. dorcas* (Gosse)
12. *Brachionus calyciflorus v. anuaeriformes* Brehm
13. *Brachionus caudatus* Barrois & Daday
14. *Brachionus caudatus apsteini* (Fadeev)
15. *Brachionus caudatus personatus* (Ahlstrom)
16. *Brachionus caudatus v. aculeatus* Hauer
17. *Brachionus diversicornis* (Daday)
18. *Brachionus donneri* Brehm
19. *Brachionus falcatus* Zacharias
20. *Brachionus falcatus v. lyratus* Lemmerman
21. *Brachionus forficula* Wierzejski
22. *Brachionus forficula forficula* Wierzejski
23. *Brachionus havanensis* Rousselet
24. *Brachionus leydigi* (Cohn)
25. *Brachionus patulus* (O.F. Muller)
26. *Brachionus patulus patulus* (O.F. Muller)
27. *Brachionus plicatilis* Muller
28. *Brachionus quadridentatus* Hermann
29. *Brachionus quadridentatus v. rhenanus* Lauterborn
30. *Brachionus quadridentatus f. cluniorbicularis* (Skorikov)
31. *Brachionus quadridentatus v. brevispinus* (Ehrenberg)
32. *Brachionus rubens* Ehrenberg
33. *Brachionus urceolaris* O.F. Muller
34. *Brachionus urceolaris v. urwaensis* Sudzuki
35. *Keralella cochlearis* Gosse
36. *Keralella edmondsoni* Nayar
37. *Keralella procurva* (Thorpe)
38. *Keralella quadrata* (O.F. Muller)
39. *Keralella ticinensis* (Carlin)
40. *Keralella tropica* (Apstein)
41. *Keralella valga* (Ehrenberg)
42. *Notholca scaphula* (O.F. Muller)
43. *Platyas patulus* (O.F. Muller)
44. *Platyas quadricornis* Ehrenberg
45. *Wolga spinifera* (Skorikov)
46. *Lophocharis* sp.

Family EIPHANIDAE

- 47. *Epiphanes clavulata* (Ehrenberg)
- 48. *Epiphanes macroura* (Barraiss and Daday)
- 49. *Epiphanes senta* (Muller)
- 50. *Epiphanes brachionus spinosus* (Rousselet)

Family MYTILINIDAE

- 51. *Mytilina ventralis* Ehrenberg
- 52. *Mytilina shape*

Family EUCHLANIDAE Bartos

- 53. *Diplois devieseeae* Gosse
- 54. *Dipleuchlanis propatula* Gosse
- 55. *Euchlanis alata* Voronkov
- 56. *Euchlanis dilatata* Ehrenberg
- 57. *Euchlanis oropha* Gosse
- 58. *Tripleuchlanis plicata* (Levander)
- 59. *Euchlanis* sp.
- 60. *Pseudoeuchlanis* sp.
- 61. *Dipleuchlanis* sp.
- 62. *Tripleuchlanis* sp.

Family TRICHOTRIDAE Bartos

- 63. *Trichotria tetractis* Ehrenberg
- 64. *Macrochaetus* sp.

Family COLURELLIDAE Bartos

- 65. *Colurella adriatica* (Ehrenberg)
- 66. *Colurella bicuspidata* (Ehrenberg)
- 67. *Colurella obtusa* (Gosse)
- 68. *Lepadella (Lepadella) acuminata* (Ehrenberg)
- 69. *Lepadella (Lepadella) minuta* (Montet)
- 70. *Lepadella (Lepadella) rhomboides* (Gosse)
- 71. *Lepadella (Lepadella) triptera* Ehrenberg
- 72. *Lepadella cristata* (Rousellet)
- 73. *Lepadella ovalis* (O.F. Muller)
- 74. *Lepadella patella* (O.F. Muller)
- 75. *Squatinella* sp.

Family LECANIDAE Bartos

76. *Lecane brauhmi* (Koste)
77. *Lecane depressa* (Bryce)
78. *Lecane elasma* (Harring & Myers)
79. *Lecane (Lecane) crepida* Harring
80. *Lecane (Lecane) curvicornis curvicornis* (Murray)
81. *Lecane (Lecane) flexilis* (Gosse)
82. *Lecane (Lecane) harnemanni* (Ehrenberg)
83. *Lecane (Lecane) inopinata* (Harring & Myers)
84. *Lecane (Lecane) leontine* (Turner)
85. *Lecane (Lecane) luna* (O.F. Muller)
86. *Lecane (Lecane) luna luna* (Muller)
87. *Lecane (Lecane) obtusa* (Murray)
88. *Lecane (Lecane) ohioensis* (Voigt)
89. *Lecane (Lecane) papuana* (Murray)
90. *Lecane (Lecane) simonneae* Segers
91. *Lecane (Lecane) sola* Hauer⁺
92. *Lecane (Lecane) unguolata* (Gosse)
93. *Lecane (Monostyla) bulla* (Gosse)
94. *Lecane (Monostyla) bulla f. diabolica* Hauer
95. *Lecane (Monostyla) closterocerca* (Schmarda)
96. *Lecane (Monostyla) conspicua* Hauer
97. *Lecane (Monostyla) decipiens* (Murray)
98. *Lecane (Monostyla) hamata* (Stokes)
99. *Lecane (Monostyla) lunaris crenata* (Harris)
100. *Lecane (Monostyla) quadridentata* (Ehrenberg)
101. *Lecane (Monostyla) stenroosi* (Meissner)
102. *Lecane (Monostyla) thalera* (Harring & Myers)
103. *Lecane (Monostyla) unguitata* (Fadeev)
104. *Cathypna amban*

Family PROALIDAE

105. *Wulfertia ornata* Donner

Family NOTOMMATIDAE Remane

106. *Cephalodella auriculata* (Muller)
107. *Cephalodelta gibba* Ehrenberg

- 108. *Eosphora anthadis* (Marring & Myers)
- 109. *Eosphora najas* Ehrenberg
- 110. *Itura aurita* (Ehrenberg)

Family DICRANOPHORIDAE

- 111. *Encentrum felis* (O.F. Muller)
- 112. *Wierzajskiella racinae* (Wierzejski)

Family TRICHOCERCIDAE Remane

- 113. *Trichocerca flagellata* Hauer
- 114. *Trichocerca porcellus* Gosse
- 115. *Trichocerca (Diurella) ruttneri* Donner
- 116. *Trichocerca (Diurella) similis* (Wierzejski)
- 117. *Trichocerca (Trichocerca) rattus* (Muller)
- 118. *Trichocerca (Trichocerca) tortuosa* (Myers)
- 119. *Trichocerca (Trichocerca) tropis* Hauer⁺
- 120. *Mastigocera* sp.

Family GASTROPODIDAE Remane

- 121. *Gastropus hyptopus* (Ehrenberg)

Family ASPLANCHNIDAE

- 122. *Asplanchna brighlwelli* Gosse
- 123. *Asplanchna herricki* de Guerne
- 124. *Asplanchna intermedia* Hudson
- 125. *Asplanchna priodonta* (Gosse)
- 126. *Asplanchna bhimavaramensis* Dhanapathi

Family SYNCHAETIDAE Remane

- 127. *Harringia rousselet* de Beauchamp
- 128. *Ploesoma lenticulare* (Herrick)
- 129. *Polyarthra multiappendiculata* (Arora)
- 130. *Synchaeta pectinata* Ehrenberg
- 131. *Polyarthra vulgaris* (Carlin)
- 132. *Ploesoma* sp.
- 133. *Polyarthra* sp.
- 134. *Polyarthra* sp. (apterous form)

Order GNESIOTROCHA De Beauchamp

Suborder FLOSCULARIACEA Remane

Family CONOCHILIDAE Bartos

- 135. *Conochilus arboreus* Rajendran⁺
- 136. *Conochilus madurai* Michael⁺
- 137. *Conochilus* sp.
- 138. *Conochiloides* sp.

Family HEXARTHRIDAE Bartos

- 139. *Hexarthra intermedia* (Wizneiwskei)
- 140. *Hexarthra mira* (Hudson)

Family TESTUDINELLIDAE Bartos

- 141. *Testudinella parva* (Ternetz)
- 142. *Testudinella patina* (Hermann)

Family FILINIDAE Bartos

- 143. *Filinia longiseta* (Ehrenberg)
- 144. *Filinia opoliensis* (Zacharias)
- 145. *Filinia pejleri* (Hutchinson)
- 146. *Filinia terminalis* (Plate)

Family FLOSCULARIDAE

- 147. *Lacinularia* sp.

Family COLLOTHECIDAE

- 148. *Collotheca ornata* (Ehrenberg)
- 149. *Cupelopagis vorax* (Leidy)

Family TROCHOSPHAERIDAE

- 150. *Horaella brehmi* (Donner)

Subclass BDELLOIDEA

Order BDELLOIDA

Family HABROTRACHIDAE

- 151. *Habrotracha* sp.

Family PHILODINIDAE

152. *Macrotrachela quadricornifera* (Milne)
153. *Philodina citrina* (Ehrenberg)
154. *Philodina roseola* (Ehrenberg)
155. *Pseudoembata acutipoda* Wycliffe & Michael⁺
156. *Rotaria citrinus* Weber
157. *Rotaria rotatoria* (Pallas)
158. *Rotifer tridentatus*

(⁺Endemic to Tamilnadu)

DISCUSSION

The present list, based on the publications, revealed 158 species of freshwater rotifers belonging to 53 genera and 23 families, which is 49% of the Indian rotifer fauna (325 species). Sharma (1983) has indicated the presence of 8 species of *Brachionus* in Tamilnadu but it is interesting to note that 16 species of *Brachionus* has been reported from Tamilnadu in this inventory. The genus *Brachionus* is entirely absent in arctic regions (Pejler, 1977), whereas it is significantly increased in equatorial and tropical regions. This concept correlates well with the fauna of Tamilnadu rotifers. It is also interesting to note that *B. donneri*, which is a cosmopolitan species, has not been recorded from Tamilnadu after the first report of Brehm (1951).

The representation of the major taxa in Tamilnadu is in the following order : *Brachionus* (33), *Lecane* (28), *Keratella*, *Lepadella* and *Trichocerca* (7 each), *Asplanchna* (5 each), *Epiphanes*, *Euchlanis*, *Polyarthra*, *Filinia* (4 each), *Colurella* and *Conochilus* (3 each). The following genera are represented by 2 species each : *Platyas*, *Dipleuchlanis*, *Tripleuchlanis*, *Cephalodella*, *Eosphora*, *Ploesoma*, *Hexarthra*, *Testudinella*, *Philodina*, *Rotaria* and the rest of the genera are one each. The order wise faunal composition of the Tamilnadu rotifers is given in fig. 1 and the genera wise representation of the Ploimidan fauna is given in fig. 2.

The study reveals that the Monogonont taxa of Tamilnadu are dominant (150 species under 43 genera) when compared to the Digonont taxa (8 species belonging to 6 genera). This pattern corresponds well with the species diversity of Indian rotifer fauna (296 species of Monogonont taxa and 29 species of Digonont taxa). The limited diversity of Digonont taxa does not mean their absence in Tamilnadu waters but inadequate analysis of the collections. The species richness of *Brachionus* and *Lecane* is attributed to the general tropical character. 5% (5 species) of the Tamilnadu rotifers are pantropical, which is 16% of the Indian pantropic taxa (32 species).

Species recorded from Tamilnadu can be ecologically categorized into many types such as, warm stenothermal, viz., *Brachionus falcatus*, *Brachionus forficula*, *Keratella tropica*, *Trichocerca flagellata*; Eurythermal, viz., *Brachionus angularis*, *Brachionus calyciflorus*, *Brachionus rubens*,

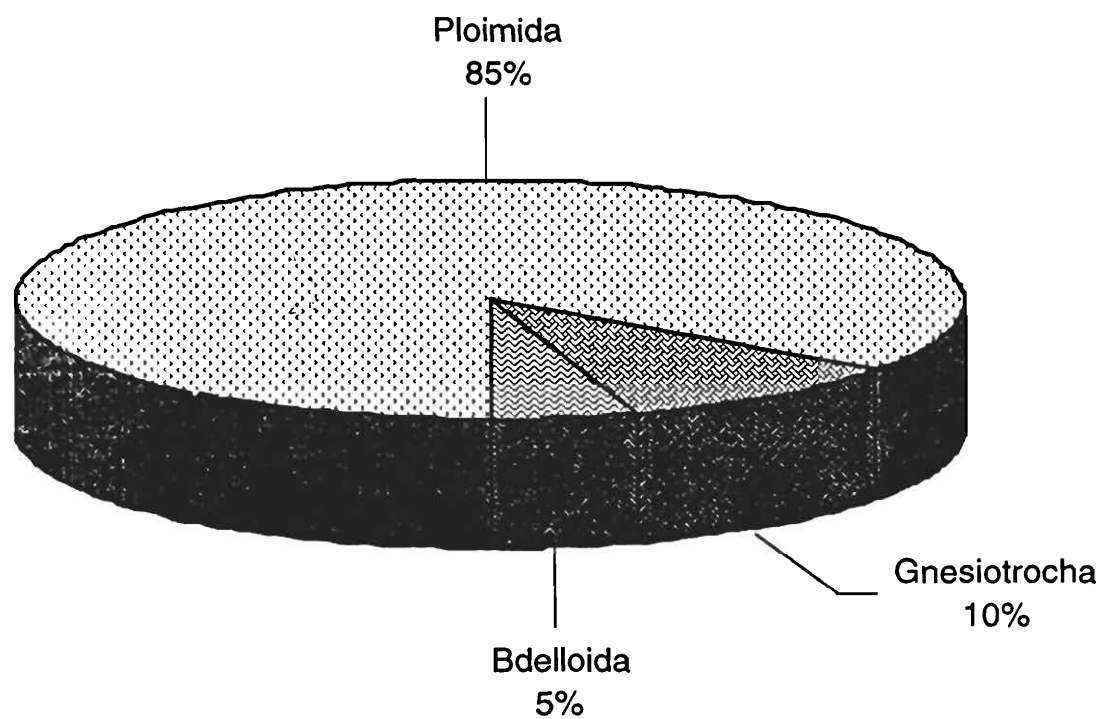


Fig. 1. : The order wise faunal composition of Tamilnadu Rotifers

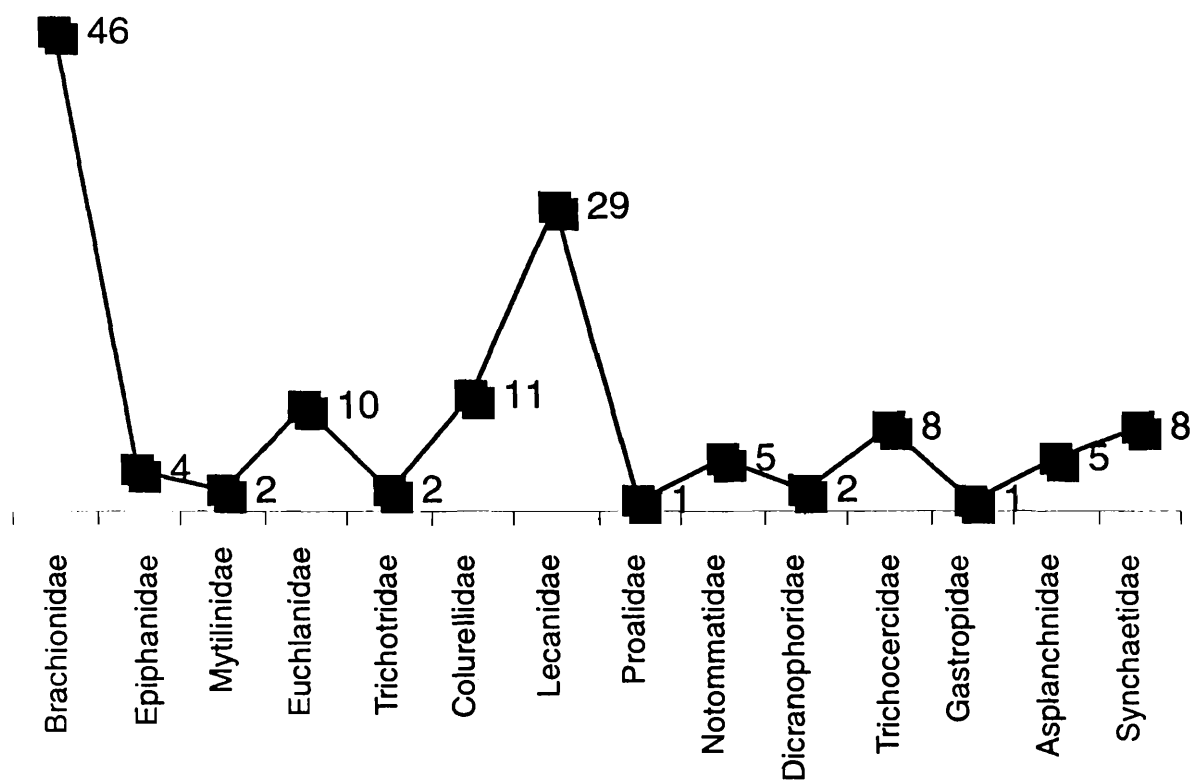


Fig. 2. : The Ploimidan composition of Tamilnadu Rotifers

Lecane hamata, *Polyarthra vulgaris* and *Testudinella patina*. The Temperate water species are *Brachionus diversicornis*, *Brachionus quadridentatus* and *Trichocerca similis* and the acidophilic species is *Lepadella triptera*. *Brachionus plicatilis* and *Brachionus urceolaris* are the mixohaline species and *Brachionus angularis*, *Brachionus caudatus*, *Brachionus rubens*, *Brachionus calyciflorus*, *Brachionus falcatus*, *Keratella tropica*, *Asplanchna brightwelli*, *Polyarthra vulgaris* and *Filinia longiseta* are representing the alkaline species. Most of the species represented in the genus *Brachionus* are bio-indicators.

The cosmopolitan species recorded are *B. angularis*, *B. calyciflorus*, *B. caudatus* and *B. quadridentata*. The species indicating the eutrophic tendencies are *B. angularis*, *B. calyciflorus* and *B. rubens* and the pollution indicator is *B. plicatilis*.

The current knowledge of Tamilnadu rotifer is yet incomplete, as revealed by the fauna of Gnesiotrocha and Bdelloida, which may be due to the inadequate analysis of collections. Most of the studies are confined to Madurai, Tiruchi, Tirunelveli and Cuddalore (Portonovo) districts and no such detailed studies are available from other districts especially from the northern districts of Tamilnadu, which may enhance the number of rotifers reported from this state. The proper collections and the identification may enrich the rotifer fauna of Tamilnadu over 250 species.

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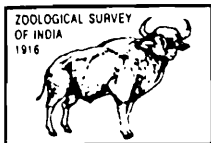
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FRESHWATER OLIGOCHAETES FROM KOLKATA AND ITS ADJACENT AREAS

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INTRODUCTION

Aquatic oligochaetes, constituting a most important component of the benthic invertebrates of littoral zones of fresh water bodies like pond, tank, ditches *etc.*, are poorly known in India. These worms belong to Phylum Annelida and are grouped together along with few earthworms into the group microdrili. There are three families such as Aelosomatidae, Naididae and Tubificidae under aquatic oligochaetes.

These worms live either singly or in groups, sometimes in association with other group of animals such as fresh water sponges or adhering to submerged and floating vegetation or substratum. They are either microscopic or small (about 200 mm) in size, colourless, pale red and deep brown in colour; slender to relatively robust in size constituting the bulk of food for other aquatic animals like fishes.

The most constant and dependable character identifiable even in the preserved state are the locomotor organelles or setae which are of various morphological patterns as regards shape, size, number and of immense taxonomical importance for the determination of genera and species. A perusal of literature reveals that altogether 67 species under 20 genera and 3 families have so far been recorded from India. Mukhopadhyay (1998) reported the record of 27 species under 14 genera and 3 families from West Bengal. The present attempt was taken to survey twelve water bodies and roadside drains in and around Kolkata (North 24 Paraganas, South 24 Paraganas, Hoogly and Howrah districts) and recorded 7 species and 5 genera and 2 families. The present material deals with two new records. Mukhopadhyay (1998) recorded only 19 species from the area recently visited by present author. Therefore the present paper includes description, distribution along with the key for identification of 26 species so far recorded from the present study area.

MATERIAL AND METHODS

Aquatic worms living in mud and silt are collected along with water soil and then washing them on a white based enamel trays. Those found on surface of water are collected readily with the help of a wide mouthed pipette or needle. Specimen living among aquatic vegetation and algal masses are collected along with the substrata and wash them out afterwards.

Preservation

The most suitable method of preservation of those delicate soft bodied specimens is to put them directly into 4% formalin solution.

Though formalin bring about certain amount of opacity of the skin, a greater part of it may be overcome by bleaching the skin with chemicals like lactophenol. Narcotisation prior to preservation with alcohol appeared to be useless because their soft bodies disintegrate easily under its influence.

Study

The best result of study is obtained by examining the specimen in living condition whenever opportunity permits. In the laboratory preserved material is treated with glycerine before study to bring about some degree of transparency of specimen. During the process of study the setae are examined in minutest details besides the prostomium, sexual organ, position of nephridia, blood vessels, bronchial organs *etc.*, for detailed study seatae the material is to be placed under oil immersion lens.

SYSTEMATIC ACCOUNT

I. Family AEOLOSOMATIDAE

Genus *Aeolosoma* Ehrenberg 1831

1. *Aeolosoma bengalense* Stephenson 1911

II. Family NAIDIDAE

Subfamily CHAETOGASTRINAE

Genus *Chaetogaster* Von Baer

2. *Chaetogaster langi* Bretscher 1896
3. *Chaetogaster limnaei bengalensis* Annandale 1905

Subfamily NAIDINAE

Genus *Allonais* Sperber, 1948

4. *Allonais inaequalis* (Stephenson, 1911)
5. *Allonais paraguayensis* (Michaelsen, 1905)

Genus *Branchiodrilus* Michaelsen, 1900

6. *Branchiodrilus hortensis* (Stephenson, 1910)

Genus *Dero* Oken, 1815

7. *Dero (Dero) dorsalis* Ferroniere, 1899
8. *Dero (Dero) indica* Naidu, 1962
9. *Dero (Dero) cooperi* Stephenson, 1932

Genus *Nais* Müller, 1773

10. *Nais elinguis* Müller, 1773
11. *Nais barbata* Müller, 1773
12. *Nais simplex* Piguet, 1906

Genus *Slavina* Vejdovsky, 1883

13. *Slavina appendiculata* (d'Udekim), 1855

Subfamily PRISTININAE Vastockin, 1924

Genus *Pristina* Ehrenberg, 1828

14. *Pristina longiseta longiseta* Ehrenberg, 1828
15. *Pristina aequiseta* Bourne, 1891
16. *Pristina proboscidea* Beddard, 1896

Family TUBIFICIDAE

Genus *Bothrioneurum* Stolc, 1885

17. *Bothrioneurum iris* Beddard, 1901

Genus *Branchiura* Beddard, 1892

18. *Branchiura sowerbyi* Beddard, 1892

Genus *Limnodrilus* Claparede, 1862

19. *Limnodrilus hoffmeisteri* Claparede, 1862

Key to the Families

1. Crochet setae and septa absent Aeolosomatidae
2. Crochet setae in both ventral and dorsal bundles Tubificidae
3. Crochet setae in ventral bundles only Naididae

Family AEOLOSOMATIDAE

Diagnosis : Setae in four bundles, in both dorsal and ventral bundles. With capillary setae, often with single or double pointed or needles setae. Septum wanting in most part small size, upto 10 mm. Prostomium ventrally with cilia, testes and ovaries in V and V segments.

Remarks : Acolosomatidae is represented by a single genus *Aeolosoma* Ehrenberg.

Genus *Aeolosoma* Ehrenberg, 1831

1831. *Aeolosoma* Ehrenberg, *Synb. Phys.* (Mammalia vertebrate : 1-293.

1980. *Aeolosoma* Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (eds). : 80.

Diagnosis : Eyes and septa absent. Prostomium not separated from body by a well marked groove. Dorsal and ventral setae from II segment onwards and composed of needles and hairs. Stomach conspicuous. Nephridia paired starts from II or III segment; budding zone present cosmopolitan.

Remarks : The genus *Aeolosoma* is represented in India by six species, one so far known from West Bengal.

1. *Aeolosoma bengalense* Stephenson 1911 is *Aeolosoma headleyi* Beddard 1888

1911. *Aeolosoma bengalense* Stephenson, *Rec. Ind. Mus. Calcutta*, **6** : 204-205.

1962. *Aeolosoma bengalense*, Naidu, *J. Bomb. Nat. Hist. Soc.*, **38**(3) : 648-649.

1998. *Aeolosoma bengalense* : Mukherjee, *Fauna of West Bengal*, State Fauna Series, **3** (Part 10) : 99.

Material examined : Material not available, description based on literature.

Diagnosis : Setae all straight, capillary bundles consists as a rule of one long and several shorter, the longer one nearly twice the length of the shorter, bayonet shaped and non serrate.

Mouth ventral V shaped; esophagi in II and stomach in IV to ½ VIII segment. *Nephridia* begins in II segment. Budding zone more than one is common.

Habit : Gliding, not swimming purely freshwater.

Distribution : INDIA : West Bengal, Kolkata, Kerala. *Outside India* : South America.

Family NAIDIDAE

Hair setae present or absent; dorsally needle setae of various kinds; pharynx with dorsal diverticulum, pharynxgeal oesophageal or septal glands present; nephridia open; testes and spermathecae in V and atria in VI segment.

Distribution : Europe; Pakistan; Tibet; India; Ceylon and South America.

Remarks : Naididae is the biggest family of the freshwater Oligochaeta including 11 genera in India and in state of West Bengal. It is divided into three subfamilies.

Key to the subfamilies

- Dorsal setae beginning from segment IV, V or VI, Prostomium without proboscis except in one genus..... Naidinae
- Dorsal setae usually, beginning from segment II or III; Prostomium with proboscis. Pristininae
- Dorsal setae absent/segment III specially elongated..... Chaetogastrinae

Subfamily CHAETOGASTRINAE

Diagnosis : Dorsal setae usually absent, when present consists of double pronged crotchets. Segment III elongated; Prostomium reduced. Eye absent oesophageal as well as septal glands absent. Nephridia closed. Testes in V and ovaries in VI segment. Prostate gland absent.

Genus *Chaetogaster* Von Baer, 1827

1827. *Chaetogaster* Von Baer, *Nova Acta Phys. Med. Acad. Weop. Card. Nat. car. Bonn.*, **13** : 611.

1980. *Chaetogaster* : Persia, In : *Aquatic Oligochaete biology*, Brinkhurst and Cook (Eds.), p. 85.

Type species : *Chaetogaster limnae* Von Boer.

Diagnosis : Dorsal setae absent; ventral setae double pronged or simple crotchets but absent in IIIrd to Vth segment. Setae incomplete. Stomach well defined. Elitellum in ½ V–VI segment. Penal setae absent.

Distribution : Europe; Pakistan; Tibet; Persia; Burma and India.

Key to the species

- 1. Double pronged crotchets with strongly curved teeth *C. limnae bengalensis*
- Double pronged crotchets with normally curved teeth *C. langi*

2. *Chaetogaster langi*

1896. *Chaetogaster langi* Bretscher, *Rev. Suisse. zool.*, **3** : 512-513. Fig. 1.

1966. *Chaetogaster langi* : Naidu, *Hydrobiologia*, **27**(1-2) : 211.

Diagnosis : Prostomium short and blunt fringed with sensory hair. Setae per bundle in II segment, 3–6 in the rest, length equal to two third the diameter of the body; distal prong of the forked end longer than the proximal. Nephridia two per segment beginning from VII segment.

Habits : Usually stick to the walls of the container. Found in brackish water also.

3. *Chaetogaster limnae bengalensis* Annandale, 1905

1905. *Chaetogaster bengalensis* Annandale, *Journ and Proc. Asiat Soc. Bengal*, **1** : 117, Pl. III, Fig. 1-4.

1966. *Chaetogaster limnae bengalensis* : Naidu, *Hydrobiologica*, **27**(1-2) : 211.

Diagnosis : Setae in bundle of 15–17, arranged in semicircles, shaft straight. Prongs almost equal in length and thickness; in segment II the setae are longer than those of others, position of nodules median to distal. Size small, about 10 mm at full length; diameter less than 0.5 mm. Prostomium practically absent.

Habit : Purely freshwater. Sometimes commensal on water snails.

Distribution : INDIA : West Bengal, Kolkata, Madhya Pradesh, Punjab. *Outside India* : Pakistan, Burma.

Subfamily NAIDINAE

Diagnosis : Prostomium simple and rounded, hind end simple; dorsal setae beginning in VI segment and include moderately long hair setae and simple or bifid needle setae; ventral bundles having double pointed crotchets. Clitellum includes segments V to VII. Penial setae present or absent.

Key to the genera

1. Oranomal process present 2
- Branchial process absent 3
2. Branchial process dorso laterally arranged, finger like, a pair per segment **Branchiodrilus**
- Branchial process are located within a branchial fossa at the hind end, leaf like of variable Number **Dero**
3. Dorsal bundle of setae with double pointed or pectinate needles **Allonais**
- Dorsal bundle of setae with simple needles 4
4. Specially elongated hair setae present in VI segment. Body covered with rows of sensory papillae **Slavina**
- Specially elongated hair setae absent, no sensory papillae **Nais**

Genus **Allonais** Sperber, 1948

1948. *Allonais* Sperber, *Zool. Bidr. Uppsala*, **28** : 299.

1980. *Allonais* : Persdia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 95.

Type species : *Allonais inaequalis* (Stephenson, 1911).

Diagnosis : Dorsal bundle of setae from VI segment and consisting of hairs and double pointed or pectinate needles; ventral setae of II to V segment only slightly different from those of following segments. Septal glands absent. No eyes. Prostomium bluntly triangular.

Distribution : Asia; Africa; North and South America; Australia.

4. *Allonais inaequalis* (Stephenson, 1911)

1911. *Nais pectinata* var. *inaequalis*, Stephenson, *Rec. Ind. Mus. Kolkata*, **6** : 208-209, Fig. 2.

1948. *Allonais inaequalis* : Sperber, *Zool. Bidr. Uppsala*, **28** : 201-203, Fig. 21 A-D.

Material : Central Kolkata Museum Tank—3 exs. 13.8.2003, Hoogly-Srirampur—2 exs. 19.8.2003. Coll. T. Biswas and C. K. Mondal.

Diagnosis : Prostomium elongated. Dorsal bundle of setae begin from VI segment and consists of 1–2 hairs and 1–2 needles per bundle, hairs smooth and slightly curved needles pectinate with 1–4 intermediate teeth connected by Webb, proximal prong longer than distal; ventral setae 4–6/ bundle those of segments II–V thinner and straighter than other with slightly proximal nodules, other having nodules slightly distal and teeth equally long clitellum embracing segments VI to VIII. Nephridium begins from VIII segment found among aquatic plants and decaying vegetable matter.

5. *Allonais paraguayensis* (Michaelson, 1905)

1905. *Nais paraguayensis* Michaelson, *Z. wiss. Zool.*, **82** : 354-355.

1948. *Allonais paraguayensis paraguayensis*; Sperber, *Zool. Bidr. Uppsala*, **28** : 203-204, Fig. 28B.

1980. *Allonaig paraguayensis* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 98.

1998. *Allonaig paraguayensis* : Mukhopadhyay, State Fauna Series 3 : Fauna of West Bengal, Part 10 : 95-102.

Material examined : Material not available, description is based on literature.

Diagnosis : Size small, 10 mm, light orange, segments 100 (approx.) Prostomium short, rounded. Anus dorsal. Dorsal setae from VI segment onwards, with needles and hair, 1–2 of each/segment; needle sickle shaped, bifid with proximal tooth being twice as long as and thicker than distal which is again bifid; ventral bundle of setae with 3–6 bifid crochets having distal prongs of equal length with the proximal clitellum embracing V–VIII segments, nephridium starts between VII and VIII. Peneal setae present.

Habit : Swims on water surface with transverse movements rotating round its axis.

Distribution : INDIA : West Bengal, Kolkata; Malda districts; Bihar; Madhya Pradesh. *Outside India* : East Asia, North and South America.

Genus *Branchiodrilus* Michaelson, 1900

1890. *Chaetobranhus* Bourne, *Quart. J. Micro. Sci.*, **31** : 83.

1900. *Branchiodrilus* Michaelson, *Das Tier.*, : 10.

1962. *Branchiodrilus* : Naidu, *J. Bomb. Nat. Soc.*, **59**(2) : 526.

1998. *Branchiodrilus* : Mukhopadhyay, Fauna of West Bengal, Part 10 : 103.

Type species : *Branchiodrilus semperi* (Bourne, 1890).

Diagnosis : Prostomium rounded; paired branchial process dorso-laterally placed on many or most of the body segments beginning immediately after anterior end of the body; dorsal setae and gill begin from the same segment and consists of hairs and needles ventral setae of bifid crotches, no Penial setae.

Distribution : Europe; Asia; Africa and Australia.

6. *Branchiodrilus hortensis* (Stephenson, 1910)

1910. *Lahoria hortensis* Stephenson, *Rec. Ind. Mus. Calcutta*, **5** : 59-66, text figs. 1-3, Pl. VII, Figs. 1-3.

1912. *Branchiodrilus hortensis* : Stephenson, *Rec. Ind. Mus. Calcutta*, **7** : 229.

1948. *Branchiodrilus hortensis* : Sperber, *Zool. Bidr. Uppsala*, **28** : 157-158, Fig. 28A.

Material examined : South Kolkata, Eden Garden, 4 exs., 13.8.2002, Central Kolkata Museum Tank, 2 exs., 13.8.2003, Hooghly-Srirampur, 5 exs., 19.8.2003, North Kolkata Ultadanga, 3 exs., 16.8.2003, Coll. T. Biswas and party.

Diagnosis : Dorsal setae consisting of usual hairs and needles, two of each/bundle; First 40 hair setae enclosed inside the gills, behind which they are free; needles short and pointed, ventral setae consisting of 4–5 bifid crotchets having distal prong longer than proximal and thinner and at the base, nodulus a little distal. Gills extend almost upto the hind end of the body, gradually diminishing in size posteriorly largest being three times the diameter of the body. Prostomium bluntly conical. Well marked, transverse pigmented bands extend over the body upto XX segment clitellum includes V to VIII segments. Peneal setae 2–3 in each bundle simple but hooked.

Habit : Mud dwellers, not swimming.

Distribution : INDIA : West Bengal, Kolkata; Uttar Pradesh; Andhra Pradesh.

Genus *Dero* Oken, 1815

1815. *Dero* Oken, *Lehrbuch der Naturgeschichte 3 Zoologie 1* : Leipzig, p. 313.

1980. *Dero* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (eds.) : 90.

1998. *Dero* : Mukhopadhyay, In : *State Fauna Series, 3 : Fauna of West Bengal, Part 10* : 104.

Type species : *Dero digitata* (Müller, 1773).

Diagnosis : Dorsal setae beginning from IV, V or VI segment onwards, consisting of hairs and double pointed, pectinate or palmate needles; ventral setae of II to V segment different from the rest having the distal teeth longer than the proximal but equally thick, compared with equally long or short but thinner in the later segments. Pharynx extends from II to V segment and have pharyngeal glands; tube dwellers.

Distribution : Cosmopolitan.

Key to the Species

1. Dorsal setae begin from VI segment, with one hair and one needle in all segments
..... *D. (D) cooperi*
2. Dorsal setae bundles with 2 hair and 2 needles in anterior and middle segment
..... *D. (D) indica*

7. *Dero cooperi* Stephenson, 1932

1932. *Dero cooperi* Stephenson, *Proc. Zool. Soc. Lond.*, **1932**(1-2) : 231-233, Figs. 2-5.

1980. *Dero (Dero) cooperi* : Persia, In : *Aquatic Oligochaetae Biology*, Brinkhurst and Cook (Eds.), 90-91.

1998. *Dero (Dero) cooperi* : Mukherjee, *Fauna of West Bengal*, Part 10 : 105-106.

Material examined : Hooghly, Sankrail; 2 exs., 19.9.2002, South 24 Parganas, Neelgunge road side pond; 2 exs., 24.7.2003, Barasat dakshinpara; 6 exs., 16.9.2003, Tollygunge pond; 3 exs., 13.8.2002, Patuli road side pond; 4 exs., 21.7.2003, Coll. T. Biswas and C. K. Mandal.

Diagnosis : Size small, 10 mm; pale red in colour. Prostomium bears sensory cilia; dorsal setae beginning from VI on words having 1 hair and 1 needle/bundle; hair bayonet shaped, needles bifid, teeth short; ventral setae 4 per bundle with distal nodulus and short teeth, proximal prong thicker and longer than distal; ventral setae from II-V, 3-5/bundle, longer, nodulus median and distal tooth 1½ times longer than proximal; branchial fossa with posterior prolongation; gills 4 pairs, dorsal pair foremost and the smallest, the hind most pair leaf like, the second and the third pair thicker than the rest; clitellum covers V to VII segment; nephridia starts from VII segment.

Habit : Live in tube with mucus sand and mud; swim with spiral movement.

Distribution : INDIA : West Bengal, Bankura, Burdwan, Malda, Midanapore and Nadia district; Andhra Pradesh; Karnataka and Uttar Pradesh. *Outside India* : Abyssinia and Pakistan.

Remarks : This species is first time recorded in Kolkata.

8. *Dero dorsalis* Ferroniere, 1899

1899. *Dero dorsalis* Ferroniere, *Bull. soc. Sci. nat. ouset. Nantes.*, **9** : 255-257.

1933. *Dero dorsalis* : Michaelsen, *Zool. Jharb. Syst.*, **64** : 334.

1998. *Dero (Dero) dorsalis* : Ferroniere, Mukhopadhaya, *Fauna of West Bengal*, Part 10 : 106.

Material examined : Shankril station road side pond, 5 exs., 21.7.2003; Ultadanga (North Kolkata), 2 exs., 14.8.2002, Shibpur, 20.8.2002, 2 exs.

Diagnosis : Size small, 10-15 mm, elongated and slender; segmentation prominent. Dorsal setae begin from IV segment, one hair and one needle or 2 of each in every bundle, hairs not much elongated, bayonet shaped; needles sickle shaped, bifid having distal tooth slightly longer than

proximal; ventral setae vary in number, usually 4, 3 or 2 per bundle in anterior, middle and posterior segment respectively. Branchial forssa with 5 pairs of gills, ciliated and foliate; anterior margin of fossa entire, posterior margin with short, broad and diverging pulplike process. Clitellum in V, VII. Peneal setae absent. Tube dweller.

Habit : Live in soft mud along with other species of the genus.

Distribution : INDIA : West Bengal, Bankura, Burdwan, West Dinajpur, Hooghly, Malda, Midnapore and Nadia districts; Andhra Pradesh and Kerala. *Outside India* : Europe.

9. *Dero indica* Naidu, 1962

1962. *Dero indica* Naidu, *J. Bombay nat. Hist. Soc.*, **59**(1) : 533-536, Fig. 14 A-G.

1980. *Dero indica* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 93.

1989. *Dero indica* : Mukhopadhyaya, *Fauna of West Bengal*, Part 10 : 106-107.

Material examined : Hooghly, Shrirampur Doctor Bagan Lane; 2 exs., 24.7.2003, Howrah, Shibpur; 3 exs., 20.8.2002, Coll. T. Biswas and C. K. Mandal.

Diagnosis : Size 19–20 mm, whitish red, Prostomium bluntly triangle with sensory cilia; dorsal setae beginning from VI with 2 hairs and 2 needles per bundle in anterior half of body while 1 of each in the remaining posterior segments, hairs bayonet shaped; needles bifid with distal nodulus and teeth equal, the outer prong being longer; ventral setae 3–4 per bundle bifid crochets teeth unequal having proximal prong thicker and slightly longer nodules distal; ventral setae of II to V segment longer and straighter; branchial organ funnel shaped; gills 4 pairs, broad. Nephridium starts in VII segment; budding zone clear.

Habit : Live in soft mud.

Distribution : Tripura, Andhra Pradesh, Karnataka, West Bengal.

Genus *Nais* Müller, 1773

1773. *Nais* Müller, *Vermium terrestrium et fluviatilium* II. Hafniae et Lipsidae, 23-24.

1980. *Nais* Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (eds). : 87.

Type species : *Nais barbata* Müller, 1773.

Diagnosis : Prostomium simple, rounded Hind end simple. Dorsal setae beginning in V segment, consisting of moderately long hair setae and simple or bifid needles. Ventral bundles consisting of double pronged crotchets, those of II to V segment well differentiated from those of the following segments. Pharynx in II and III segment. Pharyngeal and oesophageal glands present. Clitellum includes segments V to VII. Pineal setae present.

Remarks : Cosmopolitan.

Key to the Species

1. Needle setae single pointed 2
 — Needle setae double pointed *N. elinguis*
 2. Needles hair like with sharp tip and nodules slightly distal *N. barbata*
 — Needles not hair like, short with fairly obtuse tip and nodulus 1/3 from distal end
 *N. simplex*

10. *Nais elinguis* Müller, 1773

1773. *Nais elinguis* Müller, Vermium terrestrium et fluviatilium II. Hafniae et Lipsidae, 22.

1980. *Nais elinguis* Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (eds). : 88.

Material examined : Material not available. Description on literature.

Diagnosis : Dorsal bundle of setae with 2–3 needles and 2–3 hairs, needles with curved tip, finely bifid; hairs three times the length of needles; ventral setae 2–5 bundles, bifid crotchets, those of II to V segments hardly longer straighten and thinner than the rest, with nodules 1/3–1/2 from distal end, and with distal tooth about twice as long as proximal; from VI segment onward nodulus distal and distal tooth twice as long as proximal. Peneal setae 4–5 in number, dorsal vessel mid-dorsal.

Habit : Frequently brackish water; swim by lateral movements. Some time live in association with fresh water sponges.

Distribution : INDIA : West Bengal, Calcutta. *Outside India* : Europe, brackish water of North sea and Baltik.

11. *Nais barbata* Müller, 1773

1773. *Nais barbata* Müller, Vermium terrestrium et fluviatileum II. Hofniae et Lipsidae : 23-24.

1980. *Nais barbata* : Spencer, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 120.

Material examined : Material not available, description based on literature.

Diagnosis : Size small, 4–6 mm long. Yellow brown anteriorly. Dorsal bundle of setae consist of 2–5 needles and 1–5 stiff hairs needles with sharp long tip, single pointed; ventral setae 2–5 per bundle, bifid crotchets, those of II to V segment much longer, thinner and straighter than the rest, having distal tooth longer than proximal and slightly thinner with proximal nodulus, others having the teeth equally long and nodulus distal. Dorsal vessel to the left to the gut, peneal setae 2–3 on each side with simple fork.

Habit : Swim with spiral movement in fresh water habitat.

Distribution : INDIA : West Bengal, Kolkata; Uttar Pradesh. *Outside India* : Europe and N. America.

12. *Nais simplex*, 1906

1906. *Nais variabilis var. simplex* Piguet, *Rev. Suisse. Zool.*, **14** : 260-266 pl. XL, Fig. 22-24. pl. XII, Fig. 1-3, 14.

1909. *Nais simplex* : Spencer, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 120.

Material examined : Material not available, description based on literature.

Diagnosis : Size small, 8 mm long. Pigmented. Dorsal bundle of setae begin in VI segment, consisting of 1–2 hairs and 1–2 needles per bundle, needle single pointed; ventral setae beginning in the II segment, 2–6 per bundle, those of II to V segments longer, straighter and thinner than the rest with proximal nodulus and having distal tooth twice the length of the proximal, others have 2–5/bundle, shorter and the teeth are about equally long. Dorsal vessel to the left of the middle line.

Habit : Swim with spiral movements among weeds in calm water.

Distribution : INDIA : West Bengal, Bankura, Howrah and 24 Parganas districts. *Outside India* : Europe; N. America.

Genus *Slavia* Vejdovsky, 1883

1883. *Salvina* (Part) Vejdovsky, *Sitz. ber. Bohn. Ges. Naturw. Prag.*, 1883, p. 219.

1980. *Salvina* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 88.

Type species : *Salvina appendiculata* (d'udekem, 1855).

Diagnosis : Body wall provided with rows of sensory papillae and usually surrounded by adhering foreign matter. Dorsal setae beginning in IV or VI segment with hair and single pointed distally curved needles. Ventral setae consist of double pronged crotchets. Clitellum embracing segment V and VI. Oesophageal and pharyngeal glands present. Pineal setae present.

Distribution : Europe : Asia; India; and S. America.

13. *Slavina appendiculata* (d'ekem, 1855)

1855. *Nais appendiculata* d'ekem, *Bull. Acad. R. Belg.*, **22** : 552. pl. Fig. 3.

1883. *Slavia appendiculata* Vejdovsky, *Sitz. ber. Bohn. Ges. Naturw. Prag.*, **1883** : 219.

1980. *Slavia appendiculata* : Spencer, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 120.

Material examined : Material not available, description based on literature.

Diagnosis : Dorsal setae starts from VI segment, consisting of 1–2 stout hairs and 1–2 needles per bundle, hairs of VI segment much longer than others, sometimes reaching four times the diameter of the body, needles simple pointed, suddenly tapering toward the end; ventral setae 2–5 per bundle bifid thinner in II to V segment and longest in II, all having proximal nodulus and angular proximal

bend and distal tooth thinner and slightly longer than proximal. Size small upto 8 mm; segments upto 45.

Habit : Live in association with bryozoans; not swimming.

Distribution : INDIA : West Bengal, Kolkata. *Outside India* : Europe; Pakistan; East Asia; North and South America.

Subfamily PRISTININAE Lastocuina, 1924

Diagnosis : Protomium forming a proboscis. Eyes absent. Dorsal setae beginning in II segment, consisting of hair and needles. Nephridia sometime invested with bladder like peritoneal cell.

Genus *Pristina* Ehrenberg, 1828

1828. *Pristina* Ehrenberg, *Symb. Phys.*, : 209.

1980. *Pristina* : Persia. In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 96.

Type species : *Pristina longiseta longiseta* Ehrenberg, 1828.

Diagnosis : Protomium may or may not form a proboscis. Dorsal setae begin from II, III or IV segment, consisting of hairs and needles with simple and bifid tip; ventral setae of one type only. Setae and septal glands well developed. Nephridium beginning from XI segment. Budding zone present.

Distribution : Cosmopolitan.

Key to the species

1. Hair setae of III segment specially elongated *P. longiseta longiseta*
 — Hair setae not specially elongated in any segment 2
2. Giant ventral setae present in IV segment, bifid *P. acquiseta*
 — Giant ventral setae absent *P. proboscidea*

14. *Pristina longiseta longiseta* Ehrenberg, 1828

1828. *Pristina longiseta* Ehrenberg, *Syrnub. Phys.*, p. 112 (Footnote).

1948. *Pristina longiseta longiseta* : Sperber, *Zool. Bidr. Uppsala*, **28** : 236-237 pl. XXI, Figs. 2, 6.

Material examined : Material not available description based on literature.

Diagnosis : Prostomium with a mobile proboscis. Dorsal bundle of setae starts from II segment and consists of 1–3 hair and 1–3 needles; size very small, 6 mm long slender light yellow; hair setae of III segment specially elongated, straight, non serrate and mobile, reaching beyond tip of proboscis when turned forward, those in others nearly straight; needles fine, straight, distal end

simple pointed, curved; ventral setae 4–5/bundle anteriorly, longest in II and III segment, medium to in others. Nephridium starts from X segment clitellum in $\frac{1}{2}$ VII to $\frac{1}{2}$ IX (2 segments).

Habit : Like among algal masses in clear water; not swimming.

Distribution : INDIA : West Bengal, Kolkata; Maharashtra; Madhya Pradesh; Kerala and Uttar Pradesh. *Outside India* : Europe; Pakistan and Australia.

15. *Pristina aequiseta* Bourne, 1891

1891. *Pristina aequiseta* Bourne, *Q. J. Mic. Sci. (N.S.)*, **32** : 352-353.

1963. *Pristina aequiseta* : Yamaguchi, *J. Fac. Sci. Hokkaido Univ; Ser.*, **6**(2) : 284-285, Fig. 4.

Material examined : Material not available, description based on literature.

Diagnosis : Dorsal setae begin in n segment, consisting of 1–2 hairs and 1–2 fine needles, hair longer than body diameter; needles bayonet shaped having distal end slightly curved, without nodulus and equal teeth; ventral setae 5–6 per bundle, bifid crotchets those of n segment much shouter than those of middle and hind segments with proximal nodules and distal tooth twice as long as proximal; in segment to V setae are shorter and thicker with distal nodulus and having distal teeth longer than proximal.

16. *Pristina proboscidea* Beddard, 1896

1896. *Pristina proboscidea* Beddard, *Ergen Hamburger Malgahaensische Sammelreise*, 1892/93, **3** : 4, Fig. 18.

1980. *Pristina proboscidea* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 96.

1989. *Pristina proboscidea* : Mukhopadhyay, *Faune of West Bengal*, Part 10 : 111-112.

Material examined : Material not available, description based on literature.

Diagnosis : Dorsal setae begin II segment consisting of hair and needles, 1–4 each per bundle; needles simple pointed, straight and fine, modulus absent, hairs serrated and none specially elongated; ventral setae vary in number 2–4 anteriorly, may go uptoa posteriorly, uniform all through distal prongs longer than proximal those of segment II longer and thinner than the rest. Prostomium continuous as a proboscis of varying length. Size small. Nephridium begins from IX segment.

Habit : Live in association with fresh water sponges, not swimming.

Distribution : INDIA : West Bengal, Bankura and Kolkata districts. *Outside India* : Africa; E; E. Asia; Java; S. America.

Habit : Usually live in association with freshwater sponges. Also live in oligohaline water.

Distribution : INDIA : West Bengal- Kolkata, Andhra Pradesh. *Outside India* : Europe; Pakistan, West Indies.

Family TUBIFICIDAE

Diagnosis : Moderate to large in size; length may extend upto 200 mm; Pale to deep red in colour; muscular both dorsal and ventral setae starting from segment II, dorsal setae either bifid to pectinates setae number varying asexual reproductive does not occur.

Distribution : Tibet; China; India; Japan; Malay; North and south America.

Key to the genera

1. Gills present in dorsal and ventral series *Branchiura*
 — Gills absent 2
2. Prostomium with a sensory pit *Borthrioneurum*
 — Prostomium without sensory pit *Limnodrilus*

Genus *Branchiura* Beddard

1892. *Branchiura* Beddard, *Quart J. Micr. Sci.*, **33** : p. 325.

1989. *Branchiura* : Mukhopadhyay, Fauna of West Bengal, Part 10 : 113.

Type species : *Branchiura sowerbyi* Beddard, 1892.

Diagnosis : Dorsal bundle with hair setae along with single pointed or bifid crotches. Posterior segments with paired gills on mid dorsal and mid ventral.

Distribution : Cosmopolitan.

17. *Branchiura sowerbyi* Beddard 1892

1892. *Branchiura sowerbyi* Beddard, *Q. J. Mic. Sci.*, **33** : 325-340. pl. XIX. Figs. 1-5.

1980. *Branchiura sowerbyi* : Persia; In : *Aquatic Oligochaeta Biology*, Brinkhurst and Cook (Eds.) : 103.

Material examined : South 24 Pgs. (Chulkunir Beel, 10 km, south-west of Ghatakpur bus stand; 5 exs., Tollygunge Pond (South Kolkata); 3 exs., Coll : T. Biswas and C. K. Mandal.

Diagnosis : Size large, 50–80 mm; robust dark brown. Posterior third with hollow mid-dorsal and mid-ventral gills serially arranged, a pair per segment gradually increasing in length to reach a length of the widest diameter of the body, about 50 to 150 pairs; these are contractile and each enclose a vascular loop. Dorsal bundle of the setae begin in II segment, having 2–4 hairs and 2–6 crotchets per bundle hairs bayonet shaped, longest anteriorly decreasing gradually in the branchial region; crotches bifid with proximal prongs longer than distal sometime pectinate; ventral setae 4–6/bundle anteriorly 1–2 posteriorly, nodulus distal simple pointed or bifid nephridium begin in IX–XII segment peneal setae absent.

Habit : Worms live in clayey silt at bottoms of tanks, canals and even drains along with *Limnodrilus hoffmeisteri*, when disturbed coil into spirals immediately. The branchial region is easily detachable.

Distribution : INDIA : West Bengal, Burdwan, Hooghly, Kolkatta, Malda, Purulia district; Madras, Manipur and Uttar Pradesh. *Outside India* : Africa; Europe; China; Japan.

Genus *Bothrioneurum* Stolc, 1888

1888. *Bothrioneurum* Stolc, *Abhik Bohn. Ges. Wiss.*, p. 43.

1980. *Bothrioneurum* : Persia, In : *Aquatic Oligochaeta Biology*, Brinkhurst and Cook (Eds.) : 103.

1989. *Bothrioneurum* : Mukhopadhyay, In State Fauna Series : Fauna of West Bengal. Part 10 : 113.

Type species : *Bothrioneurum vejdoskyauum*, Stolc, 1888.

Diagnosis : Prostomium with a sensory pit. Both dorsal and ventral bundle of setae consisting of bifid crotches; hair setae absent special branchial region in the body absent.

Distribution : Cosmopolitan.

18. *Bothrioneurum iris* Beddard, 1901

1901. *Bothrioneurum iris* Beddard, *Proc. Zool. Soc. London*, 1, 81, text Figs. 8-10.

1989. *Bothrioneurum iris* : Mukhopadhyay, Fauna of West Bengal, Part 10 : 113.

Material examined : North 24 Paraganas; Bangaon road side pond; 4 exs., Shriampur Doctor Bagan Lane (Hooghly); 3 exs., Krishnapur road side pond (North Kolkata); 2 exs., Coll. T. Biswas and C. K. Mandal.

Diagnosis : Prostomium semicircular setae beginning from segment II composed of crotchets 4 per bundle; dorsal crotchets having distal prong thinner and shorter than proximal one; ventral crotchets having distal prongs much thinner and longer in outer but shorter in inner bundles than proximal prong; clitellum covering XI to XII segment nephridium beginning on VII segment.

Habit : Live usually in soft mud of ponds and lakes; coil up readily when disturbed.

Remark : This species is first time recorded from Kolkata.

Genus *Limnodrilus* Claparede, 1862

1862. *Limnodrilus* Claparede, *Mem. Soc. Phys. Hist. nat. Geneve*, 16 : 248-252, pl. I, Figs. 1-3; pl. II, Fig. 12; pl. IV, Fig. 6.

1980. *Limnodrilus* Persia, In : *Aquatic Oligochaeta Biology*, Brinkhurst and Cook (eds).

Type species : *Limnodrilus hoffmeisteri*, Claparede, 1862.

Diagnosis : Dorsal and ventral bundles of setae are bifid crotches of same type; hair setae absent. Vascular net work in posterior part of the body lateral pulsative heart in VIII segment testes in X and ovaries in XI segment.

Distribution : Cosmopolitan.

19. *Limnodrilus hoffmeisteri* Claparede, 1862

1862. *Limnodrilus hoffmeisteri* Claparede, *Mem. Soc. Phys. Hist. nat. Geneve*, **16** : 248-252, pl. I, Figs. 1-3; pl. II, Fig. 12; pl. IV, Fig.
1912. *Limnodrilus socialis* Stephenson, *Roy. Soc. Edin*, **48** : 294-302, pl. II, Figs. 1-3, 6, p. 93, pl. VI, Figs. 6-7.
1980. *Limnodrilus hoffmeisteri* : Persia, In : *Aquatic Oligochaete Biology*, Brinkhurst and Cook (Eds.) : 99.
1989. *Limnodrilus hoffmeisteri* : Mukhopadhyay, In : *State Fauna Series : Fauna of West Bengal, Part 10* : 114.

Diagnosis : Size large, 70–80 mm, brown anteriorly and light posteriorly. Posterior portion whip like and without setae (achaetous). Both dorsal and ventral bundle of setae start from II segment and are bifid crotchets of one type only, having both prongs equal in length, the distal prong thinner; dorsal bundles consisting of 6–7 setae in anterior, 3–5 in the middle and 1–2 setae in hind segments, thinner and shorter than the setae of ventral bundles. Nephridium begins between VIII and IX segment. Clitellum embraces XI segment, opaque white.

Habit : These worm live buried in soft clay or mud in clear, turbid even foul water and perform wavy movements of the hind portion and disappear in the mud the moments they are disturbed.

Distribution : INDIA : West Bengal, Burdwan, Coochbihar, Howrah, Jalpaiguri, Malda, Midnapur, Nadia and Purulia district; Andhra Pradesh; Karnataka. *Outside India* : Europe, Pakistan, Turkey, China, Java, Japan, Malay and S. America.

SUMMARY

The paper deals with description distribution, key for identification of 19 species under 10 genera of fresh water aquatic Oligochaeta hitherto known from Kolkata and its adjacent areas. 7 species and 5 genera have been collected in present surveys and two species are first time reported from Kolkata. A classified upto date list of aquatic oligochaetes of Kolkata and adjacent areas has been furnished.

ACKNOWLEDGEMENTS

I am thankful to the Director, Dr. J.R.B. Alfred and Sri. A.K. Singh, Officer-in-Charge, F.P.S. Building, Dr. A.K. Misra, Officer-in-Charge, General Non-Chordata Section, Dr. A.K. Sanyal, Officer-in-Charge, Technical Section of Zoological Survey of India for the facilities and necessary help and suggestions provided to the authors for undertaking the tour. I am also grateful to S.K. Mukherjee for his constant encouragement, inspiration, active support in many ways.

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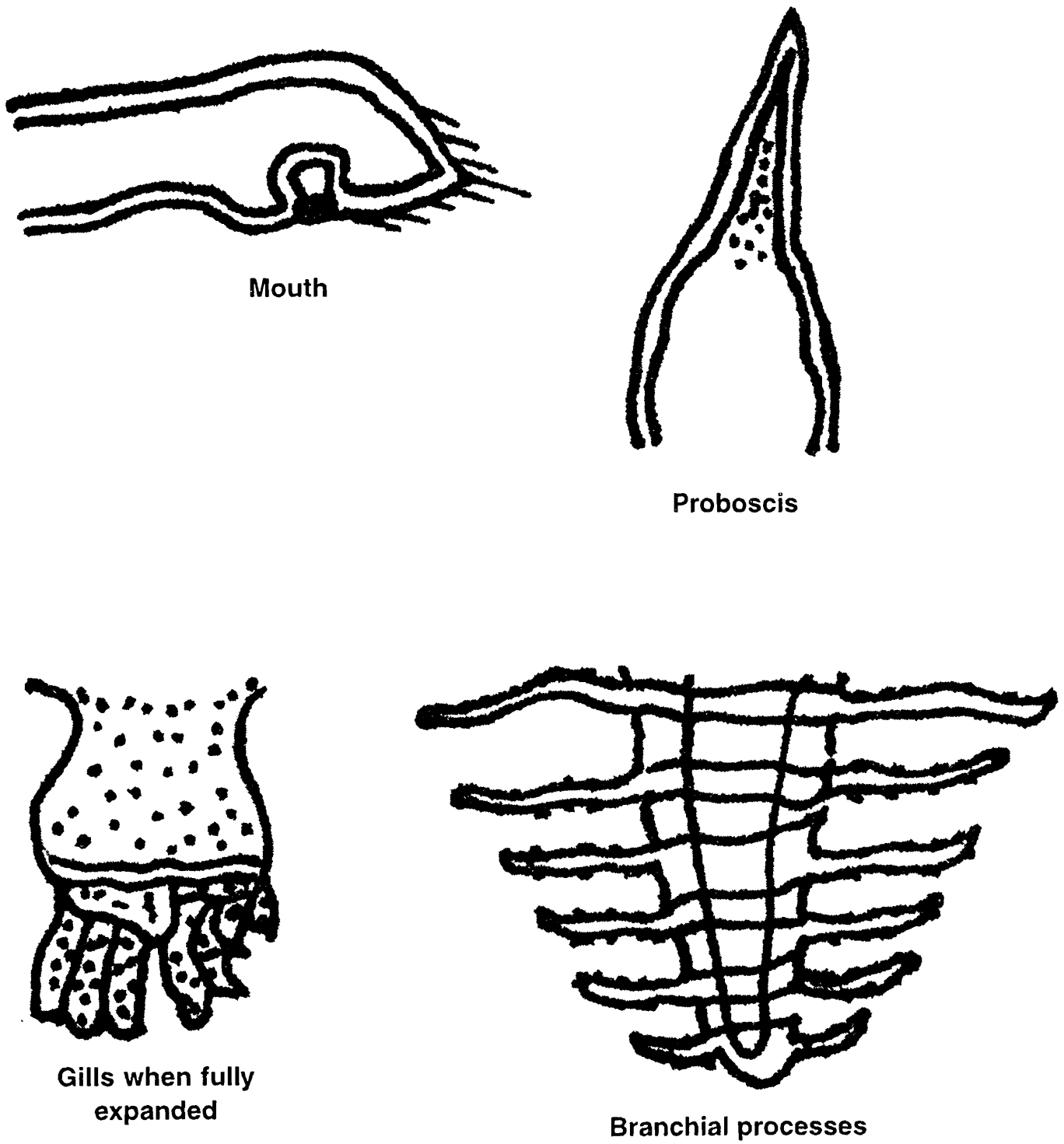


Fig. 1.

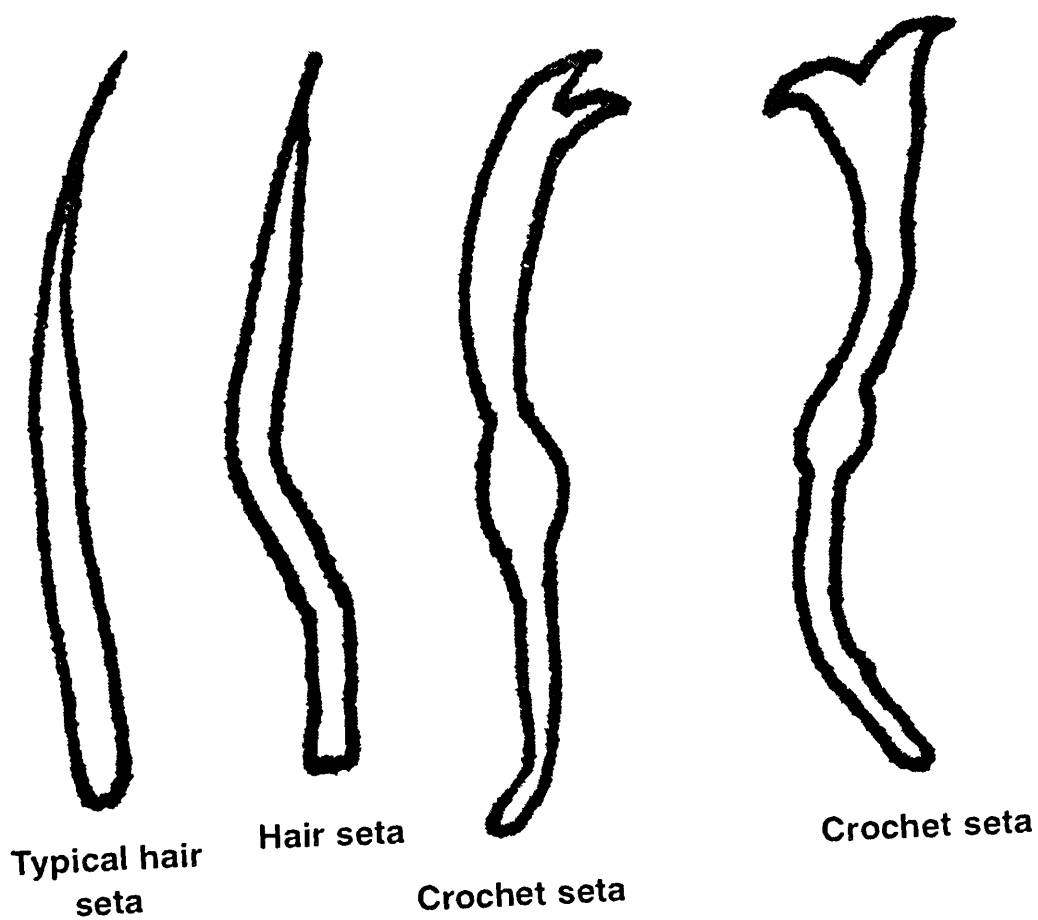
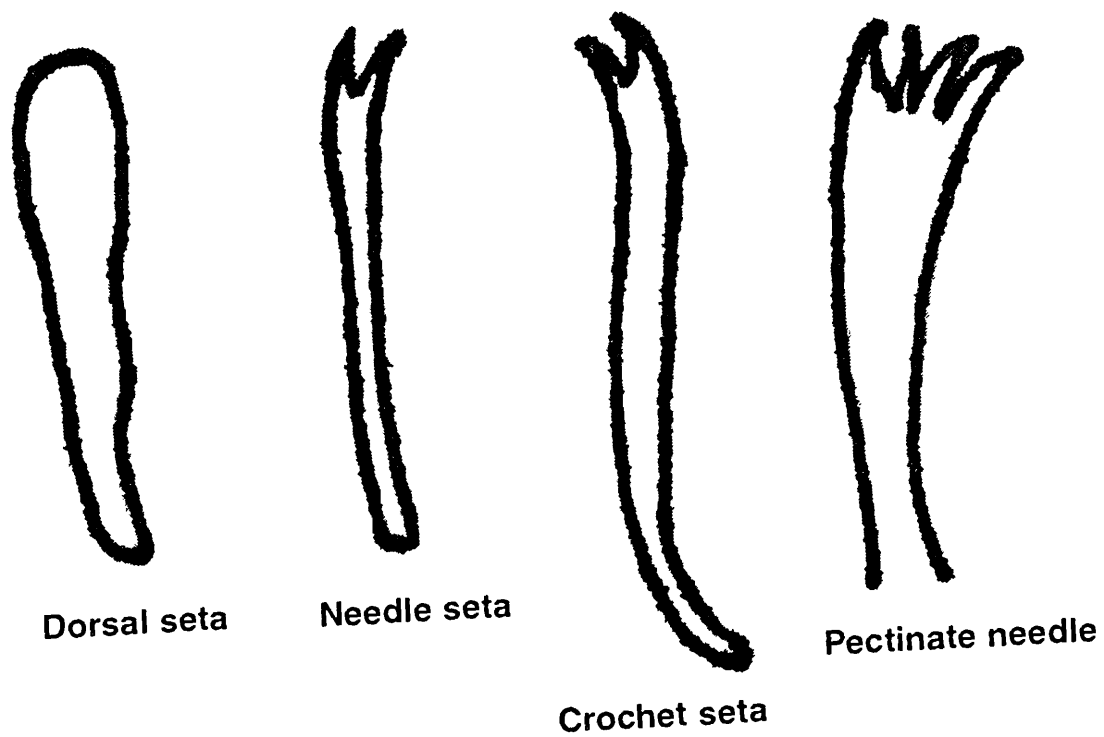
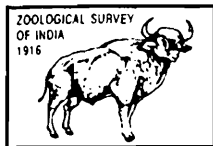


Fig. 2.



Rec. zool. Surv. India : 106(Part-2) : 99-104, 2006

A NEW SPECIES OF THE FAMILY MOCHLOZETIDAE (ACARINA : ORIBATIDA) FROM TRIPURA, INDIA

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INTRODUCTION

The family Mochlozetidae was established by Grandjean (1960). Balogh (1965, 1972) placed the family Mochlozetidae under the superfamily Ceratozetoidea Balogh, 1961 and accommodated seven genera. Balogh and Balogh (1992) in the book 'The Oribatid Mites Genera of the World (Vols. I & II)' shifted the genus *Uracrobates* Balogh and Mahunka, 1967 from family Ceratozetidae Jacot, 1925 to the family Mochlozetidae. They also transferred the genus *Drymobatoides* Jacot, 1936 from the family Oribatulidae Thor, 1929 to this family. Norton (1984) erected a new genus *Mochlobates* with the type species *Oribata affinis* Banks, 1895 under this family. Mahunka (1987) described another new genus *Calugarella* with the type species *Unguizetes sabahnus* Mahunka, 1987. Mahunka (1988) erected a new genus *Mahunkazetes* with the type species *Mochlozetes africanus* Mahunka, 1988. Balogh and Balogh (1992) in their book accommodated 12 genera under the family Mochlozetidae.

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

Genus *Unguizetes* Sellnick

1925. *Unguizetes* Sellnick, *Treubia*, 6 : 473.

Type-species : *Unguizetes triplicatus* Grandjean, 1960.

The genus *Unguizetes* was instituted by Sellnick (1925) with *U. sphaerula* as the type collected from Java. *Unguizetes triplicatulus* Grandjean, 1960 was considered as the type (as originally

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proposed by Grandjean, 1960) of the genus by Balogh (1965, 1972) (*Unguizetes triplicatulus* nom. Nov. pro, *U. sphaerula* Sellnick, 1925 not Berlese 1904).

Wallwork (1965) described *U. reticulatus* from Tchad. Aoki (1967) reported another new species, *U. clavatus* from Thailand. Species under this genus also reported by Sellnick (1925), Grandjean (1960), Wallwork (1965), Aoki (1967), Fujikawa (1972), Chakrabarti *et al.* (1973, 1977).

Mahunka (1987) described *U. sabahnus* from Sabah and in 1990 *U. inermis* from Philippines.

Chakrabarti *et al.* (1973) reported the genus for the first time from Indian territory. Chakrabarti *et al.* (1977) and Sanyal (1992) reported the genus from West Bengal. The genus is reported for the second time from Tripura.

Generic Diagnosis : Fairly large species; lamellae connected by linear translamella; cuspis not projecting from line of translamella; no chitinous bridge between pteromorphae; notogaster nearly circular, as long as broad, setae entirely reduced and indicated by 10 pairs of minute alveoli, with 4 pairs of area porosae; legs moderately long and tridactylous.

Distribution : INDIA : Tripura, West Bengal. *Elsewhere :* Japan, Java, South Africa, Thailand.

DESCRIPTION OF SPECIES

Unguizetes granulatus sp. nov.

(Text figs. 1-3)

Colour : Brown.

Measurements (in μm) : Length of the body : 855-875; width of the body : 724-750.

Prodorsum : Prodorsum distinctly granulated; rostrum rounded; rostral setae moderately long (66), smaller than their mutual distance (84), thin with pointed tip, barbed outwardly; lamellar setae smooth, thin, long (122), smaller than their mutual distance (141), arise from translamellar crest; translamella with an undulation at middle and lateral crest which joins with broad lamellae; interlamellar setae longest (179) of all prodorsal setae, smooth, thin, arise from elevated base above dorsosejugal line; exobothridial setae short (28), thin, bilaterally barbed; sensillus with long stalk (94) and lanceolate head.

Notogaster : Dorsosejugal suture faint and incomplete like other members of this genus; pteromorphae immovable; notogastral setae represented by 7 pairs of alveoli; 4 pairs of area porosae, Aa , A_1 , A_2 , A_3 ; A_2 placed in middle of A_1 and A_3 ; notogaster densely granulated.

Ano-genital Region : Ano-genital region finely punctated; genital plates rectangular (length : 94, width : 85) with 6 pairs of smooth, minute setae; anal plates separated from genital plates by a distance of 150; anal plates punctated, squarish (length : 188, width : 188) with 2 pairs of

minute setae; 3 pairs of minute adanal setae; aggenital setae 1 pair, very short; *iad* parallel to anal plates.

Legs : Tridactylous. Leg chaetotaxy : I : 4-4-5+1-20-3; II : 4-3-3+1-11-3; III : 2-2-4-8-3; IV : 1-2-3-10-3.

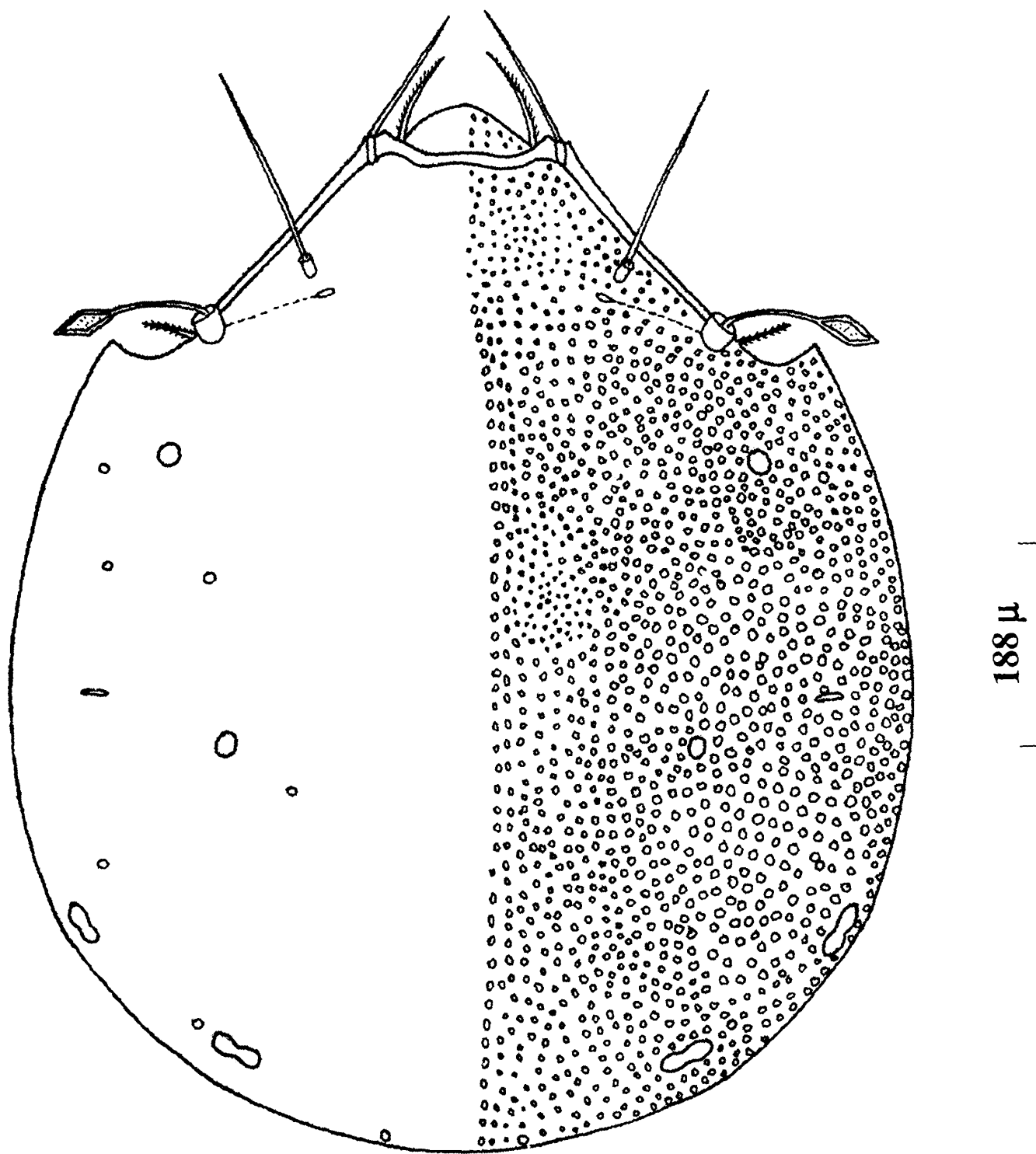


Fig. 1. : *Unguizetes granulatus* sp. nov., Dorsal view.

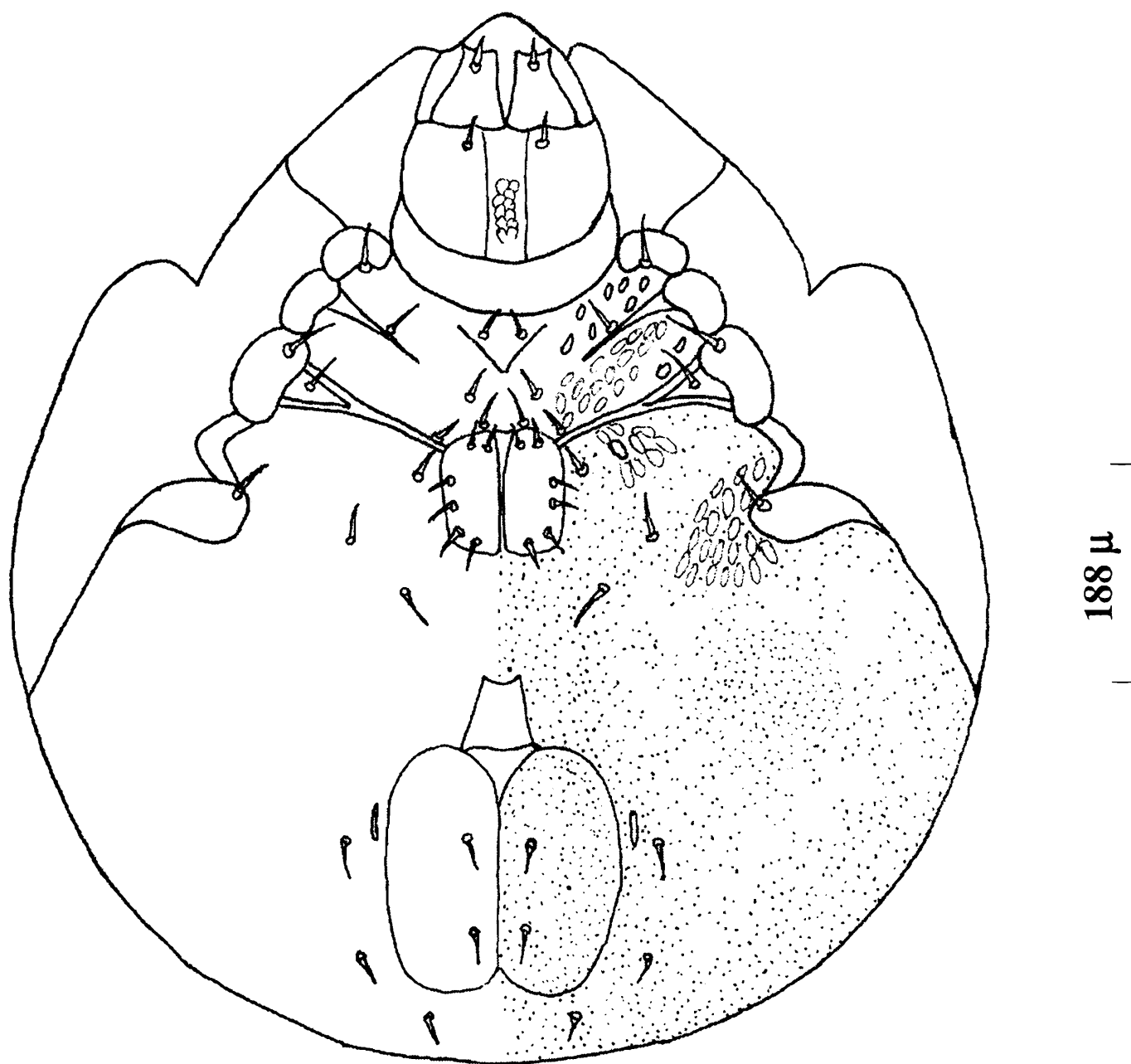


Fig. 2. : *Unguizetes granulatus* sp. nov., ventral view.

Material examined : HOLOTYPE : Adult female, India : Tripura : Birchandranagar (Amarpur), 12.x.1993, from loose humus with decaying leaves, stem and roots, coll. D. Saha. PARATYPES : 2 adult females, India : Tripura : Jatanbari (Amarpur), 2.i.1992, from soil and litter beside paddy field, coll. S. Saha.

Distribution : INDIA : Tripura (South District).

Remarks : The new species approaches close to *Unguizetes clavatus* Aoki, 1967 in body shape, nature of rostral setae and ventral characters, but can easily be separated from the latter species in having smooth lamellar and interlamellar setae, sensillus with long stalk and lanceolated head, fine

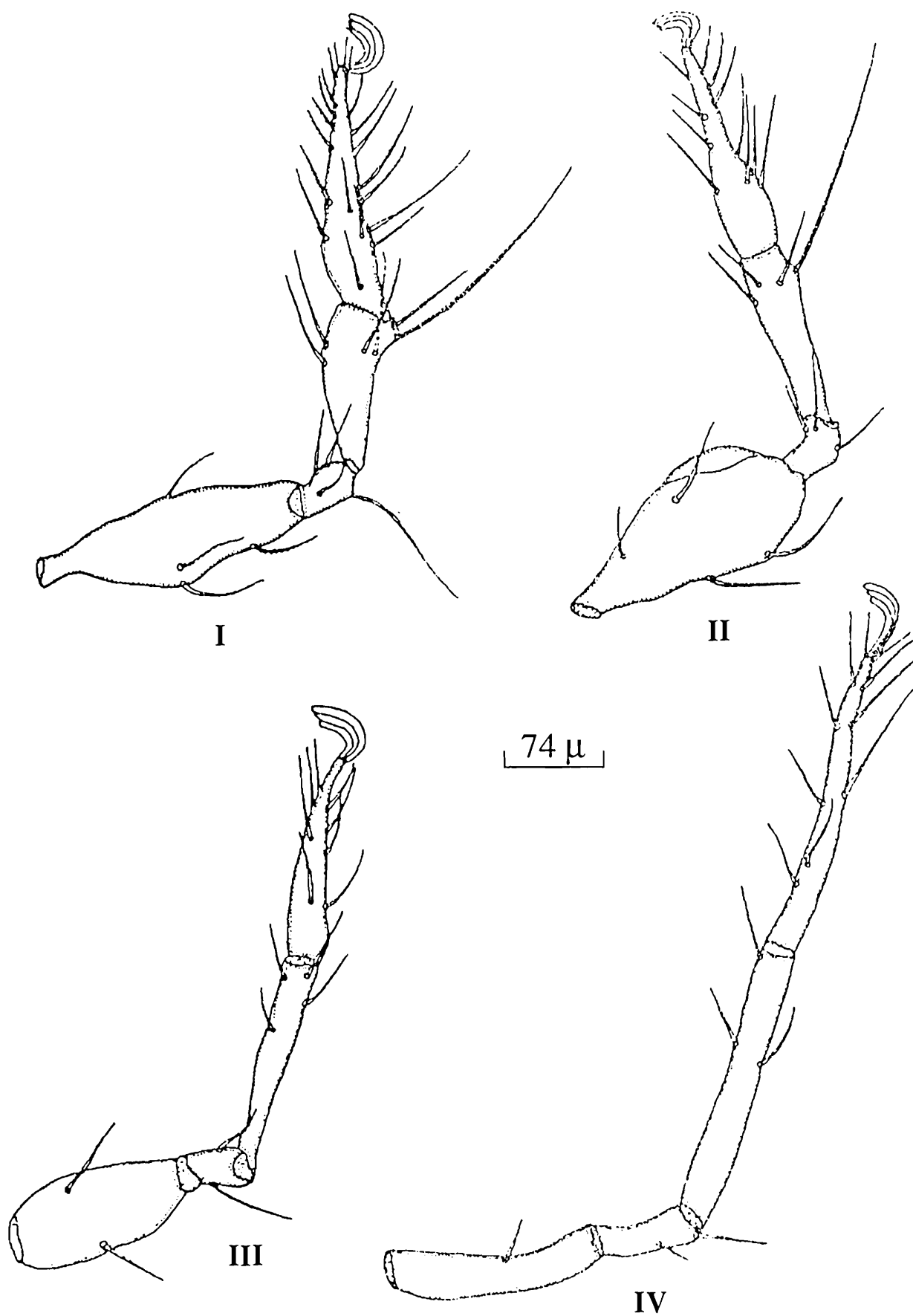


Fig. 3. : Legs (I-IV) of *Unguizetes granulatus* sp. nov.

granulation on notogaster, punctated ventral plates, absence of a projection in the middle of rostrum, absence of a crest behind the translamella and also in absence of beaded string like ornamentation on notogaster.

SUMMARY

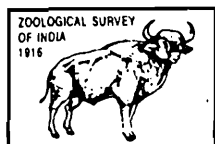
The paper contains the description along with illustrations of a new species viz., *Unguizetes granulatus* from Tripura, India.

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Rec. zool. Surv. India : **106**(Part-2) : 105-119, 2006

TWO NEW SPECIES OF THE FAMILY SCHELORIBATIDAE (ACARINA : ORIBATIDA) FROM TRIPURA, INDIA

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INTRODUCTION

The family Scheloribatidae includes the pterogasterine mites. Members of this family were previously placed under family Oribatulidae by most authors (Baker and Wharton, 1952; Woolley, 1961; Balogh, 1961, 1965, 1972; Hammer, 1971, 1973). Balogh (1972) in his book "The Oribatid genera of the world" included 59 genera, including genus *Scheloribates* under Oribatulidae. Grandjean (1933, 1954) mentioned that Scheloribatidae and Oribatulidae are to be separated on the basis mainly of presence of only one anal setae in the larval stages of Oribatulidae and absence of any anal seta in the larva of Scheloribatidae. Grandjean (1954) included six genera viz., *Scheloribates*, *Hemileius*, *Dometorina*, *Siculobata*, *Liebstadia* and *Eporibatula* under Scheloribatidae. Most workers, however, considered that *Scheloribates* and other related genera belong to the family Oribatulidae.

Balogh and Balogh (1984) in the review of the superfamily Oribatuloidea, suggested many modification and erected many new families under this superfamily. In this work he (1984) mentioned Scheloribatidae as a new family and erected five new subfamilies under this family. Balogh and Balogh (1990) also maintained that Scheloribatidae is a separate family. However, Grandjean (1933) had first mentioned Scheloribatidae as a new family and the present workers feel that Grandjean (1933) should be considered as the author of family Scheloribatidae.

Important contributions to the study of the mites of the family Scheloribatidae (many of which were previously placed under family Oribatulidae) have been made by Jacot (1929), Thor (1929), Pletzen (1963), van der Hammen (1952), Coetzer (1968), Mahunka (1975), Corpuz-Raros (1980) etc.

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Luxton (1982), Mahunka (1988a, 1988b), Ayyildiz and Luxton (1989), Norton and Kethley (1989), Lee and Pajak (1990) and Balogh and Balogh (1990) contributed 8 more new genera under the family Scheloribatidae. Thus the family Scheloribatidae till now possess 35 genera.

In India, the family is represented by only 3 genera viz., *Scheloribates* Berlese, 1908; *Euscheloribates* Kunst, 1958 and *Hammerobates* Balogh, 1970. The genus *Scheloribates* was first reported from India by Baker (1945), the genus *Euscheloribates* by Sanyal (1981) and the genus *Hammerobates* by Sanyal (1992). The family Scheloribatidae is presented here with two genera viz., *Scheloribates* and *Fijibates* from the South District of Tripura.

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

Key to the genera of the family Scheloribatidae

- 1(2). Rostral setae placed apart; dorsosejugal suture distinct *Scheloribates* Berlese, 1908
 2(1). Rostral setae near each other; dorsosejugal suture in distinct *Fijibates* Hammer, 1971

Genus *Scheloribates* Berlese

1908. *Scheloribates* Berlese, *Redia*, **5** : 2.
 1929. *Storkania* Jacot, *Trans Am. Microsc. Soc.*, **48** : 429.
 1934. *Paraschelobates* Jacot, *Bull Bishop Mus., Honolulu*, **114** : 225.
 1934. *Protoschelobates* Jacot, *Ibid*, **121** : 40.
 1934. *Styloribates* Jacot, *Ibid*, **121** : 61.
 1936. *Propeschelobates* Jacot, *Am. Midl. Nat.*, **17** : 547.

Type-species : *Oribates latipes* Berlese, 1886, not *Zetes latipes* C.L. Koch, 1844 (*Oribates latipes* Berlese, 1886 is a junior synonym of *Zetes pallidulus* C.L. Koch, 1841) (In : Balogh and Balogh, 1984 : 287).

Berlese (1908) first established the genus. His generic diagnosis was insufficient and inadequate. Jacot (1929) elaborated the diagnostic characters viz. presence of triangular pteromorph, sometimes slightly decurved; complete lengthwise attachment of lamellae with prodorsum. Later he (1934) further differentiated the genus by the presence of well developed rostro-lamellar ridge and the absence of cusps at the apex of lamella. Willmann (1931) while pointing out that the nature of pteromorph is extremely variable within the genus, recognized the presence of well developed rostro-lamellar ridge and tapering lamellae without cusps as of generic importance. Balogh (1961) considered the number of genital setae and the absence of rostral apophyses as important characters of the genus. Pletzen (1963) reviewed the characters of the genus very nicely.

The genus is reported by a large number of species which have been described and reported from the various parts of the world by several workers like Berlese (1908-1920), Sellnick (1928-1959), Jacot (1934a, 1934b, 1936a, 1936b, 1937), Willmann (1931a, 1931b, 1951), Wharton (1940), Baschkirova (1941), Baker (1945), Buitendijk (1945), Sengbusch (1951), Anantharaman (1951), van der Hammen (1952), Hammer (1952, 1958, 1961, 1962a, 1962b, 1967, 1968, 1971, 1973, 1977), Evans (1952), Michelcic (1956, 1957, 1963, 1964, 1965, 1968), Schweizer (1956), Haarlov (1957), Balogh (1958, 1959, 1962a, 1962b), Sellnick (1959), Wooley (1961), Csiszar and Jelava (1962), Pletzen (1963, 1965), Wallwork (1964, 1966), Aoki (1965, 1966, 1967, 1984), Bulanova-Zachvatkina (1967), Coetzer (1969), Perez-Inigo (1968), Kurcheva (1971) Vasiliu and Magda (1973), Feider *et al.* (1973), Balogh and Mahunka (1974, 1977), Hafeez-Kardar (1976, 1988), Mahunka (1977a, 1977b, 1982, 1983, 1985, 1987, 1988a, 1988b, 1991), Aoki *et al.* (1977), Dhali *et al.* (1980), Calugar and Vasiliu (1983), Balogh and Balogh (1984), Bayoumi and Al-Khalifa (1985), Lan *et al.* (1986), Minguez *et al.* (1986), Perez-Inigo and Baggio (1986), Fujita and Fujikawa (1987), Subbotina (1987), Morell (1987, 1990), Perez-Inigo, Jr. *et al.* (1987), Jeleva and Vu (1987), Marshall *et al.* (1987), Katsumata (1988), Ayyildiz (1988), Hafez *et al.* (1989), Lee and Pajak (1990), Weigmann and Wunderle (1990), Wunderle *et al.* (1990), Kahwash *et al.* (1991), Makhmudova (1991), Sanyal (1988, 1992), Wu Hongji (1994).

Balogh (1965, 1972) considered 5 genera viz., *Storkania* Jacot, 1929, *Styloribates* Jacot, 1934, *Propeschelobates* Jacot, 1936, *Paraschelobates* Jacot, 1934 and *Protoschelobates* Jacot, 1934 as the synonyms of the genus *Scheloribates*. But later on, Lee and Pajak (1990) removed the former 3 genera from the synonym list and simultaneously added 2 other genera, *Neoscheloribates* Hammer, 1973 and *Semischeloribates* Hammer, 1973 as new synonyms of the genus *Scheloribates*.

Lee and Pajak (1988, 1990), Balogh and Balogh (1990) and Grobler (1991) transferred some species of the genus *Scheloribates* to other genera under the same family. Bayoumi and Al-Khalifa (1985), Ayyildiz (1988), Luxton (1989) and Balogh and Balogh (1990) provided key to the species to the genus *Scheloribates* from Saudi Arabia, Turkey, Great Britain and Neotropical region respectively. Balogh and Balogh (1992) provided a key of the genus *Scheloribates* in their book 'The Oribatid Genera of the World (vols. I & II)'

The genus *Scheloribates* is well represented in India and has been previously reported by Baker (1945) from Uttar Pradesh. Later on, Anantharaman (1951), Banerjee (1974), Narsapur (1975, 1976), Choudhuri and Banerjee (1975, 1977), Hafeez-Kardar (1976, 1988), Chakrabarti *et al.* (1977), Bhattacharya (1979), Chakrabarti and Roy Talukdar (1979), Chakrabarti *et al.* (1979), Bhattacharya and Joy (1980), Bhattacharya *et al.* (1980), Dhali *et al.* (1980), Mishra *et al.* (1980), Joy and Bhattachayra (1981), Banerjee and Roy (1981), Ghatak and Roy (1981), Chakrabarti and Mondal (1981, 1983), Gupta and Paul (1965, 1989), Sanyal (1988, 1992, 2000), Sanyal and Das (1989), Sanyal and Sarkar (1983), Sarkar (1984, 1990), Bhattacharya *et al.* (1985), Bhattacharya and Halder (1984), Chakraborty and Bhattacharya (1992), Bhattacharya and Chakraborty (1995) have

also reported and contributed number of species and subspecies under the genus from different parts of India.

Generic Diagnosis : Anteriorly attenuated lamellae without cusps; rostro-lamellar ridge present or absent; rostral apophyses present or absent; pteromorphae variable, never auriculate, may or may not be slightly decurved; areae porosae generally reduced to sacculi, sometimes represented by slit like pores; 10 pairs of notogastral setae; sacculi 4 pairs on notogaster, genital plates far removed from anal plates, with 4-5 pairs of genital setae; apodemata IV relatively short or long, abutting the genital field; femur II generally with a ventral keel; legs monodactylous or tridactylous, rarely bidactylous.

Distribution : INDIA : Tripura (North, West, South Districts), Andhra Pradesh, Assam, Kerala, Maharashtra, Orissa, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal.

Elsewhere : Antarctica, Argentina, Australia, Brazil, Bangladesh, Cuba, China, Canada, Campbell Islands, Cape Verde Islands, Egypt, Eua and Upolu Islands, East Malaysia, Fiji Islands, Great Britain, Georgia, Hungary, Hawaiian Islands, Kazakhstan, Midway Islands, New Zealand, Russia, Saudi Arabia, Spain, Sub-Antarctic Islands, South Africa, Tahiti, Tonga Tapu, Turkey, Tanzania, Turkmania, Ukraine, Uzbekistan.

Scheloribates samirani sp. nov.

(Figs. 1-4)

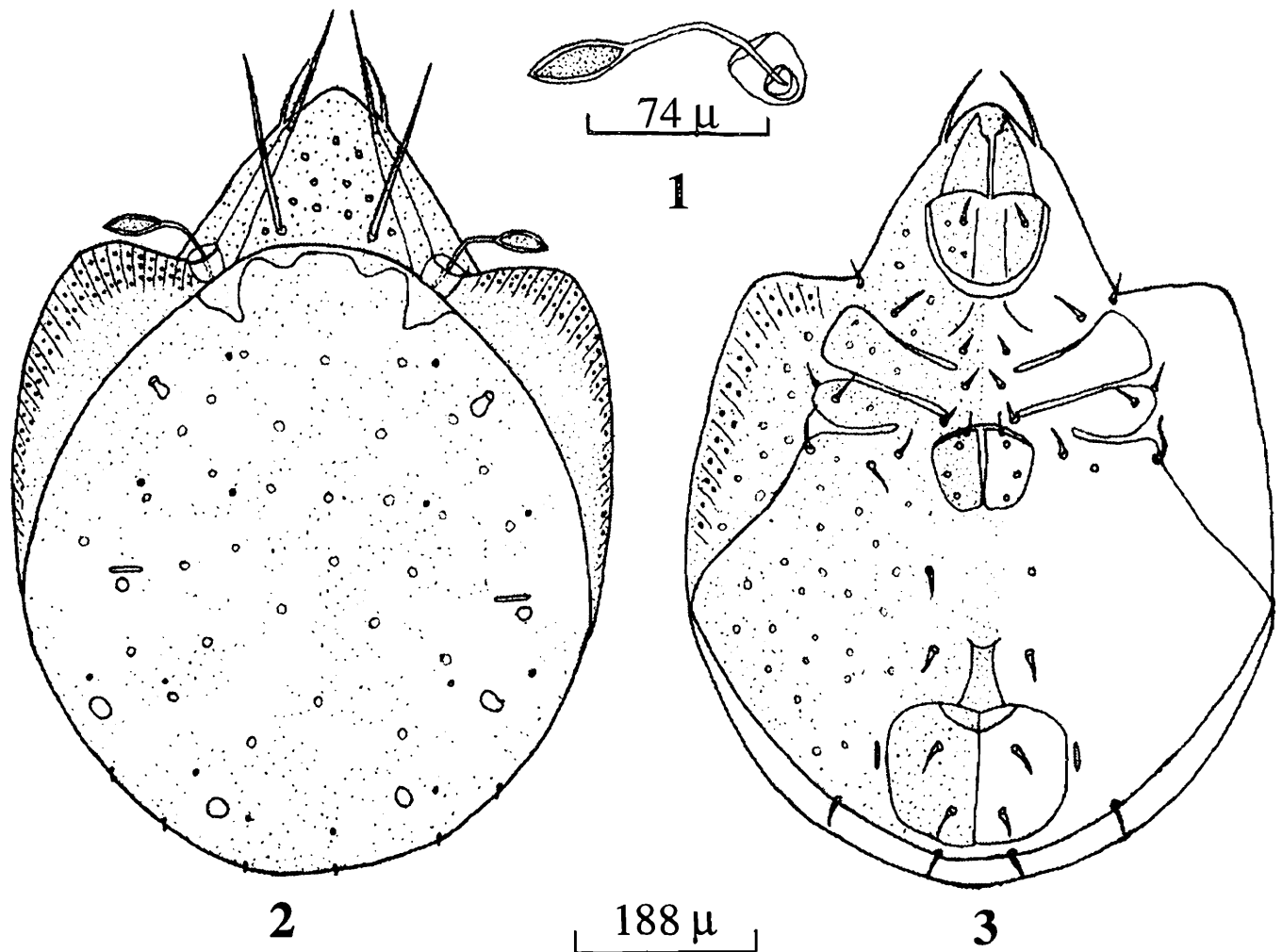
Colour : Yellowish brown.

Measurements (in μm) : Length of the body : 714-730; width of body : 536-545.

Prodorsum : Rostrum conical; rostral setae moderately long (78-80), thin, rough, curved inward, placed on lateral margin of rostrum, reach beyond tip of rostrum by half their length; lamellar setae long (115-120), thin, slightly rough, extend beyond tip of rostral setae, longer than their mutual distance (92); interlamellar setae longest (155-160) among prodorsal setae, more than double their mutual distance (74-80), smooth, thin; pseudostigmatic organ directed outward, forming obtuse angle, become straight with slender clavate head, pointed at tip, inside faintly granular, stalk (63) almost twice as long as head (33); prodorsum foveolated and with fine punctations.

Notogaster : Anterior border of notogaster form a broad, even arch with angular shoulder, pteromorphae broad, rounded, anterior and lateral margins of pteromorphae striated with granules and punctations, notogastral setae not visible; sacculi 4 pairs, rounded; notogaster punctated and with foveolae.

Epimeral Region : Sternal plate ill-developed; apodemata IV absent; epimeral region punctated and with foveolae; epimeral setal formula 3-1-3-3, epimeral setae thin, smooth.



Figs. 1-3. : *Scheloribates samirani* sp. nov.

1. Sensillus; 2. Dorsal view; 3. Ventral view.

Ano-genital Region : Genital plates rectangular (length : 78, width : 81) with 4 pairs of genital setae; genital plates punctated; anal plates broader than long (length : 141, width : 161) with 2 pairs of setae, punctated; adanal setae 3 pairs, *ad*₁ placed posteriorly, *ad*₂ placed postero-laterally and *ad*₃ placed antero-medially; ventral plates foveolated and punctated.

Legs : Tridactylous, punctated and with foveolae. Leg chaetotaxy : I : 0-4-2-4+1-16+1-3; II : 0-2-3-4+1-12-3; III : 1-3-2-4-10-3; IV : 0-2-1-4-9-3.

Material examined : HOLOTYPE : Adult female, India : Tripura : Garjanmura (Udaipur), 10.vii.1991, from litter and soil below Sal tree, coll. S. Saha. PARATYPES : 6 adult females, India : Tripura : Chandrapur (Udaipur), 10.vii.1991, from litter and soil below banana plant, coll. S. Saha; 4 adult females, Ampinagar (Amarpur), 15.xii.1991, from soil and litter of mixed type vegetation, coll. S. Saha.

Distribution : INDIA : Tripura (South District).

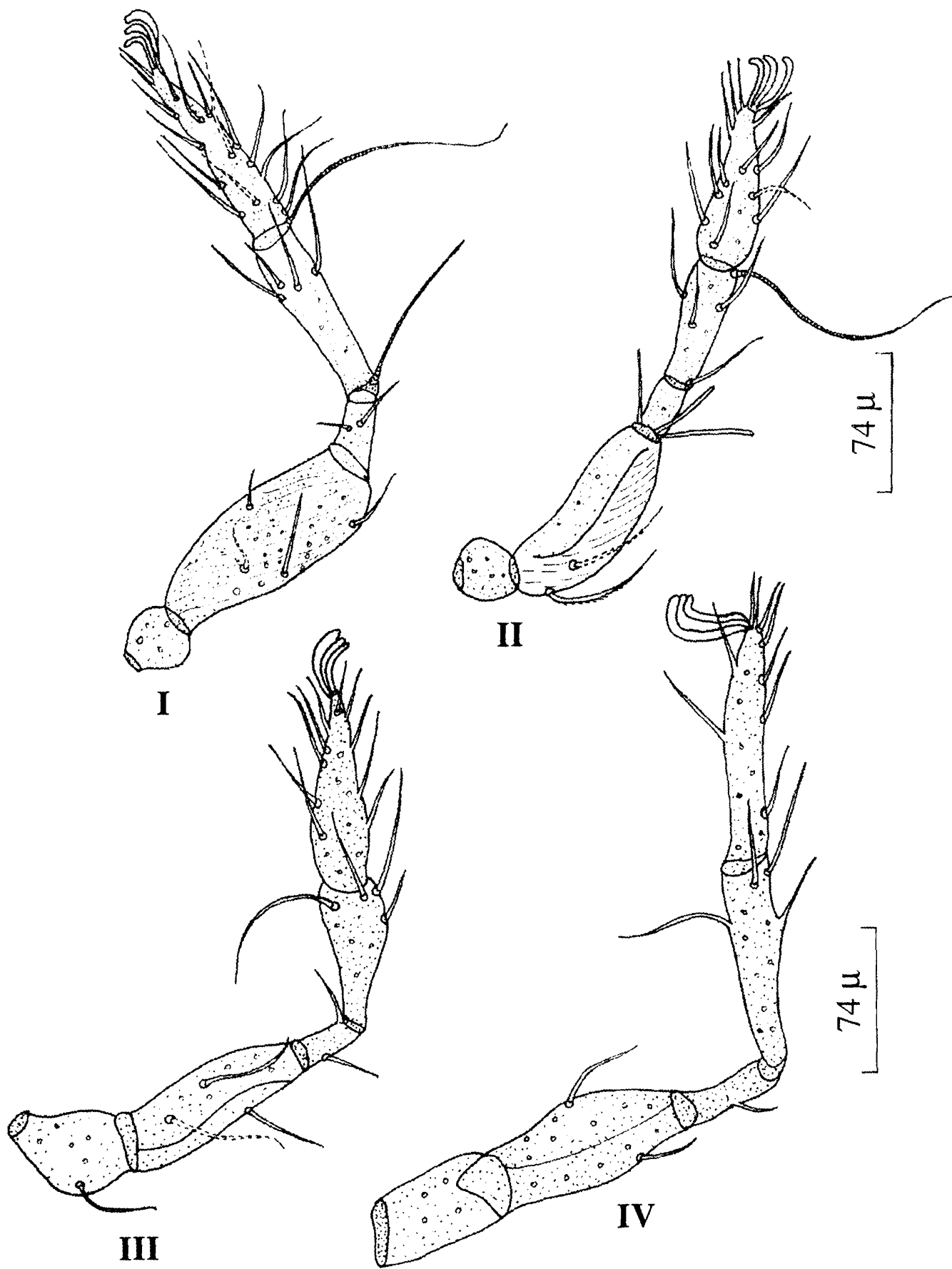


Fig. 4. : Legs (I-IV) of *Scheloribates samirani* sp. nov.

Remarks : The new species agrees well with *Scheloribates luteomarginatus* Hammer, 1958 in the shape of body and shape of prodorsal setae. But the present species differs markedly from the later species by the presence of rough rostral and lamellar setae; smooth and clavate-shaped with pointed head of sensillus, striated pteromorphae with foveolae and punctation and scattered foveolae along with fine punctation on dorsal and ventral surface of the body. Hence the species is described as new to science.

The new species has been dedicated to Dr. Samiran Chakrabarti, teacher of the second author.

Genus *Fijibates* Hammer

1971. *Fijibates* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **16**(6) : 48.

Type-species : *Fijibates rostratus* Hammer, 1971.

Hammer (1971) erected the genus *Fijibates* with *F. rostratus* from Java, Fiji Islands. Later Corpuz-Raros (1980) described another new species, *F. anterostratus* from Philippines. Till now only 2 species are known from the world. Balogh and Balogh (1992) in the book 'The Oribatid Mites Genera of the World (vols. I & II)' included genus *Fijibates* with 2 species under the family Scheloribatidae Grandjean, 1953.

The genus *Fijibates* is reported here for the second time from India. It was reported first from the state by Sanyal (2000).

Generic Diagnosis : Rather small, oval species; rostrum entire and rostral setae arising dorsally; prolamellar ridges absent; lamella without cuspis; sensillus short to moderately long, clavate; dorsosejugal suture incomplete or very faint medially; pteromorphae immovable; notogastral setae 10 pairs, sacculi 4 pairs; epimeral apodemes short to moderately long but not reaching frame of genital field; genital setae 4 pairs, aggenital setae 1 pair, anal setae 2 pairs and adanal setae 3 pairs; legs monodactylous.

Distribution : INDIA : Tripura (South District).

Elsewhere : Fiji Islands, Philippines.

Fijibates rostopilosus sp. nov.

(Figs. 5-7)

Colour : Light brown.

Measurements : (in μm) : Length of the body : 399-420; width of the body : 296-310.

Prodorsum : Rostrum acutely rounded on dorsal side on which rostral setae situated; rostral setae moderately long (41), almost contiguous basally, arising on crescent-shaped tubercles, densely pilose tapered distally to a fine point; prolamellar ridges absent; a faint transverse line present

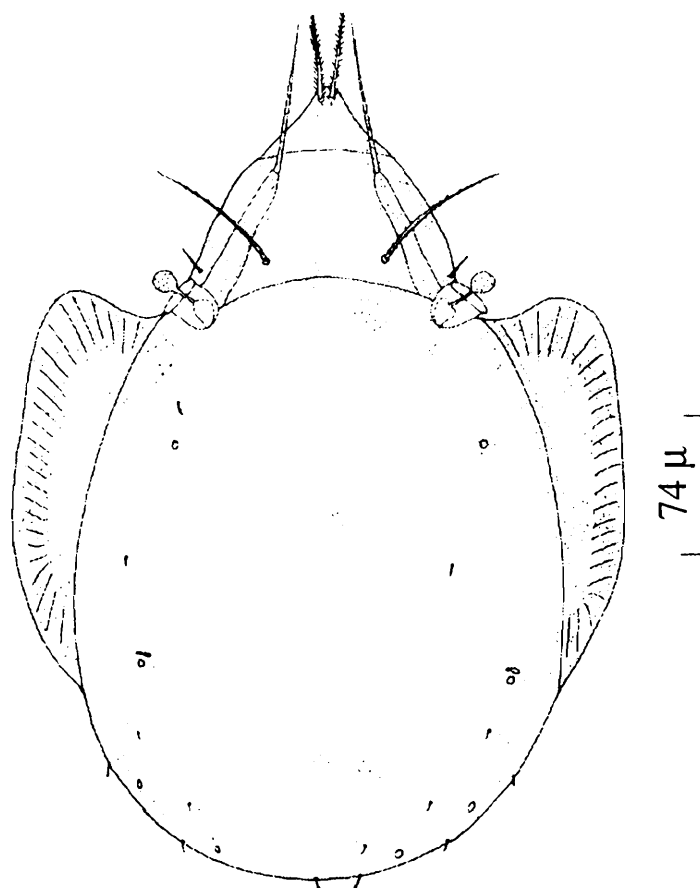


Fig. 5. : *Fijibates rostopilosus* sp. nov., Dorsal view.

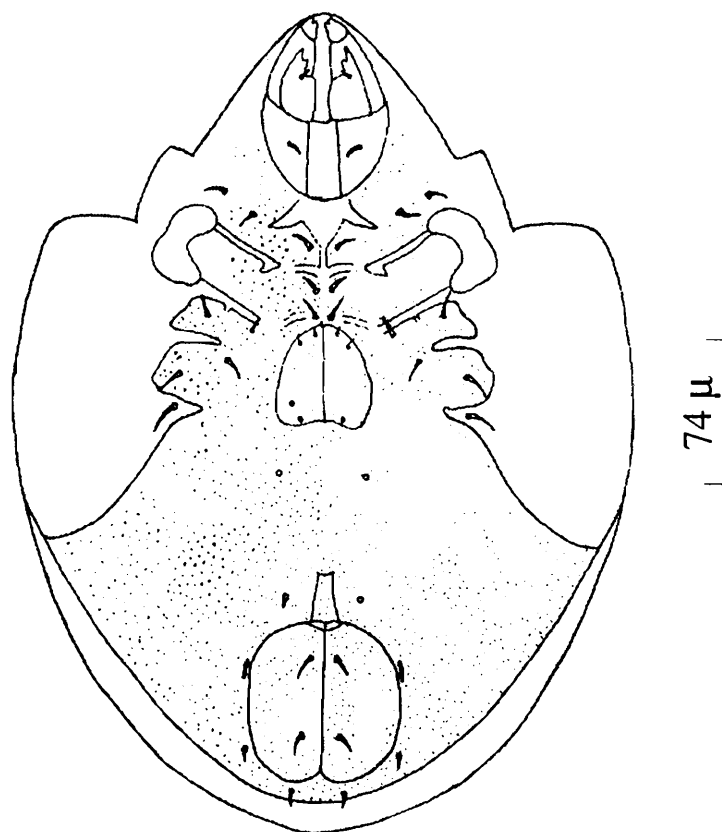


Fig. 6. : *Fijibates rostopilosus* sp. nov., Ventral view.

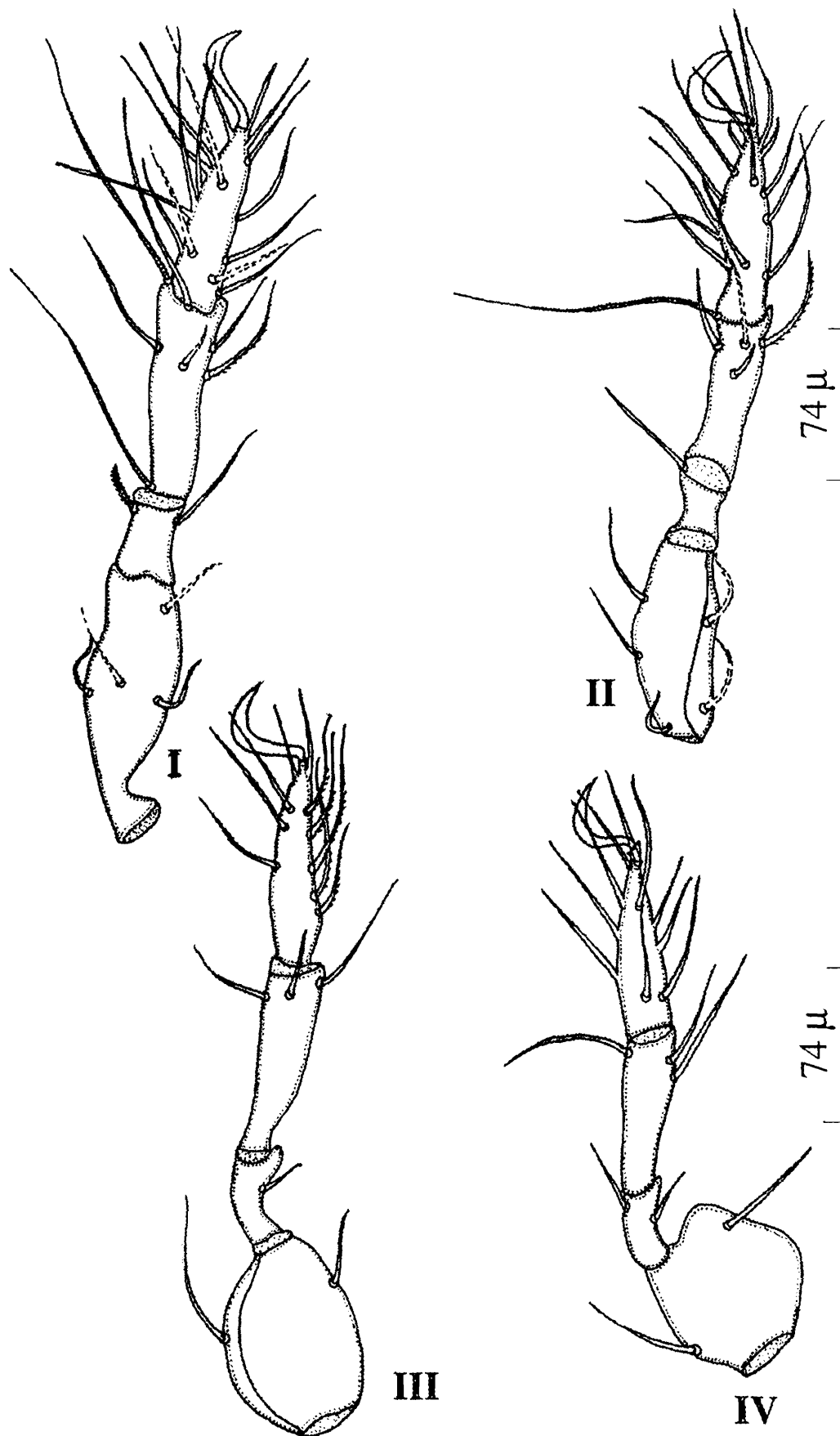


Fig. 7. : Legs (I-IV) of *Fijibates rostopilosus* sp. nov.

just above apices of lamellae; lamellae long, almost touching transverse lines; lamellar setae long (81), almost twice of rostral setae, thick with pointed tip, minutely barbed; interlamellar setae long (78), thick with pointed tip, rough; exobothridial setae short, thin with pointed tip; sensillus with short stem (15) and rounded; head (15 in diameter) with granules inside, prodorsum finely punctated.

Notogaster : Dorsosejugal suture complete; pteromorphae immovable with striation and punctation; notogaster punctated with 10 pairs short, thin setae; sacculi 4 pairs, small.

Epimeral Region : Epimeral apodemes II and *sj* long, III moderately long but not reaching frame of genital field; epimeral chaetotaxy 3-1-3-3; epimeral region punctated.

Ano-genital Region : Genital plates trapezoidal (length : 52, width : 48) and punctated with 4 pairs of minute setae; anal plates separated from genital plates by 133; anal plates almost oval (length : 74, width : 84) punctated with 2 pairs of setae; fissure *iad* parallel to anal field; 3 pairs of adanal and 1 pair of aggenital setae; ventral plate punctated.

Legs : Monodactylous. Leg chaetotaxy : I : 4-1+1-5+1-16+1; II : 5-1-4+1-16-1; III : 2-2-3-10-1; IV : 2-1-3-10-1.

Material examined : HOLOTYPE : Adult female, India : Tripura : Baisabari (Udaipur), 10.viii.1991, from litter and soil of paddy field, coll. S. Saha. PARATYPES : 3 adult females, data same as for holotype.

Distribution : INDIA : Tripura (South District).

Remarks : The new species resembles *F. anterostratus* Corpuz-Raros, 1980 in the position of rostral setae, same nature of lamellar and interlamellar setae, similar structure of sensillus and ventral character, but can be separated from *F. anterostratus* by the presence of snout-like rostrum, densely pilose rostral setae, long lamellae, having complete dorsosejugal suture, striation on pteromorphae and presence of punctation on body.

SUMMARY

Two new species viz., *Scheloribates samirani* and *Fijibates rostopilosus* of the family Scheloribatidae are described here along with illustrations from Tripura, India.

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Rec. zool. Surv. India : **106**(Part-2) : 121-122, 2006

Short Communication

NOTES ON A RARE FROG, *PTERORANA KHARE* KIYASETUO AND KHARE 1986, FROM NORTH EAST INDIA, WITH REPORT ON ITS HITHERTO UNKNOWN FEMALE

Pterorana khare was originally described from Sanuoru and Rukhroma waterfalls in Nagaland based on two male specimens (Kiyasetuo and Khare, 1986). Chanda (1994) in his Anuran (Amphibia) fauna of North East India included the description of this species quoting Kiyasetuo and Khare. He however inadvertently mentioned the types as females. Sen and Mathew (2003) reported on its extension of range to Mizoram based on a male specimen collected from Dhaleswari river, Bairabi. Dey and Ramanujam (2003) reported another male specimen from Mizoram.

We have a female specimen collected by S.J.S. Hattar from Pongsung, Tirap district of Arunachal Pradesh on 17.1.1996. This specimen measures snout –vent length 55 mm. Unlike male specimens, the present female specimen does not have much extended skin flap either laterally or on thigh, (Plate I, A, Plate II) meaning, the lateral skin is not stretchable like in male specimens (Plate I, B). Dorso-lateral glandular fold is not very prominent as in males. Vomerine teeth more or less cluster type, oblique, equidistant from choanae and each other (in males it is narrow, oblique, closer to choanae than each other). Tongue shorter than in male with a depression anteriorly. First finger broad at base without spinules (in males it is prominent).

Considering the presence of unique “winglike lateral flaps of skin” Kiyasetuo and Khare (1986) erected a new genus *Pterorana* for their new species *khare*, though their specimens shared many characters of *Rana*. However, Dubois (1992) treated *Pterorana* as subgenus of *Rana* without studying the types, Chanda, Das and Dubois (2000), who had not studied a female of the species, ranked *Pterorana* as a genus on the basis of the “highly distinctive patagium”

After studying the female specimen of *Pterorana khare* wherein “highly distinctive patagium” is not present, (Plate I, A), the authors are of the opinion that this species could be retained in the genus *Rana* under sub genus *Pterorana*.

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NIBEDITA SEN AND ROSAMMA MATHEW
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Zoological Survey of India, Shillong*

PLATE I



A



B

Plate I. : *Pterorana khare*. A. Female, B. Male.

PLATE II

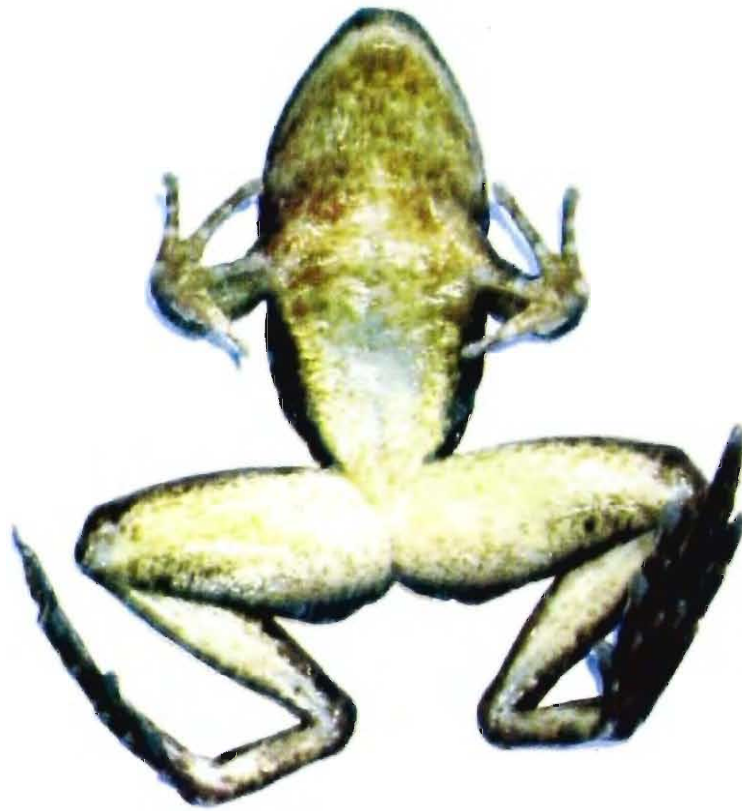
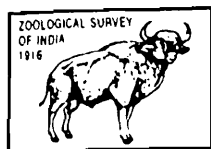


Plate II. : Ventral View of female *Pterorana khare*.



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Short Communication

FIRST REPORT OF *CYCLOGOMPHUS HETEROSTYLUS* SELYS (ODONATA : INSECTA) FROM KERALA, SOUTH INDIA

Members of the genus *Cyclogomphus* Selys (Gomphidae : Anisoptera : Odonata : Insecta) are small gomphines characterized by having the basal antenodal nervure incomplete on all wings.

Within Indian limits, the genus is represented by three species viz : *C. heterostylus* Selys, *C. ypsilon* Selys and *C. wilkinsi* Fraser. The genus *Cyclogomphus* has never been reported from Kerala in south India. While studying the odonate collection from Thiruvananthapuram district, Kerala, we came across a specimen that belonged to *C. heterostylus* Selys, the details of which are presented below. Accordingly, the genus *Cyclogomphus* and the species *C. heterostylus* Selys are reported here for the first time from Kerala.

Material examined : *Cyclogomphus heterostylus* Selys, 1 male, India : Kerala : Thiruvananthapuram district : Thenmalai urukunnu, Coll. P.T. Cherian, 5 April, 1998.

Diagnostic characters : Thorax with two “Y”-shaped markings on each side; superior anal appendages pale yellow, short, straight, slightly separated, and directed straight backwards.

Distribution : India : Darjeeling (West Bengal), Poone (Maharashtra), Madras (Tamil Nadu), and Thiruvananthapuram (Kerala)—the present record.

Remarks : Fraser (1934) stated that *C. heterostylus* Selys is very similar to *C. ypsilon* Selys and the differences indicated by Selys are found inconstant on examination of a large number of specimens, so that no dependence can be placed on the colouration and nodal index to separate *C. heterostylus* from *C. ypsilon*, barring the characters found by Fraser (*Op. Cit*) such as, the distinctly thicker black band on the lower part of frons, entirely yellow labrum, two “Y”-shaped markings on each side of the thorax and the superior anal appendages short, straight, slightly separated, and directed straight backwards, possessed by *C. heterostylus*.

The taxonomic identity of the material studied by us has been fixed based on the reliable characters proposed by Fraser (*Op. Cit*). However, since *C. heterostylus* Selys is known to exhibit great variations in colour and nodal index, for a future comparison with material from elsewhere, we are recording below certain characters, apart from the diagnostic ones, observed on the specimen

studied by us. They are, occiput yellow with black cloudings on either side and with pointed small spines on the lower border; anterior lobe of prothorax yellow in front, black on the basal part; middle lobe of prothorax black with two small round yellow spots on the center and two large oval shaped yellow spots on each side; posterior lobe of prothorax black with a small yellow spot at the centre; thorax yellow with two broad black "U"-shaped markings dorsally on either side, confluent on the anterior part and narrowly separated by a fine yellow median ridge on the posterior part; mesothoracic collar yellow; pterostigma brown at the centre and dull white at either end, covering $2\frac{1}{2}$ –3 cells; anal appendages yellowish brown; nodal index— $\frac{8-11}{8-8} / \frac{11-8}{8-7}$

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Short Communication

NEW HOST PLANT RECORDS OF THE SHORT-BANDED SAILER, *NEPTIS COLUMELLA* (CRAMER) AND THE CHESTNUT-STREAKED SAILER, *NEPTIS JUMBAH* (MOORE) [NYMPHALIDAE : LEPIDOPTERA : INSECTA]

INTRODUCTION

During our monitoring surveys of Butterflies around the sacred groves of Kannapuram, Kannur district, Kerala, India, we encountered many larvae and pupae of butterflies that are common around the locality. On 26th October 2003, we collected a bluish green larva from *Gmelina arborea*, a Verbenaceae plant. The larva was voraciously feeding on the leaves of the plant with its typical manner of scraping the edge of the leaf. We observed the larva for sometime and noticed its nature of feeding. It consumed several leaves partly and left the leaves half eaten. We collected the larva along with the leaf and kept it in an insect cage for two days. Apparently due to the dryness of the leaf, the larva was reluctant to feed the leaf. However, we provided leaves of the Changing Rose (*Hibiscus mutabilis*, family : Malvaceae), a common plant available in our gardens. The caterpillar accepted the leaf and in due course, pupated successfully and emerged in to an adult butterfly, *Neptis columella* (Cramer) [Nymphalidae : Lepidoptera : Insecta]. Later, we searched *Hibiscus mutabilis* plant for the butterfly larvae and we could collect many caterpillars of *Neptis columella* (Cramer) during October and November months in 2003. Fed by the leaves of *Hibiscus mutabilis*, we could rear the caterpillars into adults.

Wynter-Blyth (1957) and Kunte (2000) listed *Dalbergia* sp. (Fabaceae) as the only host plant known for the Short-banded Sailer. The present observations add two more species namely, *Gmelina arborea* and *Hibiscus mutabilis* to the host plant inventory of the Short-banded Sailer, *Neptis columella* (Cramer).

Locally, the Short-banded Sailer is not so common, but appears in small numbers immediately after the southwest monsoon in October and November.

Our next observation deals with the Chestnut-streaked Sailer, *Neptis jumbah* (Moore) [Nymphalidae : Lepidoptera : Insecta]. The Chestnut-streaked Sailer is a locally common butterfly

frequenting wooded country mostly at low elevations. In north Kerala, the species is commonly found flying in the vicinity of sacred groves and nearby areas and can be observed during the rainy season and thereafter.

During early October 2003, we observed a Chestnut-streaked Sailer laying eggs on the leaf tip of *Cassia fistula* (Caesalpiniaceae) tree. After a week, we observed a butterfly larva at the tip of the same leaf feeding on it. It was dirty brown in colour without any markings on its body and spiny in appearance. Subsequent to its pupation, we collected the pupa and an adult Chestnut-streaked Sailer emerged out of it after 8 days.

Similarly, we collected a fairly grown caterpillar of the same butterfly, while it was feeding on the leaf of the plant *Sterculia guttata* (Sterculiaceae) on 9th November 2003. In 3 days, it pupated and after 8 days an adult Chestnut-streaked Sailer emerged out of the pupa.

The earlier known larval food plants of the Chestnut-streaked Sailer are *Bombax ceiba* (Bombacaceae), *Moulluva spicata* (Caesalpiniaceae), *Xylia xylocarpa* (Mimosaceae), *Thespesia populnea* and *Hibiscus* sp. (Malvaceae), *Byttneria* sp. (Sterculiaceae), *Pongamia pinnata* and *Dalbergia* sp. (Fabaceae), *Elaeocarpus* sp. (Elaeocarpaceae), *Grewia* sp. (Tiliaceae) and *Ziziphus* sp. (Rhamnaceae) [Wynter-Blyth, 1957 and Kunte, 2000]. Based on our present observations, *Cassia fistula* and *Sterculia guttata* form new host plant records for the Chestnut-streaked Sailer.

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