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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 4) : 1-12, 2006

ORIBATID MITES OF TRIPURA, INDIA – FAMILY OTOCEPHEIDAE (ACARINA : ORIBATIDA) WITH DESCRIPTION OF TWO NEW SPECIES

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INTRODUCTION

The Oribatid mites are commonly inhabit the soil ecosystem as the most abundant representative of microarthropods. Their role in humification process, transmission of cestode parasites, producing diseases in man and domestic animals and capacity as biological indicators are well recognized. A survey programme was therefore, undertaken to explore the soil oribatid fauna of south district of Tripura, India. The results of the study of a part of the collected specimens reveal the occurrence of two new species viz., *Acrotocepheus punctatus* and *Archegotocepheus robustus*.

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

Key to the genera of the family OTOCEPHEIDAE from Tripura

- 1(2) Pedotecta 2 + 3 distinct but not so conspicuous, triangular or trapezoid in shape
..... *Dolicheremaeus* Jacot, 1938
- 2(1) Pedotecta 2 + 3 conspicuously developed, axe-shaped in ventral view and tail fin-shaped in dorsal view
- 3(4) Two pairs of prodorsal condyles and tow pairs of notogastral condyles present; anal setae 3 pairs, adanal fissure (*iad*) adanal in position *Acrotocepheus* Aoki, 1965
- 4(3) Only one pair of notogastral condyle present, anal setae 2 pairs, adanal fissure (*iad*) apoanal in position *Archegotocepheus* Mahunka, 1988

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Genus *Acrotocepheus* Aoki, 1965

1965. *Acrotocepheus* Aoki, *Bull. natn. Sci. Mus., Tokyo*, 8(3) : 260.

Type-species : *Acrotocepheus quateorum* Aoki, 1965.

While revising the genus *Otocepheus*, Aoki (1965) divided the genus into 2 subgenera viz., *Otocepheus* (*Otocepheus*) Berlese 1905 and *Otocepheus* (*Acrotocepheus*) Aoki, 1965. He established subgenus *Acrotocepheus* with the type species *Otocepheus* (*Acrotocepheus*) *quateorum* Aoki, 1965 from New Guinea. In the same work he described four more new species viz., *O. (A.) excelsus*, *O. (A.) holtmanni*, *O. (A.) philippinensis* and *O. (A.) duplicornutus*. Aoki in the same year transferred *Acrotocepheus* from subgenus to genus status.

Balogh and Mahunka (1967) described a subspecies *A. duplicornutus discrepans* and one species *A. triplicornutus* from Vietnam. Balogh (1970) reported two more new species *A. bucephalus* and *A. consimilis* from Sri Lanka. Aoki (1973) established new species *A. gracilis* from Japan. The eleventh species *A. besucheti* was described by Mahunka (1974). In the year 1979, Cropuz-Raros described a new species *A. surigaoensis* from Philippines. Mahunka (1987) reported *A. burckhardh* and *A. horakae* from east Malaysia. He again (1989a) identified two new species, *A. lienhardi* and *A. wallacei* from Singapore. In the same year (1989b) Mahunka reported *A. diehli* from Sumatra. Corpuz-Raros (1990) reported *A. pangasuganensis* and *A. tupasae* from Philippines.

The Genus *Acrotocepheus* was first reported from India as well as from Tripura by Sanyal (2000).

Generic Diagnosis : Rostrum normal, sometimes with a narrow flat edge; lateral lamelliform expansion (*spa. l.*) distinctly developed, protruding laterally beyond lateral margin of prodorsum, terminating at or near insertion of rostral setae, tutorium distinctly developed, gently arched in lateral view; lamellae subparallel to each other, extending anteriorly more or less beyond insertion for lamellar setae; dorsal bothridial plate (*tbd*) completely or incompletely covers bothridium, not markedly protruding laterally, but smoothly continued from lamella; ventral bothridial plate (*tbv*) well developed and broadly triangular, sensillus with fusiform head; lateral and median prodorsal condyle (*co. nl.*) conspicuously developed; marginal ridge (*vm*) completely or incompletely developed; a pair of gland (*gla*) and 5 pairs of notogastral fissures present; *gla* and *im* situated close to each other nearly in level of *ti*; *ih* located anterior to *r₃* and tip between *p₂* and *p₃*, while *ips* either anterior or posterior to *r₃*; adanal fissure (*iad*) typically aligned longitudinally or situated adjacent to anal aperture (exceptionally aligned transversely and somewhat distant from anal aperture).

Distribution : INDIA : Tripura. *Elsewhere* : Indonesia (Sumatra), Japan, New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Vietnam.

Acrotocepheus punctatus sp. nov.

(Figs. 1-8)

Colour : Dark to medium brown.

Measurements : Length of the body : 462; width of the body : 189.

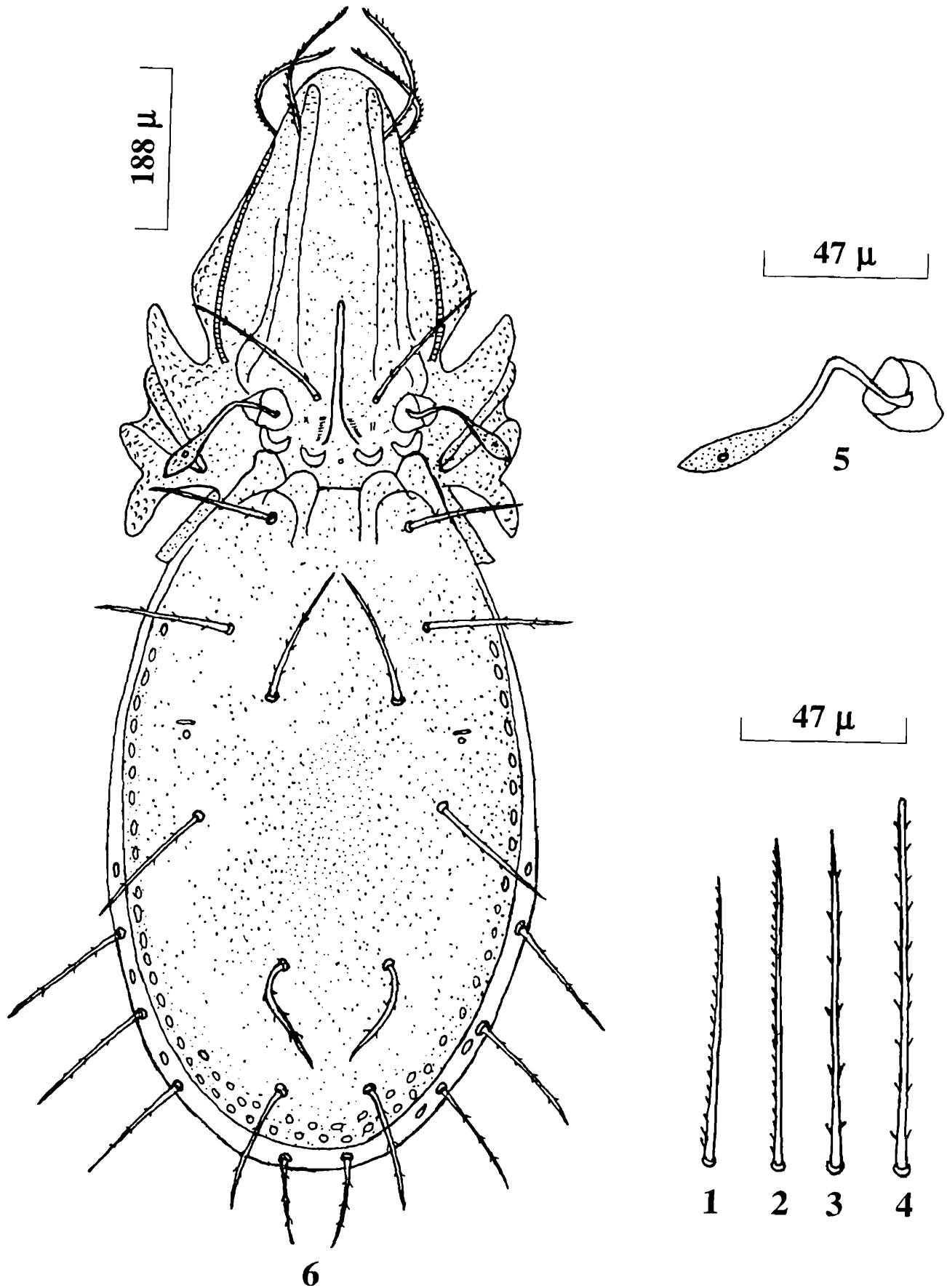
Prodorsum : A distinct *spa. 1.* present on each side of prodorsum, never protruding beyond lateral margin of propodosoma, no tooth on *spa. 1.*; tatoria distinctly developed; lamellae rather broad, of same width along their length, reaches rostrum and running subparallel with each other; outer margin of *tba* almost straight, smoothly continued from that of lamella, *tba* broadly triangular in shape; sensillus clavate in shape, but with a rather pointed apex and apical margin slightly rough; rostral setae moderately long (37), curved inward, thin, attenuating into a fine tip, thickly barbed unilaterally (very weakly in distal half); lamellar setae long (48) whip like, bending inward, barbed unilaterally; interlamellar setae longer (67) than lamellar setae, weakly roughened and 2.2 X as long as their mutual distance; interlamellar wrinkles poorly developed; a pair of longitudinal rows of crescent-shaped ornamentations found in postero-median part of prodorsum; *co.pl.* almost semicircular, overlapping tip of *co. pl.* on each side; *co. pm.* nearly semicircular.

Pedotecta : Pedotecta 1 (*pd 1*) rather strongly excavated at anterior margin, surface distinctly foveolated; anterior end of subpedotectum (*spd*) angulate; dorsal and lateral sides of *pd 2-3* distinctly granulated; *pd-4* only partly visible in dorsal aspect.

Notogaster : Elongated surface densely punctuated and with foveoli (arranged marginally), anterior border of notogaster concave; *co.nl.* of a characteristic shape, inner angulation of each condyle very prominent and separated from main part as a subcondyle, so that each condyle, as a whole, appears to be double-structured, outer portion of *co. nl.* rounded anteriorly, directed latero-anterior, interspace between *co. nl.* 18; *cp. nm.* absent; *vm* prominent; 10 pairs of notogastral setae, slightly roughened along their length; relative length to length of notogaster (RLN) varies from 15–22; *gla* situated in between insertions of *ti* and *ms*, 5 pairs of relatively long notogastral fissures present, *im* located close to *gla*, *ia* aligned oblique to *ta*, *ih* aligned parallel to *ms*, *ips* in between insertions for *p₃* and *r₃* and *ip* in between insertions for *p₂* and *p₃*.

Epimeral Region : Apodemata II (*apo. 2*) and *sj* (*apo.sj*) developed; sternal ridge developed as a short ridge only on *ep. 1*; apodemata *apo. 2* and *apo. sj* on left side, those on right side separated from one another, not fused with each other medially; in place of *apo.4* on each side a chain of several (5–6) worm-like ornamentations; epimeral setal formula 3-1-3-3; epimeral region densely punctuated, setae smooth.

Ano-Genital Region : Genital aperture a little longer than wide (length : 122, width : 112), darker in colour compared to surrounding ventral plate, with 4 pairs of glabrous setae, insertion for *g₃* and *g₄* closer to outer margins of plates while *g₁* and *g₂* closer to inner margin; anal aperture little longer than wide (length : 178, width : 160) with 2 pairs of barbed setae; *an₂* (58) longer than *an₁* (48);



Figs. 1-6. : *Acrotocephalus punctatus* sp. nov.; 1. rostral setae, 2. lamellar setae, 3. interlamellar setae, 4. notogastral setae, 5. sensillus, 6. dorsal view.

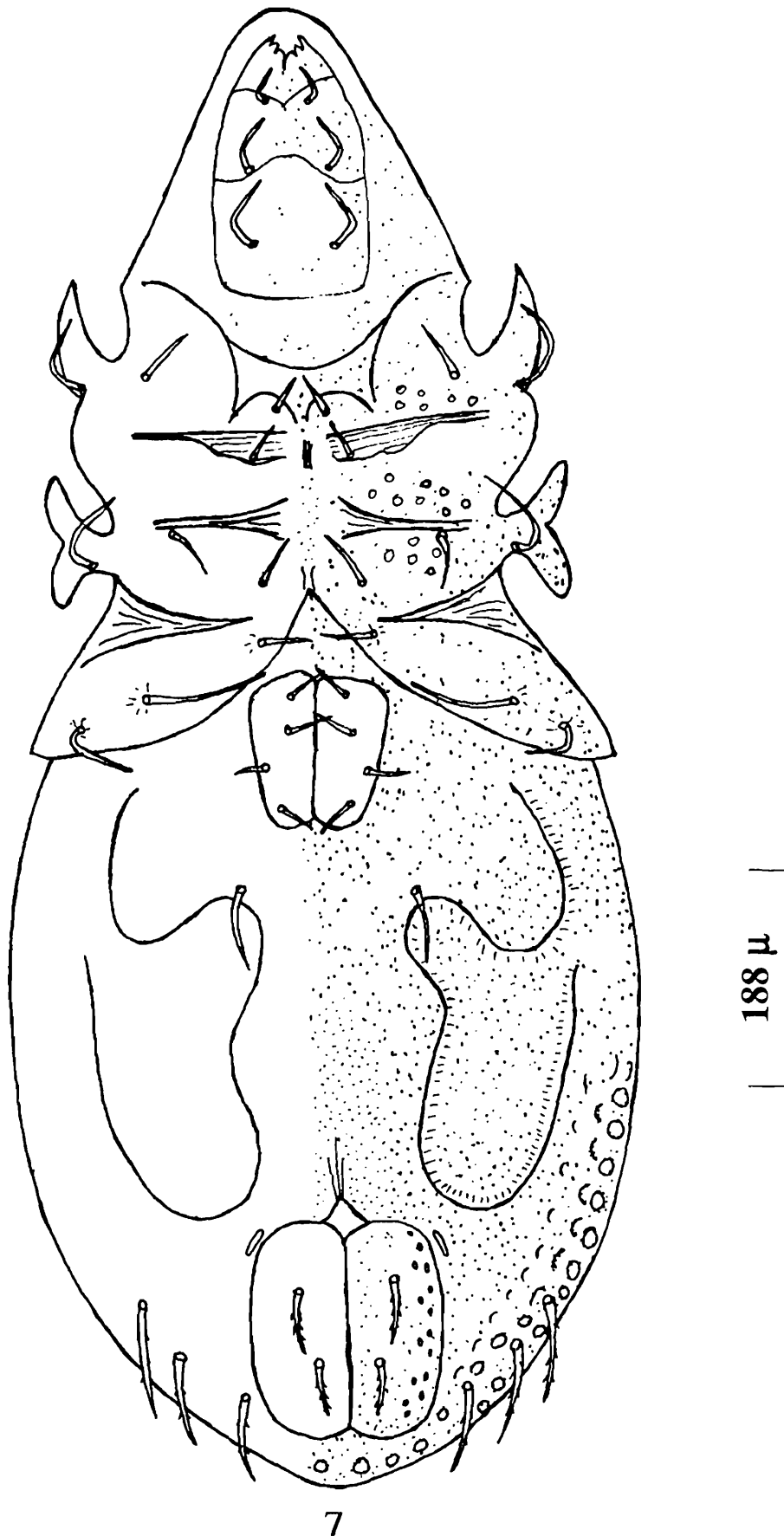


Fig. 7. : *Acrotocepheus punctatus* sp. nov.; ventral view.

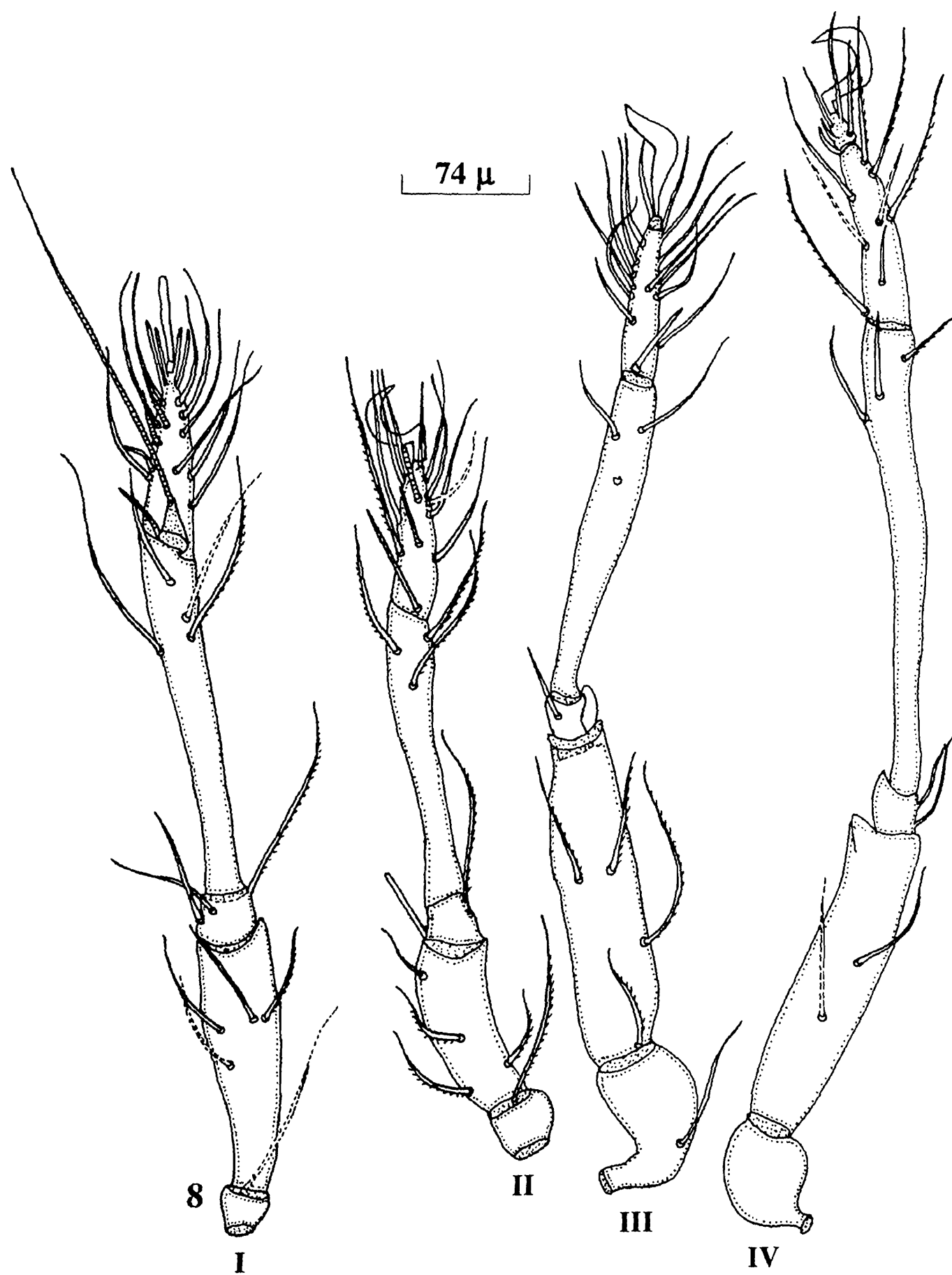


Fig. 8. : *Acrotocepheus punctatus* sp. nov.; legs (I-IV).

3 pairs of adanal setae, barbed with pointed tip, aggenital setae smooth with pointed tip; ventral plate densely punctated with foveoli.

Legs : Monodactylous. Leg chaetotaxy : Leg I : 1-4-3-14+4-I; Leg II : 1-4-2-3-11+2-1; Leg III : 1-4-1-3-15-1; Leg IV : 0-2-2-3-13-1.

Material Examined : HOLOTYPE : Adult female : India : Tripura : Radhanagar (Belonia), 12.x.1993, from loose clay loam soil with decomposed leaves, coll. D. Saha. PARATYPES : 6 adult females, India : Tripura : Radhakisorganj (Belonia), 12.x.1993, from loose soil by the side of root of bamboo tree with cowdung and rotten straw, coll. D. Saha.

Distribution : India : Tripura (South District).

Remarks : The new species is very much similar to *Acrotocepheus duplicornutus* Aoki, 1965 regarding the nature of *co. nl.*, *co. pl.*, and *cp. pm.*, nature of notogastral setae and their RLN. But differs from the latter in the alignment of *iad*, smooth epimeral setae, foveolated nature of notogaster and ventral plate, granulated and foveolated anal plate.

The species from Tripura also agrees to some extent with *A. consimilis* described by J. Balogh 1970 from Sri Lanka in the position of *iad* which is oblique in both the species and nature of *co. nl.* and *co. pl.* But the new species can be clearly differentiated from the Sri Lankan species in the nature of prodorsal and notogastral setae, alignment of adanal and anal setae and structure of sensillus.

Genus *Archegotocepheus* Mahunka, 1988

1988. *Archegotocepheus* Mahunka, *Revue Suisse Zool.*, **95**(3) : 839.

Type-species : *Archegotocepheus singularis* Mahunka, 1988.

Mahunka (1988) erected the genus *Archegotocepheus* with *A. singularis* as the type species from Sabah (East Malaysia). Mahunka (1989a) identified another new species *A. brevisetus* from Singapore. The third known species was *A. latus* (Aoki, 1965)

Balogh and Balogh (1992) in their book 'The Oribatid Mites of the World (vols. I & II)' placed the genus *Archegotocepheus* under family Otocepheidae Balogh, 1961 under superfamily Carabodidae Koch, 1837. The genus *Archegotocepheus* was first reported from India as well as from Tripura by Sanyal (2000).

Generic Diagnosis : Lamellae long; lamelliform expansion (*spa.l.*) curved, reaching to the insertion points of rostral setae; tutorium short, not connected with *spa.l.*; pedotecta 2-3 symmetrical, fish-tail-like; two pairs of prodorsal, one pair of (lateral) notogastral condyles; ten pairs of notogastral setae; epimeral setal formula 3-1-3-3; four pairs of genital, one pair of aggenital, three pairs of anal and three pairs of adanal setae, pori *iad* in apoanal position, pori *ips* located between setae *r*₃ and *ps*₃.

Distribution : INDIA : Tripura. *Elsewhere* : Malaysia, Singapore.

Archegotocepheus robustus sp. nov.

(Figs. 9-12)

Colour : Dark brown.*Measurements* : Length of the body : 996; width of the body : 583.

Prodorsum : Rostrum sparsely punctated; lamellae broad, of same width along their length and reaching rostrum; tatoria distinctly developed; rostral setae long (113), curved inward, thin, attenuating into a fine tip, barbed unilaterally; lamellar setae largest (160) prodorsal setae, whip-like, bending inward, barbed unilaterally; interlamellar setae long (150), blunt at tip, much stronger and weakly roughened; sensillus short, with curved peduncle (length : 38) and clavate head (diameter : 56); median and lateral condyles on prodorsum; median condyles surrounded with granules and a pair of light area.

Pedotecta : Surface of pedotecta I and II-III foveolated and with granules; pedotecta IV only partly visible in dorsal aspect; pedotecta II-III asymmetrical, fishtail-shaped.

Notogaster : Notogaster elongate, surface densely punctated and with foveoli; *vm* prominent; ten pairs of roughened notogastral setae; relative length to length of notogaster (RLN) varies from 20–23; setae *p*₂ longest (141), setae *ti* (113) shortest of all; median notogastral condyles absent, lateral pairs prominent; gland opening (*gla*) between insertion of *te* and *ti*; five pairs of relatively long notogastral fissures present; *im* located close to *gla*, *ia* aligned oblique to *ta*, *ih* aligned parallel to *ti*, *ips* in between insertion for *r*₃ and *p*₃, *ip* in between insertion for *p*₂ and *p*₃.

Epimeral Region : Apodemata II (*apo.2*) and *sj* (*apo.sj.*) developed; sternal ridge developed as a short ridge only on *ep1*; apodemata *apo2* and *apo.sj.* on left side, those on right side separated from one another, not fused with each other medially; in place of *apo. 4* on each side a chain of worm-like ornamentation; epimeral setal formula 3-1-3-3, smooth; epimeral region densely punctated with foveoli.

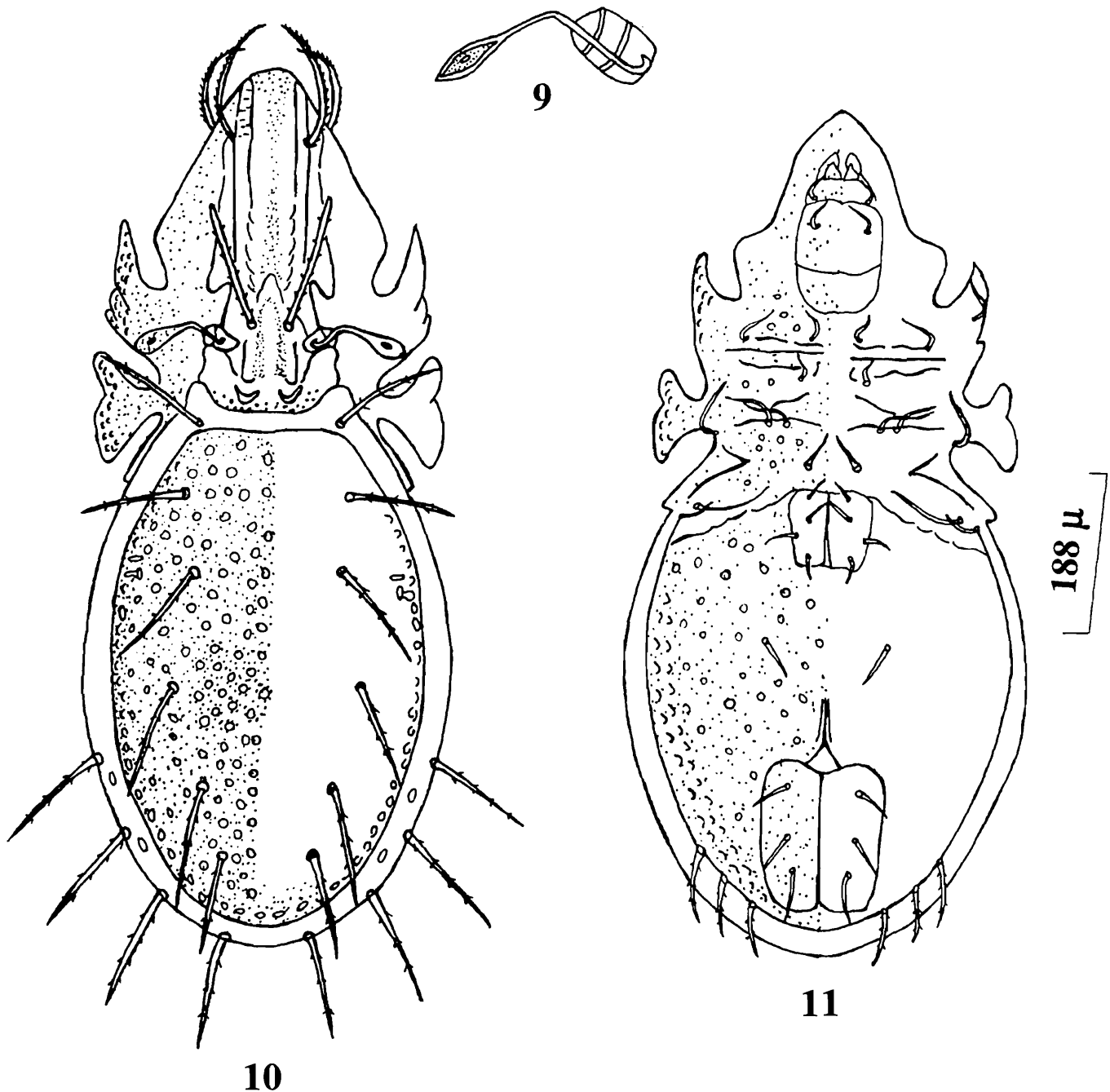
Ano-Genital Region : Sparsely foveolated with granules; genital aperture squarish (length : 94, width : 94) with 4 pairs of smooth setae; interspace between anal and genital aperture (235) about 2.5 X as long as length of genital aperture; anal aperture a little longer than wide (length : 170, width : 141), granulated, 3 pairs of smooth anal setae; *an*₁ (47) shorter than *an*₂ and *an*₃ (56); adanal setae 3 pairs, barbed with pointed tip, *ad*₁ (75) longer than *ad*₂ and *ad*₃ (66).

Legs : Monodactylous. Leg chaetotaxy : Leg I : 1-4-1+2-4-14+1-1, Leg II : 1-4-1+2-3-16-1; Leg III : 0-2+1-1-3-15-1; Leg IV : 0-1-2+1-11-1.

Material Examined : HOLOTYPE : Adult female, India : Tripura : Jarimura (Amarpur), 12.x.1993, from humus with decomposed plant material, coll. D. Saha. PARATYPES : 4 adult females, India : Tripura : Birchandranagar (Amarpur), 12.x.1993, from loose humus with decaying leaves, stem and roots, coll D. Saha.

Distriubution : INDIA : Tripura (South District).

Remarks : This species resembles *A. singularis* Mahunka, 1988 regarding body shape, position of prodorsal and notogastral setae and shape of sensillus. But it can be separated from *A. singularis* by its granulated anal aperture, smooth anal setae, foveolated and granulated notogaster. In this new species notogastral setae are roughened only, but in *A. singularis* they are well ciliated. Among the prodorsal setae, lamellar setae are the longest prodorsal setae, but in *A. singularis* interlamellar setae are the longest setae. In the new species the chitinous lath that is not much prominent as in the Mahunka's species.



Figs. 9-11. : *Archegotocepheus robustus* sp. nov.; 9. sensillus, 10. dorsal view, 11. ventral view.

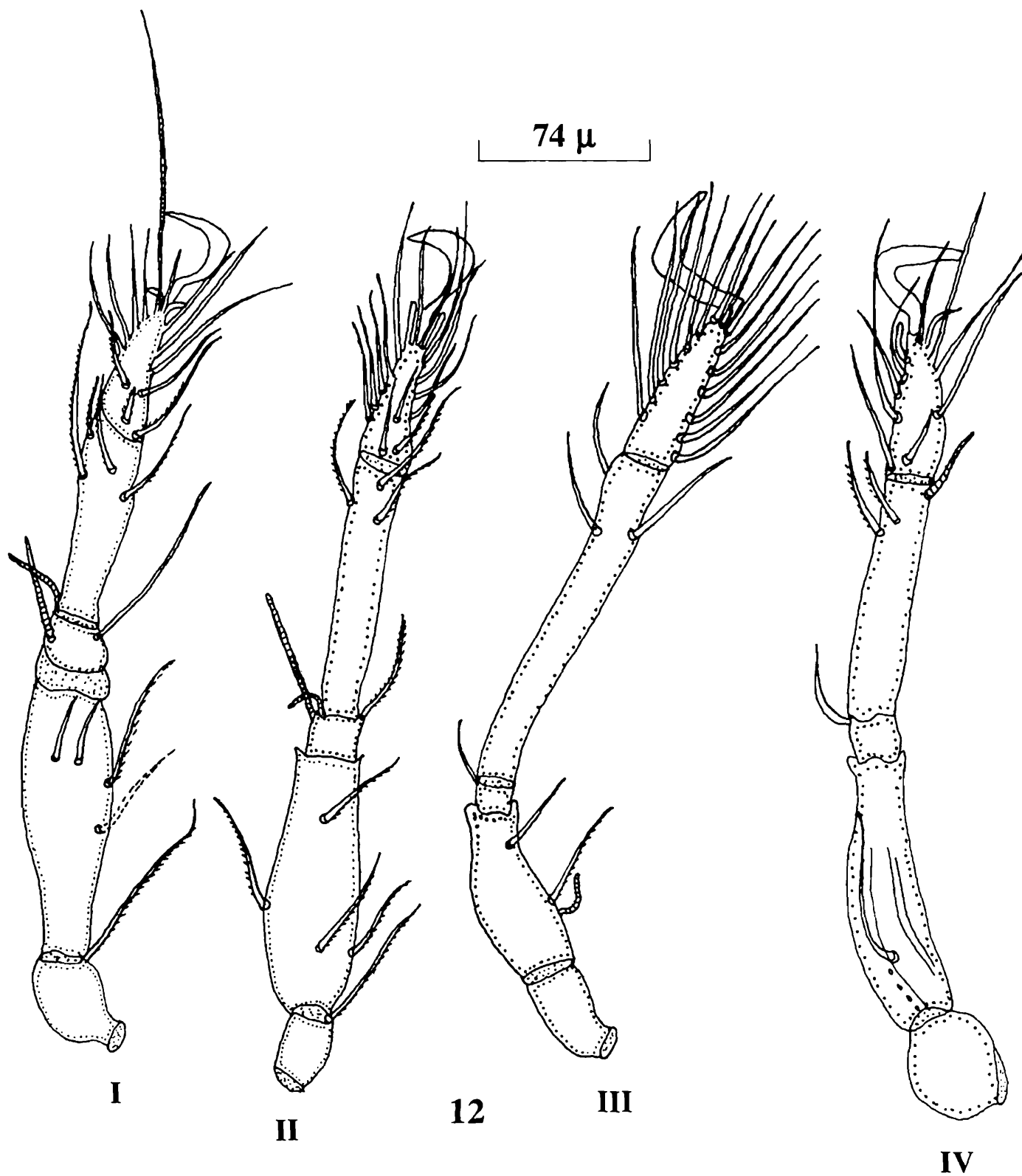


Fig. 12. : *Archegotocepheus robustus* sp. nov.; legs (I-IV).

SUMMARY

The present paper contains description along with illustrations of two new species viz., *Acrotocepheus punctatus* and *Archegotocepheus robustus* of the family Otocepheidae from Tripura, India.

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The authors are thankful to the Director, Zoological Survey of India, Kolkata and Head of the Department of Zoology, University of Kalyani, Nadia, West Bengal, for laboratory facilities.

REFERENCES

- Aoki, J. 1965. A preliminary revision of the family Octopheidae (Acari, Cryptostigmata) I. Subfamily Otocepheinae. *Bull. natn. Sci. Mus., Tokyo*, **8**(3) : 259-341.
- Aoki, J. 1973. Oribatid mites from Mt. Poroshiri in Hakkaido, North Japan. *Annotnes zool. Jap.*, **46**(4) : 241-252.
- Balogh, J. 1961. Identification keys of world oribatid (Acari) families and genera. *Acta zool. Hung.*, **7**(3-4) : 243-344.
- Balogh, J. 1970. New oribatid (Acari) from Ceylon. The scientific results of the Hungarian soil zoological expedition. *Opusc. zool., Bpest.*, **10** : 33-67.
- Balogh, J. and Balogh, P. 1992. The oribatid mites genera of the world vol I and II. *Hungarian National History Museum, Budapest*, 1-375.
- Balogh, J. and Mahunka, S. 1967. New oribatids (Acari) from Vietnam. *Acta zool. Hung.*, **13**(1-2) : 39-74.
- Berlese, A. 1905. Acari nuovi Manipules IV. Acari di Giave. *Redia*, **2** : 154-176.
- Corpuz-Raros, L.A. 1979. Philippine Oribatei (Acarina). 1. Preliminary list of species and description of forty new species. *Philipp. Agric.*, **62**(1) : 1-82.
- Corpuz-Raros, L.A. 1990. A new genus and five new species of Otocepheidae Acari : Oribatida) from Leyte and Samar, Philippines. *Philipp. Entomol.*, **8**(3) : 973-983.
- Koch, C.L. 1837. *Deutschlands Crustaceen, Myriapoden und Arachniden*, vol. 10-16.
- Mahunka, S. 1974. Neue und interessante Milben aus dem Genfer Museum : XII. Beitrag Zur Kenntniss der Oribatiden – Fauna Greichenlands (Acari). *Revue Suisse Zool.*, **81**(2) : 568-590.
- Mahunka, S. 1987. Neue und interessante Milben aus dem Genfer Museum, 60. Oribatids from Sabah (East Malaysia) II. (Acari : Oribatei). *Revue Suisse Zool.*, **94**(4) : 765-817.

- Mahunka, S. 1988. New and interesting mites from the Geneva Museum, 61. Oribatid from Sabah (East Malaysia). 3. (Acari : Oribatida). *Revue Suisse Zool.*, **95**(3) : 817-888.
- Mahunka, S. 1989a. New and interesting mites from the Geneva Museum, 64. Oribatids from Singapore (Acari : Oribatida). *Revue Suisse Zool.*, **96**(2) : 381-402.
- Mahunka, S. 1989b. New and interesting mites from the Geneva Museum, 64. Oribatids of Sumatra (Indonesia) – I (Acari : Oribatida). *Revue Suisse Zool.*, **96**(3) : 673-696.
- Sanyal, A.K. 2000. Oribatid mites (Acari : Oribatei). *Zool.Surv.India, State Fauna Series 7 : Fauna of Tripura*, Part 2 : 33-112.



Rec. zool. Surv. India : **106**(Part 4) : 13-19, 2006

EFFECTS OF THERMAL POWER FLY ASHES ON THE POPULATION STRUCTURE OF SOIL MICRO-ARTHROPODS AT KOLAGHAT, EAST MIDNAPORE DISTRICT, WEST BENGAL

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ABSTRACT : *A field study was conducted at Thermal Power Station area in East Midnapore district of West Bengal for the purpose of establishing the effects of continuous emitting of fly euedaphic ashes on the soil ecosystem and microarthropods.*

KEYWORDS : *Pollution, Soil microarthropods, Population.*

INTRODUCTION

Kolaghat Thermal power station emits fly ashes from coal combustion for generating electricity. A high amount of fly ash has been disposed from the power station units in surrounding areas. Some studies have been conducted on the environmental impact of fly ashes on upper soil (Sahota and Gill, 1998), on the aquatic populations (Guthrie *et al.*, 1973), cultivated crops (Sarangi and Mishra, 1998), soil and vegetation (Bohra and Kumar, 2002) etc. Since there was no work about the effect of fly ashes on soil micro arthropod fauna for this reason the present investigation was undertaken.

SAMPLING SITES

Three plots were chosen for the sampling viz. (i) **Kolaghat Thermal Power Station area**, (ii) **Burari**, 3 km away from Thermal Power Station and (iii) **Kankta**, 7 km away from Thermal Power Station.

**Vidyasagar University, Department of Zoology, West Midnapore, West Bengal*

MATERIALS AND METHODS

A total of 108 soil samples were drawn. Altogether 6 plots were chosen from three sites and two per area. Three cores from each area of sampling were collected at random at an interval of one month from January, 2004 to November, 2004. The cores were taken by stainless steel corers having the inner (Core cross section diameter of 8 sq cm). The extraction of the soil core was made by means of Tulgren funnels modified by Macfadyen (1953). A 40-watt bulb was used as source of lighted heat. The relative humidity of surface soil was recorded by using a dial hygrometer, temperature by soil thermometer and pH was estimated by using electronic pH meter.

OBSERVATION

Total arthropod populations of Thermal Power station were 256 in number (Table 1). Acarina and Collembolan were dominant group. Maximum soil arthropod's population was found in the month of September and minimum was found in the month of March. Mesostigmata (Acarina) was the dominant group followed by Isotomidae (Collembola), Diplura, Entomobryidae (Collembola), Prostigmata (Acarina), Cryptostigmata (Acarina), Coleoptera, Isopoda, Millipede, Centipede.

Table 1. : Thermal power station showing the microarthropods population in different months of the year 2004.

Group/Order	Jan.	March	May	July	Sep	Nov	Total
1. Prostigmata (A)	1	0	1	5	6	3	16
2. Mesostigmata (A)	9	3	12	17	19	7	67
3. Cryptostigmata (A)	0	1	0	6	7	0	14
1. Entomobryidae (C)	3	0	0	2	7	8	20
2. Hypogastridae (C)	3	3	0	7	5	0	18
3. Isotomidae (C)	17	5	7	18	12	1	60
4. Sminthuridae (C)	0	1	0	3	0	0	4
DIPLURA	9	5	5	7	9	3	38
ISOPODA	1	0	0	2	2	0	5
MILLIPED	1	0	0	1	2	0	4
COLEOPTERA	3	1	1	0	3	1	9
CENTIPED	1	0	0	0	0	1	1
Total	48	19	26	68	72	23	256

Table 2. : Showing microarthropods population in different months of the year 2004 at Burari.

Group / Order	Jan.	March	May	July	Sep	Nov	Total
1. Prostigmata (A)	7	5	5	18	22	6	63
2. Mesostigmata (A)	18	8	7	9	18	7	67
3. Cryptostigmata (A)	7	5	1	12	12	0	37
1. Entomobryidae (C)	9	5	3	6	12	5	40
2. Hypogastridae (C)	3	6	7	12	7	0	35
3. Isotomidae (C)	5	2	6	21	11	3	48
4. Sminthuridae (C)	7	9	0	5	0	0	21
DIPLURA	1	1	2	5	7	2	18
ISOPODA	2	1	0	7	5	0	15
MILLIPED	2	3	2	3	2	0	12
COLEOPTERA	4	7	5	0	6	1	23
CENTIPED	1	0	0	0	1	0	2
Total	66	52	38	98	103	23	381

Table 3. : Showing microarthropods population in different months of the year 2004 at Kankta.

Group / Order	Jan.	March	May	July	Sep	Nov	Total
1. Prostigmata (A)	17	5	18	37	26	7	110
2. Mesostigmata (A)	26	11	9	12	21	9	88
3. Cryptostigmata (A)	12	8	9	19	18	4	70
1. Entomobryidae (C)	26	17	12	13	21	6	95
2. Hypogastridae (C)	18	7	9	18	13	3	68
3. Isotomidae (C)	7	12	9	39	12	5	84
4. Sminthuridae (C)	7	13	4	12	0	2	38
DIPLURA	3	3	2	1	7	2	18
ISOPODA	7	4	3	12	6	3	35
MILLIPED	6	4	3	5	1	1	20
COLEOPTERA	5	9	9	3	6	2	34
CENTIPED	0	0	1	3	1	0	5
Total	134	93	88	174	132	44	665

A = Acarina; C = Collembola

Total arthropod populations in Burari were 381 in number (Table 2). Maximum arthropod populations were found in the month of September, 2004 and minimum in the month of November, 2004. Mesostigmata (Acarina) was the most dominant followed by Prostigmata (Acarina), Isotomidae (Collembola), Entomobryidae (Collembola), Hypogasturidae (Collembola) Coleoptera, Sminthuridae (Collembola), Diplura, Isopoda, Centipede.

Total arthropod populations in Kankta were 665 in number (Table 3). Maximum arthropods populations were found in the month of July, 2004 and minimum in the month of November, 2004. Prostigmata (Acarina) was the most dominant group followed by Entomobryide (Collembola), Isotomidae (Collembola), Cryptostigmata (Acarina), Hypogastruridae (Collembola), Sminthuridae (Collembola), Isopoda, Coleoptera, Millipede, Diplura, Centipede.

RESULTS AND DISCUSSION

From the present study the faunal group like Prostigmata, Mesostigmata, Cryptostigmata, Entomobryidae, Hypogastruridae, Isotomidae, Sminthuridae, Diplura, Isopoda, Millipede, Coleoptera, Centipede were obtained from Table 1, 2, 3 of three sites (Thermal Power Station area, Burari, Kankata). Table 1, 2 & 3 also reveals that the higher soil microarthropods populations were found in Kankta followed by Burari, Thermal Power Station area. During the study period monthly soil microarthropods populations' fluctuations were found but soil microarthropod population was higher in ash free area than ash field area. Soil factors were found to vary in different sites in different months of the year (Fig. 2). In thermal power station area Relative Humidity was higher than Burari, Kankta sites. Table 4, 5 & 6 shows the maximum temperature was found in March and that of minimum in January in all three sites. Maximum pH value was obtained from Kankta and minimum value from Thermal Power Station area. During the study period pH value was found to be comparatively lower in Thermal Power Station area than other two study sites (Fig. 2). This might be due to high amount of fly ashes and their biochemical changes. Maximum Relative Humidity was found in Thermal Power Station area in July and that of minimum was found in Kankta (Fig. 2). Fig. 3 shows maximum density was found in Kankta than Burari & Thermal Power Station area. Figure 1 shows the highest soil microarthropods population peak always found in Kankta than Burari & Thermal Power Station area. Figure 1 also shows that the highest populations were found in the month of July and lowest populations were found in the month of November. The density of soil microarthropods population increase with the increase of distance from the discharge source of ashes. This might be due to the toxicity of ashes become lower as the site away from the discharge source Dindal *et al.*, (1973) reported from U.S.A. that industrial discharge decrease the micro community stability of Acari and Collembola, which result coincide with the present investigation. So it can be concluded that soil microarthropods population may be affected adversely by the deposition ashes toxicity on top soil. Details study is in progress.

Table 4. : Showing number of microarthropods, Temperature, Relative Humidity & pH at the Thermal Power Station area in different months of the year 2004.

Months	Arthropods population	Temperature (°C)	pH	RH (%)
January	48	22	6.7	90.2
March	19	32	7.2	88.2
May	26	28	6	92
July	98	27	6.2	95
September	72	27.5	6.7	87.8
November	23	24.5	6.9	88
Mean value	48	26.83	6.61	90.02

Table 5. : Showing number of microarthropods, Temperature, Relative Humidity & pH at the Burari area in different months of the year 2004.

Months	Arthropods population	Temperature (°C)	pH	RH (%)
January	66	22	7.2	88
March	52	32.2	7	87
May	38	28	6.9	89.2
July	98	26.5	7.22	88
September	103	27	7.3	85.6
November	23	24.5	7.1	85
Mean value	64	26.7	7.12	87.13

Table 6. : Showing number of microarthropods, Temperature, Relative Humidity & pH at the Kankata area in different months of the year 2004.

Months	Arthropods population	Temperature (°C)	pH	RH (%)
January	134	21.5	7.2	85
March	93	32	7.1	86
May	88	27.8	7.1	82
July	174	26	7	81.2
September	132	26.5	7.3	85
November	44	24	7.2	80
Mean value	111	26.3	7.15	83.2

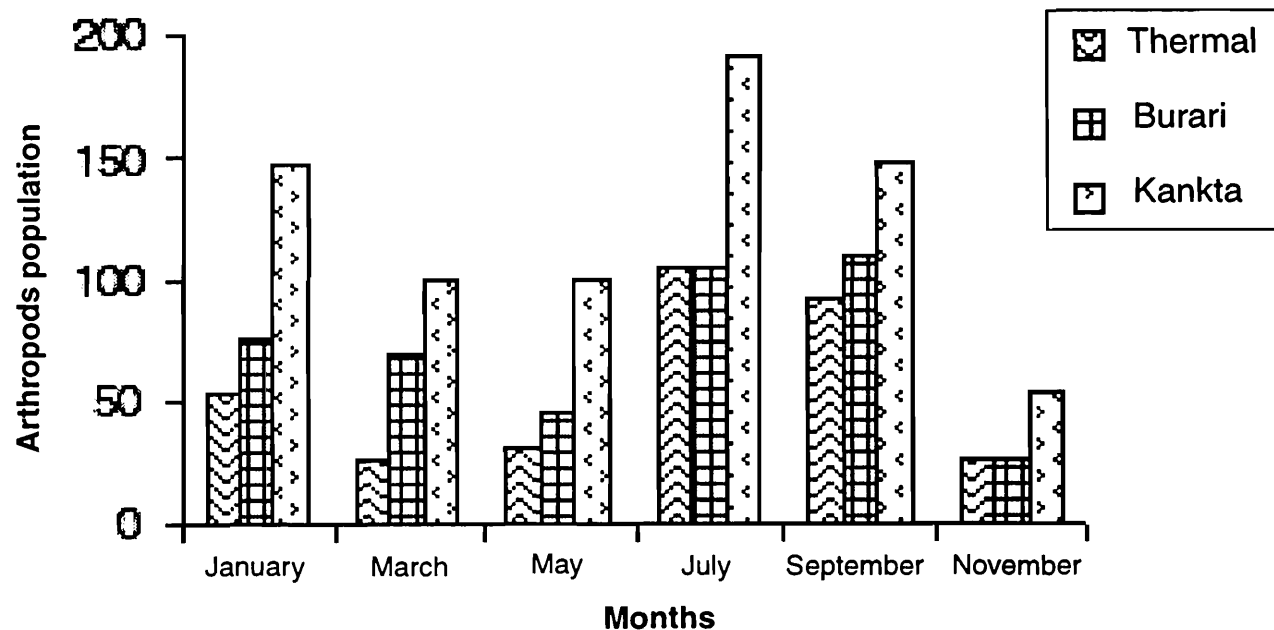


Fig. 1. : Histogram showing microarthropods population in Thermal, Burari & Kankta sites in different months of the year 2004.

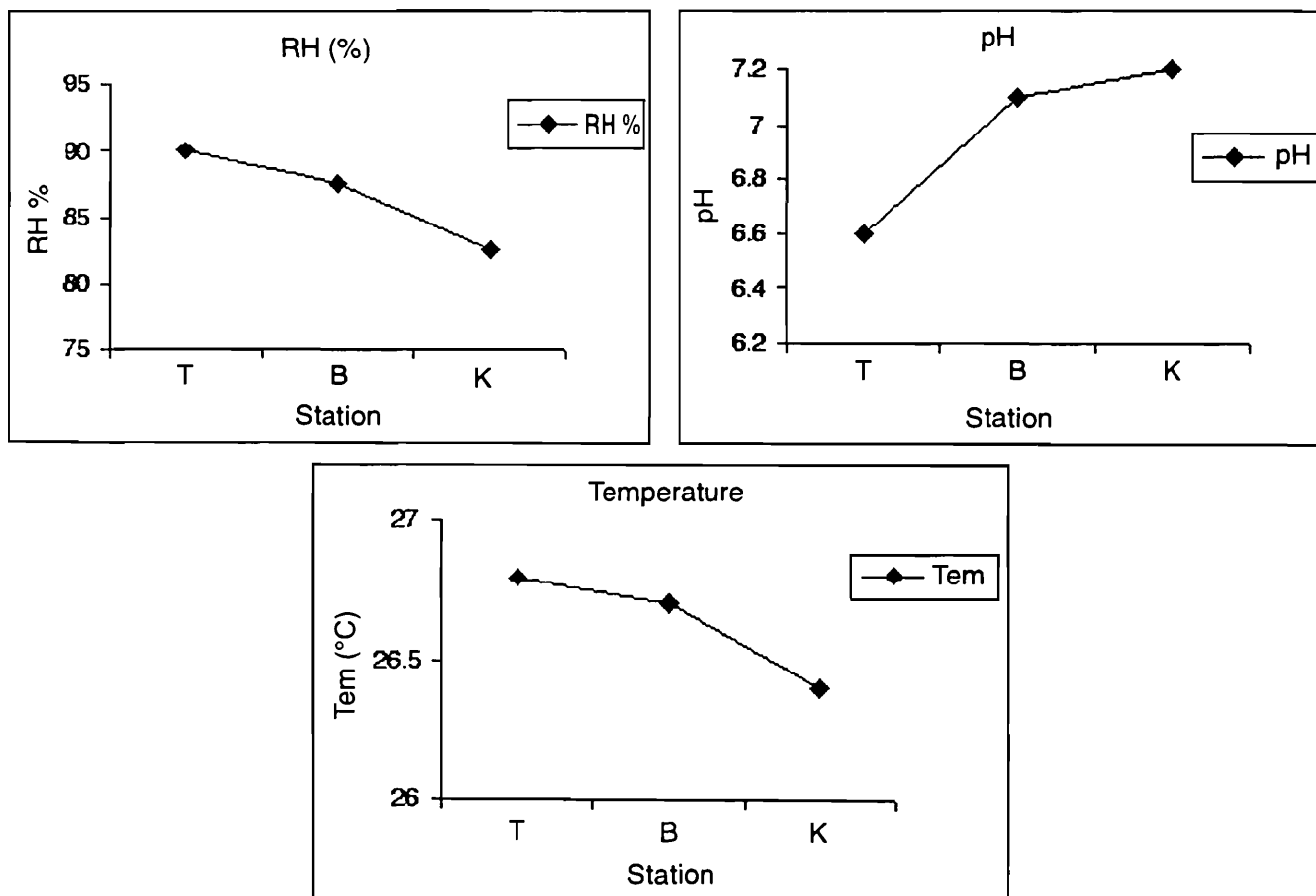
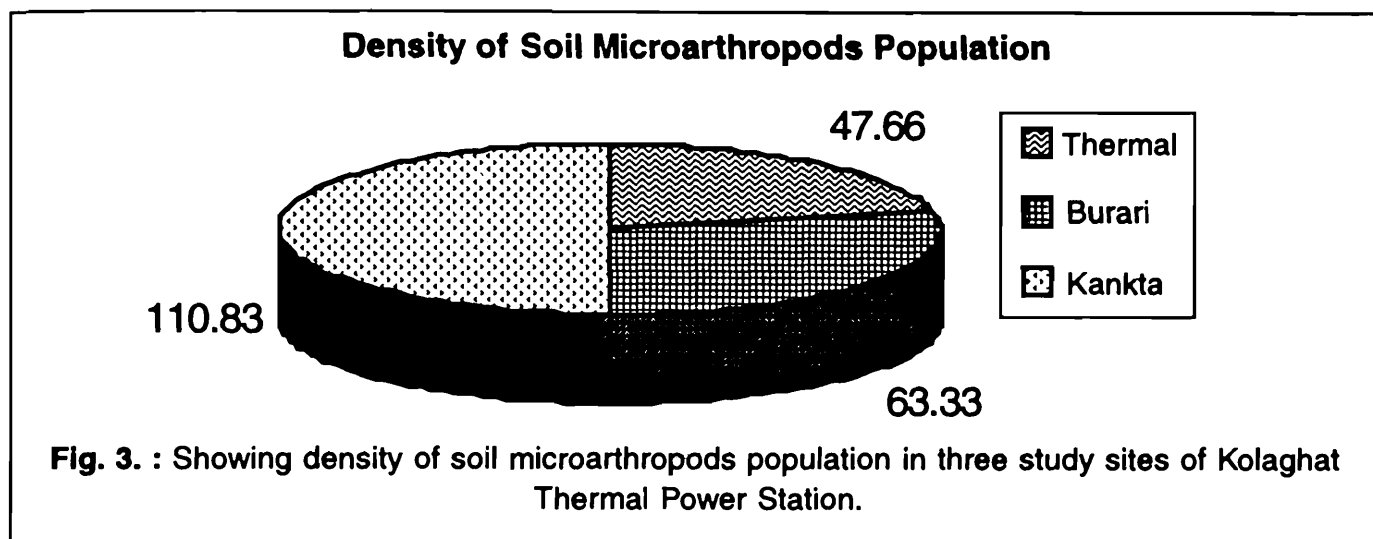
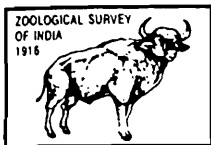


Fig. 2. : The graphs showing mean values of different soil factors in Thermal (T), Burari (B) and Kankta (K) sites.



REFERENCES

- Bohra, C. and Kumar, A. 2002. Impact of fly ash on heavy metals on soil and vegetation, *J. Curr. Sci.*, **2** : 87-93.
- Dindal, D.L., Schwert, D. and Norton, R.A. 1973. Effect of sewage effluent disposed on community structure of soil invertebrates. In : *Progress in soil zoology* (Edited by Jan Vanek) Prague, 1975; 419-427.
- Guthrie, R.K., Cherry, D.S. and Ferebee, R.N. 1973. Laboratory studies of thermal effects on bacterial populations from a reservoir ecosystem. *ASB Bull*, **20** : 56.
- Macfadyen, A. 1953. Notes on methods for the extraction of small soil arthropods. *J. Anim. Ecol.* **22** : 65-77.
- Sahota, R.S. and Gill, S.K. 1998. Effect of Ropar Thermal Power Plant and environment samples of Sutlej river. *Research Journal of Chemistry and Environment*. **2** : 49-50.
- Sarangi, P.K. and Mishra, P.C. 1998. Soil metabolic activities and yield in groundnut ladies finger and radish in fly ash amended soil. *research Journal of Chemistry and Environment*. **2** : 7-13.



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ON SOME COLLECTION OF GRASSHOPPERS (ACRIDIDAE : ORTHOPTERA) FROM RADHANAGARI, BISON RESERVE FOREST, KOLHAPUR, MAHARASTRA

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INTRODUCTION

The short horned grasshoppers belong to the family Acrididae which are the interesting agriculturally important group of insects. The present work is mainly based on the taxonomic study of grasshopper from the Kolhapur, Bison Reserve forest in Maharashtra. It was a part of environmental impact assessment survey. The area is mining area on the hill top. There was good grass cover and various types of trees were also present.

The present paper deals with 22 examples of grasshoppers belong to 6 genera and 7 species specially from the mining area. So far, there is no earlier reports on this group from this area.

The classification followed here is after Dirsh (1961).

The diagnostic characters for identification of each species has been given along with the global distribution.

TAXONOMIC ACCOUNT

Key to family ACRIDOIDEA

1. Foveolae of the vertex contiguous, superior and forming the extremity of the fastigium; stridulatory mechanism absent..... **Pyrgomorphidae**
- Foveolae lateral or inferior, never forming tip of the fastigium, stridulatory mechanism present..... **Acrididae**

Key to the genera

1. Head acutely conical, tuberculate, rugose fastigial furrow present; lower basal lobe of hind femur usually longer than upper *Chrotogonus* Serville
 - Head variable in shape; fastigial furrow absent; lower basal lobe of hind femur usually shorter than or equal to upper one 2
2. Fastigial foveolae visible from above *Aulacobothrus* Bolivar
 - Fastigial foveolae not visible from above 3
3. Hind femur comparatively slender, much narrowed towards knees, prosternal tubercle, compressed, truncated slightly in flated at apex *Tylotropidius* Stal
 - Hind femur normal and not much narrowed towards knees; prosternal tubercle absent 4
4. Pronotum with strong crest or acutely tectiform; wings with dark brown or black fascia *Gastrimargus* Saussure
 - Pronotum without very distinct crest; wings with yellowish near the base .. *Heteropternis* Stal

Family PYRGOMORPHIDAE

Genus *Chrotogonus* Serville, 1839

1. *Chrotogonus* (*Chrotogonus*) *tr. Trachypterus* (Blanchard)

1836. *Ommexecha trachypterus* Blanchard, *Ann. Soc. Ent. France*, 5 : 618.

1959. *Chrotogonus* (*Chr.*) *tr. trachypterus*: Kevan, *Publcoes. Cult. Co. Diam* angola, no. 43 : 147.

Material examined : 1 ♀ Kolhapur, Radganagari, 9.ix.1998, coll. A.K. Hazra.

Diagnosis : Size medium; robust and dorsoventrally depressed body; tegmina reaches about 2/3 of the body, hind wings smaller than tegmina, hind wings hyaline, or occasionally faintly tinged yellowish brown but never infumated or fuscated.

Distribution : Bangladesh; Nepal; E. Iran; Pakistan; India (Maharastra, Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Orissa, Punjab, Rajasthan, Uttar Pradesh and West Bengal).

Remarks : In general it is found in northern India and found in bare ground.

Subfamily GOMPHOCERINAE

Genus *Dnopherula* (*Aulacobothrus*)

Key to the genera

1. Fastigium of vertex sub-triangular, a pale stripe usually runs from fastigium to vertex *decicus* (Walker)
 - Fastigium of vertex almost trapezoidal with truncate apex *luteipes* (Walker)

1. *Dnopherula (Aulacobothrus) decisis* (Walker)

1871. *Stenobothrus decisis* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** : 80.

1921. *Aulacobothrus decisis* : Uvarov, *Ann. Mag. Nat. Hist.*, **7**(9) : 482.

Material examined : 2♂♂ E.I.A. Survey, Kolhapur, 9.i.1998, coll. A.K. Hazra & party.

Diagnosis : Size small; antennae filiform; fastigium of vertex sub-triangular; tegmen extend beyond the hind femur; brown in colour, a pale stripe runs from the tip of the fastigium to the end of the pronotum, wings hyaline.

Distribution : India (Maharashtra, Andhra Pradesh, Tamil Nadu and West Bengal).

Remarks : This species is limited in distribution. Generally it is found on long grasses and cultivated field.

2. *Dnopherula (Aulacobothrus) luteipes* (Walker)

1871. *Stenobothrus luteipes* Walker, *Cat. Derm. Salt. Brit. Mus.*, **5** : 82.

1971. *Dnopherula (Aulacobothrus) luteipes* : Jago, *Proc. Acad. Nat. Sci. Philad.*, **123**(8) : 243.

Material examined : 6♂♂, E.I.A. Survey, Kolhapur, Loliganj, 9.i.1998, coll. A.K. Hazra & party.

Diagnosis : Size small; fastigium of vertex trapezoidal, apex truncate with transverse basal furrow; pronotum with nearly parallel lateral carinae; hind femora with three black bands on the dorsal surface.

Distribution : India (Maharashtra, Andhra Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu and West Bengal); N. America; China; Europe; Japan; Myanmar and Sri Lanka.

Remarks : Generally this species is available in long grass and cultivated fields.

Subfamily OEDIPODINAE

Genus *Gastrimargus* Saussure, 1884

3. *Gastrimargus africanus africanus* (Saussure)

1888. *Oedaleus (Gastrimargus) marmoratus* var. *Africana* Saussure, *Mem. Soc. Phys. Hist. nat. Geneve*, **30**(1) : 39.

1982. *Gastrimargus africanus africanus* : Ritchie, *Bull. Brit. Mus. Nat. Hist. (Ent.)*, **44**(4) : 248.

Material examined : 1♂, Kolhapur, Dajipur, Kankuliriverbed, 13.i.1998, coll. A.K. Hazra.

Diagnosis : Size medium; pronotum tectiform with a high shaped medium carina; metazoan of pronotum without pale striae; tegmen and wings with complete fascia; base of the wing is bright yellow; hind femur bluish black; hind tibiae usually reddish.

Distribution : India (Maharastra, Andhra Pradesh, Bihar, Delhi, Goa, Himachal Pradesh, Madhya Pradesh, Orissa, Sikkim, Uttar Pradesh and West Bengal); Nepal; Saudi Arabia; Sri Lanka; Thailand; Tibet and Yemen A.R.

Remarks : A single specimen has been collected from this area.

Genus *Tylotropidius* Stål, 1873

4. *Tylotropidius varicornis* (Walker)

1870. *Heteracris varicornis*, Walker, *Cat. Derm. Salt. Brit. Mus.*, 4 : 667.

1914. *Tylotropidius varicornis* : Kirby, *Fauna. Brit. India Orthopt.* (Acrididae) : 265.

Material examined : 1 ♂ 1 ♀ Kolhapur, Loegons, 9.i.1998, coll. A.K. Hazra; 1 ♀ Radhanagari, 9.i.1998, coll. A.K. Hazra; 200, 2nymph, Kolhapur, Durgawandimining, 10.i.1998, coll. A.K. Hazra; 1 ♀ Dajipur Bison Reserve, 13.i.1998, coll. A.K. Hazra & party.

Diagnosis : Size medium; prosternal tubercle compressed, truncated and slightly bifurcate at apex; tegmen and wings longer than abdomen but smaller than femur; hind femora very slender and thickened at base; supra anal plate of male elongate and triangular; tegmina with a triangular whitish spots in the costal area.

Distribution : India (Maharastra, Andhra Pradesh, Goa, Orissa, Rajasthan, Tamil Nadu, Uttaranchal and West Bengal). *Elsewhere* : Myanmar; Sri Lanka.

Remarks : It is fairly distributed in Maharastra.

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REFERENCES

- Bolivar, I. 1902. Les Orthopteres de St. Joseph's college Tiruchinopoly. *Annls. Soc. ent. France*, 70 : 580-635, Pls. 1-9.
- Dirsh, V.M. 1961. A preliminary revision of the families and subfamilies of Acridoidea (Orthoptera : Insecta). *Bull. Br. Mus. Nat. Hist. (Ent.) London*, 10(9) : 351-419.
- Kirby, W.F. 1914. *The fauna of British India, including Ceylon and Burma*. (Orthoptera : Acrididae). IX + 276 pp.



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CHROMOSOME EVOLUTION IN *TRISTRIA PULVINATA* (UVAROV) (ORTHOPTERA : ACRIDIDAE : CATANTOPINAE)

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Family ACRIDIDAE

Subfamily TROPIDOPOLINAE

Species *Tristria pulvinata* (Uvarov)

Locality of collection : Golf club, Kolkata.

INTRODUCTION

Karyological features of a species are of considerable importance in studying the origin of chromosomal changes and trend of selection within and between populations. Acridids and Pyrgomorphids have long been recognized as chromosomally conservative groups. Majority of the species have 19, XO males; 20, XX females (Pyrgomorphidae) and 23, XO males; 24, XX females (Acrididae) with all the members of the chromosome complement to be *acrocentrics*. A number of deviations from this uniformity have however been recorded (White 1973; Hewitt 1979). In *Tristria pulvinata*, some of the autosomes have been observed to have been eliminated resulting in monosomic and nullisomic conditions. Individuals with nullisomic chromosome complement ($2n = 21$) have been found to be in greater frequency in the populations. This we observed to be somewhat unique, because the parental complement of this species comprises 23 acrocentric elements, and no other mechanism which reduces the $2n$ or FN could be recorded in this species. In all the cytotypes published, $2n$ and FN are equal with XO and XX sex-mechanism in the present series of investigation. The 21, 22 or 23 chromosomes scored for different karyotypes of the individuals was studied with the conventional C- and Hoechst 33258 banding technique.

MATERIAL AND METHODS

One hundred and forty males and two females comprised the material for the present series of investigation. The insects were collected from Golf club, Kolkata. The females are very similar to males except that they are little larger.

For metaphase arrest, individuals were injected with colchicine at a concentration of 0.05% and with an amount of 0.03 to 0.04 ml in each case. Thereafter they were kept alive for at least 4 hrs., in insect cages. Chromosomal preparations were made from the testes and hepatic caecae cells. The tissues were dissected out and cleaned in 0.67% sodium chloride solution. The testes were pretreated in 0.9% sodium citrate solution (hypotonic treatment) for 45 minutes and hepatic caecae for 1 hr. in the same solution, diced and fixed in freshly prepared methanol-acetic acid (3 : 1) with three changes of 15 minutes. In the field the tissues were fixed to small tubes, brought to laboratory and stored at 4°C. For preparation of the slides the fixed tissues were transferred to 50% acetic acid till it became soft. The materials were then teased and squashed in one or two drops of 50% acetic acid. The slides were stored in vapours of 50% acetic acid overnight in cold. Next morning the slides were brought at room temperature and immersed in a solution of 3 : 1 methanol-acetic acid for an hour. The cover slips were removed with the sharp edge of a blade, while immersed in the medium and dried at room temperature in a dust free chamber. Staining was done in 2% Giemsa prepared in phosphate buffer (pH 6.8). After differentiating in phosphate buffer (pH 6.8), slides were air-dried, cleaned in xylene and mounted in DPX. Only well spread and well stained mitotic and meiotic stages were photomicrographed with a Leitz Ortholux microscope. For photographs black and white film viz., NP 22 (120 ASA) were used. The negatives were printed on sterling SW glossy 3 and glossy 4 papers of Allied Photographics India Ltd. Fine grain film and paper developers of Agfa-Gevaert (A901 and A902) and Kodak (D76 and D163) were used in developing negatives and also for positive prints.

C-banding was carried-out following the method by Sumner (1972) with some minor modifications. The air-dried slides were treated with 0.2 N Hydrochloric acid for 30-60 minutes at room temperature, rinsed in distilled water and dried. The slides were then dipped in a freshly prepared 5% aqueous solution of Barium Hydroxide octahydrate kept at 50°C for 1-10 minutes; the timing depended on the age of the slides; the slides produced sharper bands with comparatively longer treatment. After a thorough rinsing with several changes in distilled water, the slides were incubated for an hour at 60°C in 2 X SSC (0.3 M sodium chloride and 0.03 M tri-sodium citrate at pH 7), rinsed in distilled water and were then dried. The slides were then stained for 30 to 90 minutes in Giemsa (2.5 ml of stock solution added to 50 ml of buffer at pH 6.8), rinsed briefly in distilled water, blotted, allowed to dry thoroughly, soaked in Xylene and mounted in DPX.

Fluorescence banding with HOECHST 33258 In this method, which was first introduced by Hilwig and Gropp (1972) and which is now popularly called Hoechst 33258, for staining the heterochromatic regions of mouse chromosomes, we slightly modified the technique by soaking the

air dried slides first in McIlvain's buffer at pH 5.4 for 10 min, and then staining them in freshly prepared Hoechst solution (0.5 µg/ml – 1 µg/ml) in the same buffer (at pH 5.4) for 15-20 minutes at room temperature. The slides were then rinsed in the same buffer and mounted either in same buffer or in a glycerol buffer mixture. The preparations were examined in a Fluorescence microscope or were stored in cold. For fluorescence a Leitz Ortholux photomicroscope was used.

Chromosome morphology and nomenclature were made according to the system of Levan *et al.* (1964). In order to compare the chromosome pairs, histograms were constructed from the relative length. Every individual of this species were tagged with a code number and details of the locality were carefully recorded in our Cytotaxonomy Lab.

OBSERVATIONS

Karyological Details :

Diploid Number, Chromosome Morphology and Sex Chromosome Constitution :

The diploid number of the chromosomes were 21 in males and 22 in females. All the chromosomes were acrocentrics (Figs. 1-13). The males were XO and the X chromosome was distinct by its negative heteropycnocity within the spermatogonial metaphase stages. In later spermatogonial stages it attained an intensity comparable to the autosomes. On an average the X was the 2nd largest element of the chromosome complement, comprising 15.06% of the relative length.

Karyotype : Thirty five conventionally stained karyotypes were analysed from 11 individuals, twenty five C-banded karyotypes of 6 individuals and fifteen Hoechst 33258 stained karyotypes of 5 individuals were analysed. Hoechst stained 8 meiotic karyotypes of 2 individuals were studied for meiotic progression and chiasma localization. In this species a very interesting variation in chromosome numbers was recorded in the male individuals, which was a variation in the diploid number from 21 to 23 in the gonads of the same individuals. The insects were collected from Golf club, a locality in the Southern part of the metropolis. It may be mentioned that this population was a community of potentially closely breeding individuals. In this population with same variation in the diploid number of chromosomes, it could be seen that in individuals with 21 and 23 chromosomes, the smallest chromosomes were the 9th 10th and 11th pairs (Figs. 1- 9). On the other hand an individual with 22 chromosomes, one of the 8th pair of chromosomes was found to be missing. And in individual with 21 chromosome, the smallest pair (the 11th) was found to be missing.

Relative length (RL) in percent : The table below (No. 1) represents the chromosome wise distribution of the relative length of the normal karyotypes of the population.

1	2	3	4	5	6	7	8	9	10	X
15.92	13.65	11.48	9.63	8.30	7.49	6.84	5.86	3.19	2.59	15.06

Supernumerary chromosomes : Two very minute (RL : 2.12%) acrocentric chromosomes of similar size were present in 17% of the individuals of the population (Figs. 1, 2 and 5, 6). On arranging the karyotypes they were found to be the smallest pair of chromosomes. These elements were of similar staining intensity as that of the other two smallest pair of chromosomes (the 9th and the 10th pair). Out of 24 individuals of the population investigated, these supernumeraries were present in 7 spermatogonial plates of only 4 individuals.

Idiogram : As mentioned earlier, we observed that in the idiogram, the last 2 pairs of chromosomes were of considerably smaller size. The X was the 2nd largest chromosome and the size difference was large among pairs 1st, 2nd, 3rd and 4th chromosome. The medium-sized chromosome pairs 5th to 8th did not show much variation in length (Fig. 13).

C-Banding : Of the 25 C-band karyotypes studied, no variation could be recorded. All the chromosomes of the complement exhibited centromeric band. The last pair was distinct comparatively with its more prominent C-band. The X chromosome had the additional feature of having an interstitial band close to the centromere. The feature can be taken as maker element for the X (Figs. 7 and 8).

H-33258 Banding : The chromosomes exhibited a very bright fluorescing centromeric region. But the X chromosome was not that distinct as it was in C-band preparations as the interstitial heterochromatic band did not fluoresce well. Also with the technique the last pair of chromosomes showed a dull centromeric region.

Chiasma Distribution : The table below (Table 2) gives an account of the distribution of chiasmata in each bivalent. Each bivalent has been arbitrarily divided into three equal parts as proximal (P) interstitial (I) and distal (D).

Bivalents	1	2	3	4	5	6	7	8	9	10
Chiasma	P, D-3	P, D-2	P-1	P-5	P, D-1	P-5	P-3	P-4		I-2
Location and Number	I, D-5	I, D-6	P, D-2 I-3 I-D-2	P, D-2 D-1	I-1 I, D-1 D-5	I-1 I, D-1 D-1	I-3 D-2	P, D-1 I-1 D-2	I-1 D-7	D-6
Total	P = 3 I = 5 D = 8	P = 2 I = 6 D = 8	P = 3 I = 5 D = 4	P = 7 I = 1 D = 3	P = 1 I = 2 D = 7	P = 5 I = 2 D = 2	P = 3 I = 3 D = 2	P = 5 I = 1 D = 2	I = 1 D = 7	I = 2 D = 6
	16	16	12	10	10	9	8	9	8	8 = 106

A total of 106 chiasmata were scored in 80 bivalents, showing 29 proximal (P), 28 interstitial (I) and 49 distal (D) type.

The 3rd, 5th and 8th bivalents at diplotene showed terminalized chiasmata (arrow; Fig. 12). Such configurations were also found in other meiocytes at later stages of meiosis of this individual.

DISCUSSION

A very interesting variation in chromosome numbers could be recorded in this species, both between and within the individuals involving the 8th and 11th pairs of chromosomes. Within them, the last pair (11th) was of considerably smaller size, sharing only 2.12% (relative length) of the complement. Both the elements of this pair were missing in the majority of the karyotypes resulting to a reduced chromosome number (21). Whereas when both the elements of the 8th pair, were present it contributed alone 5.86% (relative length) of the 21 chromosome complement. Sometimes however it retains one of the supernumerary, resulting in a chromosome count of 20 in some karyotypes. Both the pairs of the species *T. pulvinata* have been designated as supernumeraries, as they did not show Mendelian segregation. We also noted that the 8th pair was associated with a chiasma in the meiocytes.

If the minute 11th pair is not considered as supernumerary, then a condition with 23 acrocentric chromosomes appears to be the normal karyotype of all the Acridids which is acknowledged to be the parental number from which a decrease or increase have been proposed to have been derived (White 1973, Hewitt 1979). However, in this species, intraindividual polymorphism of a “transient” type is observed that evolved towards elimination of a small pair (11th) with a consequent fixation of a lower chromosome number in their parental karyotype. Occurrence of any orthodox mechanism viz., “Robertsonian” type of translocations (Robertson, 1916) is not convincing since acrocentric nature of all the chromosomes in the complement was evident. Also a fusion followed by pericentric inversion (to restore acrocentric condition) is opposed by the observation of small increase in the relative lengths of the 21 chromosome groups. This is expected in case of a loss or elimination of a small chromosome pair alone.

Loss of a normal chromosome reflects a decrease in the recombination potential in the species. The recombination potential of the 11th pair, due to its minute size might have been very low. Consequently, a lack of its pairing and lagging of unpaired homologues, led to the production of gametes with deficient genomes. A high frequency of spontaneous non-disjunctions along with a high degree of inbreeding increased the possibilities for a rapid spread of various chromosome numbers in the population. This type of chromosome polymorphism, approaching with the extinction of a pair of chromosome, which has lost its property of Mendelian segregation and turned to be a supernumerary, is quite unusual in the Acridoids.

The behaviour of the 8th pair as supernumerary was not so pronounced. Both the homologues of this pair were mostly represented in the karyotypes and found associated with a chiasma. This pair was nowhere distinct as supernumerary in conventional staining (Figs 1-6). In C-banding, centromeric region of all the chromosomes in the complement were C-band positive (Figs. 7 and 8). In one karyotype, one chromosome at 8th position was found to be more stained (Fig. 8). In a Hoechst 33258 stained karyotype, the 8th pair was found comparatively brighter (Fig. 9), while in other cells (Figs. 10-12) all the chromosomes were uniformly stained. One reason for this might be that there was no uniform condensation of this pair or like all the other members of a complement at a given

stage of the mitotic cycle. This pair was also did not agree with the concept of it to be a megameric element. This is because a large part of a megameric chromosome is characteristically heterochromatic in male meiotic prophase and for this reason, it is frequently associated with similarly condensed X-chromosome (Hewitt, 1979). The etiology underlying heterochromatic parts of a megameric chromosome is that they are duplications of some part of the basic genome that have been heterochromatinised (Hewitt, 1979). In the present case (i) by the Barium hydroxide saline Giemsa technique which provides the most consistent method for identifying constitutive heterochromatin, this pair was not found to be C-band positive, (ii) biosynthetically inactivated or switched off euchromatic elements are not depicted by this C-banding procedure. For example, the facultative heterochromatinized X-chromosome of grasshoppers in male meiosis do not give positive C-banding, (iii) regarding 'H' fluorescence in grasshoppers, it has been proposed that "H-fluorescence is modulated by chromosome condensation brought about by differential ratios of DNA/protein at different chromosome regions and at different stages" (Das *et al.* 1979). With this procedure no bivalent had displayed prominently its condensed nature, as is seen for the condensed X chromosome in diplotene (Fig. 12).

We know that there is no direct relationship between a heterogeneity identified by one staining technique and those identified by others. But the Sumner's method employed here has been ~~not enough in~~ revealing recognizing the chromosomes which were otherwise indistinguishable in the conventional staining method. This technique constantly revealed a marker element as an interstitial C-band on the X-chromosome. In the present case 'C' and Hoechst procedures were kept uniform throughout. The 8th pair is therefore not supported as a megameric pair in this species.

The cytological features which have favoured the proposal that this pair is supernumerary are as follows :

- (i) At meiosis, homologues had paired with one another and formed chiasma. They had not paired with members of the normal chromosomes of the complement i.e., not homologous with any other member of the normal complement.
- (ii) This pair had never revealed any secondary constrictions, therefore did not have the probability of having a nucleolus organizer.
- (iii) Non-disjunction at anaphase of spermatogonial mitosis ~~duplicate~~ its non-Mendelian type of inheritance.
- (iv) This pair had revealed constitutive heterochromatin (centromeric C-band) which presumably contains no Mendelian genes and is not transcribed (Therman, 1980). However our proposal regarding the absence of any major genes in the euchromatic region of this pair can not be explained only on the above findings alone. But to explain our finding we refer Jones and Rees (1982) who on the genetic material of B-chromosomes have concluded that "the organization of the genetic material within B chromosomes is distinctive in that the B-chromosomes at metaphase of mitosis are more densely coiled than the A chromosomes, with the result that the DNA density per unit volume is greater."

SUMMARY

Karyological features of *Tristria pulvinata* (Uvarov) have been investigated. In the present series of investigation the grasshoppers belonged to a community of close breeding individuals from Golf club, a locality in the Southern part of Kolkata. Karyotypes with 21, 22 and 23 chromosomes were observed within and between individuals of this species. A deviation from 23 (parental complement) to 21 and 22 chromosomal types have been attributed to loss of 2 and 1 normal elements respectively. Individuals with 21 chromosomes were considerably more in number in the population. The idiogram of this cytotype depicted that the last two pairs had a small gap and first 4 pairs had $\neq$ wider gaps within. On the C-banding, a distinct prominent centromeric band revealed 1st pair. On Hoechst staining, all the chromosomes showed brighter fluorescing centromeric region but proximal C- band of the X did not fluoresce prominently. In meiotic study, chiasma was not restricted to any particular region of the bivalents.

ACKNOWLEDGEMENTS

I am indebted to Dr. J.R.B. Alfred, Director, Zoological Survey of India for providing facilities and for his continued interest and encouragement in the work. I thank Prof. J.S. Yadav, Kurukshetra University for promptly providing me all his reprints. I also thank Prof. B.N. Singh of Banaras Hindu University and Prof. A.K. Duttgupta of Calcutta University for their hospitality during consultation of literature in their laboratories. I am thankful to Dr. Ch. Satyanarayana of Z.S.I. For helping me in shaping the manuscript in electronic form and to Dr. M.S. Shishodia for identifying all these grasshoppers.

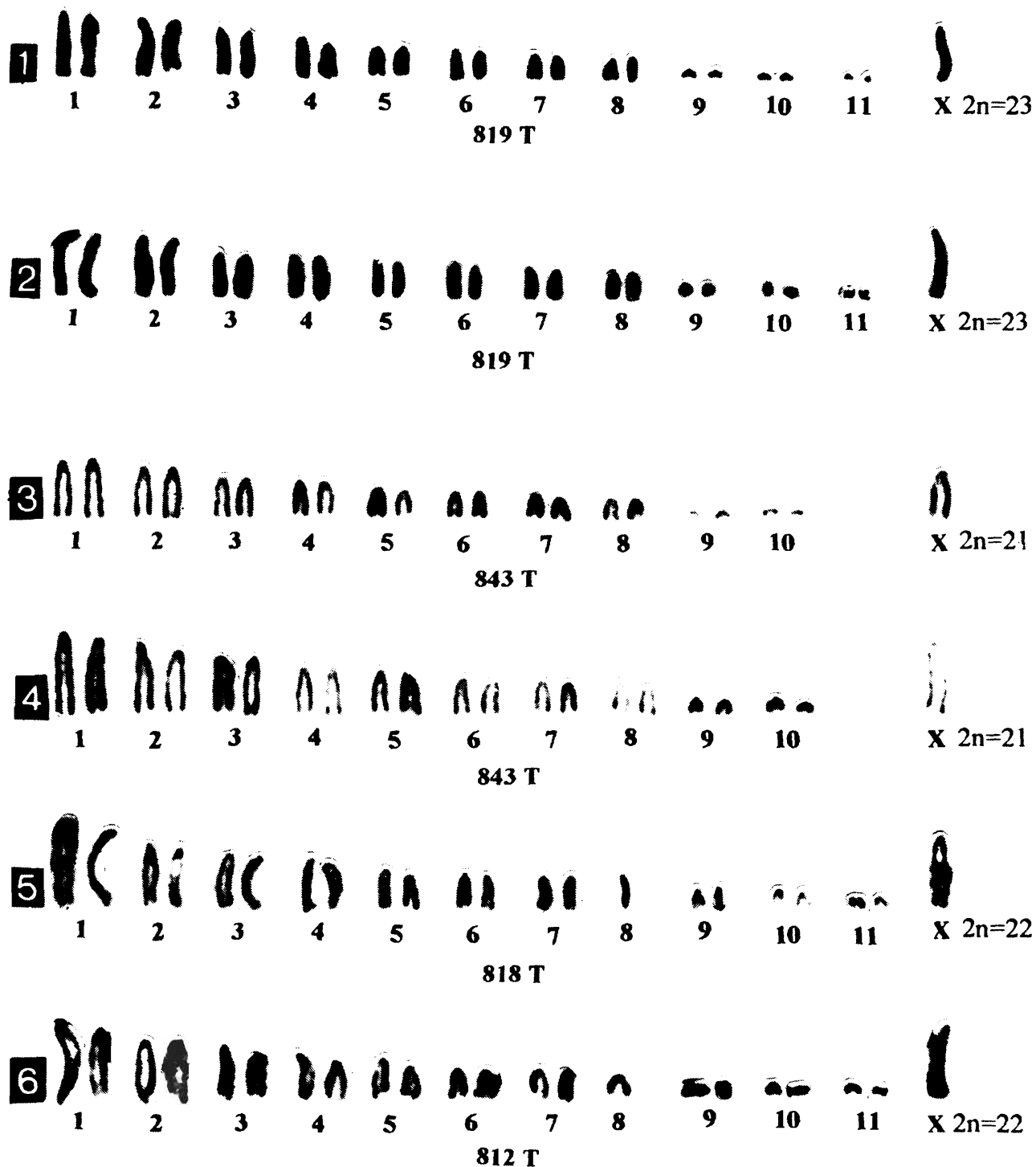
REFERENCES

- Das B.C., Raman R. and Sharma, T. 1979. Chromosome condensation and Hoechst 33258 fluorescence in meiotic chromosomes of the grasshopper *Spathosternum prasinerum* (Walker). *Chromosoma*, **70** : 251-258.
- Hewitt, G.M. 1979. Animal Cytogenetics, Vol. **3**, Insecta 1. Orthoptera. Gebrüder Borntraeger Berlin Stuttgart : 170.
- Hilwig, I. and Gropp, A. 1972. Staining of constitutive heterochromatin in mammalian chromosomes with a new fluorochrome. *Exptl. Cell Res.*, **75** : 122-126.
- Jones, R.N. and Rees, H. 1982. B Chromosomes. Academic press, London : 266.
- Robertson, W.R.B. 1916. Chromosome studies. I. Taxonomic relationships shown in the chromosomes of Tettigidae and Acrididae. V-shaped chromosomes and their significance in Acrididae, Locustidae and Gryllidae : chromosomes and variation. *J. Morph.* **27** : 179-331.

- Sumner, A.T. 1972. A simple technique for demonstrating centromeric heterochromatin. *Exptl. Cell Res.*, **75** : 304-306.
- Therman, E. 1980. Human Chromosomes : Structure, Behaviour, Effects. Springer-Verlag, Berlin : 235.
- White, M.J.D. 1973. Animal Cytology and Evolution. Cambridge University Press, London : 961.

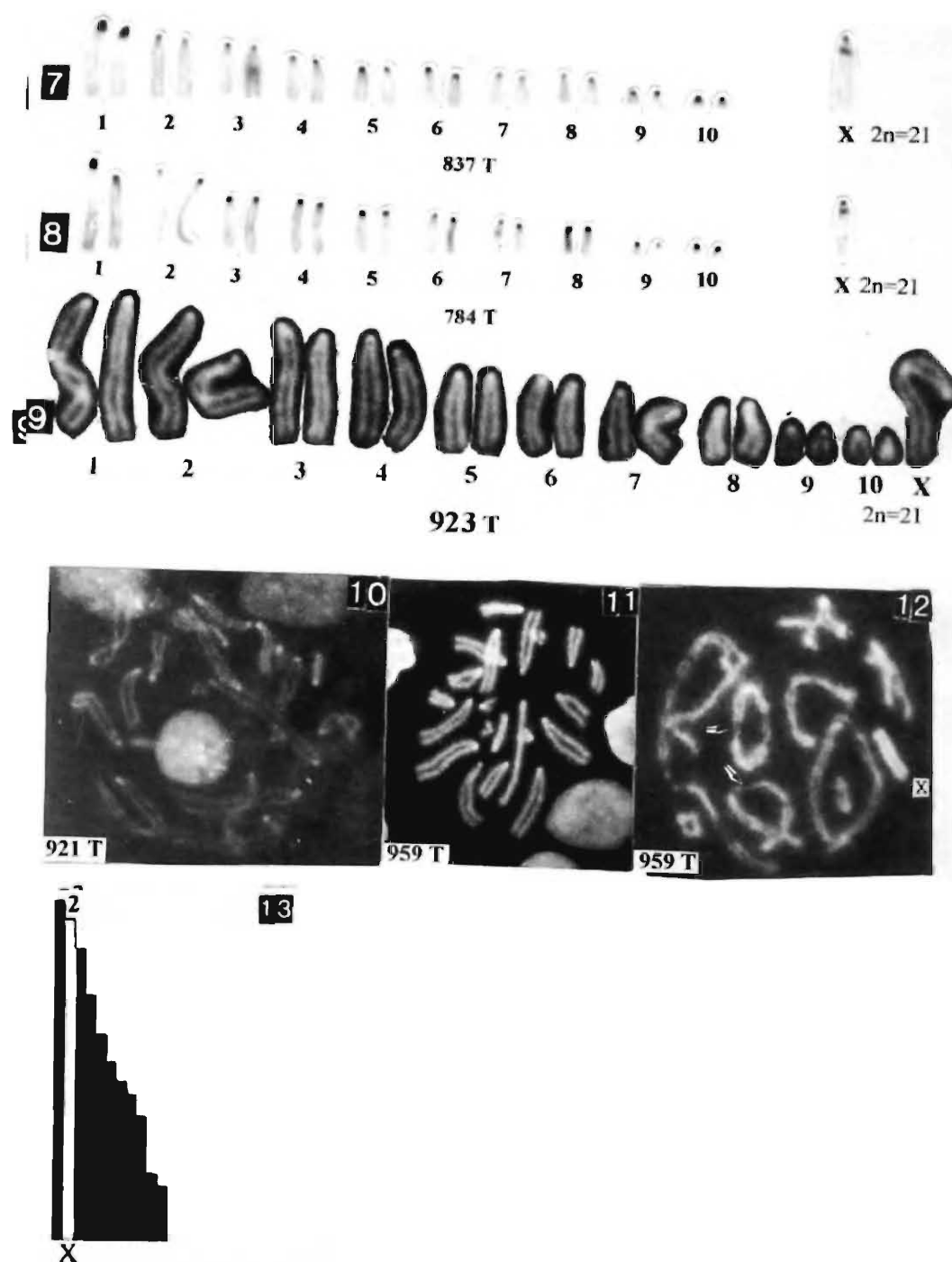
PLATE I

Chromosome Evolution in *Tristria pulvinata* (Uvarov)



Figs. 1-2. : Karyotypes of *T. pulvinata* with 23 acrocentric chromosomes.
 Figs. 3-4. : Karyotypes of the species with 21 acrocentric chromosomes.
 Figs. 5-6. : Karyotypes of the species with 22 acrocentric chromosomes.

PLATE II
Chromosome Evolution in *Tristria pulvinata* (Uvarov)

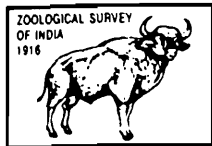


Tristria pulvinata (Uvarov)

Figs. 7-8. : C-band karyotypes of the species. Centromeric band is visible on all the chromosomes. On the 1st pair is quite prominent. One interstitial band is distinct on the X close to the centromeric band. On this feature the X becomes the marker element in the complement.

Figs. 9-11. : Hoechst 33258 stained chromosomes. Centromeric end of all the chromosomes are brightly fluorescing. 21 chromosomes are visible in all the figures.

Figs. 12. : Meiotic bivalents at diplotene stage. The Hoechst stained bivalents reveal terminal association of its 3rd, 5th and 8th bivalents (arrow).



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FIRST REPORT OF WHIP SPIDER *PHRYNICUS PHIPSONI* POCOCK FROM THE HUMAN HABITATIONS AND PROTECTED AREAS OF GOA STATE, INDIA; WITH NOTES ON ITS HABITS AND HABITAT

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INTRODUCTION

Arachnids have not received the attention that they deserve from taxonomists, despite the fact that the Indian subcontinent supports a rich Arachno-faunal diversity. In absence of recent exploratory surveys, the monumental work of the early workers continues to retain its importance as exemplified by Pocock's classic work, dating back to last century. Comprising the largest of the Chelicerate classes, arachnids are generally not so easily understood and appreciated. Further, forms such as the whip spiders continue to be seen with awe, due to their strange look, habits and secretive habitats. Pocock's bifurcation of the whip spiders and whip scorpions into orders Amblypygi and Uropygi respectively was unified under a single order Pedipalpida by Werner (1935). As for this order, there is a paucity of updated information at least for the Indian region. Presented here is the range extension, only a fifth record since *Fauna of British India* (Pocock, 1900) and the first definitive record of the whip spider, *Phrynicus phipsoni* from the state of Goa. Interestingly, it is also the first case on record, of their presence from human habitations in India.

METHODOLOGY

The data presented here is a part of the long-term fieldwork on Arachno-faunal diversity of Goa, largely focused on 2 of its talukas, viz. Salcete and Sanguem. Though both these differ in geography; the former having a coastline and the latter being in the hinterland, the specific locations of sightings in the two places share common latitude. Pre-surveyed localities were visited at

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fortnightly intervals all throughout the year for gross evaluation of habits and habitat of the pedipalps under study. Careful observations were recorded on the hygro-thermal character of microhabitat, nature of substratum, associated flora and fauna and behaviour. Sightings were supported with geographical positioning system (Etrex Garmin 12 Channel GPS). A single specimen was collected from the human habitations for examination of meristic and spination characters, to confirm the species identity. Similarly, the epigyne was dissected out, cleared in 50% lactic acid and examined under stereomicroscope (Model CZSMX). The meristic characters are as given in Table 1.

Table 1. : Meristic character in the collected species of *Phrynicus phipsoni*.

Parts of appendages	Pedipalps (mm)	1 st leg (mm)	2 nd leg (mm)	3 rd leg (mm)	4 th leg (mm)
Trochanter	06.75	5.00	4.00	4.50	5.00
Femur	32.50	26.00	16.50	16.75	15.00
Patella	40.40	02.10	02.75	02.25	02.25
Tibia	07.50	40.25 (32 digits)	—	—	—
Basitibia L.	—	—	16.50	17.00	16.00
Distitibia L.	—	—	08.00	08.25	09.00
Metartarsus	—	—	04.25 (Ex.)	04.75 (Ex.)	04.75 (Ex.)
Tarsus +	05.00	44.75 (65 digits)	04.00 (Int.)	04.25 (Int.)	04.25 (Int.)
Protarsus (Interior)	08.75	—	—	—	—
Protarsus (Exterior)	07.00	—	—	—	—
Total length	107.90	118.10	56.00	57.75	56.25

OBSERVATIONS AND DISCUSSION

There has been no serious attempt made so far to inventory the terrestrial invertebrates of the state of Goa and hence a comprehensive list of any of these groups is not available. This limitation had been cited in the report on Goa state biodiversity strategy and action plan (GBSAP, 2002). Against this background, there was a complete paucity of information on Arachno-faunal composition of this state until recently. Borkar *et al.*, (2000) presented their preliminary observations on the spider fauna of one taluka of the state. In course of these observations range extensions were also reported; and in some cases, first reports of interesting Arachnids were made. A case in

point is that of Amblypygid *Phrynicus* species, whose range until then had not been reported beyond Maharashtra, in Western India in the north and Kerala and Karnataka in south. Three years after the genus *Phrynicus* was reported by Borkar *et al.*, (2000) from Salcete taluka of Goa, a habitat supporting small population of affiliated species of this genus was located from the protected areas of the state. Species level taxonomy of the individuals from both these places confirmed these individuals to be *P. phipsoni*.

Amblypygids are elusive arachnids with mysterious habits and habitat that have largely escaped the attention of even keen field biologists. Commonly known as whip spiders, they are generally confined to dense and humid forest patches, living their secret lives either in rock crevices, beneath tree trunk, termite mounds, or tree stumps, beneath the peeling bark, subject to availability of moisture. Their sightings become progressively difficult with the cessation of rains. Though perusal of literature does not throw any light on their preferred periods of activity, they are nocturnal and a peak of intense activity can be witnessed at late hours past midnight. They are relatively solitary in existence, though in some cases we have observed even up to 15–20 individuals of fairly uniform size assembled on a single tree trunk; a sight so commonly witnessed during the early monsoons in some dense forested areas of Goa, where the hygro-thermal profiles encourage these strange creatures to move in a relative openness of their microhabitat.

Difficult to notice at the first sight, the whip spiders camouflage very well on the surface of rough moss infested wet tree trunks on which they remain still. Even when they share the common microhabitat such as a single tree trunk or the incavings of mud embankment, the conspecifics maintain disciplined distance from each other and have a common orientation along the vertical axis. Individuals are normally seen with retracted pedipalps that move in horizontal plane, folded at joints. The first pair of antenniform legs that measure a little less than thrice the length of carapace is fully extended; and sometimes moved in front and side ways probably as feelers. When alarmed, individuals straighten out the pedipalpi and maneuver their associated spines in clapping motion. It has been our observation that in case of extreme intimidation, the animal raises itself above the substratum and makes a sudden dash sideways in a very erratic fashion to confuse the intruders.

Barring the western ghat stretch, where vegetation is tropical evergreen, the rest of the state holds a cover of moist deciduous vegetation. The species has adapted itself to both these vegetation types.

Hitherto there had been no reports from any part of India where, *P. phipsoni* has been an associate of human habitation, however whip spiders have been sighted by us and at times collected from the mud-plastered walls of old and abandoned houses in Goa. Reliable individuals in such areas vouch for having witnessed their domestic cat playing with these strange “spiders without silk” Gravely (1915) records similar observations on *Phrynicus lunatus* met within the human habitation in Sri Lanka. In the protected areas of Goa, molts of these animals are commonly seen

within, and in the vicinity of forest cottages. In some instances, the specimens were sighted in moist tree hollows. In such places as well, they tend to be less secretive and come out in the open during the monsoon. Excessive moisture during the rains drives them out of the hiding places, and probably this explains their occurrence in human habitat in this season.

On 20th Oct. 2002, in course of our routine nocturnal surveys for Amblypygids in the protected areas of Molem range, we encountered seven large specimens on a single surface totaling about 12–13 mts² with an average height of 3 mts above the ground level. The location was in cavings of an embankment along the forest path 50 mts from a flowing stream (Fig. 1). The GPS reading was N 15°23'58.8" lat and E 74°15'37.7" The embankment comprised of Red loam with interspersed basalt sand stone. The humidity was over 92% with a temp range of 27–30°C. The soil also had very high moisture content. The specimens settled at an average height of 94 cms from the ground level (see Fig. 2). The arboreal flora in this region comprised of *Macaranga peltata* (Roxb.) Muell-Arg., *pentagyna* (Roxb.), *Bambusa arundinacea* (Retz.) Roxb., *Careya* Roxb., *Terminalia crenulata* Roth, *Terminalia paniculata* Roth. Similarly, the shrubs comprised of *Leea indica* (Burm. F.) Merr., *Calcopteris floribunda* (Roxb.) Poir, *Carvia callosa* (Ness.) Bremek., *Ixora coccinea* L., *Helicteres isora* L., *Calamus pseudotenuis* Becc. Ex Hook f. Herbs and climbers are represented by *Adiantum* sp, *Selaginella* sp, *Cissus discolor* B1., *Desmodium triangulare* (Retz.) Merr.

These embankments are also shared by relatively interesting fauna such as anuran *Ramnella* sp. (Fig. 3) and banded rock Gecko *Cyrtodactylus dekkansensis* (see Fig. 4). Interestingly, *Ramnella montana* is also an associate of *Heterometrus* species of scorpions in Canacona taluka of Goa (Unpublished data). Such associations may lead one to speculate on the possibility of trophic relationship; as for instance *Pocelotherus regalis* actually feeds on Geckos (personal communication). Incidentally, we observed one adult whip spider in possession of a tiny frog on the floor of a human dwelling. It had sunk its chelicerae into the trunk of the frog, its left pedipalp holding the head whereas the right one having firmly seized the left leg of the frog. However, we could not make further observation as the whip spider quickly moved to the safety of its seclusion in a crevice. Further, it may be pertinent to put on record that one of our night trails in protected areas of Molem range in the month of January, we came across whip spider nibbling at the molt of a rat snake. The feeding habits of the whip spiders are indeed an area of investigation requiring more inputs.

We have also observed thelyphonids on these embankments and these are being separately reported. Whether these associates have any ecological relationships with whip spider, or that it is an assemblage promoted by similar requirements of microhabitat warrants detailed investigations. A recent study conducted by Lamabam and Samant (2003) has brought on record a rich spectrum of Arachno-fauna from the Bhagwan Mahavir Sanctuary and Molem National park of Goa. Rough estimates reveal the presence of at least 28 families of order Araneae in this region; detailed work is in progress.

The collected specimen tallies very well with gross morphometric characters recorded for *Phrynicus phipsoni* by Bastawade (1995). The identification of the present specimen was confirmed by detailed stereomicroscopic examination of morphology and epigyne character. Stereomicroscopic examination of internal genitalia revealed a pair of somewhat rounded and distally invaginated gonopods riddled with few minute pores and striations. Also, a distinct ridge runs along the antero-lateral edge of each gonopore. Further, each gonopore is laterally flanked by a somewhat triangular plate (see Fig 5). Recently Harvey and West (1998) have revised the genus *Charon*; with emphasis on structure of the genitalia, which they opine is of extreme importance in taxonomy of amblypygids.

The specimen observed by us collected from Goa only differed in respect of their size when compared with those reported by Bastawade (1995). The matured female examined measured 28 mm in its total length; with cephalothorax 9.50 mm in length and 18 mm in width and the abdomen 19 mm long. The measurements of the appendages are given in Table 1. The molts of these specimens were collected in large numbers in late July. The empty exoskeleton on closer examination revealed that molting is facilitated by precise splitting of carapace all along its circular margin, which then opens up and remains attached like a lid only at innermost point of posterior concavity in the pars thoracic region. The abdominal tergal shield was lacking in all of the molts. The freshly molted specimen is milky white in colour. One such specimen was observed to display change in colour from milky white to grayish green until it stabilized on greenish brown shade, very close to that adorned by adult. Efforts are being made to record the reproductive behavior under natural as well as laboratory conditions.

Currently the oriental species of Amblypygids are classified under two distinct families, on the basis of differences in dimension of their sternal plates and presence and absence of pulvillus on the posterior tarsal segment of legs. Perusal of literature reveals that not much has been written on Amblypygids after the monumental work of Pocock (1900), who is credited with the earliest record of Amblypygids from the Bombay region. Thereafter the only collections on record are from Sanjay Gandhi National Park Borivli, Mumbai and North Arcot district of Tamil Nadu. Bastawade (1995) has reported the recent collections from the Western Ghats of Sindhudurg district, Maharashtra. These specimens have been redescribed and identified to be females of *Phrynicus phipsoni* (Pocock). Many workers (Gravely, 1915; Mulenex, 1975 and Quintero, 1981) have recognized oversimplification of species level taxonomy in this group. In the light of the prevailing confusions, revisionary work is imminent in taxonomy of Indian forms.

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REFERENCES

- Bastawade, D.B. 1995. Redescription of *Phrynicus phipsoni* (Pocock) (Family : Phrynicidae : Arachnida) collected after 100 years from new locations in Maharashtra, Western India, *J. Bombay nat. Hist. Soc.*, **92**(1) : 132-135.
- Borkar, M.R., Pereira, P. and Bastawade, D.B. 2000. Preliminary observations on the spider fauna of Salcete taluka of Goa, Proceedings of the National Seminar on "Zoology for the 21st century" Organized by the PG. Dept. of Zoology, Goa, University, Abstract : 19.
- GBSAP, 2002. Goa state Biodiversity Strategy and Action Plan. A report submitted to Ministry of Environment and Forest. New Delhi, by the Goa Foundation, under the NBSAP : 128.
- Gravely, F.H. 1915. A revision of the Oriental sub families of Tarantulidae. *Rec. Indian Mus.*, **11** : 433-455.
- Harvey, M.S. and West L.J. 1998. New species of *Charon* (Amblypygi : Charontidae) Northern Australia and Christmas Island. *J. Arachnol.*, **26** : 273-284.
- Lamabam, S. and Samant, S. 2003. Diversity and habitat associations of some Arachno-faunal elements of Protected Areas of Molem Range. Dissertation submitted to Goa University in partial fulfillment of B.Sc. degree in Zoology : 99 pp.
- Mullinex, C.L. 1975. Revision of *Paraphrynus moreno* Amblypygida : Phrynidae) for North American and the Antiles. *Occ. Pap. California Acad. Sci.*, **116** : 1-80.
- Pocock, R.I. 1900. *Fauna of British India, Arachnida*, Taylor & Francis, London, 279 pp.
- Quintero, D. 1981. The amblypygid genus *Phrynus* in the Americas (Amblypygi : Phrynidae). *J. Arachnol.*, **9** : 117-166.
- Werner, F. 1935. Scorpiones Pedipalpi Leipzig. *Akademische verlagsgesellschaft M. B. H.* 72 pp.
- Weygoldt, P. 1998. Revision of the species of *Phrynichus* Karsch, 1879 and *Euphrynichus* Weygoldt, 1995 (Chelicerata : Amblypygi) *Zooligica*, **147** : 1-65.
- Weygoldt, P. 2000. Whip spiders (Chelicerata : Amblypygi) Apollo Books, *Stenstrup*, 1-163.

PLATE I



1



2



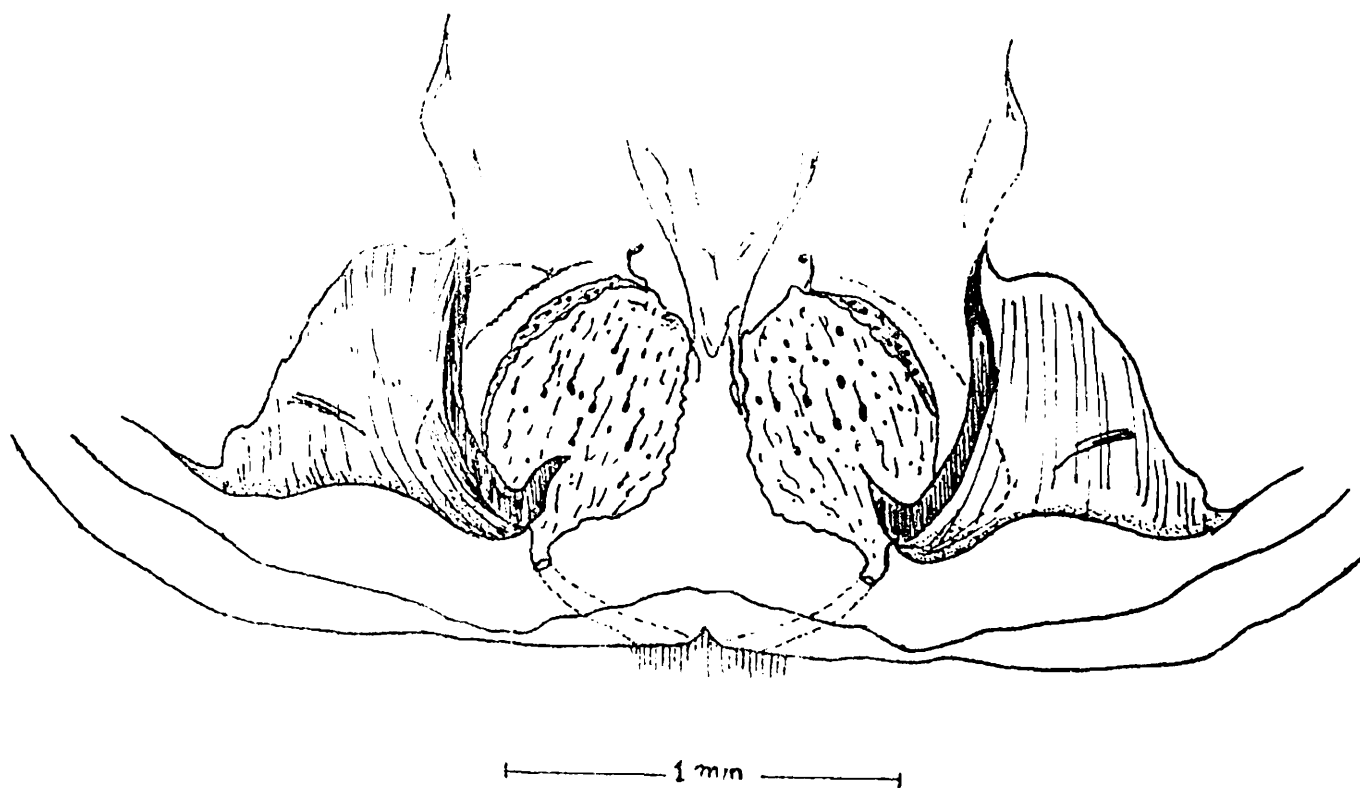
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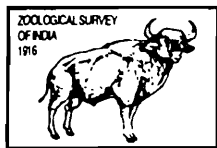
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Figs. 1-4. : *Phrynicus phipsoni* and its faunal associates

PLATE II



Figs. 5. : Internal (dorsal) ♀ genetelia of *P. plipzori* (Pocock)
Loc : Borivilli (SGNP) Mumbai & Goa



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SEXUAL DIMORPHISM IN *AMBLYCEPS MANGOIS* (HAMILTON-BUCHANAN) (AMBLYCIPITIDAE : SILURIFORMES : PISCES) WITH NOTES ON SOME MORPHOLOGICAL CHARACTERS

NIBEDITA SEN

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INTRODUCTION

The genus *Amblyceps* was first described by Blyth (1858). It is a monotypic genus with only one species *Amblyceps mangois* (Hamilton-Buchanan). Earlier, considerable variations amongst different populations resulted in description of several names for this species (Blyth 1860; Day 1878; Chaudhuri 1919). Menon (1999) in his checklist included two species under genus *Amblyceps* namely *A. laticeps* (McClelland) and *A. mangois* (Hamilton-Buchanan).

Nath and Dey (1989) described two new species namely *A. apangi* and *A. arunachalensis* from Arunachal Pradesh, N. E. India on the basis of presence of complete or incomplete lateral line, shape of caudal fin, length of adipose dorsal fin etc. Jayaram (1999) synonymised these two species with *A. mangois* quoting Hora (1933). Hora (1933) in his revisionary work gave diagrams of different specimens showing variations in the form and extent of adipose dorsal fin, shape of caudal fin etc. (p. 618, fig. 5). Though as per diagram, in top two specimens dotted lines have been shown but as per text, "the lateral line is entirely absent" The same was reported by different authors (Hamilton-Buchanan, 1822; Blyth, 1860; Day, 1878; Talwar and Jhingran, 1991). Jayaram (1999) only mentioned, "lateral line generally absent"

In spite of considerable differences in various populations, Day (1878) and Hora (1933) opined that all are varieties of one species only, which is still followed (Talwar and Jhingran, 1991; Jayaram, 1999).

OBSERVATIONS

While studying the *A. mangois* specimens from North East India, the author also came across considerable and interesting variations amongst same or different populations. A detailed study resulted some significant findings.

The present paper deals with 139 examples of *Amblyceps mangois* from different states (Meghalaya, Assam, Manipur, Tripura and Arunachal Pradesh) of N. E. India. 73 exs. (25-72 mm TL) from Meghalaya, 22 exs. (25-91 mm TL) from Assam, 1 ex. (55 mm TL) from Manipur, 31 exs. (28-63 mm TL) from Tripura and 12 exs., (45-110 mm TL) from Arunachal Pradesh were studied.

Diversified variations noticed in different populations are as follows :

(1) *In Meghalaya populations* : Body is generally subcylindrical; sometimes it is elongated with equal depth throughout. Pelvic fins may or may not be closer to anal fin; when closer, sometimes touching anal fin. The length of adipose dorsal fin varies; either smaller, slightly longer or equal to anal fin base length; sometimes even confluent with caudal fin. Concealed dorsal and pectoral fin spines are generally sharp; either long, short or not visible; when it is not visible first unbranched ray is fleshy. The barbels are longer or shorter than head length. Anal opening placed in between pelvic fins, either middle or end of its length; *with or without fleshy papilla just behind*. Caudal fin either slightly or deeply emarginated or forked. When forked, lobes are subequal or upper lobe slightly longer; sometimes lobes are filamentous. Lateral line generally absent; in few specimens 4-5 pores are noticed; sometimes extending upto end of dorsal fin.

(2) *In Assam populations* : Body is generally subcylindrical. Pelvic fins may or may not be closer to anal fin. The length of adipose dorsal and anal fin base almost equal; in some, adipose fin confluent with caudal fin. Concealed dorsal and pectoral fin spines are generally sharp, long. The barbels are longer. Anal opening placed in between pelvic fins, either at base, midway or end of fins *with fleshy papilla just behind*. Caudal fin deeply emarginated or forked; lobes subequal or upper lobe slightly longer. Lateral line generally absent; Sometimes with 3-4 pores.

(3) *In Manipur population* : Body elongate. Pelvic fins placed at considerable distance from anal fin. The length of adipose dorsal fin longer than anal fin base. Concealed dorsal and pelvic fin spines are smaller. The barbels are shorter. Anal opening placed in between pelvic fins at the end of its length *without fleshy papilla*. Caudal fin slightly emarginated. Lateral lines with a few pores.

(4) *In Tripura populations* : Body subcylindrical. Pelvic fins placed closer to anal fin; sometimes even touching the later. The length of adipose dorsal fin equal to anal fin base. Concealed dorsal and pectoral fin spines are sharp, long. The barbels are long. Anal opening placed in between pelvic fins at the end of its length *with fleshy papilla behind*. Caudal fin forked; lobes are either subequal or upper lobe slightly longer or sometimes filamentous. Lateral line absent.

(5) *In Arunachal Pradesh population* : Body generally robust. Pelvic fins placed almost midway between pectoral and anal fins (more closer to anal fin). The adipose dorsal fin is confluent with caudal fin with a depression at base of caudal fin. Concealed dorsal and pectoral fin spines are weak and first unbranched ray of both the fins are fleshy. The barbels are smaller. Anal opening placed in between just at the base of pelvic fins in a pit followed by a *fleshy papilla* in most of the

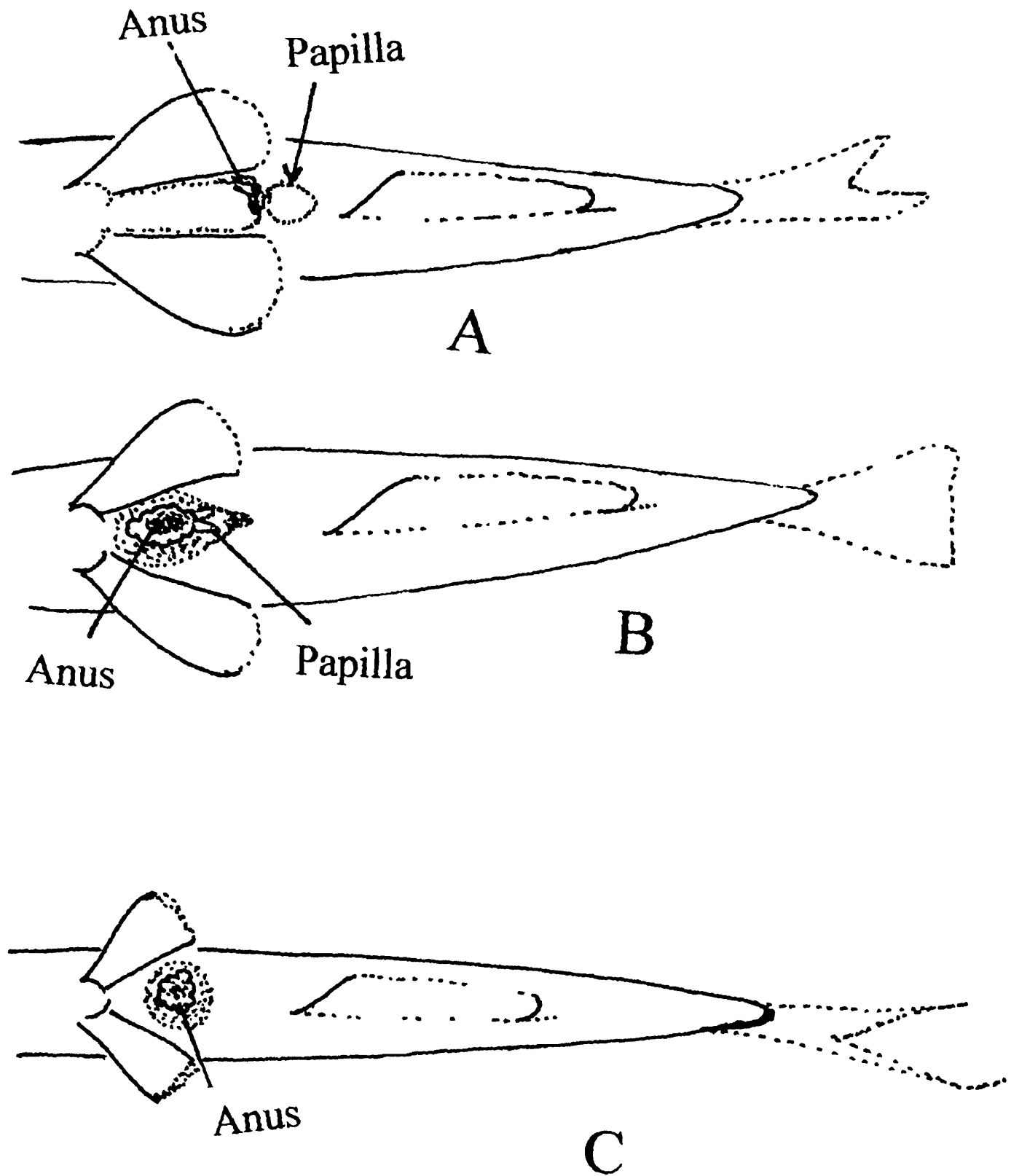


Fig. 1. : Diagrammatic representation showing position of anal aperture in male with papilla (A, B) and in female without papilla (C).

specimens except one *without papilla*. Caudal fin truncate or slightly emarginated. Lateral line generally absent; in some specimens 5-6 pores are there and one specimen is having distinct, complete lateral line.

From the above, considerable variations amongst inter and intra populations leads the author to study in details resulting some significant findings which are not reported earlier.

Out of 139 specimens studied, 11 specimens (8 from Meghalaya, 1 from Manipur, 2 from Arunachal Pradesh) are *not having any papilla behind anus*. On detailed study it is noted that the specimens *having papilla are males* (Plate II. A, B and Figure 1. A, B) and those *without papilla are females* (Plate II. C, D and Figure 1. C). Further, there are differences in following characters also :

Females : Body is elongated, almost equal depth throughout (Plate I. C, D). The pelvic fins always placed at a considerable distance from anal fin (Plate IV. C, D). Concealed dorsal and pectoral fin spines are sharp, minute or shorter than in males. Anal opening placed in between pelvic fins, generally mid way, occasionally at the end of its length (Plate II. C, D); rarely it is placed just at the base of pelvic fins (Arunachal Pradesh specimen). Lateral lines always present with 5-6 pores, ceases at middle or end of dorsal fin. The barbels are generally smaller than in males. Caudal fin generally emarginated, occasionally forked and filamentous (Plate III. C, D). The length of adipose dorsal fin smaller than anal fin base in general; sometimes equal and rarely confluent with caudal fin.

Males : Body subcylindrical, anteriorly lower surface is flattened in front of pelvic fins (Plate I. A. B). The head greatly swollen in opercular region. The pelvic fins always placed closer to anal fin (Plate IV. A), sometimes even reaching the later except in Arunachal Pradesh specimens where pelvic fins placed at a distance (Plate IV. B). Concealed dorsal and pectoral fin spines are generally sharp, longer than in females; occasionally spines are weak and present as soft, fleshy unbranched ray. Anal opening placed in between pelvic fins, generally at the end of its length (Plate II. A) but occasionally either midway or at base of pelvic fins (Plate II. B). Lateral line entirely absent. The barbels are generally longer than in females. Caudal fin generally forked (Plate III. A) with lobes either equal or upper lobe longer; sometimes subround, truncate (Plate III. B) or slightly emarginated. The length of adipose dorsal fin varies; it is either equal or slightly longer than length of anal fin base or confluent with caudal fin.

DISCUSSION

From above findings it is clear that *A. mangois* shows considerable variations amongst inter and intra populations. Some of the variations may be due to sexual dimorphism. Other variable characters in same sex are also remarkable. It can be concluded that only genetical studies may throw some light whether the divergent forms can be separated as new species or not.

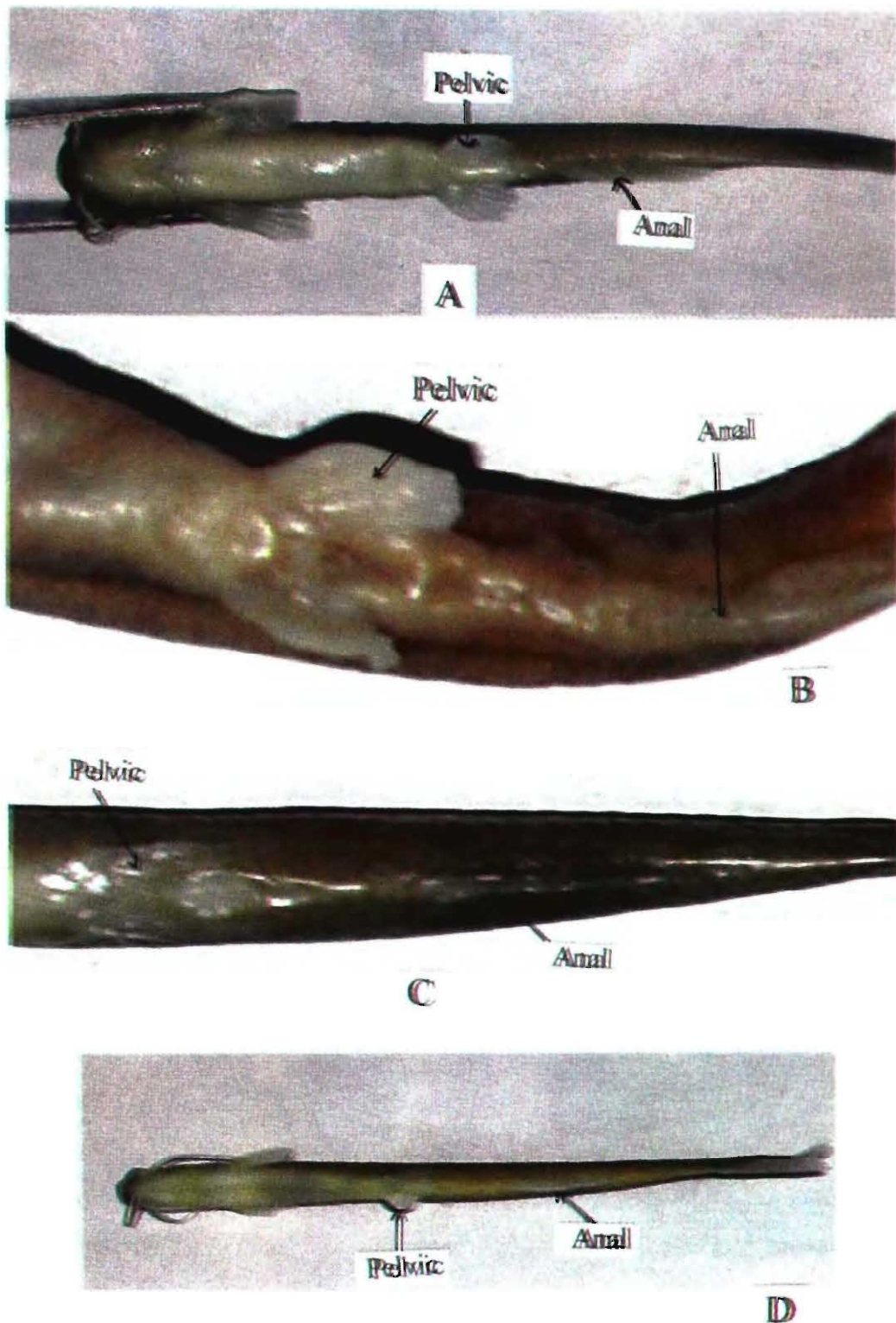
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REFERENCES

- Blyth, E. 1860. Report on some fishes received chiefly from the Sitang River and its tributary streams, Tenasserim Provinces. *J. Asiat. Soc., Bengal*, **29** : 138-173.
- Chaudhuri, B. L. 1919. Report on a small collection of fish from Putao (Hkamti Long) on the northern frontier of Burma. *Rec. Indian Mus.*, **16**(4) : 271-288.
- Day, F., 1878. *The fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India. Burma and Ceylon*. Text and atlas in 4 parts. London : xx + 778, 195 pls.
- Hamilton-Buchanan, F. 1822. *An account of the fishes found in the river Ganges and its branches*. Edinburg and London : vii + 405, 39 pls.
- Hora, S. L. 1933. Siluroid fishes of India, Burma and Ceylon. I. Loach like fishes of the genus *Amblyiceps* Blyth. *Rec. Indian Mus.*, **35**(4) : 607-621.
- Jayaram, K. C. 1999. The freshwater fishes of the Indian region.—Narendra Publishing House, Delhi-110006 (India). xxvii + 551, XVIII plates.
- Menon, A. G. K. 1999. Checklist—Freshwater fishes of India, *Rec. zool. Surv. India* Occasional paper No. 175, I-xxix, 1-366 pp (Published-Director, Zoological Survey of India).
- Nath, P. and Dey, S. C. 1989. Two new species of the genus *Amblyiceps* Blyth from Arunachal Pradesh, India. *J. Assam Sci. Soc.*, **32**(1) : 1-6.
- Talwar, P. K. and Jhingran, A. 1991. *Inland fishes of India and adjacent countries*—Oxford and IBH Publishing Co. Pvt. Ltd., N. Delhi, 2 volumes : xix + 1158.

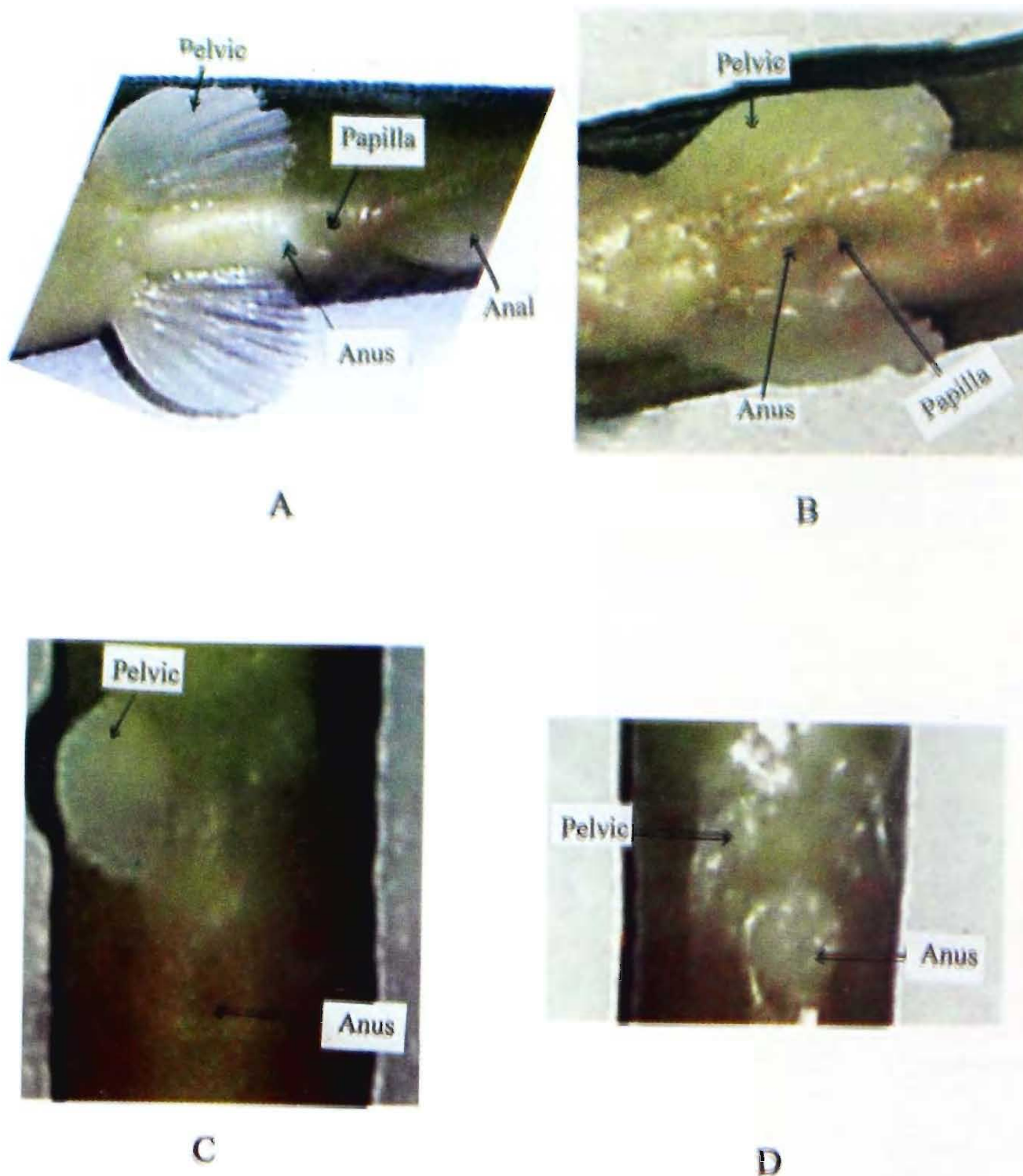
PLATE I



Varieties of *Amblyceps mangois* (Hamilton-Buchanan) occurring in North East India.

- A. Male having forked caudal fin, pelvic and anal fin closer, length of adipose and anal fin equal.
- B. Male having truncate caudal fin, pelvic and anal fin at distance, adipose dorsal fin confluent with caudal.
- C. Female having emarginated caudal fin, pelvic and anal fin at distance, adipose dorsal fin placed behind origin of anal fin.
- D. Female having forked and filamentous caudal fin, pelvic and anal fin at distance, small adipose dorsal fin.

PLATE II



Variations in position of anal aperture.

- A. Male – anus placed at the end of pelvic fin with papilla.
- B. Male – anus placed at the base of pelvic fin with papilla.
- C. Female – anus placed at the end of pelvic fin without papilla.
- D. Female – anus placed almost at the end of pelvic fin without papilla.

PLATE III



A



B



C



D

Variations in shape of caudal fin.

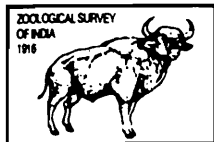
A. forked; B. truncate; C. emarginate; D. forked and filamentous.

PLATE IV



Ventral view of different forms showing distance between pelvic and anal fin.

A. Male; B. Male; C. Female; D. Female



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NEW RECORDS OF FREE-LIVING MARINE NEMATODES FROM INDIA

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INTRODUCTION

Free-living marine nematodes are usually the most abundant metazoans inhabiting marine benthic ecosystems, often representing more than 90% of the benthic meiofauna. Their significance in terms of habitat energy fluxes in the food chain and degradation and mineralization of organic matter are high. An important feature of nematode populations is the large number of species present in any one habitat, often an order of magnitude higher than for any other taxon (Platt & Warwick, 1980).

Although the nematodes comprise a large fraction of marine benthic communities, only little information is available on its assemblage in India waters. Studies on marine meiofaunal taxonomy and ecology have increased considerably in the last 20 years and progress has been made in facilitating meiofaunal work by non-specialists. Significant contributions on nematode assemblage structure at the generic or specific level of the mangrove sediments from the world has been made (Hopper *et al.*, 1973, Vanhove *et al.*, 1992, Olafson, 1995, Olafsson *et al.*, 2000, Decraemer & Coomans, 1978, Hodda & Nicholas, 1985 & 1986, Alongi, 1987a & 1987b, 1990, Nicholas *et al.*, 1991, Nicholas & Stewart, 1993, Somerfield *et al.*, 1998), while there are only three such studies from India (Krishnamurthy *et al.*, 1984, Rao, 1986, Sinha *et al.*, 1987).

Pichavaram mangrove situated along the southeast coast of India (Lat. 11°27' N; Long. 79°47' E), lies about 200 km. south of Chennai, the capital of Tamilnadu state and about 10 km. south of Parangipettai (Portonovo). It is one of the typical mangrove swamps of India, with a cover of about 1,100 hectares.

Faunastic surveys of Pichavaram mangrove was conducted during 2002. During this study, six species (*Ptycholaimellus ponticus*, *Paracomesoma dubium*, *Desmodora* (*Desmodorella*))

tenuispiculum, *Camacolaimus barbatus*, *Haliplectus dorsalis* and *Thalassomonhystera parva*) and one genus (*Pseudolella* sp) were recorded for the first time from Indian waters from intertidal sediments. This paper deals with the systematic account of each species, materials collected (number of specimens and date of collection), brief description and its geographical distribution.

MATERIALS AND METHODS

The sediment samples were collected using a hand corer (3 cm. dia.) up to a depth of 10 cm. Sampling was made during low tide, mostly near the mid tide level. The sediment samples were anaesthetized with a solution of magnesium chloride isotonic with seawater and meiofauna were extracted by the standard decanting-sieving method, and were stored in 5% formalin. Nematodes were picked out and mounted on a drop of water free glycerin on a microscopic slide from a subsample. The cover slip was sealed using paraffin wax. Identification to species level was done under a high power microscope using the pictorial keys of Platt and Warwick (1983 & 1988) and Warwick *et al.* (1998). Drawings were made using a Camera Lucida. The measurements of species presented in this study are based on De Man's formula, as adopted by Jensen (1978 & 1979).

SYSTEMATIC ACCOUNT

Order CHROMADORID

Family CHROMADORIDAE Filipjev, 1917

1. *Ptycholaimellus ponticus* (Filipjev, 1922)

(Figs. 1-2)

Material examined : 7 females, Pichavaram mangrove, 28.01.02.

Description (Female) : Body slender and attenuating towards ends, 0.8-0.95 mm in length. Maximum diameter of body 25-30 μ m. Cuticle annulated; lateral files raised with longitudinal rows of coarse dots; four longer cephalic setae 7-10 μ m in length; four files of short setae down body length, each situated slightly median to the longitudinal files of cuticle dots. Amphids transverse slits immediately posterior to cephalic setae. Buccal cavity with large strongly cuticularised S-shaped dorsal tooth and a dorsal apophysis. Oesophagus swollen dorsally at anterior end around dorsal tooth with an elongate double posterior bulb. Tail tapering, 3.5-3.7 a.b.d., with distinct spinneret. Ovaries opposite, reflexed, anterior ovary to the right of intestine and posterior ovary to the left.

Male : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : North East England : Blyth estuary, South West England : Exe estuary, South West England : Tamar estuary, Essex : Skippers Island, North East coast of England, British Isles and North Wales.

Remarks : The specimens agree well with the earlier description (Platt & Warwick, 1988). This is the first record of the species from the Indian waters.

Family COMESOMATIDAE Filipjev, 1918

2. *Parcomesoma dubium* (Filipjev, 1918)

(Figs. 3-4)

Material examined : 3 males, Pichavaram mangrove, 28.01.02.

Description (Male) : Body length 1.3-1.4 mm. Maximum diameter of body 37-40 μm . Cuticle smooth, without punctation; six small labial papillae. Six anterior cephalic setae; four 5-6 μm posterior cephalic setae; four files of setae upto 3-4 μm long in oesophageal region and numerous short setae on tail but setae sparse in mid-body region. Amphids spiral, of 3 turns, 6-8 μm wide. Buccal cavity conical with three small pointed triangular teeth. Tail distal third cylindrical, 2.6-2.8 a.b.d. Spicules long, 170-180 μm in length slender, curved with delicate ventral ala. Gubernaculum small, in three pieces and without apophysis.

Female : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : South West England : Tamar estuary, Island of Scilly and British Isles.

Remarks : The material examined conforms well with earlier description, except for the smaller body size. The total body length described was 2.8 mm and tail length varied between 4.8-5.0 a.b.d. (Platt & Warwick, 1988). The body length of the specimen studied at present is lesser being 1.3-1.4 mm and tail 2.6-2.8 a.b.d. This is the first record of the species from the Indian waters.

Family DESMODORIDAE Filipjev, 1922

3. *Desmodora (Desmodorella) tenuispiculum* Allgen, 1928

(Figs. 5-6)

Material examined : 7 males, Pichavaram mangrove, 28.01.02.

Description (Male) : Body length 0.8-0.9 mm. Maximum diameter of body 58-66 μm . Cuticle with coarse transverse striation and longitudinal files of ridges; posterior part of cephalic capsule with rounded punctations. Six slender 1 μm labial setae; six slender 3-4 μm and four stouter 3-5 μm cephalic setae, the lateral level with the anterior of the amphids; four short subcephalic setae on cephalic capsule posterior to amphids. Amphids spiral, of 2.5 turns, 10-12 μm wide. Buccal cavity

with weakly cuticularised dorsal tooth. Oesophagus with distinct posterior bulb. Tail conical with unstriated tip, 1.1-1.6 a.b.d. Spicules 1.0-1.1 a.b.d., slender, indistinct and precloacal supplements absent.

Female : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : Northumberland coast, North East England and British Isles.

Remarks : The material examined conforms well with the earlier description, except for larger body size. The total body length described varied between 0.7-0.8 mm and tail 2.4-2.5 a.b.d. (Platt & Warwick, 1988). The body length of the present specimen is more being 0.8-0.9 mm, but tail was shorter 1.1-1.6 a.b.d. This is the first record of the species from the Indian waters.

Family LEPTOLAIMIDAE Orley, 1880

4. *Camacolaimus barbatus* Warwick, 1970

(Figs. 7-8)

Material examined : 5 females, Pichavaram mangrove, 29.01.02.

Description (Female) : Body length 0.4-0.58 mm. Maximum diameter 25-26 μm . Cuticle with widely spaced transverse striations. Six anterior cephalic sensilla minute, conical, papilliform; four short 2 μm cephalic setae. Amphids spiral, of 2.5 turns, 5 μm wide. Buccal cavity with a long style-like dorsal tooth 23-26 μm long, with a prominent shoulder near its distal tip. Oesophagus narrow cylindrical. Tail conical and pointed (3.1-3.3 a.b.d.), unstriated spinneret. Ovaries paired and reflexed.

Male : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : Exe estuary, South West England and British Isles.

Remarks : The specimens examined agree well with the earlier description, except for the smaller body size. The total body length described varied between 1.8-2.0 mm and tail 3 a.b.d. (Platt & Warwick, 1988). The body length of the present specimen is very much lesser (0.4-0.58 mm), but tail was longer 3.1-3.3 a.b.d. This is the first record of the species from the Indian waters.

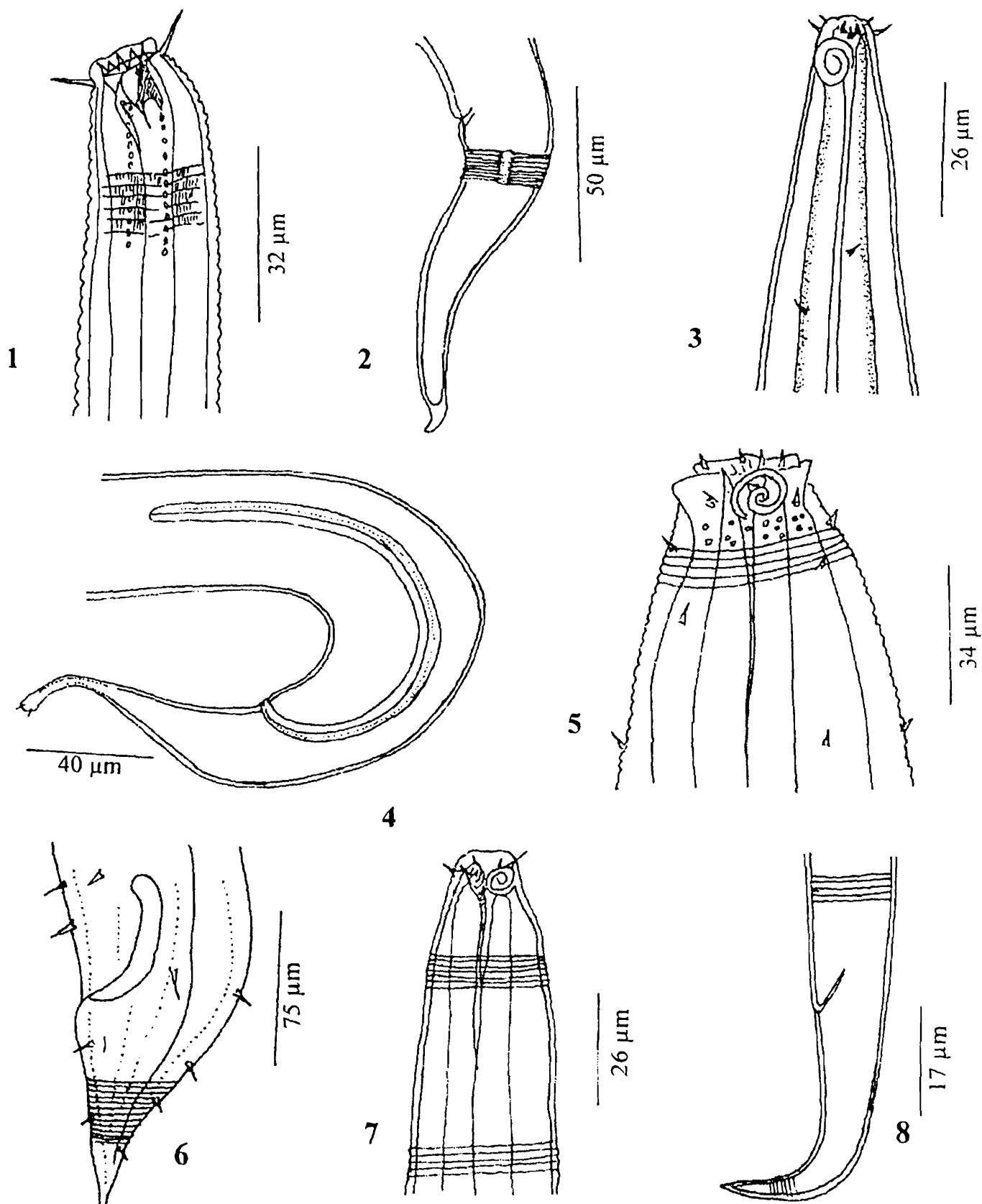
Family HALIPECTIDAE Chitwood, 1951

5. *Haliplectus dorsalis* Cobb in Chitwood, 1956

(Figs. 9-10)

Material examined : 2 males, Pichavaram mangrove, 29.01.02.

Description (Male) : Body length 0.75-0.86 mm. Cephalic sensilla absent. Amphids circular, 2.5-3 μm wide. Buccal cavity narrow, tubular. Oesophagus only weakly muscular in anterior part,



Figs. 1-8. : *Ptycholaimellus ponticus* (Female); 1. Anterior region, 2. Posterior region; 3-4. *Paracomesoma dubium* (Male); 3. Anterior region, 4. Posterior region; 5-6. *Desmodora (Desmodorella) tenuispiculum* (Male); 5. Anterior region, 6. Posterior region; 7-8. *Camacolaimus barbatus* (Female); 7. Anterior region, 8. Posterior region.

but with a small bulb in the middle and a large posterior bulb with a well cuticularized lining. Cuticle striated without lateral differentiation. Tail conical, 2.1-2.3 a.b.d. Spicules short, 1.5 a.b.d.

Female : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : Skippers Island; Essex and British Isles.

Remarks : The specimens examined agree well with the earlier description, except for the larger body size. The total body length described was 0.7 mm and tail 1.8 a.b.d. (Platt & Warwick, 1988). The body length of the present specimen is 0.75-0.86 mm and tail 2.1-2.3 a.b.d. This is the first record of the species from the Indian waters.

Order MONHYSTERIDA

Family MONHYSTERIDAE De Man, 1876

6. *Thalassomonhystera parva* (Bastian, 1865)

(Figs. 11-12)

Material examined : 2 females, Pichavaram mangrove, 29.01.02.

Description (Female) : Body length 0.9-1.3 mm. Maximum diameter of body 28-30 μm . Cuticle smooth, cephalic setae 3 μm . Amphids circular, 4.5-5 μm in diameter. Buccal cavity simple conical. Oesophagus without posterior bulb. Tail evenly tapering, without terminal setae, 8.1-8.4 a.b.d.

Male : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : South West England : Falmouth and Plymouth, Isles of Scilly, Rockall, off West Ireland, South West England : Exe and Fal estuary, British Isles.

Remarks : The present specimens had a larger body size. The body length being 0.9-1.3 mm and tail 8.1-8.4 a.b.d. The total body length described earlier varied between 0.6-0.7 mm and tail 7.7 a.b.d. (Warwick *et al.*, 1998). This is the first record of the species from the Indian waters.

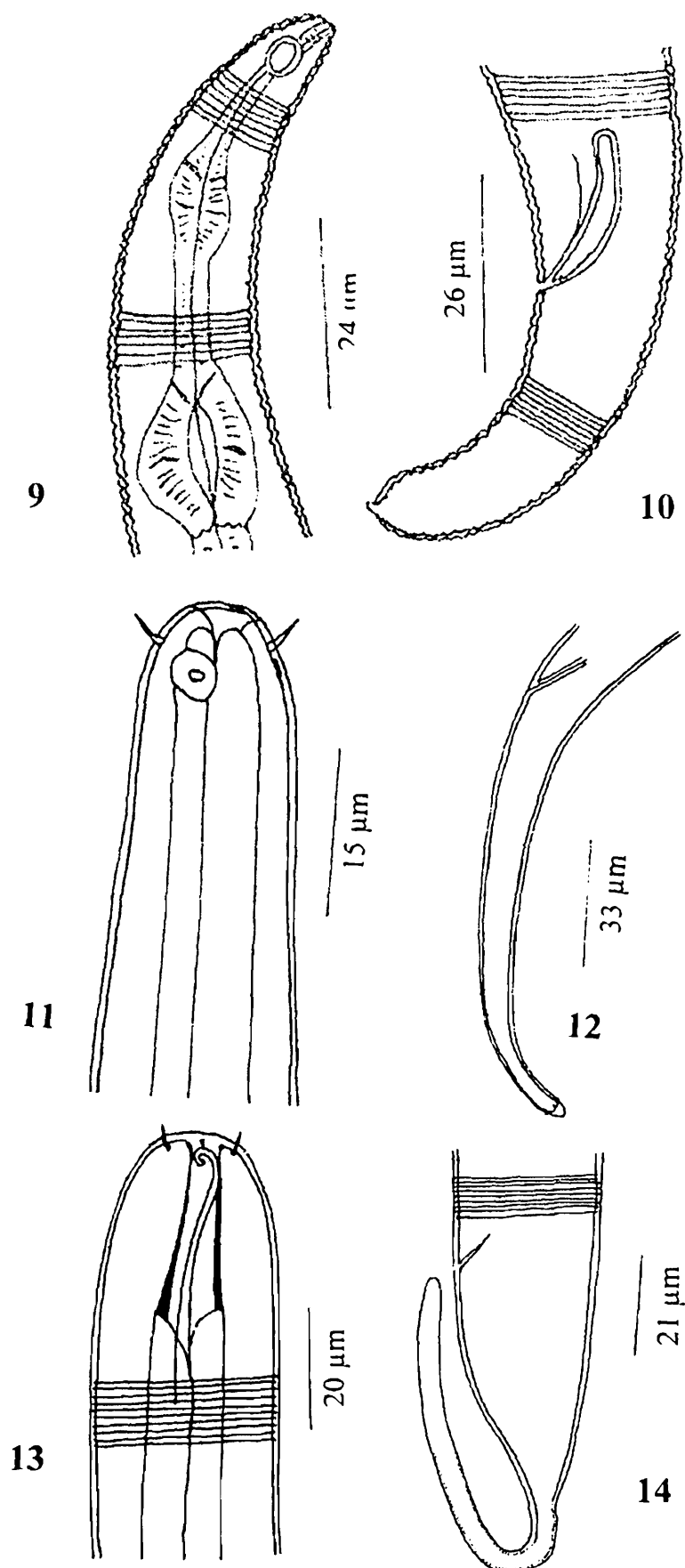
Family AXONOLAIMIDAE Filipjev, 1918

7. *Pseudolella* sp Cobb, 1920

(Figs. 13-14)

Material examined : 2 females, Pichavaram mangrove, 29.01.02.

Description (Female) : Body length 0.6-0.8 mm. Maximum width of body 33-34 μm . Cuticle striated. Six smaller and four longer cephalic setae. Buccal cavity large, 32-34 μm in length. Ventral



Figs. 9-14. : 9-10. *Haliplectus dorsalis* (Male); 11-12. *Thalassomonhystera parva* (Female); 13-14. *Pseudolella* sp (Female); 9, 11,13. Anterior region; 10, 12,14. Posterior region.

limp of amphids elongated, 44 μm in length. Oesophagus small bulb in posterior portion. Tail conical, 4.6 a.b.d. Ovaries paired.

Male : Not found.

Distribution : India (Tamil Nadu) : Pichavaram mangrove.

Elsewhere : British Isles.

Remarks : The specimens agree well with the earlier description of the genus. It was difficult to identify the species of the present specimen. This is the first record of the genus from Indian waters.

SUMMARY

In the present study 6 species (*Ptycholaimellus ponticus*, *Paracomesoma dubium*, *Desmodora* (*Desmodorella*) *tenuispiculum*, *Camacolaimus barbatus*, *Haliplectus dorsalis* and *Thalassomonhystera parva*) and 1 genus (*Pseudolella* sp) of free-living marine nematodes belonging to 2 orders and 7 families are recorded for the first time from Indian waters from intertidal sediments of Pichavaram mangroves, Southeast coast of India. Krishnamurthy *et al.* (1984) recorded 27 genera and 4 species from the same study area. Rao (1986) recorded 15 genera and 14 species from south Andaman Islands. Sinha *et al.* (1987) has recorded a new species of nematode *Anoplostoma macrospiculum* from the mangrove environment of deltaic Sundarbans, West Bengal, India, however none of them had been recorded earlier.

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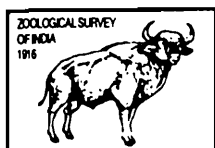
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REFERENCES

- Alongi, D.M., 1987a. Inter-estuary variation and intertidal zonation of free-living nematode communities in tropical mangrove systems. *Mar. Ecol. Prog. Ser.*, **40** : 103-114.
- Alongi, D.M., 1987b. Intertidal zonation and seasonality of meiobenthos in tropical mangrove estuaries. *Mar. Biol.*, **95** : 447-458.
- Alongi, D.M., 1990. Community dynamics of free-living nematodes in some tropical mangrove and sandflat habitats. *Bull. Mar. Sci.*, **46** : 358-373.
- Decraemer, W. & Coomans, A., 1978. Scientific report on the Belgian expedition to the Great Barrier Reef in 1967. Nematodes XII. Ecological notes on the nematode fauna in and around mangroves on Lizard Island. *Aust. J. Mar. Freshw. Res.*, **29** : 497- 508.

- Hodda, M. & Nicholas, W.L., 1985. Meiofauna associated with mangroves in the Hunter river estuary and Fullerton cove, South-Eastern Australia. *Aust. J. Mar. Freshw. Res.*, **36** : 41-50.
- Hodda, M. & Nicholas, W.L., 1986. Temporal changes in littoral meiofauna from the Hunter river estuary. *Aust. J. Mar. Freshw. Res.*, **37** : 729-741.
- Hopper, B.E., Fell, J.W. & Cefalu, R.C., 1973. Effect of temperature on life cycles of nematodes associated with the mangrove (*Rhizophora mangle*) detrital system. *Mar. Biol.*, **23** : 293-296.
- Jensen, P., 1978. Revision of Microlaimidae, erection of Molgolaimidae fam. N., and remarks on the systematic position of *Paramicrolaimus* (Nematoda, Desmodorida). *Zool. Scr.*, **7** : 159-173.
- Jensen, P., 1979. Revision of Comesomatidae (Nematoda). *Zool. Scr.*, **8** : 81-105.
- Krishnamurthy, K., Sultan Ali, M.A. & Jeyaseelan, M.J.P., 1984. Structure and dynamics of the aquatic food web community with special reference to nematodes in mangrove ecosystem. In: Soepadmo, E., Rao A.N. & MacIntosh D.J. (eds.), *Proc. As. Symp. Mangr. Env. -Res. & Manag.*, University of Malaya, Kuala Lumpur. pp. 429-452.
- Nicholas, W.L. & Stewart, A.C., 1993. The nematode fauna of two estuarine mangrove mud-flat on the South coast of New South Wales. *Wetlands* (Australia), **12** : 16-28.
- Nicholas, W.L., Elek, J.A., Stewart A.C. & Marples, T.G., 1991. The nematode fauna of a temperate Australian mangrove mudflat; its population density, diversity and distribution. *Hydrobiologia*, **209** : 13-27.
- Olafsson, E., 1995. Meiobenthos in mangrove areas in Eastern Africa with emphasis on assemblage structure of free-living marine nematodes. *Hydrobiologia*, **312** : 47-57.
- Olafsson, E., Carlstrom, S. & Ndaro, S.G.M., 2000. Meiobenthos of hypersaline tropical mangrove sediment in relation to spring tide inundation. *Hydrobiologia*, **426** : 57-64.
- Platt, H.M. & Warwick, R.M., 1980. The significance of nematodes to the littoral ecosystem. In: Price, J.H., D.E.C. Irvine & W.H. Farnham (eds.) '*The shore Environment, Vol. 2-Ecosystems*' (Academic Press: London.). pp. 729-759
- Platt, H.M. & Warwick, R.M., 1983. Free-living marine nematodes. Part I: British Enoplids. *Synopses of the British Fauna (New Series) No. 28*, Cambridge University Press. 307pp.
- Platt, H.M. & Warwick, R.M., 1988. Free-living marine nematodes. Part II: British Chromadorids. *Synopses of the British Fauna (New Series) No. 38*, Brill, E.J., Leiden, 501pp.
- Rao, G.C., 1986. Meiofauna of the mangrove sediments in South Andaman. *J. Andaman Sci. Assoc.*, **2(2)** : 23-32.
- Sinha, B., Choudhury, A. & Baqri, Q.H., 1987. Studies on the nematodes from mangrove swamps of deltaic Sundarbans, West Bengal, India. III. *Anoplostoma macrospiculun* N. sp. (Anoplostomatidae: Nematoda). *Curr. Sci.*, **56(11)** : 539-540.

- Somerfield, P.J., Gee, J.M. & Aryuthaka, C., 1998. Meiofaunal communities in a Malaysian mangrove forest. *J. Mar. Biol. Ass. U.K.*, **78** : 717-732.
- Vanhove, S., Vincx, M., Van Gansbeke, D., Gijssels, W. & Schram, D., 1992. The meiobenthos of five mangrove vegetation types in Gazi Bay, Kenya. *Hydrobiologia*, **247** : 99-108.
- Warwick, R.M., Platt, H.M. & Somerfield, P.J., 1998. Free-living marine nematodes. Part III: *British Monhysterids*. *Synopses of the British Fauna (New series) No. 53*, Shrewsbury: Field Studies Council, 296pp.



Rec. zool. Surv. India : **106**(Part 4) : 55-60, 2006

ON A COLLECTION OF SOIL ORIBATID MITES FROM SANDAKPHU, DARJEELING, WEST BENGAL, INDIA

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INTRODUCTION

Taxonomic studies on oribatid mites of Darjeeling Himalayas have been done by a number of workers like Chakrabarti and Mondal (1981), Mondal and Kundu (1983, 1986 and 1988) and Ghosh and Roy (2004). However, not much information is available on oribatid fauna in altitudes higher than 3000m in the Darjeeling Himalayas of West Bengal.

In the present paper an account of oribatid mites, collected from Sandakphu (alt. 3636 m) is given. Sandakphu, the highest peak of West Bengal is located in Singalila range of the Darjeeling Himalayas of the state. This is a well-vegetated place under the temperate climatic zone of West Bengal. Temperature is low throughout the year and often falls below 0°C in winter. Fog and snowfall are common here. Relative humidity (69%-92%), soil moisture (22%-42%) and annual average rainfall (300-400 cm) are quite high in the region. Common trees in the area include *Arundinaria racemosa* (common bamboos of the hill), different species of *Rhododendron*, *Lithocarpus pachyphylla*, *Quercus spicata*, *Acer campbelii*, *Magnolia campbelii*, etc.

MATERIALS AND METHODS

Soil samples with litter were collected by shovel up to a depth of 10cm of soil profile and brought to laboratory in polythene bags. Extraction was done by a battery of Tullgren funnel apparatus and mites were collected in vials with 90% alcohol and treated with a mixture of lactic acid and 90% alcohol (1 : 1) before identification.

Identification of specimens was done by consulting the keys prepared by Balogh and Balogh (1992) and the checklist of world oribatid mites by Subias (2004). The identified collections are

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deposited in the National Zoological Collection, Zoological Survey of India, Kolkata. All the specimens recorded in this paper are collected by the first author.

SYSTEMATIC ACCOUNT

I. Family PHTHIRACARIDAE Perty, 1841

1. *Hoplophorella vitrina* (Berlese, 1913)

1913. *Hoploderma* (H.) *vitrina* Berlese, Red. Firenze, **9** : 77-111.

1967. *Hoplophorella africana* Wallwork, *Revue. Zool. Bot. Afr.*, **75** : 35-45.

2004. *Hoplophorella* (H.) *vitrina*, Subias, *Graellsia*, **60** (numero extraordinario) : 49.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

2. *Hoplophthiracarus tropicus* Mondal and Kundu, 1988

1988. *Hoplophthiracarus tropicus* Mondal and Kundu, *Rec. zool. Surv. India*, **85**(1) : 111-116.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004; 3 ♀ ♀; Sandakphu, Darjeeling; 20. iv. 2005.

3. *Phthiracarus* (P.) *claviger* (Pearce, 1906)

1906. *Hoploderma claviger* Pearce, *Journ. Roy. Micr. Soc.*, 273.

2004. *Phthiracarus* (P.) *claviger*, Subias, *Graellsia*, **60** (numero extraordinario) : 53.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : The genus and the species are recorded here for the first time from the Darjeeling Himalayas.

II. Family EUPHTHIRACARIDAE Jacot, 1930

4. *Acrotrititia otaheitensis* (Hammer, 1972)

1972. *Rhysotrititia ardua* var. *otaheitensis* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, **19**(3) : 12.

2004. *Acrotrititia otaheitensis*, Subias, *Graellsia*, **60** (numero extraordinario) : 46.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : This is first record of genus and species from Darjeeling.

5. *Acrotrititia furcuta* (Bayumi and Mahunka, 1979)

1979. *Rhysotrititia furcuta* Bayumi and Mahunka, *Entomologia Basiliensia*, **4** : 13-24.

2004. *Acrotrititia furcuta*, Subias, *Graellsia*, **60** (numero extraordinario) : 45.

Material examined : 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

III. Family OPPIDAE Sellnick, 1937

6. *Quadroppia* sp.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

IV. Family HYPOCHTHONIIDAE Berlese, 1910

7. *Hypochthonius rufulus* Koch, 1836

1836. *Hypochthonius rufulus* Koch, 1836 *Deutschlands Crustaceen, Myriapoden und Arachniden*, 3.

Materials examined : 3 ♀ ♀, 2 ♂ ♂; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : The species is recorded for the first time from West Bengal.

V. Family NOTHRIDAE Berlese, 1896

8. *Nothrus gracilis* Hammer, 1961

1961. *Nothrus gracilis* Hammer, *Biol. Skr. Dan. Vid. Selsk.*, 13(1) : 28.

Materials examined : 3 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 19. xi. 2004.

9. *Nothrus* sp.

Materials examined : 2 ♂ ♂; Sandakphu, Darjeeling; ex. soil and litter; 20.iv. 2005.

VI. Family ORIBOTRITIIDAE Grandjean, 1954

10. *Oribotritia gigas* Bayumi and Mahunka, 1979

1979. *Oribotritia gigas* Bayumi and Mahunka, *Entomologia Basiliensia*, 4 : 13-24.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : This is first record of the genus and species from West Bengal.

VII. Family NANHERMANNIIDAE Sellnick, 1928

11. *Masthermannia* sp.

Materials examined : 3 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

VIII. Family SUCTOBELBIDAE Jacot, 1938

12. *Rhynchobelba* sp.

Materials examined : 2 ♀ ♀; Sandakphu, Darjeeling; ex. soil under grass; 18. xi. 2004.

Remarks : This is first record of the genus from India.

IX. Family TETRACONDYLIDAE Aoki, 1961

13. *Dolicheremaeus speciosus* (Pearce, 1906)

1906. *Amerus speciosus* Pearce, *Journ. Roy. Micr. Soc.*, 272.

2004. *Dolicheremaeus speciosus*, Subias, *Graellsia*, **60** (*numero extraordinario*) : 143.

Materials examined : 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004. 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 20. iv. 2005.

Remarks : The species is recorded here for the first time from Darjeeling.

X. Family PTEROCHTHONIIDAE Grandjean, 1950

14. *Pterochthonius* sp.

Material examined : 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 19. xi. 2004.

Remarks : The genus is recorded for the first time in India.

XI. Family CARABOCEPHEIDAE Mahunka, 1986

15. *Carabocephus* sp.

Materials examined : 2 ♂♂; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : This is the first record of the genus from India.

XII. Family CARABODIDAE Koch, 1837

16. *Trichocarabodes* sp.

Materials examined : 2 ♀♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

Remarks : This is the first record of the genus from India.

XIII. Family TECTOCEPHEIDAE Grandjean, 1954

17. *Tectocephus velatus* Michael, 1888

1888. *Tectocephus velatus* Michael, *Ray. Soc.*, 65.

Materials examined : 2 ♀♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004. 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 20. iv. 2005.

18. *Tectocephus* sp.

Materials examined : 2 ♀♀; Sandakphu, Darjeeling; ex. soil and litter; 19. xi. 2004.

XIV. Family CERATOZETIDAE Jacot, 1925

19. *Ceratozetes gracilis* Michael, 1884

1884. *Ceratozetes gracilis* Michael, *British Oribatidae*, London : 8, xi & 336.

Material examined : 1 ♀; Sandakphu, Darjeeling; ex. soil and litter; 18. xi. 2004.

XV. Family AUSTRACHTERIIDAE Luxton, 1985

20. *Lamellobates (L.) molecula molecula* Berlese, 1916

1916. *Achipteria molecula* Berlese, *Red. Firenze*, 12 : 289-338.

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

2004. *Lamellobates (L.) molecula molecula*, Subias, *Graellsia*, 60 (numero extraordinario) : 167.

Materials examined : 4 ♀ ♀; Sandakphu, Darjeeling; ex. soil and litter; 20. iv. 2005.

SUMMARY

The paper contains the record of 20 species under 17 genera and 15 families of soil and litter inhabiting oribatid mites collected from Sandakphu (3636 m), Darjeeling, West Bengal. Of these, 4 genera are recorded here for the first time in India. Further 2 genera and 2 species and 2 genera and 3 species are recorded as first time from West Bengal and Darjeeling district, respectively.

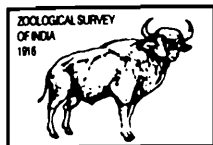
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REFERENCES

- Balogh, J. and Balogh, P. 1992. *The oribatid mites genera of the world*. Hungarian Natural History Museum, Budapest, I : 263 pp; II : 375 pp.
- Chakrabarti, D. K. and Mondal, B. K. 1981. Taxonomic investigations on the oribatid fauna (Acari) of forest and tea soil in Darjeeling, West Bengal, India. *Sci. & Cult.*, 47(5) : 181-183.
- Ghosh, T. C. and Roy, S. 2004. Distribution and diversity of acarine community in three gardens at different altitudes of Darjeeling Himalayas. *Proc. zool. Soc., Calcutta*. 57(2) : 87-93.
- Mondal, B. K. and Kundu, B. G. 1983. A new species of *Pseudotocepheus* (Acari : Otocepheidae) from Darjeeling, India. *Indian J. Acar.*, 8(2) : 63-67.

- Mondal, B. K. and Kundu, B. G. 1986. A new species of Otocepheidae (Acari : Oribatei) from Darjeeling, India. *Bull. zool. Surv. India*, **83** : 91-96
- Mondal, B. K. and Kundu, B. G. 1988. Two new species of oribatid mites (Acari) of the genus *Hoplophthiracarus* Jacot, from Darjeeling, India. *Bull. zool. Surv. India.*, **85** : 111-118.
- Subias, L. S. 2004. Systematic, synonymical and biogeographical check-list of the world's oribatid mites (Acariformis, Oribatida) (1758-2002). *Graellsia*, **60** (*numero extraordinario*) : 3-305.



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ON A COLLECTION OF SOIL PROSTIGMATID MITES (ACARI) FROM SOUTHERN PARTS OF WEST BENGAL, INDIA

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INTRODUCTION

Mites form very important biotic component in soil, litter, mosses and lichens. Any sample from these environs will reveal the occurrence of a large number of species. These are important not only because of the fact that they help in biodegradation of soil organic matter and enrich fertility but also help in recycling of soil nutrients and help in dispersal of soil fungi which, in turn, help in biodegradation process. Many of the soil prostigmatid mites are useful predators of soil insects and nematodes. Among the soil mites, the prostigmatid mite fauna of India has not been properly explored as evident from the fact that only 26 spp. under 16 genera and 7 families are so far known from soil, of those 11 spp. under 4 genera and 2 families are known from West Bengal (in Prasad, 1974; Gupta, 1991).

This indicates that there is a vast scope to explore prostigmatid mite fauna from soil and indepth taxonomic study will reveal many interesting and hitherto unrecorded species. While in other orders like Cryptostigmata over 500 spp. (Sanyal, 1991) and Mesostigmata 156 spp. (Bhattacharya *et al.*, 1996) are known from India.

Because of being highly fragile, soft bodied, and colourless bodies of these mites, these mites are often ignored during the process of sorting of soil extracted mite specimens considering these as immature stages, although it is a fact that this habitat is highly rich with the prostigmatid mite fauna.

Cosidering the inadequacy of knowledge in this group of mites, the authors carried out survey of these mites in West Bengal during 2003-2005 and results thereof are presented in this paper.

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MATERIAL AND METHODS

The mite specimens studied in this paper were collected from soil samples taken from Howrah, Hooghly, 24-Parganas (N), 24-Parganas (S), East Medinipur and West Medinipur districts of West Bengal. The samples were extracted by using the standard method of extraction with the Tullgren funnel apparatus. The identified specimens are deposited in the National Zoological Collection, Zoological Survey of India, Kolkata.

SYSTEMATIC ACCOUNT

Order PROSTIGMATA

Family 1. TYDEIDAE Kramer

1. *Pronematus tenuisetosus* Meyer & Rodrigues

1966. *Pronematus tenuisetosus* Meyer & Rodrigues, *Garcia Orta*, **13**(2) : 1-33.

1968. *Pronematus tenuisetosus*, Baker, *Annals Ent. Soc. Amer.* **61**(5) : 1096.

Collection Records : One female; vegetable field, Janglepara, Uday Narayanpur, Howrah, West Bengal; from soil rich with leaf litter; 20.ix.2003.

Remarks : This was described basing on collection made on *Gossypium* sp. in Mozambique and therefore its record on leaf litter is a new habitat record.

2. *Pronematus* sp.

Collection Records : One male; village area, Bargachia, Howrah, West Bengal; from soil; 22.ix.2003.

Remarks : The specimen was in badly damaged condition and hence specific determination could not be done.

3. *Parapronematus* sp.

Collection Records : One male, one female; mango and banana garden, Maheshpur, Simlapole, Chinsura, Hooghly, West Bengal; from soil; 25.ix.2003.

Remarks : The specimen was damaged during the process of extraction of soil litter sample and therefore further identification was not possible.

4. *Paralorryia* sp.

Collection Records : Two males collected from organic manure dumping ground, Basirhat, 24-Parganas (North), West Bengal; from soil; 27.ix.2003.

5. *Triophtydeus* sp.

Collection Records : One male, one female; vegetable field, Narna, Bhaskur, Howrah, West Bengal; from soil; 22.ix.2003; one male, one female; fruit garden, Gayeshpur, Howrah, West Bengal, from soil; 8.iv.2004; one male; flower garden, Bagur, Deulia Bazar, East Medinipur, West Bengal; from soil; 20.iii.2005; three females; Kamal nursery, Minitikiri, East Medinipur, West Bengal; from soil; 20.iii.2005; one male; Shilamon, Mohalishoi, West Medinipur, West Bengal; from soil; 22.iii.2005; one male; Khapramari, Mohalishoi, West Medinipur, West Bengal; from soil; 22.iii.2005.

Remarks : Baker (1965) described a species *Triophtydeus alaskansis* collected on *Salex* sp, in quarantine. The occurrence of this species in soil is therefore a record of new habitat.

6. *Microtydeus* sp.

Collection Records : One male; vermicompost ground, Babubazar, Babughat, Bhaddreshwar, Hooghly, West Bengal; from soil; 4.iv.2004.

Remarks : Normally, the specimens of this genus are inhabitants of moss. However, in the present case it was collected from soil and therefore it is a new habitat record.

7. *Tydeus* sp.

Collection Records : One male, one female; orchard, Gazipur, Amta, Howrah, West Bengal; from soil; 7.iv.2004; one female; Social Forestry area of Dakshinsole, Arabari, West Medinipur, West Bengal; from soil; 25.ix.2004.

Remarks : It was damaged while mounting.

8. *Paratriophtydeus* sp.

Collection Records : One male; Chowkisolet forest of Ramgarh, Goaltore, West Medinipur, West Bengal; from soil; 23.iii.2005.

Remarks : The specimen of this genus are habitants of mosses and lichens and soil therefore is a new habitat record.

Family 2. CUNAXIDAE Thor

9. *Cunaxa* sp. nr. *setirostris* (Hermann)

Collection Records : Two males; Agricultural field, Buroshibtola, North Kalyanpur, 24-Parganas (South), West Bengal; from soil; 21.ix.2004; one female; vegetable field, Nasibpur, Hooghly, West Bengal; from soil; 24.ix.2004.

Remarks : The present specimen is very close to *C. setirostris* in having almost similar palpal chaetotaxy but the spines on genu and tibiotarsus are relatively smaller. Inadequate material did not allow further identification.

10. *Cunaxa* sp. nr. *carina* Den Heyer

Collection Records : One male; vermicompost ground, Babubazar, Babughat, Bhaddreshwar, Hooghly, West Bengal; from soil; 4.iv.2004.

Remarks : Den Heyer (1979) collected *Cunaxa carina* from litter in South Africa. The present specimen also collected from litter is close to *C. carina* but final decision regarding identity could not be taken pending study of further material.

11. *Dactyloscirus* sp.

Collection Records : One female; vegetable ground, Jamtola, 24-Parganas (South), West Bengal; from soil; 16.iii.2005.

Remarks : The members of this genus occur in bark, litter, leaf etc. From India three species are known (Gupta, 2002) but the present one differs from all the known species in dorsal chaetotactic pattern. Final decision regarding identification will be taken after studying further material.

12. *Coloscirus* sp.

Collection Records : One female; mango garden, Gazipur, Amta, Howrah, West Bengal; from soil; 7.iv.2004.

Remarks : The members of this genus are inhabitants of soil, litter, pine cone, leaves, etc. The present specimen collected from soil is being recorded here for the first time in India and no member of this genus was earlier reported from India.

13. *Parabonzia* sp.

Collection Records : One male, one female; vermicompost ground, Babubazar, Babughat, Bhaddreshwar, Hooghly, West Bengal; from soil; 2.iv.2004.

Remarks : The members of this genus occur in soil rich, in organic matter, tree hole, litter, etc. (Smiley, 1992) and earlier this genus was not recorded from India. Final decision regarding identity will be taken after further study and collection of additional material.

14. *Neocunaxoides* sp.

Collection Records : One female; Chowkiso forest, Ramgarh, Goaltore, West Medinipur, West Bengal; from soil; 23.iii.2005.

Remarks : So far only four species of this genus are known from India (Gupta, 2002). The specimen collected in the present case did not tally with any of those. Further examination is on with the collection of additional material and the result thereof will be published elsewhere.

15. *Scirula* sp. nr. *impressa* Berlese

Collection Records : One male; paddy field, Haripur Hattala, Taki, 24-Parganas (North), West Bengal; 2.iv.2004.

Remarks : This genus was so far not reported from India. The present species appears to be a new one which will be described elsewhere.

Family 3. CHEYLETIDAE Leach

16. *Cheyletus fortis* Oudemans

Collection Records : One male; village area, Bargachhia, Howrah, West Bengal; from soil; 22.ix.2003.

Remarks : This mite species is more common in storage habitats and has also has been recorded on tree trunk, leaf (Gupta, 2002). Therefore is occurrence in soil is interesting.

17. *Cheyletus malaccensis* Oudemans

Collection Records : One female; vegetable field, Bargachhia, Howrah, West Bengal; from soil; 22.ix.2003.

Remarks : This mite is known from habitats like paddy, guava, magnolia, debris, leg horn, skin of bird (Gupta, 2002) and is not known from habitat like soil.

18. *Chelacaropsis moorei* Baker

Collection Records : One male; Khapramari, Mohalishoi, West Medinipur, West Bengal; from soil; 22.iii.2005.

Remarks : Earlier records of this species in India are from garlic, in association with *Aceria tulipae* and paddy in association with paddy. Therefore, soil is the new habitat of this species.

Family 4. ERYTHRAEIDAE Robineau-Desvoidy

19. *Paraerythraeus indicus* Khot

1963. *Paraerythraeus indicus* Khot, *Acarologia*, **5** : 236-238.

Collection Records : One male; guava garden, Bamungachi, Baruipur, 24-Parganas (South), West Bengal; from soil; 20.ix.2004.

Remarks : The earlier record of this species is from debris in Madhya Pradesh and hence soil is the new habitat of this species and is reported here for the first time from West Bengal.

Family 5. TARSONEMIDAE Kramer

20. *Tarsonemus* sp.

Collection Records : One male; Maheshpur, Chinsura, Hooghly, West Bengal; from soil; 25.ix.2003.

Remarks : The specimen was damaged during extraction and mounting.

Family 6. BDELLIDAE Duges

21. *Bdellodes* sp.

Collection Records : One male; vermicompost ground, Babubazar, Babughat, Bhaddreshwar, Hooghly, West Bengal; from soil; 4.iv.2004.

Remarks : The specimen was damaged during extraction and mounting.

Family 7. TROMBIDIIDAE Leach

22. *Trombidium gigas* Trouessart

1894. *Trombidium gigas* Trouessart, *Ann. Soc. Ent. Fr.*, **63** : 92.

1931. *Trombidium gigas*, Cherian, *J. Asiat Soc. Beng.*, **27** : 141-147.

Collection Records : One male; flower garden, Bagur, Deulia Bazar, East Medinipur, West Bengal; from soil; 20.iii.2005.

Remarks : Earlier it was recorded from soil in Tamil Nadu.

Family 8. RAPHIGNATHIDAE

23. *Undetermined* sp.

Collection Records : One male; Maheshpur, Chuchura, Hooghly, West Bengal; from soil; 25.ix.2003.

Family 9. SCUTACARIDAE Oudemans

24. *Diversipes simplex* Mahunka

1971. *Diversipes simplex* Mahunka, *Acta Zool. Acad. Sci. Hungaricae*, **17** : 26-27.

Collection Records : One male; vegetable garden, Sripur, Khukurdah, East Medinipur, West Bengal, from soil; 19.iii.2005.

Remarks : Earlier record of this species was from mossy fern from Orissa and this is the first record from West Bengal and soil is the new habitat.

Family 10. PYGMEPHORIDAE

25. *Bakerdania spinifera* Mahunka

1971. *Bakerdania spinifera* Mahunka, *Acta zool. Acad. Sci. Hung.*, **17**(1-2) : 21-22.

Collection Records : One male; kitchen garden of C.I.S.F. House, Haldia, East Midnapur, West Bengal; from soil; 22.ix.2004.

Remarks : Mahunka (1971) recorded it from soil of West Bengal.

Family 11. OEHSERCHESTIDAE

26. *Oehserchestes* sp.

Collection Records : One male; central nursery, Arabari, near Chandrakona road, West Medinipur, West Bengal; from soil; 26.ix.2004.

Remarks : A very interesting species of this genus was collected from soil which does not tally with any of the known species of this genus. The family and the genus were previously unknown from India. The material is under study and final decision regarding its identity will be taken with the availability of further material.

**Key to the families and genera of soil Prostigmatid mites
collected from Southern West Bengal**

1. Females (rarely males) with a pair of anterolateral stigmata and associated trachea; peritreme absent. Opisthosoma generally showing indication of segmentation; palpi often 2 segmented, greatly reduced and closely appressed to a small capsulate gnathosoma Cohort Eleutherengonina
..... sub-cohort Heterostigmae, 7
- Females and males with stigmata between cheliceral bases or on posterodorsal margin of gnathosoma, or stigmata absent; peritreme often present in stigmatiform forms, extending along anterior propodosomal margins. Opisthosoma without indications of segmentation. Gnathosoma variously shaped, generally conspicuous with articulated palpi 2
2. Palpal thumb claw process in all stages, primarily terrestrial form 7
- Palpi simple, chelate or produced distidorsally in postlateral instars, rarely flange-like, occasionally absent; larvae of aquatic species may have a palpal thumb-claw process 3
3. Prodorsal sensilla present, hair-like or variously produced but differing in form from other prodorsal setae, inserted in bothridia 4
- Prodorsal sensilla absent, prodorsal setae paired, similar in size and form, or absent 9

4. Chelicerae free, broad basally, narrowed apically, often chelate or hooked terminally, inserted on elongated rostral snout in such a way that lateral motion possible with trichobothria on various leg segments Bdelloidea, 5
- Chelicera free or fused without lateral motion, inserted on or fused with short rostrum, leg trichobothria absent 6
5. Palpi long, antenniform, often elbowed typically with strong distal setae, with 3 pairs of genital acetabula Bdeiliidae
- Palpi extending beyond gnathosoma or equal to chelae in length terminating in tarsal claw (exception *Parabongia*) with 2-3 pairs of acetabula Cunaxidae, 18
6. Cheliceral digits opposed, cheliceral bases free *
- *Claws present on tarsi II-IV, present or absent on tarsus I **
- **With one pair of prodorsal sensilla, tarsus I without true claws, with or without empodi ..
..... Oehserchestidae
- Fixed cheliceral digits, cheliceral bases fused or contiguous along their mesal edges of movable digits short, needle-like Tydeidae, 12
7. Leg IV of female with separate femora and genua, often with claws and membranous empodia, leg IV of female 5 segmented Pygmephoroidae, 8
- Legs IV of female, when present, with fused femora and genua and without claws or empodia; legs IV of male, when present usually 4 segmented with a single sessile claw....Tarsonemoidea*
- *Female always with 4 pairs of legs, leg IV attenuate, 3 segmented, male with leg IV ventrally inserted, 3 or 4 segments Tarsonemidae
8. Podonotal shield large, covering propodorsoma completely, free margin of shield striated, forming roof over gnathosoma, distance between insertions of legs II-III equal to that between legs III-IV Scutacaridae
- Podonotal shield generally smaller and not covering entire propodosoma or absent, distance between insertions of legs II-III at least twice that of distance between legs III-IV
..... Pygmephoridae
9. Adults and nymphs often strongly hypertrichous, idiosomal setae not arranged in orderly rows, often forming thick peltage, with one or two pairs of prodorsal sensilla usually inserted into median crista metopica, larvae heteromorphic, adults parasitic, nymphs freeliving 11
- Body setae of adults and nymphs relatively few, generally arranged in transverse rows, rarely with hypertrichous patches, prodorsal sensilla usually absent, larvae homomorphic, similar to nymphs and adults 10
10. Cheliceral bases forming a stylophore which is fused with the rostrum Cheyletidae
- Cheliceral bases closely contiguous or fused with each other, rarely integrated with other gnathosomal elements Raphignathidae

11. Movable digit – of nymphs and adults short, curved, sometimes toothed distally; chelicerae and associated gnathosomal entities fixed, not retractable into idiosoma; with or without empodia. Larvae heteromorphic, with urstigma and an anal opening with one pair of bothridial sensilla on the prodorsal shield. Coxae I – II usually contiguous, parasites of vertebrate and invertebrates Trombidioidea*
 *Terrestrial species, sometimes found in damp habitats, sensilla variously inserted, often median in position, empodia present or absent, larvae parasitic on variety of arthropods Trombidiidae
- Movable chelae of nymph and adults, long, straight, either independently retractile or integrated with a wholly retractile gnathosoma, empodia absent. Larvae homomorphic or heteromorphic, larval morphology variable, but; usually with 2 pairs of bothridial sensilla on the prodorsal shield Erythraeoidea*
 *Gnathosoma normally developed, chelicerae independently retractile; propodosoma not narrowed anteriorly, generally with ossiform crista. Body setae simple or pectinate, often somewhat broadened. Larvae parasitic on insects and arachnids or predators Erythraeidae
12. With hysterosomal setae L_2 in normal lateral position 13
- With hysterosomal L_2 in dorsal position 15
13. Striae transverse or reticulate between second pair of hysterosomal dorsocentral setae 14
- Striae longitudinal between second pair of hysterosomal dorsocentral setae *Paralorryia*
14. Dorsal striae not forming reticulate pattern *Tydeus*
- Dorsal striae forming reticulate pattern in whole or in part *Lorryia*
15. Tarsus I without empodium or claws 16
- Tarsus I with empodium or claws 17
16. Without anal setae, femur II and IV each with prominent forked seta *Parapronematus*
- With a single pair of anal setae, setae normal on femora III and IV *Pronematus*
17. Femur IV not divided *Microtydeus*
- Femur IV divided *Triophtydeus*
18. Palpal tibiotarsus with an apical solenidia, ventral hypostome usually with geniculate setae ..
 Bonziinae*
 — *Dorsal palpal segment without a claw, palpal tibiotarsus without tubercle *Parabonzia*
 — Palpal tibiotarsus without a solenidion, ventral hypostome never with geniculate setae 19
19. Palpus with fewer than 5 segments 20
- Palpus with 5 segments 21

20. Palpus with 4 segments Seirulinae*
 *Body strongly sclerotized, dorsum with strong furrow, femur with 2 dorsal spine like setae *Scirula*
 — Palpus with 3 segments Cunaxoidenae*
 *Setae L_4 absent, venter with or without coxae I-II forming a pentagonal-shaped sternal plate *Neocunaxoides*
21. Dorsum either with a single shield on the propodosoma or a single shield originating on anterior edge of propodosoma and extending beyond metapodosoma Coleoscirinae*
 *Female with sternal and ventrolateral plates. Dorsum with a single Shield extending from propodosoma into hysterosomal region *Coleoscirus*
 — Dorsum of propodosoma with or without shield Cunaxiinae, 22
22. Without conspicuous lateral bilobed flanges terminally *Cunaxa*
 — With lateral bilobed fanges, with one sensory setae having a stout elongate base *Dactyloscirus*
23. All tarsi with paired claws *Cheyletus*, 24
 — One or more tarsi without paired claws *Cheletogenes*
24. Palp claw with one large basal tooth *fortis*
 — Palp claw with 2 or more basal teeth *malaccensis*

SUMMARY

The present paper is a record of collection of soil inhabiting mites of the order Prostigmata belonging to 22 genera and 26 species from Howrah, 24 Parganas (N & S), Hooghly, East Medinipur and West Medinipur districts of West Bengal, India.

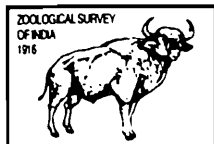
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REFERENCES

- Baker, E.W. 1965. A review of the genera of the family Tydeidae (Acarina). In : *Advances in Acarology*, Vol. 2, Cornell University Press, New York, 95-133.
- Bhattacharyya, A.K., Sanyal, A.K. and Sengupta, D. 1996. Present state of knowledge of taxonomy of soil mesostigmata (Acari) in India. *Environment & Ecology*, **14**(4) : 850-857.

- Den Heyer, J. 1979. Description of seven African species of *Cunaxa* von Heyden, 1826 (Actinedida : Acarida), with remarks on the genus. *Phytophylactica*, **11**(1) : 24-42.
- Gupta, S.K. 1991. Acari : Prostigmata, Astigmata and Mesostigmata. In : *Animal Resources of India* (Ed. Director, ZSI), Zoological Survey of India, 483-499.
- Gupta, S.K. 2002. A monograph on plant inhabiting predatory mites of India. Part I. Order Prostigmata, Astigmata and Cryptostigmata. *Mem. zool. Surv. India*, **19**(2) : 1-183.
- Mahunka, S. 1971. Tarsonemina (Acari) species from India. *Acta zool. Acad. Sci. Hungaricae*, **17**(1-2) : 11-49.
- Prasad, N. 1974. *A catalogue of mites of India*. Indira Acarology Publishing House, Ludhiana, 320 pp.
- Sanyal, A.K. 1991. Acari : Cryptostigmata. In : *Animal Resources of India* (Ed. Director, ZSI), Zoological Survey of India, 505-511.
- Smiley, R.L. 1992. The predatory mite family Cunaxidae (Acari) of the world with a new classification. Indira Publishing House, Michigan, 356 pp.



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A CHECKLIST OF ENCYRTIDAE (HYMENOPTERA : CHALCIDOIDEA) FROM UTTAR PRADESH (INDIA)

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INTRODUCTION

The family Encyrtidae is one of the largest among chalcidoidea next to Pteromalidae in number of recently accepted valid genera 587 (Noyes, 2001; Sureshan & Narendran, 2003). Within chalcidoidea the Encyrtidae is the most important family whose members are used in the biological control of insect pests. The family Encyrtidae is mostly primary internal parasitoids and hyperparasitoids of coccoidea (Homoptera), Lepidoptera, Diptera, Coleoptera and also attack on aphids and psyllids.

There are several publications on the Indian Encyrtidae mostly made by Mani, 1939, 1941; Agarwal, 1965; Shafee *et al.*, 1975; Hayat & Subba Rao, 1982; Hayat *et al.*, 1975; Hayat, 1985, 1986. In recent year several new genera and species of Encyrtidae described from various Indian states by Mani, 1989; Noyes & Hayat, 1984, 1994; Huang & Noyes, 1994; Hayat, 2002, 2003; Kazmi & Hayat, 1995, 1998; Hayat & Kazmi, 1999; Anis & Hayat, 1998, 2002; Singh & Hayat 2005. Accordingly an updated checklist of the Encyrtidae fauna of Uttar Pradeshh is presented here. It includes 88 genera and 191 species.

Arrangement : In checklist, under each subfamily genera and under each genus species are arranged in alphabetical order followed by author(s) and year. Encyrtids genera known from state Uttar Pradesh are grouped under separate subfamilies. The suprageneric classification given by Trjapitzin, 1973a, b with modification by Noyes & Hayat, 1984 and Hayat, 2004 are followed.

SYNOPSIS OF THE CLASSIFICATION

Subfamily ENCYRTINAE Walker, 1837

Tribe ENCYRTINI Walker, 1837—*Encyrtus*, *Neocladia*.

Tribe AMIRINI Girault, 1913—*Amira*.

- Tribe BOTHRIOTHORACINI Howard, 1895—*Amicencyrtus*, *Cerchysiella*, *Cowperia*, *Hemileucocerus*, *Trjapitzinellus*.
- Tribe COPIDOSOMATINI Hoffer, 1995—*Ageniaspis*, *Coelopencyrtus*, *Copidosoma*.
- Tribe APHYCINI Hoffer, 1954—*Acerophagus*, *Aphycus*, *Astymachus*, *Homalotylus*, *Indaphucus*, *Mashhoodiella*, *Parablastothrix*, *Prochiloneurus*.
- Tribe HABROLEPIDINI Hoffer, 1995—*Adelencyrtus*, *Coccidencyrtus*, *Comperiella*.
- Tribe CERAPTEROCERINI Hoffer, 1955—*Anicetus*, *Cerapterocerus*, *Diversinervus*, *Lakshaphagus*, *Paraceraptoerus*.
- Tribe ECTROMATINI Ashmead, 1900—*Achalcerinys*, *Cheiloneurus*, *Echthrogonatopus*, *Mahencyrtus*, *Zaomma*.
- Tribe CERCOBELINI Hoffer, 1953—*Cercobelus*.
- Tribe TRECHNITINI Hoffer, 1955—*Blastothrix*, *Cerchysius*, *Psyllaephagus*, *Trechnites*.
- Tribe DISCODINI Hoffer, 1955—*Agarwalencyrtus*, *Diaphorencyrtus*, *Erencyrtus*, *Forcipestricis*, *Haligra*, *Helegonatopus*, *Lamennaisia*, *Metaphycus*, *Microterys*, *Neastymachus*, *Ooencyrtus*, *Parablatticida*, *Parechthrodryinus*, *Syrphophagus*, *Tachardiaephagus*, *Tassonia*, *Trichomasthus*, *Tyndarichus*.
- Tribe ARRHENOPHAGINI Ashmead, 1900—*Arrhenophagus*.
- Tribe THOMSONISCINI Hoffer, 1956—*Thomsonisca*.
- Tribe PROTYNDARICHOIDINI Hayat, 2004—*Protyndarichoides*.
- Tribe MAYRIDIINI Hoffer, 1955—*Mayridia*.

Subfamily TETRACNEMINAE Howard, 1892

- Tribe TETRACNEMINI Howard, 1892—*Adektitopus*, *Charitopus*, *Clausenia*, *Eotopus*, *Manicnemus*, *Neocharitopus*, *Paraclausenia*, *Sakencyrtus*, *Tetracnemus*.
- Tribe NEODUSMETIINI Hayat, 2004—*Neodusmentia*.
- Tribe AENASIINI Kerrich, 1967—*Aenasius*, *Blepyrus*, *Cladiscodes*, *Metaphaenodiscus*, *Neodiscodes*, *Neoplatycerus*.
- Tribe ANAGYRINI Hoffer, 1953—*Alamella*, *Anagyrus*, *Anomalencyrtus*, *Apoleptomastix*, *Callipteroma*, *Cremesina*, *Doliphoceras*, *Dusmetia*, *Gyranusoidea*, *Hamusencyrtus*, *Leptomastix*, *Rhopus*.

Subfamily ENCYRTINAE Walker, 1837

Genus *Acerophagus* Smith, 1880

Acerophagus solidus Hayat, 1981

Host : Parasitoids of Pseudococcidae (Homoptera).

Acerophagus serpentines Fatma & Shafee, 1988

Host : Parasitoids of Pseudococcidae (Homoptera).

Genus *Achalcerinys* Girault, 1915

Achalcerinys gorodkovi (Myartseva), 1983

Host : Unknown.

Achalcerinys lindus (Mercet), 1921

Host : Unknown.

Genus *Adelencyrtus* Ashmead, 1900

Adelencyrtus bimaculatus Alam, 1972

Host : *Aonidiella orientalis*; indet diaspids.

Adelencyrtus mayurai (Subba Rao), 1957

Host : *Melanaspis glomerata*.

Adelencyrtus moderatus (Howard), 1897

Host : *Duplachionaspis* sp., *Lepidonaspis* sp.

Adelencyrtus quadriguttus (Girault), 1932

Host : Red scale.

Genus *Agarwalencyrtus* Hayat, 1981

Agarwalencyrtus citri (Agarwal), 1965

Host : *Planococcus citri*, *Tomosvaryella* sp.

Genus *Ageniaspis* Dahlbom, 1857

Ageniaspis fulvicornis Kazmi & Hayat, 1998

Host : Polyembryonic parasitoids of larva of Yponomeutidae.

Genus *Amicencyrtus* Hayat, 1981

Amicencyrtus obscurus Hayat, 1981

Host : Unknown.

Genus *Amira* Girault, 1913

Amira fabrei Girault, 1913

Host : Parasites of spider eggs.

Genus *Anicetus* Howard, 1896

Anicetus aligarhensis Hayat *et al.*, 1975

Host : *Ceroplastes* sp.

Anicetus beneficus Ishii & Yasumatsu, 1954

Host : *Ceroplastes* sp., *Ceroplastes actiniformis*.

Anicetus deltoideus Annecke, 1967

Host : *Coccus* sp.

Anicetus dodonia Ferriere, 1935

Host : *Ceroplastes* sp., *Ceroplastes floridensis*; *C. pseudoceriferus*; *Pulvinaria maxima*.

Anicetus howardi Hawat *et al.*, 1965

Host : *Ceroplastes* sp.

Anicetus yasumatsu Subba Rao, 1977

Host : *Ceroplastes* sp.

Genus *Aphycus* Mayr, 1876

Aphycus sapporoensis Compere & Annecke, 1961

Host : Parasitoids of pseudococidae (Homoptera).

Genus *Arrhenophagus* Aurivillius, 1888

Arrhenophagus chionaspidis Aurivillius, 1888

Host : *Chionaspis ramakrishnai*, *Contigaspidis* sp., *Pinnaspis strachani*.

Genus *Astymachus* Howard, 1898

Astymachus felix Singh & Hayat, 2005

Host : Unknown.

Astymachus japonicus Howard, 1898

Host : *Saccharococcus sacchari*.

Genus *Blastothrix* Mayr, 1876

Blastothrix siddiquii (Bhatnagar), 1952

Host : *Eulecanium tiliae*.

Genus *Cerapterocerus* Westwood, 1833

Cerapterocerus virens Agarwal, 1963

Host : *Planococcus citri*, Hyperparasitoid of coccidae (Homoptera) via encyrtidae.

Genus *Cerchysiella* Girault, 1914

Cerchysiella harliga Hayat & Basha, 2003

Host : Unknown.

Cerchysiella kamathi (Mani & Saraswat), 1974

Host : Unknown.

Cerchysiella latiscapa (Shafee & Fatima), 1984

Host : Unknown.

Genus *Cerchysius* Westwood, 1832

Cerchysius longicarpus Fatima & Shafee, 1994

Host : Parasitoids of Chamaemyiidae (Diptera).

Genus *Cercobelus* Walker, 1842*Cercobelus saki* Hayat, 2005

Host : Unknown.

Genus *Cheiloneurus* Westwood, 1833*Cheiloneurus bangalorensis* (Subba Rao), 1957Host : *Atonina graminis*, *Atonina* sp.*Cheiloneurus gonatopodis* Perkins, 1906Host : Pupae of *Richardsidryinus* on sugarcane.*Cheiloneurus latifrons* Hayat, Alam & Agarwal, 1975Host : *Peliococcus* sp. on *Prosopis spicigera*.*Cheiloneurus longipennis* Fatma & Shafee, 1988

Host : Unknown.

Cheiloneurus noyesi Anis & Hayat, 2002

Host : Unknown.

Cheiloneurus pyrillae Mani, 1939Host : Eggs of *Pyrilla* sp. on sugarcane, *Saccharum officinarum*.*Cheiloneurus yasumatsui* Trjapitzin, 1971

Host : Unknown.

Genus *Coccidencyrtus* Ashmead, 1900*Coccidencyrtus mandibularis* (Hayat *et al.*), 1975Host : *Phenacaspis* sp., *Pinnaspis strachani*.*Coccidencyrtus shafeei* (Hayat *et al.*), 1975

Host : Parasites of Diaspididae (Homoptera).

Genus *Coelophencyrtus* Timberlake, 1919*Coelophencyrtus krishnamurtii* (Mahdihassan), 1957Host : *Xylocopa tenuiscapa*.Genus *Comperiella* Howard, 1906*Comperiella aspidiotiphaga* Subba Rao, 1966Host : *Aonidiella orientalis*, *Aspidiotus* sp.*Comperiella indica* Ayyar, 1934Host : *Aspidiotus tamarindi*.*Comperiella lemniscata* Compere & Annecke, 1961Host : *Aonidiella orientalis*.*Comperiella unifasciata* Ishii, 1925

Host : Parasites of Diaspididae (Homoptera).

Genus ***Copidosoma*** Ratzeburg, 1844*Copidosoma floridanum* (Ashmead), 1900Host : *Plusia signata*, *Cosmophila sabulifera*.*Copidosoma gracilis* (Kaul & Agarwal), 1985

Host : Unknown.

Copidosoma transversum Kazmi & Hayat, 1998

Host : Unknown.

Copidosoma varicorne (Nees), 1834Host : *Anarsia ephippias*, *A. sigmatica*, *Dichomeris eridontis*, *Eucosma* sp.Genus ***Cowperia*** Girault, 1919*Cowperia indica* (Kerrich), 1963Host : *Cryptolaemus montronzieri*, *Jauravia* sp., *Scymnus* sp., *Pseudococcus* sp., *Rastrococcus iceryoides*.Genus ***Diaphorencyrtus*** Hayat, 1981*Diaphorencyrtus aligarhensis* (Shafee *et al.*), 1975Host : *Diaphorina* sp., *D. cardiae*, *Psylla* sp.Genus ***Diversinervus*** Silvestri, 1915*Diversinervus madgaoensis* Hayat *et al.*, 1975Host : *Ceroplastes actiniformis*, *Ceroplastes pseudoceriferus*.Genus ***Echthrogonatopus*** Perkins, 1906*Echthrogonatopus nigricornis* (Hayat), 1980

Host : Hyperparasites of leafhoppers (Homoptera : Auchenorrhyncha).

Echthrogonatopus parvus (Hayat), 1980

Host : Hyperparasites of leafhoppers (Homoptera : Auchenorrhyncha).

Genus ***Encyrtus*** Latreille, 1809*Encyrtus lecaniorum* (Mayr), 1876Host : *Coccus viridis*, *Chloropulvinaria* sp., *C. psiddi*, *Lecanium* sp., *Parasaissetia nigra*, *Saissetia coffeae*, *S. privigna*.Genus ***Erencyrtus*** Mahdihassan, 1923*Erencyrtus dewitzi* Mahdihassan, 1923Host : *Kerria communis*, *K. fici*, *K. lacca*, *K. nagoliensis*, *Metatachardia conchiferata*.Genus ***Forcipestricis*** Burks, 1968*Forcipestricis dasys* Hayat, 2003

Host : Unknown.

Genus *Haligra* Noyes & Hayat, 1984*Haligra concolor* Noyes & Hayat, 1984

Host : Unknown.

Genus *Helegonatopus* Perkins, 1906*Helegonatopus pulchricornis* Hayat & Verma, 1978

Host : Unknown.

Genus *Hemileucocerus* Hoffer, 1976*Hemileucocerus longicornis*, Hayat, 2003

Host : Unknown.

Genus *Homalotylus* Mayr, 1876*Homalotylus albiclavatus* (Agarwal), 1970

Host : Pullus sp. on *Robusta coffee*; Coccinellids predaceous on *Coccidhystrix insolita* on *Solanum melongena*; *Achyranthes aspera*; *Nipaecoccus viridis* on *Tephrosia purpurea*; *Zizyphus* sp.; *Pseudococcus* sp. on *citrus medica*.

Homalotylus eytelweinii (Ratzeburg), 1844

Host : *Adonia variegata*; *Brumoides suturalis*; *Chilocorus* sp.; *C. bijugus*; *Chilomenes* sp.; *Menochilus sexmaculata*; *Rodolia* sp.; *R. cardinalis*; *R. fumida*; *R. guerni*; *Dorsicha stebbeni*; *Icerya purchasi*; *I. pilosa nordi*; *Lecanium* sp. on *Jack*; *Artocarpus heterophyllus*; *Nipaecoccus viridis* on *Citrus medica*.

Homalotylus ferrierei Hayat et al., 1975Host : Coccinellids predaceous on *Cerococcus* sp. on *Hibiscus* sp. *C. hibisci*.*Homalotylus flaminius* (Dalman), 1820Host : Coccinellids predaceous on *Nipaecoccus viridis* on *Solanum* sp.*Homalotylus formosus* Anis & Hayat, 1998

Host : Unknown.

Homalotylus indicus (Agarwal), 1966.

Host : *Scymnus* sp. indet. Scymnini on *Azadirachta indica*; Coccinellids predaceous on *Coccidhystrix insolita* on *Solanum melongena*; *Nipaecoccus viridis* on Mulberry; *Nerium* sp.; *Zizyphus* sp.; *Planococcus citri* on *Citrus medica*; *Rastrococcus iceryoides* on *Capparis* sp. indet. mealybugs on wild plant and *Solanum* sp.

Homalotylus longipedicellus (Shafee & Fatma), 1984Host : Coccinellids predaceous on *Aonidiella orientalis* (Newstead) on *Dalbergia sissoo*.*Homalotylus mangiclavus* (Fatma & Shafee), 1989

Host : Unknown.

Homalotylus terminalis (Say), 1828Host : *Chilomenes sexmaculatus*; *Scymnus quadrillum*.

Homalotylus turkmenicus Myartseva, 1981

Host : Coccinellids predaceous on : *Centrococcus* sp. on *Wittania somnifera*; *Coccidohystrix insolita* on *Solanum melongena*; *W. somnifera*; *Nipaecoccus* sp. on *Peristrophe bicalyculata*; coccids on *Dalbergia sisso*, *Zizyphus* sp.; mealybugs on *Solanum* sp.

Genus *Indaphycus* Hayat, 1981

Indaphycus planus Hayat, 1981

Host : Unknown.

Genus *Lakshaphagus* Mahdihassan, 1931

Lakshaphagus fusiscapus (Agarwal), 1965

Host : *Cerococcus* sp.; *Ceroplastodes* sp.; *Planococcus citri*.

Genus *Lamennaisia* Girault, 1922

Lamennaisia ambigua (Nees), 1834

Host : Parasitoids of diaspinae scale.

Genus *Mahencyrtus* Masi, 1917

Mahencyrtus assamensis Singh & Agarwal, 1993

Host : Unknown.

Mahencyrtus ranchiensis Fatima & Shafee, 1994

Host : Unknown.

Genus *Mashhoodiella* Hayat, 1972

Mashhoodiella echthromorpha Hayat, 1972

Host : *Ceroplastes* sp.

Genus *Mayridia* Mercet, 1921

Mayridia caerulea (Hayat & Verma), 1978

Host : Unknown.

Mayridia miranda Hayat, 2003

Host : Unknown.

Mayridia splendida Hayat, 2003

Host : Unknown.

Genus *Metaphycus* Mercet, 1917

Metaphycus breviellus Kaul & Agarwal, 1985

Host : Unknown.

Metaphycus gilvus Compere, 1957

Host : *Ceroplastes* sp.; *Ceroplastodes cajani*; *Chloropulvinaria* sp.; *Chloropulvinaria polygonata*; *Pulvinaria maxima*.

Metaphycus latiscapus Alam, 1972

Host : (?) *Aonidiella orientalis*.

Metaphycus zebratus (Mercet), 1917

Host : *Ceroplastodes cajani*; (?) *Aonidiella orientalis*; (?) *Nipaecoccus* sp.

Genus *Microterys* Thomson, 1856

Microterys anomalococci Shafee *et al.*, 1975

Host : *Anomalococcus crematogasteri*.

Genus *Neastymachus* Girault, 1915

Neastymachus axillaries Singh, Agarwal & Basha, 1991

Host : Unknown.

Neastymachus burksi (Shafee *et al.*), 1975

Host : *Anomalococcus crematogasteri*.

Neastymachus cerococci (Shafee *et al.*), 1975

Host : *Cerococcus* sp.; *Cerococcus hibisci*; *C. indicus*.

Genus *Neocladia* Perkins, 1906

Neocladia indica (Agarwal), 1970

Host : *Pseudococcus* sp.

Genus *Ooencyrtus* Ashmead, 1900

Ooencyrtus acus Huang & Noyes, 1994

Host : Hyperparasitoid of prepupa or pupae of *Epiricania melanoleuca*.

Ooencyrtus guamensis Fullaway, 1946

Host : Pupal parasitoids of Syrphidae (Diptera); *Paragus auritus*; *Asarkira pura*; *Ischiodon scutellaris*.

Ooencyrtus manii Huang & Noyes, 1994

Host : Eggs of *Pyrilla perpusilla*.

Ooencyrtus neptunus Huang & Noyes, 1994

Host : Unknown.

Ooencyrtus segestes Trjapitzin, 1965

Host : Unknown.

Ooencyrtus utetheisae (Risbec), 1951

Host : Eggs of *Utetheisae pulchella* (Lep. : Arctidae); Eggs of *Anoplocnemis curvipes*; *Pseudothertaptus wayi*; *Clavigralla elongate*; *C. tomentosicollis*; *Mictis profana*; *Nezara viridula*.

Genus *Parablastothrix* Mercet, 1917*Parablastothrix zygonomus* Khan, 1983*Host* : *Acerocercops zygonoma*.Genus *Parablatticida* Girault, 1915*Parablatticida aligarhensis* Hayat, 2003*Host* : Unknown.*Parablatticida breviclava* Hayat, 2003*Host* : Unknown.*Parablatticida citri* (Mercet) 1921*Host* : Unknown.Genus *Paraceraptocherus* Girault, 1920*Paraceraptocherus italicus* (Masi), 1917*Host* : *Ceroplastes* sp.Genus *Parechthrodryinus* Girault, 1916*Parechthrodryinus clavicornis* (Cameron), 1913*Host* : *Kerria chinensis*; *K. communis*; *K. lacca*; *Paratachardia lobata*.*Parechthrodryinus excelsus* Hayat, 2003*Host* : *Rastrococcus iceryoides* on *Mangifera indica*.Genus *Prochiloneurus* Silvestri, 1915*Prochiloneurus testaceus* (Agarwal), 1965*Host* : *Coccus viridis*; *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Rastrococcus iceryoides*.Genus *Protyndarichoides* Noyes, 1980*Protyndarichoides aligarhensis* (Fatima & Shafee), 1984*Host* : Unknown.*Protyndarichoides indicus* Singh & Agarwal, 1993*Host* : Unknown.*Protyndarichoides punctatifrons* Sushil & Khan, 1996*Host* : Unknown.Genus *Psyllaephagus* Ashmead, 1900*Psyllaephagus africanus* Prinsloo, 1981*Host* : Parasites or hyperparasites of nymph of Psyllidae (Homoptera).*Psyllaephagus aligarhensis* Shafee *et al.*, 1975*Host* : *Psylla* sp.

Genus *Syrphophagus* Ashmead, 1900*Syrphophagus aeruginosus* (Dalman), 1820*Host* : Puparia of *Syrphis* sp.*Syrphophagus aphidivorus* (Mayr), 1876*Host* : *Aphis craccivora*; *A. gossypii*; *A. laburni*; *A. pomi*; *Rhopalosiphum maidis*; *Uroleucom compesitae*.*Syrphophagus hakki* Agarwal, 1962*Host* : Puparia of *Syrphis* sp.*Syrphophagus hofferi* (Hayat), 1973*Host* : Aphids.*Syrphophagus kumaoensis* (Bhatnagar), 1952*Host* : *Aphis helichrysi*.Genus *Tachardiaephagus* Ashmead, 1904*Tachardiaephagus tachardiae* (Howard), 1896*Host* : *Kerria albizziae*; *K. chinensis*; *K. communis*; *K. lacca*.Genus *Tassonia* Girault, 1921*Tassonia aphidivora* (Shafee, Alam & Agarwal), 1975*Host* : Parasites of Aphididae (Homoptera).*Tassonia gloriae* Girault, 1921*Host* : Parasites of Aphididae (Homoptera).*Tassonia magniclava* (Hayat & Subba Rao), 1981*Host* : *Hysteroneura setariae*; *Longiunguis sacchari*; *Myzus persicae*.Genus *Thomsonisca* Ghesquiere, 1946*Thomsonisca indica* Hayat, 1970*Host* : *Anoidiella orientalis*.*Thomsonisca pakistanensis* (Ahmad), 1970*Host* : *Aspidiotus destructor*; *Aulacaspis* sp.; *Phenacaspis* sp.Genus *Trechnites* Thomson, 1876*Trechnites aligarhensis* Hayat, Alam & Agarwal, 1975*Host* : Psyllids.Genus *Trichomasthus* Thomson, 1876*Trichomasthus frontalis* Alam, 1957*Host* : Parasites of Coccidae, Diaspididae, Eriococcidae and Pseudococcidae (Homoptera).

Genus *Trjapitzinellus* Viggiani, 1967*Trjapitzinellus obscurus* (Mercet), 1921*Host* : Parasites of immature stages of Coniopterygidae (Neuroptera).Genus *Tyndarichus* Howard, 1910*Tyndarichus nitidulus* Hayat, 2003*Host* : Unknown.Genus *Zaomma* Ashmead, 1900*Zaomma lambinus* (Walker), 1838*Host* : *Chrysomphalus aonidum*; *Pseudaulacaspis pentagona*.

Subfamily TETRACNEMINAE Howard, 1892

Genus *Adektitopus* Noyes & Hayat, 1984*Adektitopus longipennis* (Shafee & Avasthi), 1983*Host* : Unknown.Genus *Aenasius* Walker, 1846*Aenasius advena* Compere, 1937*Host* : *Ferrisia virgata*.Genus *Alamella* Agarwal, 1966*Alamella flava* Agarwal, 1966*Host* : *Eriococcus greeni*; *Maconelliococcus hirsutus*; *Nipaecoccus* sp.; *Nipaecoccus viridis*.Genus *Anagyrus* Howard, 1896*Anagyrus agraensis* Saraswat, 1975*Host* : Unknown.*Anagyrus aligarhensis* Agarwal, 1965*Host* : *Saccharicoccus sacchari*.*Anagyrus almoriensis* Shafee *et al.*; 1975*Host* : *Nipaecoccus viridis*.*Anagyrus aquilonaris* (Noyes & Hayat), 1984*Host* : Parasites of Pseudococcidae (Homoptera) and Coccinellidae (Coleoptera).*Anagyrus citri* Agarwal, 1965*Host* : *Planococcus citri*.*Anagyrus clavatus* Sushil & Khan, 1996*Host* : Indt. Coccids.

Anagyrus diversicornis Mercet, 1921

Host : Unknown.

Anagyrus fatimae Fatima & Agarwal, 1994

Host : Unknown.

Anagyrus flavidus Shafee *et al.*, 1975

Host : *Planococcoides robustus*; *Pseudococcus* sp.

Anagyrus frontolatus Sushil & Khan, 1996

Host : Unknown.

Anagyrus gracilis (Hayat), 1970

Host : Parasites of Pseudococcidae (Homoptera).

Anagyrus indicus (Subba Rao), 1967

Host : *Ferrisia virgata*.

Anagyrus inopus Noyes & Hayat, 1975

Host : *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Centrococcus* sp.; *Ferrisia virgata*; *Rastrococcus iceryoides*.

Anagyrus kamali Moursi, 1948

Host : Parasitoids of Coccids.

Anagyrus longiventris Hayat, 1979

Host : Unknown.

Anagyrus mandibularis Sushil & Khan, 1996

Host : Indt. Coccids.

Anagyrus pseudococci (Girault), 1915

Host : Indet. Scales.

Anagyrus punctulatus Agarwal, 1965

Host : *Saccharicoccus sacchari*.

Anagyrus sawadi Ishii, 1928

Host : *Rastrococcus iceryoides*.

Anagyrus scutomaculatus Agarwal, 1965

Host : *Nipaecoccus viridis*; *Pseudococcus* sp.

Anagyrus shahidi Hayat, 1979

Host : Unknown.

Anagyrus subflaviceps (Girault), 1915

Host : Parasites of Pseudococcidae (Homoptera) and Coccinellidae (Coleoptera).

Anagyrus tibimaculatus Agarwal, 1965

Host : *Planococcoides robustus*; *Planococcus citri*.

Genus *Anomalencyrtus* Hayat & Verma, 1980*Anomalencyrtus longicornis* Hayat & Verma, 1980*Host* : Unknown.Genus *Apoleptomastix* Kerrich, 1982*Apoleptomastix spoliata* Kerrich, 1982*Host* : Parasitoids of Pseudococcidae (Homoptera).Genus *Blepyrus* Howard, 1898*Blepyrus insularis* (Cameron), 1886*Host* : Parasitoids of Pseudococcidae (Homoptera).Genus *Callipteroma* Motschulsky, 1863*Callipteroma sexguttata* Motschulsky, 1863*Host* : Parasitoids of Pseudococcidae (Homoptera).*Callipteroma testacea* Motschulsky, 1863*Host* : Indet. Sugarcane Mealybug.Genus *Charitopus* Foerster, 1856*Charitopus apicatus* (Mani & Saraswat), 1974*Host* : Parasitoids of Pseudococcidae (Homoptera).*Charitopus fulviventris* Foerster, 1860*Host* : Parasitoids of Pseudococcidae (Homoptera).*Charitopus panchgania* (Mani & Saraswat), 1974*Host* : Parasitoids of Pseudococcidae (Homoptera).Genus *Cladiscodes* Subba Rao, 1977*Cladiscodes sacchari* Subba Rao, 1977*Host* : *Saccharicoccus sacchari*.Genus *Clausenia* Ishii, 1923*Clausenia lacca* (Agarwal), 1962*Host* : *Kerria lacca*.*Clausenia longipennis* Shafee & Avasthi, 1983*Host* : *Coccidohystrix insolitus*.Genus *Cremesina* Noyes & Hayat, 1984*Cremesina aquilonaris* Noyes & Hayat, 1984*Host* : Unknown.

Genus *Doliphoceras* Mercet, 1921*Doliphoceras gracilis* Hayat, 1970

Host : Parasites of Pseudococcidae (Homoptera)

Genus *Dusmetia* Mercet, 1921*Dusmetia fuscipennis* (Noyes & Hayat), 1984

Host : Unknown.

Genus *Eotopus* Noyes & Hayat, 1984*Eotopus beneficus* (Shafee), 1981Host : *Icerya pilosa*.Genus *Gyranusoidea* Compere, 1947*Gyranusoidea ceroplastis* (Agarwal), 1965Host : *Ceroplastis rubens*.*Gyranusoidea flava* Shafee *et al.*, 1975Host : *Planococcoides robustus*.*Gyranusoidea indica* Shafee *et al.*, 1975Host : *Nipaecoccus viridis*.*Gyranusoidea mirzai* (Agarwal), 1965Host : *Ferrisia virgata*; *Icerya formicarum*; *Maconellicoccus hirsutus*; *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Planococcus citri*; *Rastrococcus iceryoides*.Genus *Hamusencyrtus* Subba Rao & Hayat, 1979*Hamusencyrtus mymaricoides* (Compere *et al.*), 1960Host : *Saccharicoccus sacchari*.Genus *Leptomastix* Foerster, 1856*Leptomastix aligarhensis* Khan & Shafee, 1975

Host : Parasites of Pseudococcidae.

Leptomastix brevipedicelus Khan & Shafee, 1975

Host : Parasites of Pseudococcidae.

Leptomastix gunturiensis Shafee, 1972Host : *Nipaecoccus viridis*.*Leptomastix longiscapus* Khan & Agarwal, 1976

Host : Parasites of Pseudococcidae.

Leptomastix nigrocincta Risbec, 1959

Host : Parasites of Pseudococcidae (Homoptera).

Leptomastix nigrocoxalis Compere, 1928

Host : *Centrococcus* sp.; *Coccidohystrix insolitus*; *Icerya aegyptica*; *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Phenacoccus* sp.; *Planococcus citri*.

Leptomastix tsukumiensis Tachikawa, 1963

Host : Parasites of Pseudococcidae (Homoptera).

Genus *Manicnemus* Hayat, 1981

Manicnemus indicus (Mani & Saraswat), 1974

Host : *Greenaspis divergens*.

Genus *Metaphaenodiscus* Mercet, 1921

Metaphaenodiscus aligarhensis Hayat, 1981

Host : Unknown.

Metaphaenodiscus proximus (Hayat), 1981

Host : Unknown.

Genus *Neocharitopus* Hayat, Alam & Agarwal, 1975

Neocharitopus orientalis (Agarwal), 1965

Host : (?) *Chionaspis* sp.; *Coccidohystrix insolitus*.

Genus *Neodiscodes* Compere, 1931

Neodiscodes indicus Narayan & Subba Rao, 1960

Host : (?) *Coccus viridis*; *Icerya formicarum*; *Nipaecoccus* sp.; *Nipaecoccus viridis*; *Planococcoides robustus*.

Genus *Neodusmentia* Kerrich, 1964

Neodusmentia sangwani (Subba Rao), 1957

Host : *Atonina* sp.; *Atonina indica*.

Genus *Neoplatycerus* Subba Rao, 1965

Neoplatycerus tachikawai Subba Rao, 1965

Host : (?) *Pulvinaria* sp.; *Icerya seychellarum*; *Rastrococcus iceryoides*.

Genus *Paraclausenia* Hayat, 1980

Paraclausenia herbicola Hayat, 1980

Host : Unknown.

Genus *Rhopus* Foerster, 1856

Rhopus aligarhensis Shamim & Shafee, 1989

Host : Unknown.

Rhopus desantisiellus Ghesquiere, 1957

Host : Sugarcane mealybug.

Rhopus nigroclavatus (Ashmead), 1902

Host : Unknown.

Rhopus qadrii (Shafee *et al.*), 1975

Host : *Ripersia* sp.

Genus *Sakencyrtus* Hayat, 1981

Sakencyrtus mirus Hayat, 1981

Host : Unknown.

Genus *Tetracnemus* Westwood, 1837

Tetracnemus heterocornis Mani & Saraswat, 1974

Host : Unknown.

Tetracnemus peninsularis (Mani & Saraswat), 1974

Host : Unknown.

Tetracnemus perspicuous Hayat & Kazmi, 1999

Host : Unknown.

ACKNOWLEDGMENTS

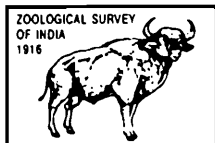
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REFERENCES

- Alam, S. M. 1957. Taxonomy of some encyrtid parasites (Hymenoptera : Chalcidoidea) of British scale insects. *Trans. R. Ent. Soc. London*, **109** : 421-426.
- Agarwal, M. M. 1965. Taxonomy of encyrtid parasites (Hymenoptera : Chalcidoidea) of Indian coccioidea, *Acta Hymenopterologica*, **10** : 37-97.
- Anis, S. B. & Hayat, M. 1998. The Indian species of *Homalotylus* (Hymenoptera : Encyrtidae). *Oriental Ins.*, **32** : 191-218.
- Anis, S. B. & Hayat, M. 2002. A revision of Indian species of *Cheiloneurus* Westwood (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Ins.*, **36** : 129-209.
- Fatima A. & Shafee, S. A. 1994. Studies on the taxonomy of the India Encyrtids (Hymenoptera : Encyrtidae). *A. M. U. (Zool. Ser.) on Indian Ins. Type*, **15** : 114pp.
- Hayat, M. 1970. New species of Encyrtidae (Hymenoptera : Chalcidoidea) reared from coccids. *Mushi*, **44** : 55-63.

- Hayat, M. 1979. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) V. *Oriental Ins.*, **33** : 349-407.
- Hayat, M. 1981. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) III. *Colemania*, **1**(1) : 13-34.
- Hayat, M. 1985. "Family Encyrtidae" in "The Chalcidoidea (Insecta : Hymenoptera) of Indian and the adjacent countries. Part I." (B. R. Subba Rao & M. Hayat eds.). *Oriental Ins.*, **19** : 192-223.
- Hayat, M. 1986. "Family Encyrtidae" In "The Chalcidoidea (Insecta : Hymenoptera) of India and the adjacent countries. Part II." (B. R. Subba Rao & M. Hayat eds.). *Oriental Ins.*, **20** : 430 pp.
- Hayat, M. 1989. Taxonomic notes on Indian Encyrtidae (Hymenoptera : Chalcidoidea) IV. *Oriental Ins.*, **23** : 275-285.
- Hayat, M. 2003. Record and descriptions of India Encyrtidae (Hymenoptera : Encyrtidae). *Oriental Ins.*, **37** : 187-260.
- Hayat, M. 2004. A review of the classification of Encyrtidae (Hymenoptera : Chalcidoidea). In *Perspective on Biosystematics and Biodiversity* TCN Com. Vol. 349-361.
- Hayat, M. 2005. Description of a new species of *Cercobelus* from India (Hymenoptera : Chalcidoidea : Encyrtidae). *Shashpa*, **12**(1) : 1-3.
- Hayat, M. & Subba Rao, B. R. 1981. A systematic catalogue of Encyrtidae (Hymenoptera : Chalcidoidea) from Indian subcontinent. *Colemania*, **1** : 103-125.
- Hayat, M. & Kazmi, S. I. 1999. The species of *Tetrachnemus* from India (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Ins.*, **33** : 279-295.
- Hayat, M. Alam, S. M. & Agarwal, M. M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *A. M. U. (Zool. Ser.) on Indian Ins. Type*, **9** : 1-112.
- Huang, D. W. & Noyes, J. S. 1994. A revision of the Indo-Pacific species of *Ooencyrtus* (Hymenoptera : Encyrtidae) parasitoids of immature stages of economically important insect species (mainly Hemiptera and Lepidoptera). *Bull. Nat. His. Mus. London (Ento.)*, **63**(1) : 1-136.
- Kazmi, S. I. & Hayat, M. 1995. The species of *Trechnites* (Hymenoptera : Encyrtidae) from India and Sri Lanka. *Shashpa*, **2**(2) : 87-94.
- Kazmi, S. I. & Hayat, M. 1998. Revision of the Indian Copidosomatini (Hymenoptera : Chalcidoidea : Encyrtidae). *Oriental Ins.*, **32** : 287-362.
- Mani, M. S. 1939. Descriptions of new and records of some known chalcidoid and other hymenopterous parasites from India. *Indian J. Entomology*, **1** : 69-99.
- Mani, M. S. 1941. Studies on Indian parasitic Hymenoptera I. *Indian J. Entomology*, **3** : 25-36.

- Mani, M. S. 1989. *The fauna of India and the adjacent countries Chalcidoidea (Hymenoptera) Part I. Zoological Survey of India*, 1-1067.
- Noyes, J. S. 2001. *Interactive catalogue of world chalcidoidea 2001. (CD-ROM). Disk Yu, Bentall centre, Canada.*
- Noyes, J. S. & Hayat, M. 1984. A review of genera of Indo-Pacific Encyrtidae (Hymenoptera : Chalcidoidea). *Bull. Brit. Mus. (Nat. Hist.), Entomology*, **48** : 131-395.
- Noyes, J. S. & Hayat, M. 1994. *Oriental Mealybug parasitoids of Anagyrini (Hymenoptera : Chalcidoidea). CAB Int. Oxon.*
- Shafee, S. A., Alam, S. M. & Agarwal, M. M. 1975. Taxonomic survey of encyrtid parasites (Hymenoptera : Encyrtidae) in India. *A. M. U. (Zool. Ser.) on Indian Ins. Type*, **10** : 125 pp.
- Singh, S. & Hayat, M. 2005. Description of three new and record of two known species of Encyrtidae (Hymenoptera : Chalcidoidea) from Northeast India. *Entomon*, **30**(1) : 57-66.
- Sureshan, P. M. & Narendran, T. C. 2003. A Checklist of Pteromalidae (Hymenoptera : Chalcidoidea) from the Indian subcontinent. *Zoos' Print Journal*. **18**(5) : 1099-1110.
- Sushil, S. N. & Khan, M. A. 1996a. Five new species of genus *Anagyrus* Howard (Hymenoptera : Encyrtidae) from northern India. *J. Insect Sci.*, **9**(1) : 19-27.
- Sushil, S. N. & Khan, M. A. 1996b. A new species of genus *Protyndarichoides* Noyes (Hymenoptera : Encyrtidae) from northern India. *J. Insect Sci.*, **9**(2) : 112-114.
- Trjapitzin, V. A. 1973a. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part-I, Survey of the system of classification. The subfamily Tetracneminae Howard 1892 [In Russian]. *Ent. Obozr.*, **52** : 163-175.
- Trjapitzin, V. A. 1973b. The Classification of parasitic Hymenoptera of family Encyrtidae (Hymenoptera : Chalcidoidea). Part-II. The subfamily Encyrtinae Walker, 1873, 1892 [In Russian]. *Ent. Obozr.*, **52** : 416-429.
- Zeya, S. B. & Hayat, M. 1993. A review of species of *Metaphycus* (Hymenoptera : Encyrtidae). *Oriental Ins.* **27** : 185-210.



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Short Communication

FIRST REPORT OF *MICRONECTA DECORATA* LUNDBLAD, 1933 (MICRONECTIDAE : CORIXOIDEA : HEMIPTERA : INSECTA) FROM LOWER SHIWALIK HILLS, INDIA

INTRODUCTION

The superfamily Corixoidea comprises of truly aquatic bugs and is found in stagnant waters or parts of streams with very little water current. These Nepomorphan water bugs are characterised by broad triangular unsegmented rostrum with transverse grooves. The fore-tarsus is single segmented and widened, also known as 'Pala'. The possession of a strigil on the right side of 6th dorsal abdominal segment in males is characteristic to the members belonging to the super family. This organ helps in maintaining the subelytral gas store while surfacing during mating in Corixidae and the function among the members of Micronectidae are yet to be understood (Popham *et al.*, 1984; Nieser, 2002).

The family Micronectidae, hitherto, considered as the subfamily Micronectinae has been raised to the family level taxon by Mahner (1993) and Nieser (2002) while doing cladistic analysis. Micronectids popularly called 'Pigmy Water Boatman' characterised by the presence of an exposed scutellum and three segmented antennae, are the one of the most truly aquatic hemipterans of India. They tend to go unnoticed because of their very small size of less than 4 mm length.

Of the two genera *Micronecta* Kirkaldy and *Synaptonecta* Lundblad, the former is represented by 21 species and the latter by a single species *S. issa* in India (Thirumalai, 1999). Most of these species are known by macropterous forms.

During a recent survey to Lower Shiwalik Hills in Himachal Pradesh, 4 males, 4 females and 12 immature stages of *Micronecta decorata* Lundblad were collected from a marshy area in Sansarpur Terrace near Karis, Pong Dam, Kangra District, Himachal Pradesh (31°55'16" N and 75°55'5" E), is the first record of the species from India.

While studying the aquatic Hemiptera of Sumatra, Java and Bali, Lundblad (1933) described *M. decorata* from Java and Sumatra. Much later, Fernando and Cheng (1974) and Nieser (2002) recorded *M. decorata* from Malaysia and Singapore respectively. This species is characterised

by a large free lobe of 8th tergite in male which is apically broad with a small median projection (Plate 1. IV). The claw of Pala slightly diverged distally without subapical tooth (Plate 1. III) The right paramere is gradually curved with indistinct tubercles or hairs and gradually tapered (Plate 1. V) The left paramere has a well developed ventral lobe, the tip is bent inwardly with wrinkles (Plate 1. VI). The length of adult macropterous males 1.87–1.91 and females 1.63–1.68 mm. The adults are small, light brown and elongate (Plate 1. I & II). The pronotum is unicolorous and corium with very poorly contrasting brown broken longitudinal stripes. There are two large dark spots in the anterior half of the lateral margin of hemelytra and the third one at the base of membrane.

The occurrence of Malayan elements of aquatic and semi-aquatic Heteroptera in India is a recognized fact and is established in a few families (Thirumalai 1986, 1996, Thirumalai & Dam, 1996). However, the present record of *Micronecta decorata* from lower Shiwalik part of Himachal Pradesh constitutes an interesting report since this species are so far known from Indonesia, Malaysia and Singapore only. Though the occurrence of fauna of Malayan derivatives is largely concentrated in Assam-Burma area, the present report of *M. decorata* from Western Part of Himalaya indicates intrusion of faunal extensions westward as a narrow tongue on the Himalaya (Mani, 1974).

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Thanks are due to the Director, Zoological Survey of India, Kolkata for the encouragement and facilities provided.

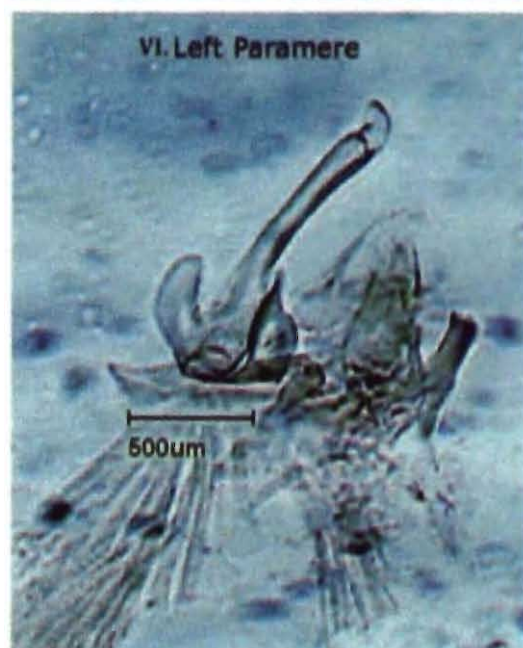
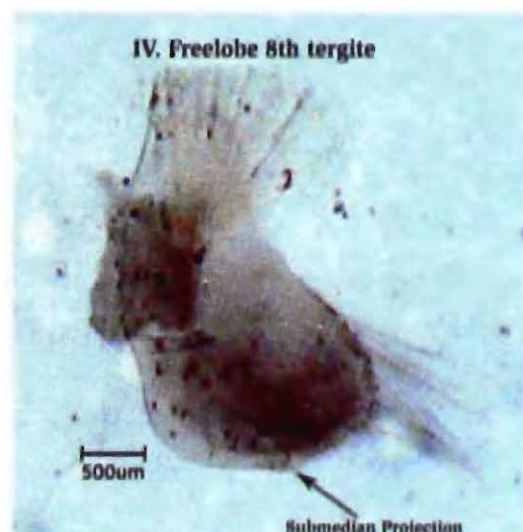
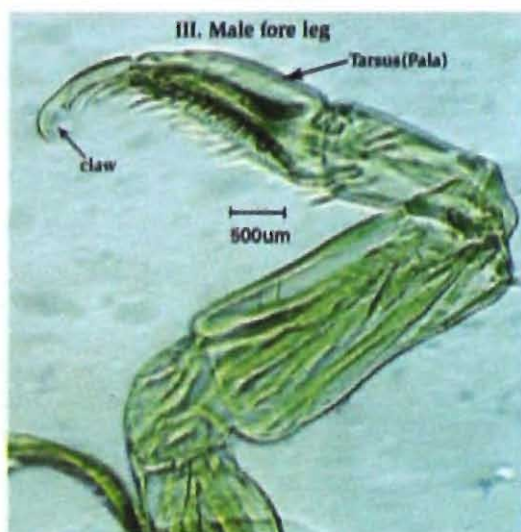
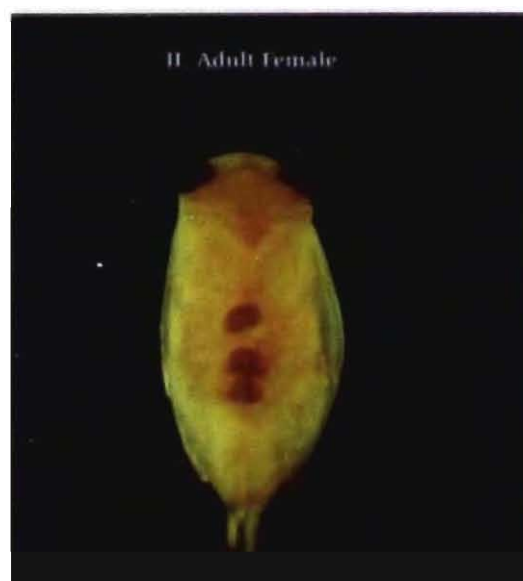
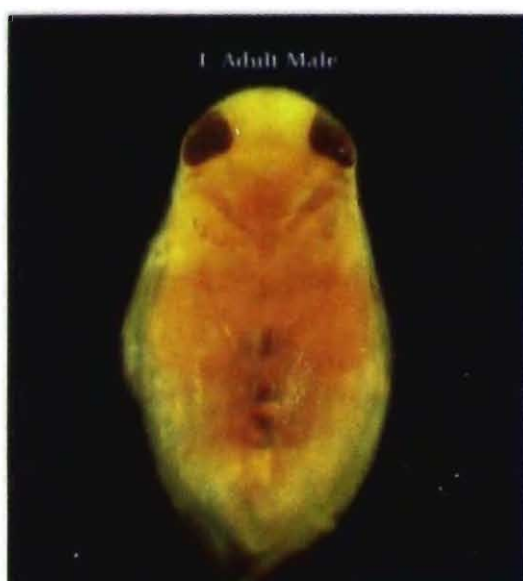
REFERENCES

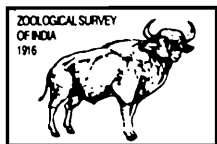
- Femando, C.H. and Cheng, L. 1974. A preliminary study on the fauna and distribution of Aquatic Hemiptera in Malaya and Singapore. *Fedn. Mus. J.*, **19** : 21-44.
- Lundblad, O. 1933. Zur kenntnis der aquatilen und semi-aquatilen Hemipteren von Sumatra, Java und Bali. *Arch. Hydrobiol., Suppliment*, **12** : 1-195, 263-489.
- Mahner, M. 1933. Systema Cryptoceratorum Phylogenticum (Insecta : Heteroptera). *Zoologica*, **48**(1) : 1-302.
- Mani, M.S. 1974. Biogeographical Evolution in India, in **Ecology and Biogeography in India**, Dr. W. Junk B.V. Publishers, the Hague, 698-722 pp.
- Nieser, N. 2002. Guide to Aquatic Heteroptera of Singapore and Peninsular Malaysia IV. Corixoidea. *Raffles Bull. Zool.*, **50**(1) : 263-274.
- Popham, E.J., Bryant, M.T. and Savage, A.A. 1984. The function of the abdominal strigil in male corixid bugs. *J. Nat. Hist.*, **18** : 441-444.
- Thirumalai, G. 1986. On Gerridae and Notonectidae (Heteroptera : Hemiptera) from Silent Valley. *Rec. zool. Surv. India*, **84**(1-4) : 9-33.

- Thirumalai, G. 1996. A new record of the subgenus *Ventidioides* Hungerford and Matsuda of the genus *Ventidius* Distant from India (Halobatinae : Gerridae : Heteroptera). *Arunachal Forest News*, **14**(2) : 14-16.
- Thirumalai, G. 1999. Aquatic and semi-aquatic Heteroptera of India. **Indian Association of Aquatic Biologists (IAAB) , Hyderabad, Publication No 7** : 74 pp. ISBN : 81-900595-6-4.
- Thirumalai, G. and Dam, D. 1996. A new record of the *Tetraripis* Lundblad (Rhagoveliidae : Veliidae : Heteroptera) from India with a key to the known species. *Hexapoda*. **8**(2) : 67-69.

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PLATE I : *MICRONECTA DECORATA* LUNDBLAD





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Short Communication

OCCURRENCE OF *DRACO NORVILLI* ALCOCK (REPTILIA : SAURIA : AGAMIDAE) IN MEGHALAYA, NORTH EAST INDIA

INTRODUCTION

According to Smith, (1935) some forty species of *Draco* are distributed over the Indo-Chinese region, the East Indian Archipelago, and the Phillipine Islands and one species in southern India thereby setting an example of its discontinuous distribution. In North-East India the genus is distributed over Assam, Arunachal Pradesh and Nagaland. A single specimen of *Draco norvilli* Alcock was collected from Maweit some 40 km away from Nongstoin in West Khasi Hills district of Meghalaya on 13th November, 2005 by Jeffrey Pohrmen. The specimen had its left hand maimed but otherwise is in good condition. Since pictures of this species are not available in literature I furnish here a detailed account of the specimen along with the pictures.

DESCRIPTION

Snout slightly turned upwards, nostrils dorsal and pointed slightly backwards, five scales between them. Tympanum scaly. Upper head scales unequal; a tubercle behind the orbit, two behind tympanum, one below lower jaw corner, series of tubercles dorso-laterally on body. Forelimbs long, slender, when straightened anteriorly the wrist cross the tip of snout.

Body greyish with mid dorsal spots, one on the head, five on body; indistinct bands on tail (Plate I). Patagium supported by five ribs and with three transverse bands; the first band indistinct, second and third scarlet and bifurcate as they approach the body. Ground colour of patagium, dorsally and ventrally, yellowish with irregular dark spots dorsally (Plate II). ten to eleven enlarged scales at regular intervals bordering the patagium. Throat and chin mottled with purple. Inside of wattles scarlet. Gular appendage longer than head, distendable, covered with large scales and of very faded purple colour. Lower portion of thigh and sides of tail with crest. Belly almost uniform yellowish, sides mottled with grey (Plate II).

MEASUREMENTS

Snout to vent–110 mm, tail 155 mm. Head length–14 mm (from the corner of jaw). Gular appendage–30 mm. Patagium (stretched)–40 mm. Wattle (stretched)–12 mm. Shoulder to elbow–18 mm. Elbow to wrist–20 mm. Thigh–20 mm. Shank–19 mm. The specimen is registered as VR/ERS/ZSI/237 and is incorporated in the collections of the ERS.

ABBREVIATIONS

mm–milimeters

VR/ERS/ZSI–Vertebrata/Reptilia/Eastern Regional Station/Zoological Survey of India.

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REFERENCES

Smith, M. A. 1935. The Fauna of British India, including Ceylon and Burma. Reptilia and Amphibia Vol. II. Sauria, Taylor and Francis, London, xiii + 440 pp + I pl.

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PLATE I

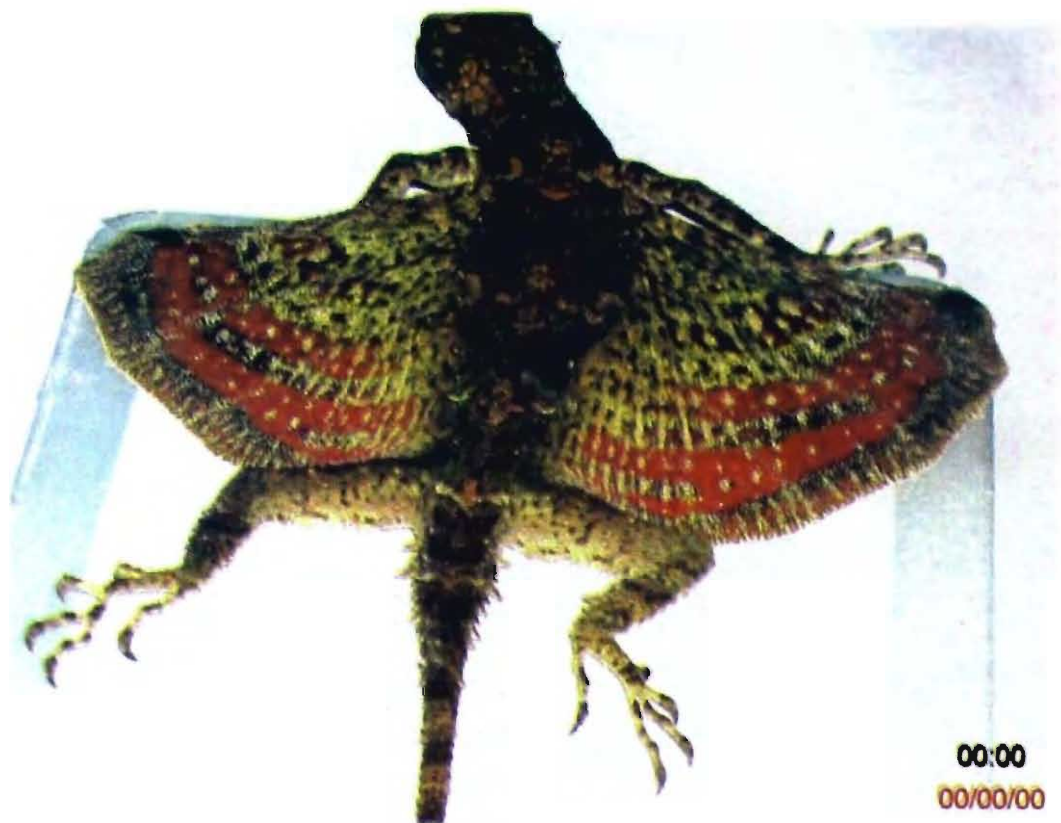


A. : *Draco norvilli* Alcock (full dorsal view).

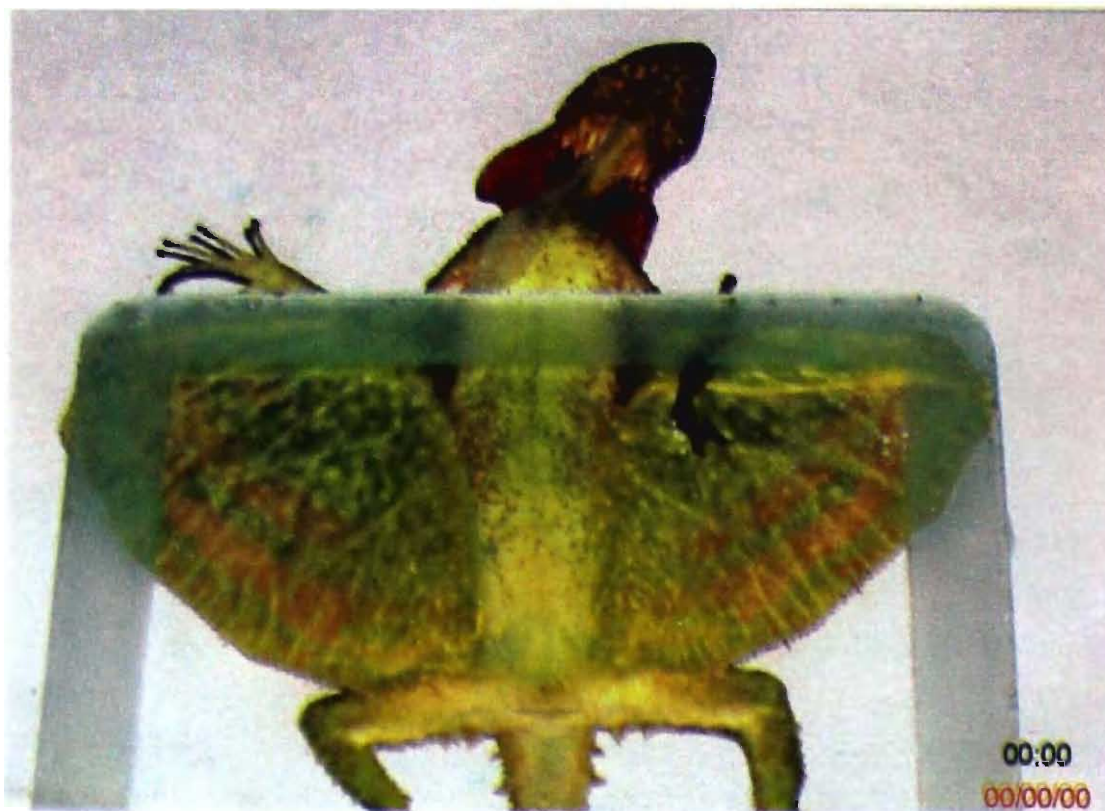


B. : *Draco norvilli* Alcock (close up).

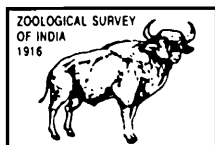
PLATE II



A. : *Draco norvilli* Alcock showing patagium, dorsal view.



B. : *Draco norvilli* Alcock showing patagium, ventral view.



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Short Communication

REPORT OF *PTERYNOTUS PINNATUS* SWAINSON (MOLLUSCA : GASTROPODA : MURICIDAE) FROM SHANKARPUR MOHONA, DIGHA, WEST BENGAL

During the course of our faunistic survey at Shankarpur Mohana, a single shell of *Pterynotus pinnatus* (Swainson, 1822) was collected.

Though moderately common in Tropical Indo-Pacific, *Pterynotus pinnatus* was hitherto recorded in India from the coast of Tamil Nadu (Porto Novo & Chennai), Andamans (Subba Rao, N.V. & Surya Rao, K.V., 1993; Subba Rao, N.V., 2003). Thus, this species has been for the first time collected from the West Bengal area.

SYSTEMATIC ACCOUNT

Phylum MOLLUSCA

Class GASTROPODA

Order NEOGASTROPODA

Family MURICIDAE

Subfamily MURICINAE

***Pterynotus pinnatus* (Swainson)**

1822. *Murex pinnatus* Swainson, A catalogue of the shells which formed the collection of Mrs. Bligh, with an appendix containing descriptions of many new species : 17.
1942. *Murex pinnatus* : Gravely, *Bull. Madras Govt. Mus. new ser.*, **5**(2) : 98, fig. 8d.
1967. *Pterynotus pinnatus* : Cernohorsky, *Marine Shells of the Pacific*, **1** : 124, pl. 26, fig. 158.
1974. *Pterynotus alatus* : Cernohorsky, *Rec. Auckland Inst. Mus.*, **11** : 173, fig. 46 (for synonyms).
1976. *Pterynotus alatus* : Radwin and D' Attilio, *Murex Shells of the world* : 98, pl. 26, fig. 158.

Material examined : 1 ex., Shankarpur Mohana (21°38'249" N & 87°33'386" E); Date of Collection : 3.9.2004.

Description : Shell moderately large, fusiform, spire high with eight whorls; body whorl large, suture shallow; aperture broad and ovate; anal sulcus not distinct; outer lip finely crenulate and interiorly liriate; inner lip smooth; siphonal canal moderate in size. Body whorl with three varices expanded into thin flanges continuing along the body and canal, ventrally scaly in appearance, a single low, knob-like axial ridge prominently on the shoulder in between the varices; spiral sculpture consists of numerous cords, in between with minor threads, a spine-like projection on the siphonal canal. Colour almost white to light fawn with brown patches on the wing. Aperture white.

Measurements :

Specimen	Length (L)	Width (W)	Length of aperture		Width of aperture
			With canal	W/O canal	
1.	57.4 mm	28.35 mm	31.45 mm	12.52 mm	7.1 mm

SUMMARY

The dry shell was collected from the exposed sandy-mudflat at Shankarpur-Mohona during low tide. The shell though a dry one, was in a fresh state with spines intact. Perhaps this indicates the availability of live specimens in this zone.

ACKNOWLEDGEMENTS

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REFERENCES

- Subba Rao, N.V. and Surya Rao, K.V. 1993. Contribution to the knowledge of Indian Marine Molluscs-Pt. 3, Family-Muricidae. *Rec. zool. Surv. India, Occ. Paper No. 153*. pp. 53-54, pl. 7, figs. 7 & 8.
- Subba Rao N.V. 2003. Indian Seashells (Part-I), Polyplacophora and Gastropoda. *Rec. zool. Surv. India, Occ. Paper No. 192*. pp. 232, pl. 54, fig. 12.

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