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Frequency of Publication: Quarterly – 4 parts in one volume.

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Silas. E.G. 1961. Occurrence of the Sea-cow *Halicore dugong* (Erxl) off Saurashtra coast. *J. Bombay nat. Hist. Soc.*, **58**(1): 263-266.

State Fauna/Conservation Areas : Mukhopadhyay, S.K. 1999. Fresh water Oligochaetes, *Fauna of West Bengal, State Fauna Series*, **3**(Part-10) : 95-123. Published by Zool. Surv. India.

Radhakrishna, C. 2007. Amphibia. In : *Fauna of Kudermukh National Park, Karnataka, Conservation Area Series*, **32**: 20-25, Published by Zool. Surv. India.

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AN APPEAL

Zoological Survey of India (ZSI) is a premier taxonomic research organization, under the Ministry of Environment, Forests and Climate Change (MoEF&CC), Govt. of India, engaged in zoological research and documentation of the faunal resources of the country. It was established on 1st July 1916 to promote the survey, exploration and research on the fauna of the Indian Region.

Zoological Survey of India at the time of its inception had inherited enormous collection of zoological specimens/ exhibits from the erstwhile Asiatic Society of Bengal and the Indian Museum, Kolkata. Since then the Survey has been acting as the custodian of this heritage collection, caring and maintaining them. The collection, comprising the zoological specimens of all groups of animals from microscopic protozoa to huge elephants and whales, is a priceless wealth of the country and is called the “National Zoological Collection” (NZC).

Zoological Survey of India has been making all efforts to enrich its zoological collections by accepting the ‘types’ and other identified faunal materials from animal taxonomists and biodiversity researchers of various zoological institutions and universities in the country and abroad. Zoological Survey of India, Kolkata, including its Regional Centres, has been designated by MoEF&CC to act as the ‘National Repository’ for all faunal groups from India, under the Act, in exercise of the powers conferred by sub-section (1) of Section 39 of the Biological Diversity Act, 2002, read with sections 6 and 12 of Notification S.O. 1911 (E), dated 8th November, 2006.

The zoological collection under the custody of ZSI has grown over the years to become the best and the largest one in South-East-Asia, with the well-represented collections of the fauna of India and adjacent countries, even that of the distant Kampuchea in Southeastern Asia. ZSI has at present in its NZC holding nearly 4.5 million specimens of about 70,000 species, out of the approximately 96,373 species (nearly 8 per cent of the world fauna) so far realized from the Indian Region. Among this collection includes about 18,000 ‘type’ specimens, such as holotypes, paratypes, syntypes, etc., which are unique and of highest scientific importance. They are the original specimens, serving as the voucher specimens, on which new species descriptions have been based. The ‘type specimens’ typify and fix the species/genus name for all time, and remain available for examination, comparison and correction in future studies.

Type specimens and identified reference collections are invaluable to researchers for any taxonomic work as they form the basis for accurate and reliable identification; they are also the fundamental units of bio-resource for new analytical techniques related to higher-level research on taxonomy and systematics (e.g. molecular taxonomy). They represent the irreplaceable national/international asset in perspectives of zoological research and biodiversity informatics.

ZSI intends to augment its zoological collection to make it a more complete one, enriching it with species not represented in the collection. Zoological Survey of India is therefore soliciting the

cooperation of the animal taxonomists, biodiversity researchers, scientists and naturalists, appealing to them to deposit their 'type' materials—holotype or paratype(s)—and other identified specimens to the 'National Repository' of Zoological Survey of India. The researchers may deposit their 'material' to ZSI in the following address:

Officer-in-Charge, Identification and Advisory Section,
Zoological Survey of India, M-Block, New Alipore,
Kolkata – 700 053.

The 'type' and other identified specimens will be duly registered, and the data will be computerized. The researchers may use the Registration number of their deposited 'type'(s) in their publications of the new taxon/ taxa.

Dr. K. Venkataraman
Director
Zoological Survey of India

HARA NARESHI, A NEW SPECIES OF CATFISH (PISCES: ERETHISTIDAE) FROM THE BARAK RIVER SYSTEM OF ASSAM, INDIA

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INTRODUCTION

Fishes of the genus *Hara* Blyth belonging to the family Erethistidae are characterised in having a robust body, moderate gill opening and extend onto venter, anterior margin of pectoral spine with serrations point towards tip and arranged in outwardly directed, anterior margin of dorsal spine smooth to granulate, upper lip papillate, anal fin rays 8-12 and thorax with no adhesive apparatus (Hora, 1949, Thomson and Page, 2006).

Viswanath & Kosygin (2000) mentioned five species of this genus, of which *Hara serratus* Viswanath & Kosygin is merged with *Hara hara* (Ng and Kottelat, 2007) Only eight species of the genus is known so far, they being *Hara filamentosa* Blyth, 1860, *H. hara* Hamilton, 1822, *H. horai* Mishra, 1976, *H. jerdoni* Day, 1870, *H. longissima* Ng & Kottelat, 2007, *H. mesembrina* Ng & Kottelat, 2007, *H. minuscula* Ng & Kottelat, 2007, *H. spinulus* Ng & Kottelat, 2007 as reported (Ng & Kottelat, 2007).

A survey was made on the fishes of Barak river. The river originates in the southern spurs of Mt. Japvo and flows through the western hill tracts of the state of Manipur. It enters the southern part of Assam and then Sylhet district of Bangladesh until it flows in the Meghna, the old bed of Brahmaputra. A collection of fishes from the Katakhal and Barak river of the southern Assam included 5 specimens of *Hara*, which do

not fit into the hitherto described eight species of the genus. The present species is being described as *Hara nareshi* in this paper.

MATERIAL AND METHODS

Fishes were collected from the different streams viz., Katakhal river belonging to Barak river system of southern Assam by using various fishing methods. After noting the fresh colour of the specimens, fishes were preserved in 10% formalin. Type specimens were deposited in the Zoological Survey of India (ZSI), Kolkata and their registration numbers are also given in this paper. Counts and measurements are followed as in Jayaram (1999). Measurements were made with a dial calliper to the nearest 0.1 mm. Identification was carried out following Mishra (1976), Tilak (1978), Jayaram (1979, 1999, 2006 & 2010), Ng & Kottelat, 2007, Talwar and Jhingram (1991).

***Erethistes nareshi* sp. nov. (Fig. 1)**

Holotype: ZSI FF/ 3966; 34 mm TL, 24 mm SL, Katakhal and Barak River, Hailakandi District, Assam, India, 07.xii.2004. Coll. B.K. Mahapatra.



Fig. 1. *Erethistes nareshi* sp. nov., Holotype:
ZSI FF/3966; 24 mm SL, Katakhal river,
Hailakandi District, Assam, India.

Paratype: ZSI FF/ 3967, 4 exs, 30-34 mm TL, 21-25 mm SL, Katakhal and Barak River, Hailakandi District, Assam, India, 07.xii.2004. Coll. B.K.Mahapatra, collection data same as holotype.

Local Name: Kauwa Maach (Assam)

Diagnosis: A Erethistid catfish of the genus *Hara* can be distinguished by the following unique combination of characters: Rayed dorsal with a strong spine serrated along both the sides; pectorals equal to head with a strong flattened spine; pectoral spine serrated anteriorly, denticulated posteriorly; serration on outer edge directed towards tip and teeth on inner edge directed towards base; caudal deeply forked, upper lobe with a filamentous prolongation.

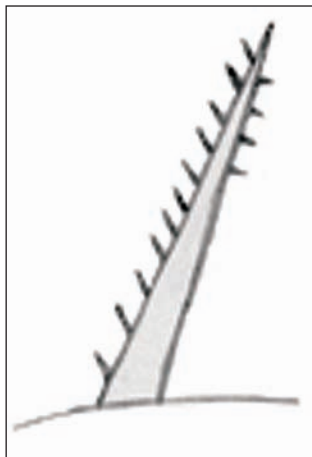


Fig. 2. Dorsal spine showing anterior and posterior serrae of *H. nareshi*.

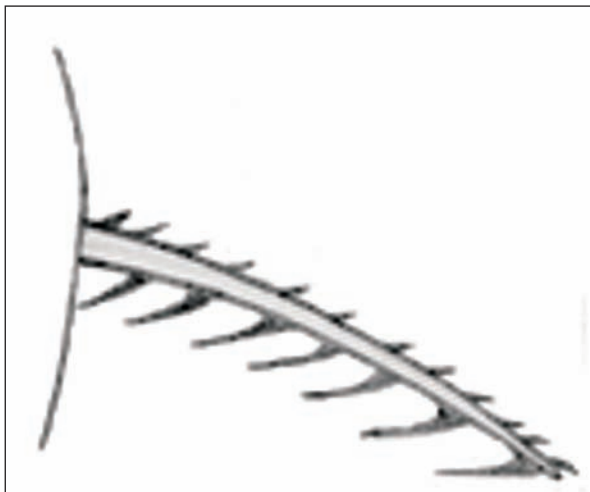


Fig. 3. Pectoral spine showing internal denticulation and external serration of *H. nareshi*.

DESCRIPTION

D I 5-6; P I 6-7; V i 5; A ii 6-7; C 15.

Body moderately elongate, flattened ventrally; head width less or equal to length, flattened ventrally; snout depressed, bluntly pointed; eyes small, subcutaneous, in the middle of head, superior; mouth inferior, upper jaw slightly longer; maxillary barbels with broad bases, reaching middle of pectoral bases, outer mandibular to base of pectoral spine, inner mandibulars to gill opening, the nasals not reaching to orbit; rayed dorsal with a strong spine serrated along both the sides; teeth serrations on the anterior side 11 and on posterior side 4 nos (Fig. 2), size of the serrations gradually smaller from tip to base, teeth on the anterior side directed towards tip; origin nearer to adipose dorsal origin than to snout end; adipose dorsal base smaller than rayed dorsal base, separated from rayed dorsal and caudal fin with considerable distance; pectorals equal to head with a strong flattened spine bearing 7 forwardly directed internal denticulations and 12 backwardly directed external serrations (Fig. 3); caudal deeply forked, upper lobe with a filamentous prolongation; lateral line is complete.

Measurement of in percent of SL of holotypes and paratypes (in parentheses)

Depth of body 25.00 (24.00 to 28.57), depth of head 20.83 (23.80 to 24.00), width of head 20.83 (20.00 to 24.00), length of head 25.00 (24.00 to 28.57), predorsal length 37.50 (32.00 to 42.85), adipose dorsal fin length 16.66 (12 to 19.04).

Measurement of in percent of HL of holotypes and paratypes (in parentheses)

Snout length 50.00 (50.00), head height at occiput 83.33 (83.33 to 100), head width 83.33 (83.33 to 100), eye diameter 13.33 (13.33), dorsal height 83.33 (66.66 to 83.33), pectoral length 100.00 (100.00), pelvic fin length 66.67 (66.67), anal fin height 66.66 (66.66 to 83.33), caudal fin length 116.66 (100.00 to 133.33), interorbital 36.66 (36.66 to 48.33) maxillary barbel length 100 (83.33 to 100.00), nasal barbel length 33.33 (16.66 to 33.33), outer mandibular barbel length 66.66 (83.33), inner mandibular barbel length 50.00 (50.00).

Diameter of eye 26.66 (26.66) in length of snout, least height of caudal peduncle 50.00 (50.00) in length of caudal peduncle.

Colouration: Body dark or yellowish brown with 3 or 4 faint broad dark band. Rayed dorsal and adipose dorsal fins with pale white outer edge. Pectoral, pelvic, anal and caudal fin with two distinct irregular broad brown bands.

Distribution: India : Katakhal River, Hailakandi Dist. Assam

Etymology: The fish is named after a renowned Ichthyologist Dr. Naresh Chandra Datta. former Professor and Head of the Department of Zoology, University of Calcutta

DISCUSSION

The species is similar to *Hara hara* from Barak river in Manipur, in having dorsal spine serrated both the sides. The new species, however, can be easily distinguished from *Hara hara* in having upper lobe of caudal fin with a long filamentous prolongation vs. absent (table 1), shorter head length (25.00% SL vs. 27.25%), shorter predorsal length (37.50% SL vs. 44.00%), longer adipose dorsal fin length 16.66 % SL vs. 11.80 %), shorter dorsal fin height (74.00% SL vs. 82.90%), shorter pectoral length (100% SL vs. 106.70%), longer pelvic fin length (66.67% SLvs. 63.30%), shorter anal fin height (73.33% SL vs. 81.80%), longer

caudal fin length (116.67% SL vs. 98%), deeper head height at occiput (90% HL vs. 84.30%), narrower head width (90% HL vs. 100.10%), shorter maxillary barbel length (93.33% HL vs. 96.90%), nasal barbel length (30%HL vs. 21.10%), outer mandibular barbel length (80% HL vs. 65.20%), inner mandibular barbel length (50% HLvs. 45.40%), shorter interdorsal length 75 % adipose dorsal base vs. 76.9%.

The species is also similar to *Hara filamentosus* from Burma, in having upper lobe of caudal fin with long filamentous prolongation. The new species, however, can also be distinguished from *Hara filamentosus* in having serration on anterior edge of dorsal spine vs. smooth and origin of pelvic fin below middle of rayed dorsal base vs. origin below last dorsal ray, shorter interdorsal length 75 % adipose dorsal base.vs. 98.7%.

The new species of *Hara* differs from other species recorded from Ganga and Brahmaputra drainage by having the following characteristics as given in table 2.

Key to species of genus *Hara*

1. Caudal fin emarginated; vertebrae 27-29 [Brahmaputra and Ganges river drainages]....
..... *H. jerdoni*
- Caudal fin deeply forked; vertebrae 30-35...
..... 2

Table 1. Characteristics of caudal fin of *Hara nareshi* sp. nov.

Specimens	Standard length(mm)	Caudal fin(mm)		Total length (mm)
		Upper lobe	Lower lobe	
Holotype	24	10	6	34
Paratype	21-25	8-9	5-6	32-34

Table 2. Comparison of *H. nareshi* sp. nov. with, *H. jerdoni*, *H. horai*, *H. hara* and Recorded from Ganga and Brahmaputra drainage.

Sl. No.	Particulars	<i>H. nareshi</i>	<i>E. jerdoni</i>	<i>E. horai</i>	<i>E. hara</i>
1	Interdorsal length	75% of adipose dorsal base	100% of adipose dorsal base	90.9% of adipose dorsal base	76.9% of adipose dorsal base
2	Caudal fin	Long filamentous prolongation in upper lobe	No filament in upper lobe	No filament in upper lobe	No filament in upper lobe

2. Serrations on anterior edge of dorsal spine present [Brahmaputra and Ganges river drainages] 3
 - Serrations on anterior edge of dorsal spine absent 4
3. Upper lobe of caudal fin simple; inter dorsal length 76.9% of adipose dorsal base *H. hara*
 - Upper lobe of caudal fin filamentous; inter dorsal length 75% of adipose dorsal base.... *H. nareshi*
4. Supraoccipital process reaching anterior nuchal plate; posterior process on coracoid extending three quarters distance between bases of pectoral spine and pelvic fins; total soft pectoral fin rays modally 5 [Sittang River drainage] *H. minuscula*
 - Supraoccipital process not reaching anterior nuchal plate; posterior process on coracoid extending two third or less distance between bases of pectoral spine and pelvic fins; total soft pectoral fin rays modally 6-7..... 5
5. Length of adipose fin base 10.0-13.7% SL; eye diameter 8.0-9.8% HL [Brahmaputra River Drainage] *H. horai*
 - Length of adipose fin base 12.9-17% SL; eye diameter 11.2-17.9% HL 6
6. Length of dorsal spine 14.7-19.8 % SL; first principal ray on upper lobe of caudal fin not extended into filament [Baw Di Chaung drainage] *H. spinulus*
 - Length of dorsal spine 20.2-27.6 % SL; first principal ray on upper lobe of caudal fin usually extended into filament..... 7
7. Posterior process on coracoid reaching to two thirds distance between bases of pectoral spine and first pelvic fin ray, its length 23.6-27.0% SL [rivers draining southern extremity of Tenasserim Range]..... *H. mesembrina*.
 - Posterior process on coracoid reaching to midway of distance between bases of pectoral spine and first pelvic fin ray, its length 19.9-23.9% SL..... 8
8. Caudal peduncle length 14.9-17.8% SL, depth 6.1-7.2% SL (depth 2.1-2.9 times in its length); body depth 13.9-19.2% SL [Ataran, Salween and Sittang river drainages]..... *H. filamentosa*
 - Caudal peduncle length 18.8-21.3% SL, depth 5.0-6.1 % SL (depth 3.1-3.9 times in its length); body depth 12.5-14.5% SL [Irrawaddy River drainage]..... *H. longissima*

SUMMARY

A new fresh water Erethistid catfish species of the genus *Hara* Blyth collected from the Katakhal and Barak River, Assam, India is described and illustrated under the name *Hara nareshi*. The new species may look similar to *Hara hara* Hamilton and *Hara filamentosus* Blyth, differs from its congeners in having caudal fin with long filamentous prolongation in the upper lobe and depth of caudal peduncle. A key to identification of species of the genus *Hara* is given.

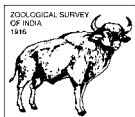
ACKNOWLEDGEMENT

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SOME SPECIES OF DORYLAIMOIDEA (NEMATODA) ASSOCIATED WITH GUAVA AND LITCHI, WITH NEW RECORDS FROM WEST BENGAL, INDIA

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INTRODUCTION

Few specimens of *Aporcelaimellus amylovorus* (Thorne and Swanger, 1936) Heyns, 1965, *Aporcelaimellus baqrii* Ahmad & Jairajpuri, 1982, *Aporcelaimellus chauhani* Baqri & Khera, 1975, *Aporcelaimellus coomansi* Baqri and Khera, 1975, *Aporcelaimellus indicus* Baqri & Jairajpuri, 1968, *Aporcelaimellus papillatus* (Bastian, 1865) Baqri and Khera, 1975, *Aporcelaimellus tritici* (Bastian, 1865) Andr ssy, 1986 and *Tyleptus projectus* Thorne, 1939 were collected from soil around the roots of guava and litchi plantations at different locations of South 24-Parganas, West Bengal, India. Among these *A. papillatus* and *A. tritici* are the new records from India. The other species are with the new distributional records from South 24-Parganas as well as from west Bengal. *Aporcelaimellus amylovorus*, *Aporcelaimellus baqrii*, *Aporcelaimellus indicus* are observed for the first time in West Bengal and *Aporcelaimellus chauhani*, *Aporcelaimellus coomansi*, *Tyleptus projectus* are the first distributional records in South 24-Parganas district of West Bengal. The present specimens of the above genera agree well with their original description except some minor variations which are considered to be intraspecific. The distributions of the species in India as well as in the world have been provided. The nomenclature for the different parts of vagina, i.e., *pars proximalis*, *pars refringens* and *pars distalis* vaginae in dorylaimoid nematodes have

been given after De lay, Loof and Coomans (1993). The measurements of these three parts of vagina have been provided in the present communication.

MATERIALS AND METHODS

The collected soil samples were processed by Cobb's sieving and decantation technique (Cobb, 1918) followed by modified Baermann funnel technique (Christie and Perry, 1951) for extraction of nematodes. The nematode specimens were fixed and preserved in their characteristic body posture in hot FA (formalin-acetic acid 4:1) solution and were mounted in anhydrous glycerin, sealed by paraffin wax (De Maeseneer & d'Herde, 1963) to make permanent slides. Then they were observed under a compound microscope (Olympus BX 41), measured and drawings were made by the help of a drawing tube attached to the same microscope.

SYSTEMATIC POSITION

Order DORYLAIMIDA Pearse, 1942

Sub order DORYLAIMINA Pearse, 1936

Super family DORYLAIMOIDEA
de Man, 1876

Family APORCELAIMIDAE Heyns, 1965

Sub family APORCELAIMINAE Heyns, 1965

Genus *Aporcelaimellus* Heyns, 1965

1. *Aporcelaimellus amylovorus* (Thorne and Swanger, 1936) Heyns, 1965

2. *Aporcelaimellus baqrii* Ahmad and Jairajpuri, 1982
3. *Aporcelaimellus chauhani* Baqri and Khera, 1975
4. *Aporcelaimellus coomansi* Baqri and Khera, 1975
5. *Aporcelaimellus indicus* Baqri and Jairajpuri, 1968
6. *Aporcelaimellus papillatus* (Bastian, 1865) Baqri and Khera, 1975
7. *Aporcelaimellus tritici* (Bastian, 1865) Andrassy, 1986

Super family TYLENCHOLAIMOIDEA
Filipjev, 1934

Family LEPTONCHIDAE Thorne, 1935

Sub family TYLEPTINAE Jairajpuri, 1964

Genus *Tyleptus* Thorne, 1939

8. *Tyleptus projectus* Thorne, 1939

1. *Aporcelaimellus amylovorus* (Thorne and Swanger, 1936) Heyns, 1965

(Figure 1)

Measurements: Females ($n = 3$): $L = 1.97\text{--}2.21\ \mu\text{m}$; $a = 26.73\text{--}30.06$; $b = 3.78\text{--}4.19$; $c = 52.6\text{--}57.3$; $c' = 0.84\text{--}0.95$; $V = 51.22\text{--}51.69\%$; $G_1 = 14.87\text{--}24.31\%$; $G_2 = 15.98\text{--}22.56\%$; odontostyle = $20.5\text{--}24.5\ \mu\text{m}$; odontostyle width = $5\ \mu\text{m}$; odontostyle aperture = $10.5\text{--}13.5\ \mu\text{m}$; odontophore = $39\text{--}43\ \mu\text{m}$; maximum body width = $66\text{--}78\ \mu\text{m}$; length of pharynx = $519.5\text{--}527\ \mu\text{m}$; body width at neck base = $62.5\text{--}68.5\ \mu\text{m}$; body width at vulva = $66\text{--}78\ \mu\text{m}$; expanded part of pharynx = $257\text{--}274.5\ \mu\text{m}$; glandularium = $217.5\text{--}223.5\ \mu\text{m}$; distance of vulva from anterior end = $1022\text{--}1139\ \mu\text{m}$; length of anterior gonad = $294\text{--}507\ \mu\text{m}$; length of posterior gonad = $316\text{--}355\ \mu\text{m}$; prerectum = $196\text{--}250\ \mu\text{m}$; rectum = $37\text{--}51.5\ \mu\text{m}$; tail length = $34.5\text{--}42\ \mu\text{m}$; anal body diameter = $39\text{--}44\ \mu\text{m}$.

Diagnosis: Female: Body ventrally curved on fixation, slightly tapering towards anterior end. Cuticle thick at anterior and posterior ends; its thickness $3.5\text{--}5\ \mu\text{m}$ at the level of odontostyle, $2.5\text{--}3.5\ \mu\text{m}$ at mid body and $3.5\text{--}5\ \mu\text{m}$ on tail. Lip region set off by deep constriction, slightly

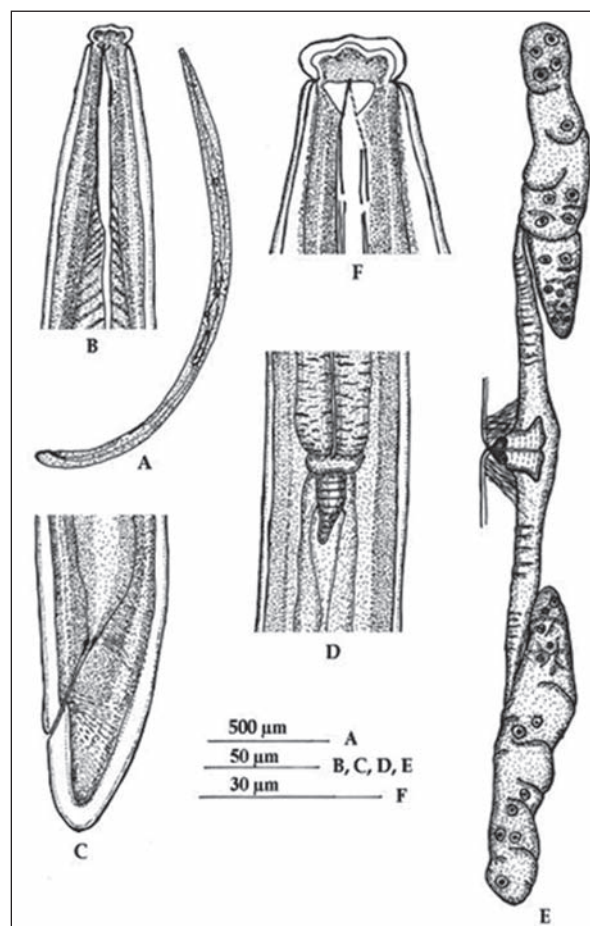


Fig. 1. *Aporcelaimellus amylovorus*. Female: A. Entire body, B & F. Anterior end showing odontostyle & amphid, C. Tail, D. Pharyngo-intestinal junction & cardia, E. Reproductive system.

wider than adjoining body, $7.0\ \mu\text{m}$ high, and $17\text{--}20\ \mu\text{m}$ wide or $1/3.5$ of the body-width at neck base. Amphids stirrup shaped, their apertures occupying about half of the lip width. Odontostyle $1\text{--}1.5$ lip region-widths long, aperture distinct and large, about $52\text{--}55\%$ of its length. Guiding ring at $10\text{--}11\ \mu\text{m}$ from anterior end. Odontophore rod-like, about $1.6\text{--}1.7$ times the odontostyle length. Nerve ring at $164\text{--}169\ \mu\text{m}$ from anterior end. Expanded portion of pharynx $49\text{--}52\%$ of the total pharyngeal length. Well developed cardiac disc present, cardia elongated. Vulva almost equatorial or slightly post-equatorial. Vagina distally sclerotized, $21.5\text{--}24.5\ \mu\text{m}$ long (*pars proximalis* vagina $12.5\text{--}14.5\ \mu\text{m}$, *pars refringens* $5\text{--}6\ \mu\text{m}$ and *pars distalis* $3.5\text{--}4\ \mu\text{m}$ long) or about one-third about the corresponding body width. Female reproductive system amphidelphic. Both

ovaries reflexed, anterior ovary 122.5–247 μm and posterior ovary 122.5–205.5 μm long. Prerectum about 4–7 and rectum about one anal body-widths long. Tail short, less than one anal body width, convex both dorsally and ventrally, ending in a rounded terminus.

Male: Not found.

Habitat and Locality: Collected from soil around the roots of guava from Sitakundu, Baruipur, South 24-Parganas.

Registration Number: On slide, WN 1440, deposited in National Zoological Collection, Zoological Survey of India, Kolkata

Distribution: In India: Himachal Pradesh and West Bengal.

In world: Hungary, Poland, Spanish mainland.

Remark: Ahmad and Jairajpuri (1982) first reported the male and female of *Aporcelaimellus amylovorus* from Himachal Pradesh, India from the soil around the roots of apricot (*Prunus armeniaca* L.). They reported the females with longer odontostyle measuring 22–23 μm (20 μm in type specimen) which agrees well with the present specimens. Females of the present specimens are also very close to those described by Thorne and Swanger (1936) except the lesser value of 'c' ($c = 67$ in type specimen). This is the first report of the species from West Bengal.

2. *Aporcelaimellus baqrii* Ahmad &

Jairajpuri, 1982

(Figure 2, 3)

Measurements: Females ($n = 14$): $L = 1.86$ – 2.43 μm ; $a = 25.8$ – 38.3 ; $b = 3.5$ – 4.4 ; $c = 59.3$ – 71.7 ; $c' = 0.5$ – 0.8 ; $V = 48.1$ – 58.8% ; $G_1 = 9.1$ – 21.3% ; $G_2 = 11.1$ – 22.7% ; odontostyle = 20.5–24.5 μm ; odontostyle aperture = 10.5–12.5 μm ; odontophore = 27.5–37.5 μm ; maximum body width = 50.5–78 μm , length of pharynx = 495–581 μm ; body width at neck base = 49–71 μm ; body width at vulva = 50.5–78 μm ; expanded part of pharynx = 267–313 μm ; glandularium = 235–262.5 μm ; distance of vulva from anterior end = 941–1240 μm ; length of

anterior gonad = 184–409 μm ; length of posterior gonad = 225.5–441 μm ; prerectum = 51.5–107 μm ; rectum = 32–49 μm ; tail length = 27–39 μm ; anal body diameter = 33–59 μm .

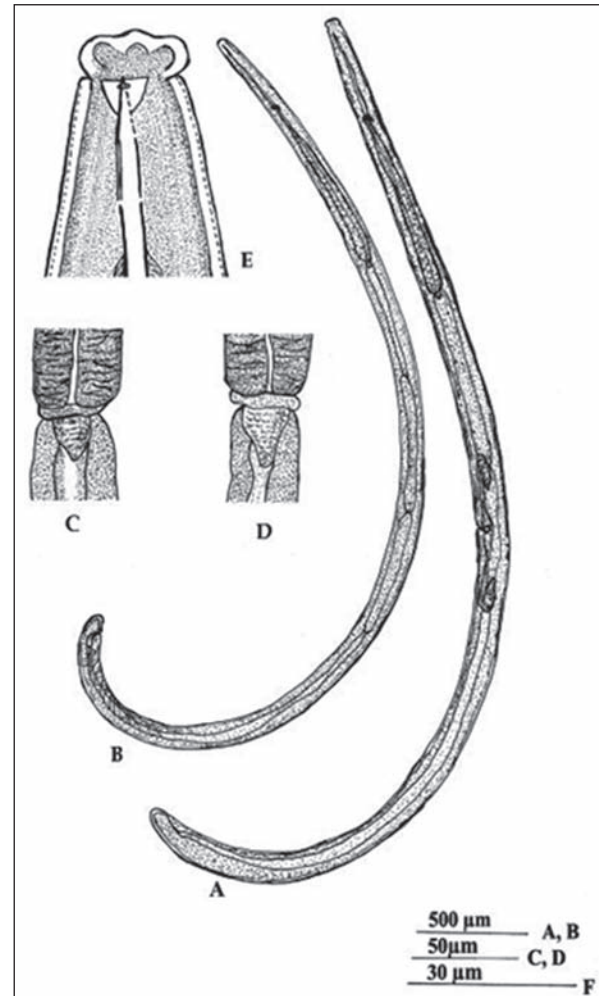


Fig. 2. *Aporcelaimellus baqrii*. Female: A. Entire body, C & D. Pharyngointestinal junction showing differences in shape of cardia, E. Anterior body end. Male: B. Entire body.

Males ($n = 02$): $L = 1.86$ – 1.93 μm ; $a = 31.7$ – 38 ; $b = 3.7$ – 3.8 ; $c = 63.4$ – 71.7 ; $c' = 0.8$ – 0.9 ; $T = 52.2$ – 57.8% ; odontostyle = 22.5–23.5 μm ; odontostyle aperture = 11.5 μm ; odontophore = 35–36 μm ; maximum body width = 49–61 μm ; length of pharynx = 485–514.5 μm ; body width at neck base = 49–58.5 μm ; expanded part of pharynx = 245–269.5 μm ; prerectum = 98–122.5 μm ; tail length = 27–29.5 μm ; anal body diameter = 31.5 μm ; length of testis = 1012–1078 μm ; spicule length = 54–56.5 μm ; lateral guiding

piece = 12–15 μm ; Number of Ventromedian supplements = 11–12.

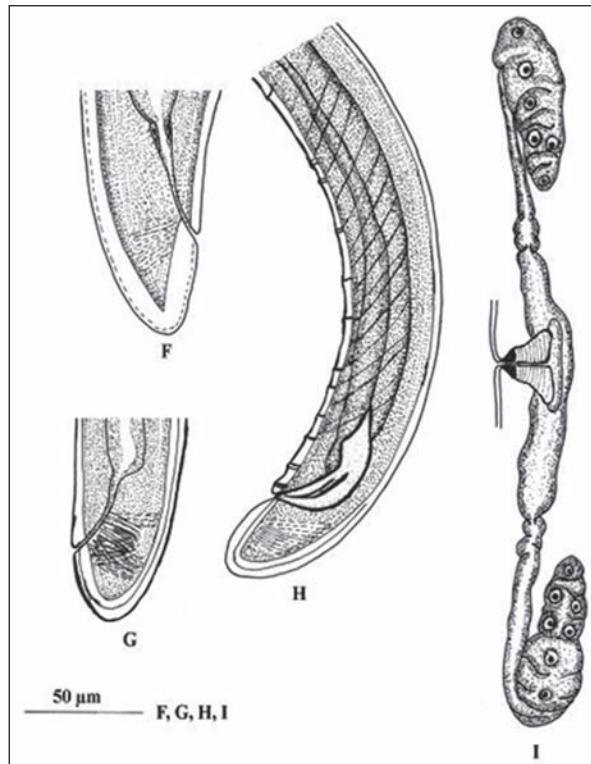


Fig. 3. A. *Aporcelaimellus baqrii*. Female: F & G. difference in tail shape, I. Reproductive system. Male: H. Posterior end showing ventromedian supplements and spicule and tail.

Diagnosis: Female: Body ventrally curved on fixation, the posterior portion in particular, slightly tapering towards anterior end. Cuticle finely striated, 3.5–5 μm thick at the level of odontostyle, 2.5–5 μm at mid body and 5–9 μm on tail. Lip region clearly set off by constriction, slightly wider than adjoining body, 16–21.5 μm wide or about one-third of body width at neck base, 6.5–10 μm high. Amphids stirrup-shaped. Odontostyle 1.1–1.5 lip region-widths long, its aperture 48–53.5% of odontostyle length. Guiding ring 10–12 μm from anterior end. Odontophore rod-like, 1.2–1.6 times the odontostyle length. Nerve ring at 139.5–174 μm from anterior end. Expanded part of pharynx 51–56% of the pharyngeal length. Cardiac disc present, cardia rounded to conoid, 10–19.5 μm long. Vulva transverse, slightly pre-equatorial to post-equatorial. Vagina 15–27 μm or about half to one-fourth of the corresponding body width

(length of *pars proximalis* vagina 13.5–17.5 μm , *pars refringens* 5–7 μm and *pars distalis* 2–4 μm), distally sclerotized. Female reproductive system amphidelphic, both ovaries reflexed. Prerectum 1–3.1 and rectum more or less one anal body-width long. Tail short, 0.6–0.88 anal body-width long, dorsally and ventrally convex ending in a bluntly conoid to hemispheroid terminus.

Male: Similar to females in general morphology except the following. Testes outstretched. Supplements consist of an adanal pair and 10–11 irregularly spaced ventromedians. Spicules 1.6–1.7 anal body diameter long. Lateral guiding piece 1/3.7–1/4.5 of spicule length. Prerectum 3.1–3.8 anal body widths long. Tail short with rounded terminus, 0.8–0.9 anal body widths long.

Habitat and Locality: Collected from soil around the roots of guava at Sonarpur and Baruipur block and from that of litchi at Joynagar, South 24-Parganas district.

Registration Number: On slides, WN1441, WN1442, WN1443 and WN1444, WN1045, WN1446, and WN 1454, deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Distribution: In India: Uttar Pradesh and West Bengal.

Remark: Ahmad and Jairajpuri (1982) described this species from soil around the roots of mosses and ferns from Uttar Pradesh, India. Females of the present population agree well with those except in having slightly shorter odontostyle and longer prerectum (odontostyle = 24–26 μm and prerectum = 45–67 μm in the female paratypes). They described *A. baqrii* based on a single male paratype. Some measurements in males, although come closer, differ from the present male specimens because no minimum-maximum range of body dimensions of male paratype was provided by Ahmad and Jairajpuri (1982) due to single male ($a = 29$; $c = 58$; prerectum = 65 μm ; spicules = 63 μm ; ventromedian supplements = 12 in the male paratype). This is the first report of the species from West Bengal.

3. *Aporcelaimellus chauhani* Baqri &
Khera, 1975
(Figure 4)

Measurements: Females (n = 11): L = 1.28–1.92 μ m; a = 23.8–33.7; b = 3.5–4.2; c = 28–34; c' = 1.4–2.1; V = 49.6–53.9%; G₁ = 15.4–22.7%; G₂ = 15.4–25.7%; odontostyle = 19.5–22.5 μ m; odontostyle width = 2.5–4 μ m; odontostyle aperture = 8–10 μ m; odontophore = 31.5–34 μ m; maximum body width = 46.5–63.5 μ m, length of pharynx = 343–453 μ m; body width at neck base = 42.5–56.5 μ m; body width at vulva = 46.5–62.5 μ m; expanded part of pharynx = 154–196 μ m; glandularium = 125.5–144.5 μ m; distance of vulva from anterior end = 674–1036 μ m; length of anterior gonad = 240–372.5 μ m; length of posterior gonad = 240–404 μ m; prerectum = 37–83 μ m; rectum = 29.5–41.5 μ m; tail length = 42–61 μ m; anal body diameter = 27–29.5 μ m.

Male (n = 01): L = 0.80 μ m; a = 27.7; b = 3.4; c = 27.7; c' = 1.1; T = 54.4%; odontostyle = 16.5 μ m; odontostyle aperture = 7.5 μ m; odontophore = 18.5 μ m; maximum body width = 29 μ m; length of pharynx = 235 μ m; body width at neck base = 29 μ m; expanded part of pharynx = 110 μ m; prerectum = 44 μ m; tail length = 29 μ m; anal body diameter = 24.5 μ m.; length of testis = 438.5 μ m; spicule length = 27.5 μ m; Number of Ventromedian supplements = 9.

Juvenile (n = 01): L = 0.85 μ m; a = 26.8; b = 3.4; c = 17.5; c' = 2.5; odontostyle = 14.5 μ m; replacing odontostyle = 14.5 μ m; odontostyle aperture = 7 μ m; odontophore = 19.5 μ m; maximum body width = 32 μ m; length of pharynx = 250 μ m; expanded part of pharynx = 117.5 μ m; body width at neck base = 29 μ m; prerectum = 32 μ m; rectum = 22 μ m; tail length = 49 μ m; anal body diameter = 19.5 μ m.

Diagnosis: Female: Body ventrally curved on fixation, gradually tapering towards anterior end. Cuticle finely striated, 1–2.5 μ m thick at the level of odontostyle, 2.5 μ m at mid body and 3.5–5 μ m on tail. Lip region distinctly set off from body by deep constriction, slightly wider than adjoining body, 15–17 μ m wide and 6–7.5 μ m high. Amphids stirrup shaped, at 8–9 μ m from the anterior end. Odontostyle 1.2–1.4 lip region widths long. Guiding ring indistinct, 9–14.5 μ m from anterior end. Odontophore 1.5–1.7 times the odontostyle length. Nerve ring at 120–127 μ m from anterior end. Expanded portion of pharynx 44.5–47% of the pharyngeal length. Cardiac disc present, Cardia 14.5 μ m long, elongate conoid with finely rounded terminus. Vulva transverse, almost equatorial to slightly post-equatorial. Vagina 18–24.5 μ m long or about half to one-third of the corresponding body width (length of *pars proximalis* vagina 10–14.5 μ m, *pars refringens* 5–6 μ m and *pars distalis* 3–5 μ m), distally sclerotized. Reproductive system amphidelphic. Ovaries reflexed and long, anterior ovary 88–159 μ m and posterior ovary 86–159 μ m long. Prerectum 1.27–1.8 and rectum 1–1.1 anal body-widths long. Tail 1.4–2.1 anal body widths long, ventrally convex-conoid with slight dorsal concavity towards extremity ending in a sub-acute to acute terminus.

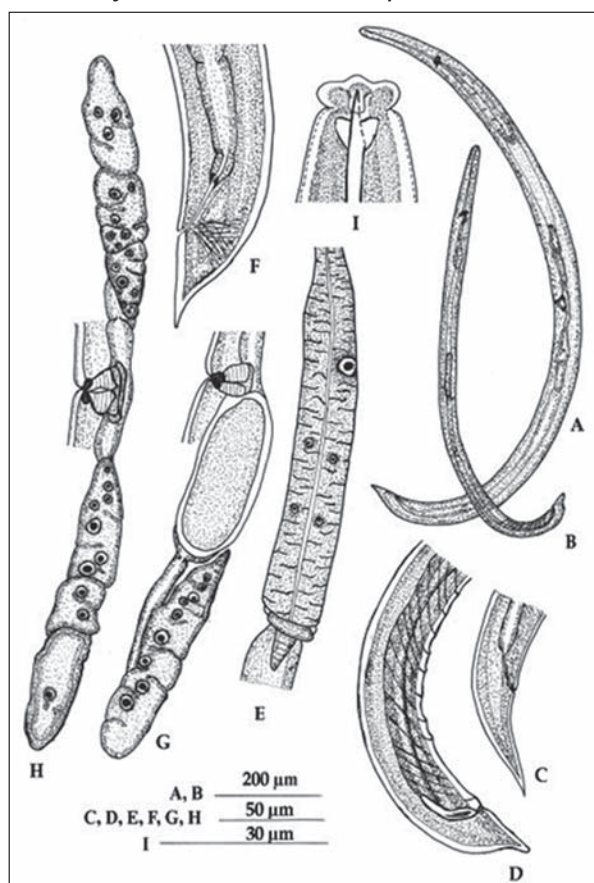


Fig. 4. *Aporcelaimellus chauhani*. Female: A. Entire body, E. Expanded part of pharynx showing gland nuclei and cardia, F. Tail end, G & H. Reproductive system & intra-uterine egg, I. Anterior end. Male: B. Entire body, D. Posterior end showing ventromedian supplements, spicule & tail. Juvenile: C. Tail end.

Male: Similar in general morphology and most of the body ratios with those of females except much shorter body length and the following features. Lip region 12.5 μm wide and 5 μm high. Amphids at 6 μm from anterior end. Odontophore shorter, 1.1 times the odontostyle length. Nerve ring at 86 μm from anterior end. Testes outstretched. Supplements consist of an adanal pair and eight regularly placed ventromedians. Spicules small, slightly arcuate, 1.1 anal body widths long. Tail 1.2 anal body widths long, with slight dorsal concavity towards extremity, ending in a subacute or finely rounded terminus.

Juvenile: General body shape similar with those of adult females. Lip region 10 μm wide and 6 μm high. Both odontostyle and replacing odontostyle 1.5 lip region-width long, aperture 45.4% of the odontostyle length. Odontophore 1.3 times the odontostyle length. Tail shape and terminus exactly as that of females, 2.5 anal body-widths long.

Habitat and Locality: Collected from soil around the roots of guava at Joynagar block, at Natunpara and Dhapdhapi of Baruipur block, and from soil around the roots of litchi at Sonarpur block, South 24-Parganas district.

Registration Number: On slides, WN 1447, WN 1448, WN 1449 and WN 1450, deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Distribution: In India: Darjeeling, Hooghly and South 24-Parganas districts of West Bengal.

Remark: The present female specimens are in well conformity with those described by Baqri and Khera (1975) from soil around the roots of banana from Darjeeling district, West Bengal, India except in having sub-acute to acute tail tip, slightly longer odontostyle and tail (odontostyle = 17–20 μm , tail = 34–45 μm with sub-acute terminus). The sub-acute tail of female paratypes agrees well with the tail of single male of the present specimen. Jana and Baqri (1981) reported this species with its first male from the soils of ladies finger (*Hibiscus esculentus*) from Hooghly district, West Bengal. This is the first report of the species from South 24-Parganas district.

4. *Aporcelaimellus coomansi*

Baqri and Khera, 1975

(Figure 5)

Measurements: Females (n = 6): L = 2.04–2.28 mm; a = 40.5–43.5; b = 4.1–4.3; c = 40.5–45.7; c' = 1.4–1.7; V = 52.9–55.2%; G₁ = 11–15.2%; G₂ = 11.7–19.7%; odontostyle = 14.5–17.5 μm ; odontostyle width = 3–4 μm ; odontostyle aperture = 8.5–10 μm ; odontophore = 27.5–29 μm ; maximum body width = 49–54 μm , length of pharynx = 490–534 μm ; body width at neck base = 46.5–51.5 μm ; body width at vulva = 49–54 μm ; expanded part of pharynx = 284–308 μm ; distance of vulva from anterior end = 1132–1240 μm ; vaginal length = 20.5–22.5 μm ; length of anterior gonad = 248–333 μm ; length of posterior gonad = 267–443 μm ; prerectum = 96–216 μm ; rectum = 29–37 μm ; tail length = 49–56 μm ; anal body diameter = 29–34 μm .

Diagnosis: Female: Body slightly ventrally curved on fixation, tapering towards anterior end. Cuticle with striations, 2.5 μm thick at the level of odontostyle and at mid body, 5–6 μm on tail and thickest on tail on tail tip being 13 μm . Lip region set off by constriction, slightly wider than adjoining body; 5 μm high, 15 μm wide or about 1/3.5 of body widths at neck base. Amphids stirrup-shaped, 5 μm from anterior end. Odontostyle 1–1.2 lip region-widths long, its aperture 55.5–56.2% of odontostyle length. Guiding ring at 6–7 μm from anterior end. Odontophore rod-like, 1.5–1.8 times the odontostyle length. Nerve ring at 125–137 μm from anterior end. Expanded portion of pharynx occupying 55–59% of total pharyngeal length. Thin pharyngo-intestinal disc present. Cardia hemispheroid, tongue-shaped. Vulva transverse, slightly post-equatorial. Vagina about 1/2.5 corresponding body-widths long (length of *pars proximalis* vagina 11.5–14.5 μm , *pars refringens* 4–5 μm and *pars distalis* 5–6 μm); very lightly sclerotized distally. Reproductive system amphidelphic. Ovaries reflexed, anterior ovary 68.5–135 μm and posterior ovary 81–174 μm long. Prerectum 3.8–6.3 and rectum 1–1.1 anal body-widths long. Tail short, convex-conoid with rounded terminus, 1.6 anal body-widths long, with two caudal pores on each side.

Male: Not found.

Habitat and Locality: Collected from soil around the roots of litchi from Baruipur and Joynagar block, South 24-Parganas district.

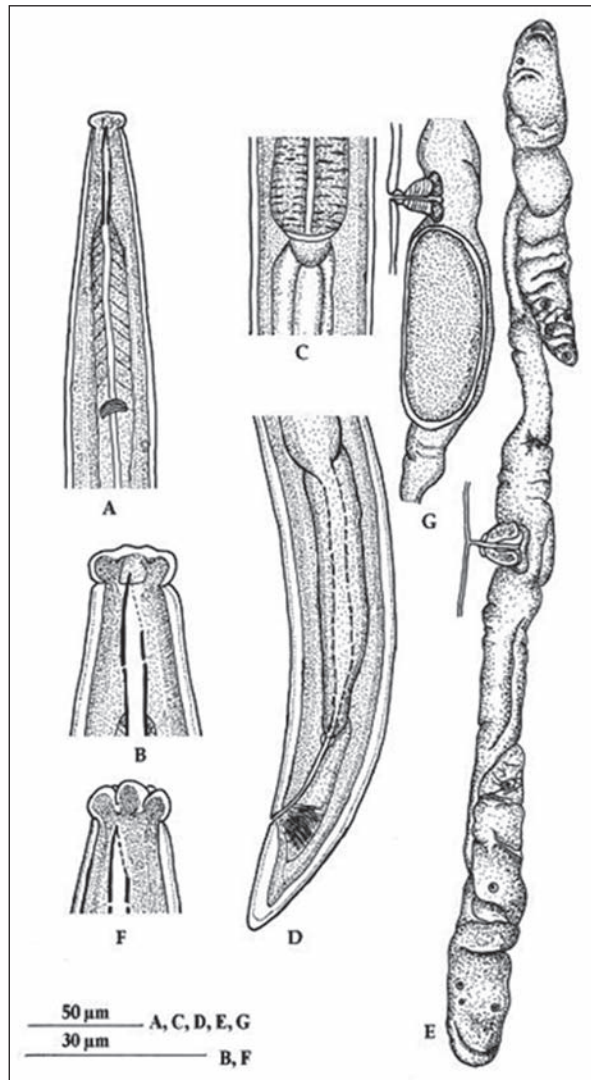


Fig. 5. *Aporcelaimellus coomansi*. Female: A. Anterior end, B & F. Variation in cephalic region, C. Pharyngo-intestinal junction & cardia, D. Posterior end, E. Reproductive system, G. Intra-uterine egg.

Registration Number: On slides, WN1451, WN1452 and WN 1453, deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Distribution: In India: Darjeeling and South 24-Parganas districts of West Bengal, Silent valley of Kerala.

Remark: Baqri and Khera (1975) described the species from soil around the roots of banana from

Darjeeling district, West Bengal, India. Further, Jana and Baqri (1981) reported the species from same habitat and locality. Then after Ahmad (1995) recorded this species along with its first report of male from soil around the roots of wild tree at Silent Valley, Kerala, India. The present specimens are in conformity with the earlier ones. Andrassy (2001) transferred the species to the genus *Metaporcelaimellus* Lordello, 1965. This is the first report of the species from South 24-Parganas.

5. *Aporcelaimellus indicus*

Baqri & Jairajpuri, 1968

(Figure 6)

Measurements: Females (n = 04): L = 2.31–2.77 mm; a = 37.2–42.8; b = 3.8–4.1; c = 39.2–47; c' = 1.3–1.8; V = 54.8–56.1%; G₁ = 11.2–17.2%; G₂ = 10.5–20.8%; odontostyle = 17.5–24.5 µm; odontostyle aperture = 9.5–12.5 µm; odontophore = 31–35 µm; maximum body width = 54–74.5 µm, length of pharynx = 600–669 µm; body width at neck base = 54–68.5 µm; body width at vulva = 54–71 µm; expanded part of pharynx = 301–392 µm; distance of vulva from anterior end = 1267–1560.5 µm; vaginal length = 27–31 µm; length of anterior gonad = 260–480 µm; length of posterior gonad = 245–580 µm; prerectum = 117.5–159 µm; rectum = 37–56 µm; tail length = 59 µm; anal body diameter = 32–44 µm.

Diagnosis: Female: Body stout, cylindrical, gradually tapering towards anterior end, ventrally curved behind vulva in the posterior portion. Cuticle smooth, 2.5–5 µm thick at the level of odontostyle and at mid body, 6–10 µm on tail and 17 µm on tail tip. Lateral, dorsal and ventral body pores not visible. Lip region set off from body by depression, 7.5 µm high, wider than adjoining body, 17–23 µm wide or about one-third of body width at neck base. Amphids broad, stirrup-shaped, occupying 8–10 µm or about two-fifth of the corresponding body width, located at 8µm from anterior end. Odontostyle slightly more than one lip region-width long, its aperture 52–55.5% of odontostyle length. Odontophore simple, rod-like, 1.4–1.7 times the odontostyle length.

Nerve ring at 139–193 μm from anterior end. Expanded portion of pharynx occupying about 50–58.5% of the pharyngeal length. Pharyngo-intestinal disc present, cardia hemispheroid or tongue-shaped. Vagina about half of the corresponding body-width long, sclerotisation absent. Reproductive system amphidelphic, uterus and oviduct distinctly separated by a sphincter in both anterior and posterior sexual branch. Ovaries reflexed, anterior ovary 90–205 μm and posterior ovary 81–284 μm long, oocytes arranged in a single row. Prerectum 3.6–3.6 and rectum 1.1–1.2 anal body-widths long. Tail 1.3–1.8 anal body widths long, slightly ventrally arcuate, conoid with rounded terminus.

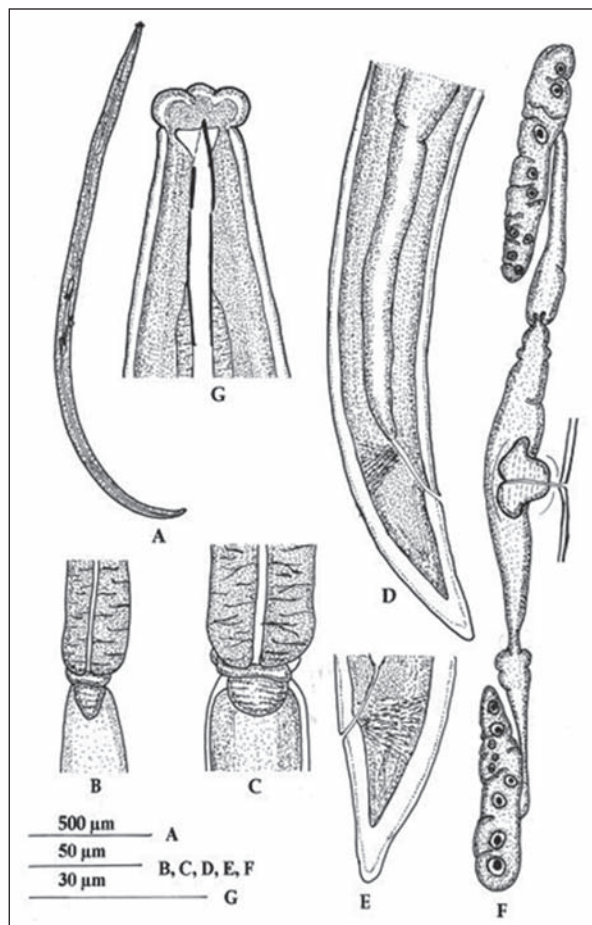


Fig. 6. *Aporcelaimellus indicus*. Female: A. Entire body, B & C. Pharyngo-intestinal junction showing variation in shape of cardia, D & E. Posterior end showing variation in tail shape, F. Reproductive system, G. Anterior body end.

Male: Not found.

Habitat and Locality: Collected from soil around the roots of guava at Dhapdhapi, Baruipur block, South 24-Parganas district.

Registration Number: On slide, WN1454, WN1455, deposited in National Zoological Collection, Zoological Survey of India, Kolkata

Distribution: In India: Uttar Pradesh and West Bengal.

Remark: The present female specimens conform well with those described by Baqri and Jairajpuri (1968) from soil around the roots of cotton (*Gossypium hirsutum* L.) from Uttar Pradesh, India except in having longer odontostyle, lesser value of a and b (odontostyle = 16 μm ; a = 49–50; b = 4.7 in type specimens). Andrassy (2001) synonymised this species with *Metaporcelaimellus mombuca* Lordello, 1965. This is the first report of the species from West Bengal.

6. *Aporcelaimellus papillatus* (Bastian, 1865)
Baqri and Khera, 1975

(Figure 7)

Measurements: Females ($n = 1$): $L = 2.23 \mu\text{m}$; $a = 45.5$; $b = 4.3$; $c = 69.6$; $c' = 1.1$; $V = 60.5\%$; $G_1 = 24.4\%$; $G_2 = 25.4\%$; odontostyle = 17.5 μm ; odontostyle width = 4.5 μm ; odontostyle aperture = 10 μm ; odontophore = 39 μm ; maximum body width = 49 μm , length of pharynx = 510 μm ; body width at neck base = 45 μm ; body width at vulva = 49 μm ; expanded part of pharynx = 284 μm ; distance of vulva from anterior end = 1350 μm ; vaginal length = 26.5 μm ; length of anterior gonad = 546 μm ; length of posterior gonad = 568 μm ; prerectum = 179 μm ; rectum = 32 μm ; tail = 32 μm ; anal body diameter = 29 μm .

Males ($n = 1$): $L = 2.24 \mu\text{m}$; $a = 41.5$; $b = 4.1$; $c = 70.1$; $c' = 0.8$; $T = 60\%$; odontostyle = 20.5 μm ; odontostyle width = 4.5 μm ; odontostyle aperture = 11.5 μm ; odontophore = 41 μm ; maximum body width = 54 μm ; length of pharynx = 539 μm ; body width at neck base = 54 μm ; expanded part of pharynx = 274 μm ; prerectum = 184 μm ; rectum = 37 μm ; tail length = 32 μm ; anal body diameter

= 36.75 μm .; length of testis = 1348 μm ; spicule length = 54.5 μm ; Number of Ventromedian supplements = 9.

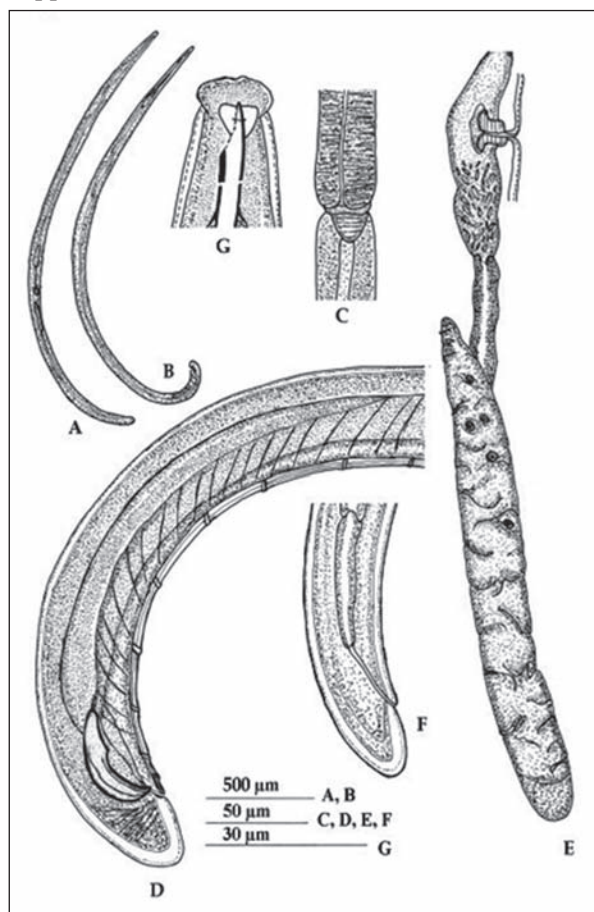


Fig. 7. *Aporcelaimellus papillatus*. Female: A. Entire body, C. Pharyngo-intestinal junction & cardia, E. Posterior branch of gonad, F. Tail end. Male: B. Entire body, D. Posterior body end showing ventromedian supplements & spicule.

Juvenile ($n = 1$): L = 1.59 μm ; $a = 40.8$; $b = 3.6$; $c = 59$; $c' = 0.9$; odontostyle = 18.5 μm ; Odontostyle width = 4 μm ; replacing odontostyle = 19.5 μm ; odontostyle aperture = 10.5 μm ; odontophore = 36 μm ; maximum body width = 39 μm ; length of pharynx = 441 μm ; expanded part of pharynx = 215.5 μm ; body width at neck base = 39 μm ; prerectum = 71 μm ; rectum = 27 μm ; tail length = 27 μm ; anal body diameter = 29 μm .

Diagnosis: Female, Male and Juvenile: Body ventrally curved upon fixation, particularly the posterior end of male. Cuticle 2.5 μm in female and juvenile and 5 μm in male at the level of

odontostyle, 2.5 μm at mid body, 7.5 μm on tail in male and female and 3.5 μm in juvenile. Body pores indistinct. Lips conspicuous, distinctly set off by constriction; 5 μm high and 15 μm wide in female, 7 μm high and 18 μm wide in male, 6 μm high and 13.5 μm wide in juvenile, slightly wider than adjoining body, exactly one-third of the body width at neck base in male and female. Amphids stirrup-shaped, at 5–7.5 μm from anterior end. Odontostyle and odontophore shorter in female than in male. Odontostyle 1.1 lip region-widths long in female and male, 1.4 lip region-widths long in juvenile; its aperture occupying 55.5–57.3% of odontostyle length. Replacing odontostyle in juvenile 1.5 times the lip region. Guiding ring at 8.5–9.5 μm from anterior end. Odontophore 2–2.2 times the odontostyle length in male and female and 1.9 times in juvenile. Nerve ring at 135 μm in female, 149.5 μm in male and 130 μm in juvenile from anterior end. Expanded portion of pharynx 55.7% in female, 51.1% in male and 48.8% in juvenile of the total pharyngeal length. Thin pharyngo-intestinal disc present, cardia 10 μm and 12 μm in male and female respectively, conoid and tongue-shaped. Female reproductive system amphidelphic. Vulva post-equatorial, vaginal length more than half of the corresponding body width, with sclerotisation. Both ovaries reflexed and long; anterior ovary 208 μm and posterior ovary 245 μm long. In male, testes opposed, anterior outstretched, posterior reflexed. Supplements consist of an adanal pair and eight regularly spaced ventromedians; first pair comes closer to the adanal pair. Spicules slightly arcuate, 1.4 anal body width long. Prerectum 5 – 6 anal body-widths long in male and female and 2.4 in juvenile. Rectum 1 – 1.1 anal body-widths long in all. Tail short, about one anal body-width, convex-conoid with rounded tip in female and in juvenile. Male tail almost hemispheroid, slightly arcuate ventrally.

Habitat and Locality: Collected from soil around the roots of litchi at Khanpara, Baruipur block, South 24-Parganas.

Registration Number: On slide, WN14556,

deposited in National Zoological Collection, Zoological Survey of India, Kolkata.

Distribution: In India: West Bengal.

In World: Italian mainland, Poland, Slovakia.

Remark: This is the first record of the species from India. The present specimens conform well to those described by Bastian (1865) under the genus *Dorylaimus* Dujardin, 1845 except the greater value of 'a' ($a = 30$ in female, 28 in male in the type specimen) Baqri and Khera (1975) transferred the species under *Aporcelaimellus* Heyns, 1965.

7. *Aporcelaimellus tritici* (Bastian, 1865)

Andrássy, 1986

(Figure 8)

Measurements: Females ($n = 06$): $L = 1.91\text{--}2.11$ mm; $a = 25.6\text{--}43.2$; $b = 3.5\text{--}3.9$; $c = 54.6\text{--}75.2$; $c' = 0.7\text{--}0.9$; $V = 45.7\text{--}53.2\%$; $G_1 = 10.2\text{--}13.5\%$; $G_2 = 10.7\text{--}13.5\%$; odontostyle = $18.5\text{--}23.5$ μm ; odontostyle width = $4\text{--}4.5$ μm ; odontostyle aperture = $8.5\text{--}11.5$ μm ; odontophore = $20\text{--}36$ μm ; maximum body width = $44\text{--}86$ μm ; length of pharynx = $505\text{--}598$ μm ; body width at neck base = $44\text{--}81$ μm ; body width at vulva = $44\text{--}83$ μm ; expanded part of pharynx = $274\text{--}331$ μm ; glandularium = $240\text{--}257$ μm ; distance of vulva from anterior end = $955.5\text{--}1134$ μm ; vaginal length = $14.5\text{--}30.5$ μm ; length of anterior gonad = $208\text{--}294$ μm ; length of posterior gonad = $247\text{--}269.5$ μm ; prerectum = $49\text{--}98$ μm ; rectum = $29\text{--}49$ μm ; tail length = $27\text{--}39$ μm ; anal body diameter = $34\text{--}49$ μm .

Diagnosis: Female: Body stout, ventrally curved upon fixation, slightly tapering towards anterior end. Cuticle $3.5\text{--}5$ μm thick at the level of odontostyle, 3.5 μm at mid body and 10 μm on tail. Lateral, dorsal and ventral body pores not visible. Lip region set off by constriction, $5\text{--}7$ μm high, slightly wider than adjoining body, $15.5\text{--}17$ μm wide or $1/2.6\text{--}1/4.7$ of the body width at neck base. Amphids stirrup-shaped, its aperture about half of the corresponding body width. Odontostyle $1.1\text{--}1.3$ lip region-widths long, its aperture $47.3\text{--}52.6\%$ of the odontostyle length. Nerve ring at $147\text{--}166$ μm from the anterior end. Expanded

portion of pharynx occupying $51\text{--}55\%$ of its total pharyngeal length. Thin pharyngo-intestinal disc present, cardia tongue-shaped, conoid, $19.5\text{--}22$ μm long. Vulva transverse, slightly pre-equatorial to almost equatorial. Vagina $1/2.6\text{--}1/4.8$ of the corresponding body-width long (length of *pars proximalis* vagina $7.5\text{--}19.5$ μm , *pars refringens* $5\text{--}6$ μm and *pars distalis* $2\text{--}5$ μm), moderately sclerotized distally. Both ovaries reflexed, anterior ovary $61\text{--}115$ μm and posterior ovary $71.5\text{--}98$ μm long. Prerectum $1.2\text{--}2.4$ and rectum $0.8\text{--}1.3$ anal body-widths long. Tail $0.7\text{--}0.9$ anal body-width long, convex-conoid with blunt or rounded terminus.

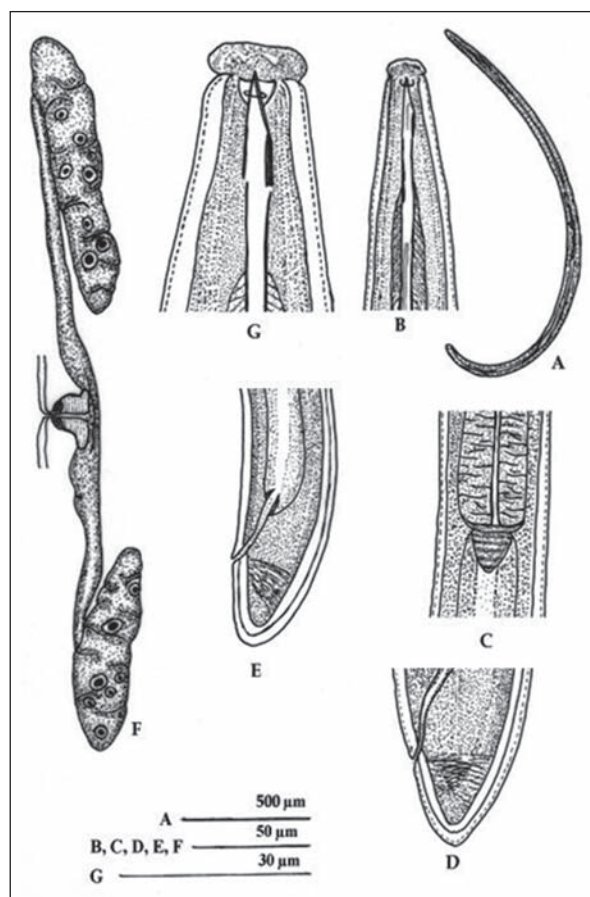


Fig. 8. *Aporcelaimellus tritici*. Female: A. Entire body, B & G. Anterior end, C. Pharyngo-intestinal junction & cardia, D & E. Variation in tail shape, F. Reproductive system.

Male: Not found.

Habitat and Locality: Collected from soil around the roots of guava at Natunpara, Dhaphdapi, Baruipur block, South 24-Parganas district.

Registration Number: On slides, WN1457 and WN 1458, deposited in National Zoological Collection, Zoological Survey of India, Kolkata

Distribution: In India: West Bengal.

In world: Italian Mainland, Poland, Slovakia, Ukraine, The Netherlands, Belgium.

Remark: This is the first report of the species from India. The present specimens conform well to those reported by Thorne and Swanger (1936) except in having greater range of 'a' value ($a = 28$ which is within the range of the present specimens).

8. *Tyleptus projectus* Thorne, 1939

(Figure 9, 10)

Measurements: Females ($n = 12$): $L = 1.06$ – 1.28 mm; $a = 29.9$ – 35.1 ; $b = 4.5$ – 5.6 ; $c = 78.8$ – 94.5 ; $c' = 0.5$ – 0.6 ; $V = 30.8$ – 34.2% ; $G_1 = 4.8$ – 7.1% ; $G_2 = 33.7$ – 48% ; odontostyle = 9 – 10 μm ; odontophore = 10 – 11.5 μm ; maximum body width = 33 – 39 μm ; length of pharynx = 208 – 254 μm ; body width at neck base = 29.5 – 34 μm ; body width at vulva = 32 – 37 μm ; basal bulb (expanded part) of pharynx = 27 – 34 μm ; glandularium = 17.5 – 26 μm ; distance of vulva from anterior end = 338 – 397 μm ; vaginal length = 15 – 17 μm ; length of anterior uterine sac = 52 – 78 μm ; length of posterior gonad = 360 – 549 μm ; prerectum = 73.5 – 91 μm ; rectum = 22 – 32 μm ; tail length = 12 – 14.5 μm ; anal body diameter = 21 – 27 μm .

Male ($n = 01$): $L = 1.03$ μm ; $a = 35.7$; $b = 4.9$; $c = 52.8$; $c' = 0.8$; $T = 56.2\%$; odontostyle = 7.5 μm ; odontophore = 7.5 μm ; maximum body width = 29 μm ; length of pharynx = 208 μm ; body width at neck base = 27 μm ; basal bulb (expanded part) of pharynx = 32 μm ; prerectum = 54 μm ; tail length = 19.5 μm ; anal body diameter = 22 μm ; length of testis = 583 μm ; spicule length = 31.5 μm ; lateral guiding piece = 12 μm ; Number of Ventromedian supplements = 3 .

Diagnosis: Female: Body slightly ventrally curved on fixation. Cuticle smooth and uniform all over the body, 1 – 2.5 μm thick at the level of

odontostyle and on tail, 2.5 μm at mid body. Sub cuticle smooth or with fine transverse striations, 1.5 – 3 μm apart. Lip region set off by depression, liplets prominent. Head narrower than adjoining body, 5 μm high, 8.5 – 10 μm or one-third or slightly more of neck base-width wide. Amphids

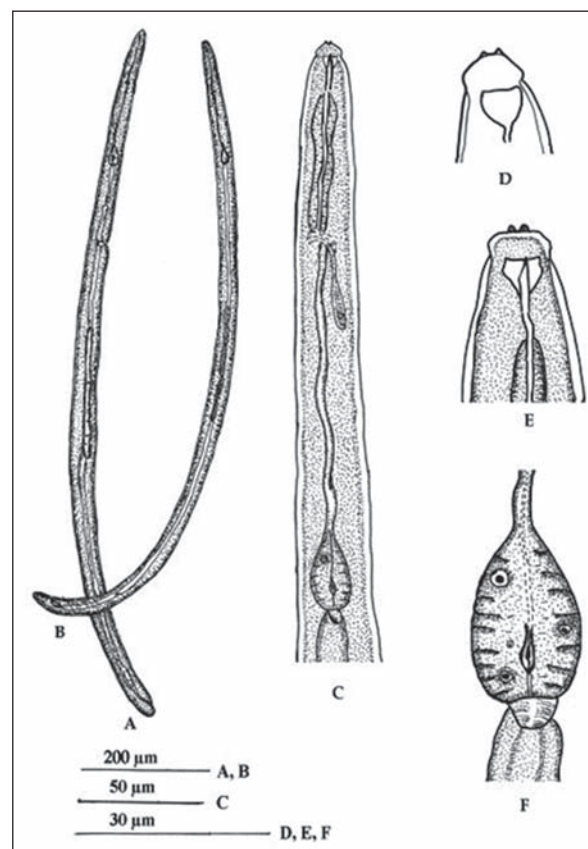


Fig. 9. *Tyleptus projectus*. Female: A. Entire body, C. Anterior portion of body showing pharynx, D & E. Anterior end showing cephalic region, amphid & odontostyle, F. Pharyngeal bulb & cardia, Male: B. Entire body

wide, stirrup-shaped, 5 – 6 μm from anterior end, apertures occupying about 6 μm or 51% of the corresponding body width. Odontostyle 0.9 – 1.1 lip region-width long. Guiding ring about 5 μm from anterior end. Odontophore 1 – 1.2 times the odontostyle length. Expanded part of pharynx a pyriform bulb measuring 27 – 34 $\mu\text{m} \times 15$ – 17 μm , occupying 12.2 – 14.9% of total pharyngeal length. Cardia small, broadly rounded, 4 – 5 μm long. Vulva transverse, distinctly pre-equatorial. Vaginal length about half or slightly more of the corresponding body width, unsclerotized. Reproductive system

mono-opisthodelphic. Anterior branch of gonad in the form of a uterine sac, 1.6–2.4 vulval body-widths long, containing spindle-shaped sperms in some specimens. Posterior branch of gonad very long well developed. Posterior ovary reflexed, 166–216 μm long. Distinct sphincter present at uterus-oviduct junction. Prerectum 3.4–4.1 and rectum 1–1.5 anal body width long. Tail short, broadly rounded, 0.5–0.6 anal body width long.

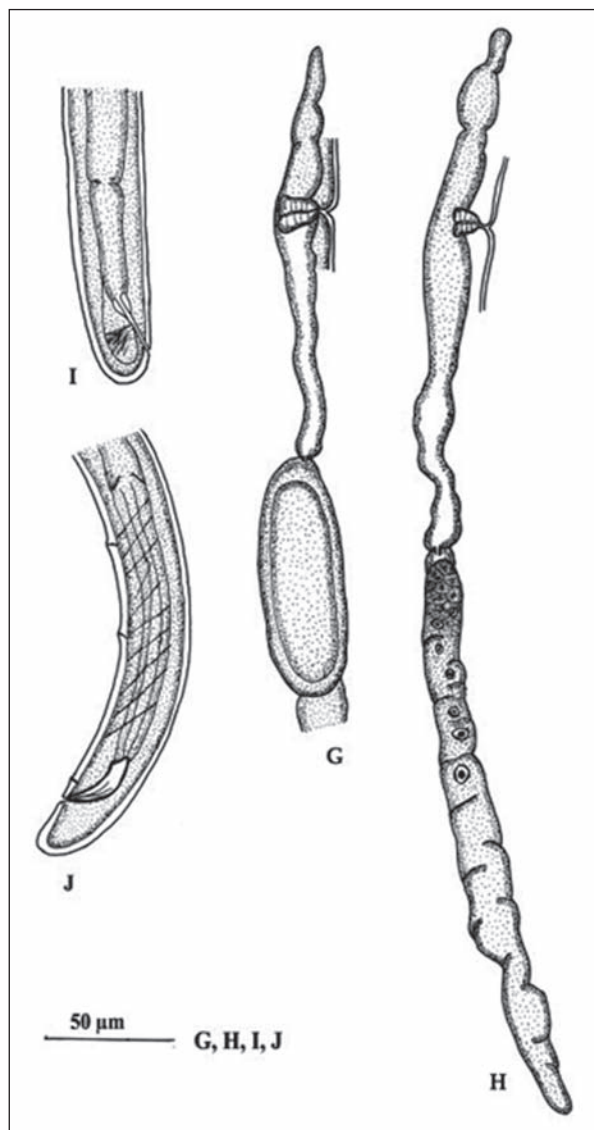


Fig. 10. *Tyleptus projectus*. Female: G & H. Mono-opisthodelphic reproductive system showing intra-uterine egg and anterior uterine sac, I. Tail, Male: J. Posterior end showing ventromedian supplements, spicule & tail.

Male: Similar to female in general morphology except the following. Testes outstretched. Spicules 1.4 anal body width long. Lateral guiding piece

1/2.6 of the spicular length. Supplements consist of two weakly developed ventromedians and an adanal pair. Tail rounded, 0.8 anal body width long.

Habitat and Locality: Collected from soil around the roots of guava at Kolupara and Sikharbali of Baruipur block, South 24-Parganas district.

Registration Number: On slides, WN1459, WN1460 and WN1461, deposited in National Zoological Collection, Zoological Survey of India, Kolkata

Distribution: In India: Jalpaiguri and South 24-Parganas districts of West Bengal.

In world: Virginia, U.S.A. and Martin State Forest, Indiana.

Remark: The present specimens fit well with the type specimens of *Tyleptus projectus* described by Thorne (1939). Goseco *et al.* (1974) reported a single male of *T. projectus* from Martin State Forest, Indiana in which spicule is 43 μm long. Jana and Baqri (1981) reported this species from soil around the roots of banana (*Musa* sp.) from Jalpaiguri district, West Bengal, India in which the spicule length of male population is 30–32 μm being totally consistent with the present specimens. This is the first report of *T. projectus* from South 24-parganas district, West Bengal, India.

SUMMARY

Few specimens of *Aporcelaimellus amylovorus* (Thorne and Swanger, 1936) Heyns, 1965, *Aporcelaimellus baqrii* Ahmad & Jairajpuri, 1982, *Aporcelaimellus chauhani* Baqri & Khera, 1975, *Aporcelaimellus coomansi* Baqri and Khera, 1975, *Aporcelaimellus indicus* Baqri & Jairajpuri, 1968, *Aporcelaimellus papillatus* (Bastian, 1865) Baqri and Khera, 1975, *Aporcelaimellus tritici* (Bastian, 1865) Andr ssy, 1986 and *Tyleptus projectus* Thorne, 1939 were collected from soil around the roots of guava and litchi plantations at different locations of South 24-Parganas district. Among these *A. papillatus* and *A. tritici* are the new records from India. The other species are

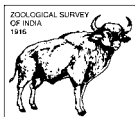
with the new distributional records from South 24-Parganas as well as from West Bengal. The distributions of the species in India as well as elsewhere in the world have been provided.

ACKNOWLEDGEMENT

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STUDIES ON THE ALCYONACEAN FAUNA OF GULF OF MANNAR

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INTRODUCTION

Soft corals are conspicuous and colourful component of coral reef through out the marine national parks of India. The soft corals are the second largest group of organisms in the coral reef environment and play a significant role in the global coral reef ecology. There is a growing interest in the biomedical applications of octocorals. The order Alcyonacea includes the soft corals and the gorgonians. Alcyonacea or soft corals, an order of corals are belongs to the sub class Octocorallia, (Class Anthozoa, Phylum Cnidaria). This class has three distinctly separated orders, Helioporacea (Blue coral), Pennatulacea (sea pens) and Alcyonacea (soft corals and gorgonians) as their name suggests, Octocorallia or Octocorals are characterized by Polyps with eight tentacles. Unlike reef building corals, soft corals do not produce hard calcium carbonate skeletons, instead typified by their internal fleshy skeletons. Soft corals are found in all marine waters; they are found in tropical, temperate and polar seas and accommodate themselves in a variety of habitats including intertidal regions, brackish and muddy water, estuaries, oceanic blue waters and even abyssal depths. Soft corals form fleshy colonies characterized by having polyps aggregated or concentrated into polyparies. The most pronounced feature is that in the subclass Octocorallia, each of the Polyps bears eight hollow tentacles which are fringed on both sides by one or several rows of pinnules.

The Alcyonacea of Gulf of Mannar is little

known. No systematic work treats them in detail. Associated organisms include Cling fish, Seahorses, brittle stars, Ctenophores, Snails, Worms, Shrimps and other crustaceans including microscopic copepods, soft corals have no massive solid skeleton. Around 90 genera of Alcyonacea, belonging to 29 families, have been described from the tropical Indo-Pacific. Of the 29 families in the order Alcyonacea, 23 are found in the warm, shallow waters of the Red Sea, the Indian and Central- west Pacific oceans. At present the system is in its least complex stage with all soft corals and gorgonians being placed in the single order. Gorgonians are popularly called Sea fan in marine Coelenterates. Their distribution and abundance are influenced by environmental factors such as light, temperature, water flow, current etc. Indo Pacific region has a high diversity of gorgonian corals (Goh and Chou, 1996). There are many taxonomic descriptions of gorgonians in most parts of the Asian region.

MATERIALS AND METHODS

Collection of soft corals from the shallow regions of the sea by snorkeling in different islands of Gulf of Mannar during 2009 and 2010. Sixteen stations were chosen for the present study along the coast. Specimens were collected and preserved in 10% buffered formalin is substituted with 70% alcohol. Sclerites were taken from Polyp, surface layer of stalk and Interior of stalk. Sclerites were obtained by treating tissue samples with 10% sodium hypochlorite in microscopic slide with central cavity (La Barre, 1983) to dissolve the

tissue and leaves the spicules intact. The spicules were rinsed with distilled water and dried on hotplate treated with xylol and mounted in DPX.

AREA SURVEYED

The survey was conducted starting from Anaipar, Palliarmunai Island, Appa Island, Keelakarai fish landing includes different stations like Vazhai island, Keelakarai, Mulli island, Ervadi, Mundal Poomarichan island, Mandapam bridge, single island, Hare island, Pamban bridge, Manauli & Manauliputti island, Pullivasal island, Krusadai island, Vedalai and Rameswaram.

EARLIER REPORTS ON ALCYONACEAN FAUNA OF INDIA

Among the Alcyonacean fauna in Indian coral reef area, three families Alcyoniidae, Nephtheidae and Xeniidae are dominant. Previous demographic investigation of reef inhabiting Xeniidae and Nephtheid taxa led to the conclusion that soft corals are ephemeral pioneer organisms, with rapid growth rates by vegetative reproduction. The Alcyonacean fauna of India is very poorly known. Earliest comprehensive report on Alcyonacean fauna from the Indian coast dates back to the collection of James Hornell during 1904-1905,

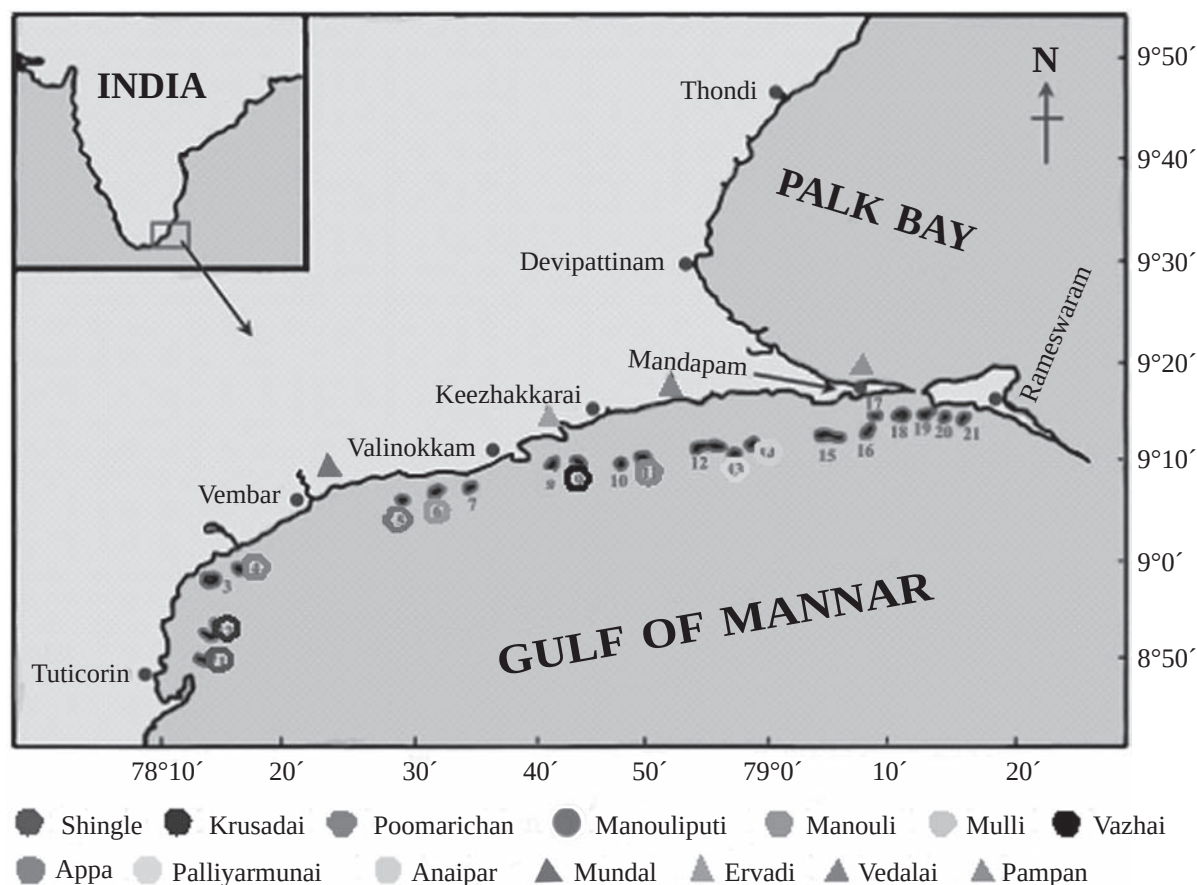


Fig 1. Map of the Study area and localities surveyed

and subsequently by Thomson and Crane (1909) described eight species of soft corals from Okhamandal, Gulf of Kachchh. Patel (1983) did extensive work in Gulf of Kachchh and reported 12 species.

Further studies on soft corals by Hickson (1903, 1905) Pratt (1903), Thomson and Henderson

(1906) and Thomson and Simpson (1909) enlightened the knowledge of Alcyonaceans of Lakshadweep. Thompson and Henderson (1905) published an inventory of deep-sea Alcyonaceans collected from the Indian Ocean. Thomson, Simpson and Henderson (1909) also published another inventory of deep sea Alcyonarians from

the Indian Ocean. Distribution of Alcyonaceans off Krusadai Island was recorded by Gravely (1927). Similarly, Jayasree *et al.*, (1997) reported 27 species of Alcyonaceans from Gulf of Mannar Biosphere reserve. The most abundant and dominating genera in Krusadai Island are *Sinularia* sp. *Sarcophyton* is also one of the most common genus in this area. Ridley (1882) conducted various taxonomic investigations on a few new species of Alcyonaceans collected from Bay of Bengal and Indian Ocean. Ofwegen Van and Vennam (1991) also reported nineteen species of Alcyonaceans (*Alcyonium*, *Lobophytum*, *Sarcophyton*, *Sinularia*) from Lakshadweep. The octocoral fauna of the Lakshadweep was also investigated by Alderslade and Shirwaiker (1991). They reported 17 species in Lakshadweep. Rao *et al.*, (2003) reported 54 species of soft corals in Andaman Islands, Bay of Bengal. According to Thomas *et al.* (1995) In India 27 species of gorgonids under 9 genera were reported from North east Coast of India. In Andaman and Nicobar Islands 10 species of gorgonids under 9 genera were reported

The following 72 Soft coral specimens were identified from the survey tour to Gulf of Mannar, Tamil Nadu as belonging to 12 species under 5 families.

SYSTEMATIC LIST OF SOFT CORALS OF GULF OF MANNAR AND PALK BAY

Classification of Alcyonacea

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

Order ALCYONACEA

Family ALCYONIDAE

1. *Sinularia Polydactyla* (Ehrenberg)-7 exs
2. *Sinularia peculiaris* Tixier-Durivault-3exs
3. *Sarcophyton troceliphorum* Von Marenzeller-5exs
4. *Sarcophyton tortuosum* Tixier-Durivault-3 exs
5. *Lobophytum sarcophytoides*-4exs
6. *Lobophytum crassum* Von Marenzeller-3exs

Family NEPHTHEIDAE

7. *Capnella parva* Light-1ex
8. *Dendronephthya hemprichii*-1ex

II. Gorgonids

Family PLEXAURIDAE

9. *Echinogorgia reticulata* Kukenthal-5exs

Family SUBERGORGIIIDAE

10. *Subergorgia suberosa* Pallas-10exs

Suborder CALCAXONIA

Family ELLISELLIDAE

11. *Verrucella umbraculum* (Ellis & Solander)-5exs

12. *Junceella juncea*

Classification of Alcyonacea

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

Order ALCYONACEA

Family NEPHTHEIDAE

All these animals have a similar, arborescent appearance with spiculate polyps. Colors are generally brown and cream associated with photosynthetic soft corals. They are found mainly on reef slopes or coral rubble with strong illumination and high water flows.

1. *Sinularia polydactyla* (Ehrenberg, 1832)

1832. *Lobularia polydactyla* Ehrenberg, Abhandl. K. Akad. Wiss, Berlin, (1): 58.

1980. *Ainularia polydactyla*: Verseveldt, Zool. Verhand, Leiden, 179: 108, fig. 57.

1996. *Sinularia polydactyla*, Jayasree *et al.*, J. Bombay. Nat. Hist. Soc, 92: 202-209.

Material Examined: Locality: Manauli island, Date: 24.12.07. Reg. No: SC-07. Collected by: G. Sivaleela & Party.

Description: Colony encrusting with tough stalk; lobes are crowded, large and with finger like branches. Surface layer of the lobes sclerites contains 0.07 to 0.19 mm long. Clubs have warty heads, the length of the clubs varies. Clubs of the surface layer of the stalk sclerites are similar to the

clubs of the lobes but their handles are stout and short; the handles of the larger clubs are straight or slightly curved. The coenenchymal sclerites are straight or curved pointed spindles, up to 4.5 mm long; smaller sclerites are bifurcated at one end. The spindles are rounded. Colour: colonies are creamy brown and Greyish.

Distribution: India (Gulf of Mannar).
Elsewhere: Indo-Pacific region and Red Sea.

2. *Sinularia peculiaris* Tixier-Durivault, 1963

1963. *Sinularia peculiaris* Tixier-Durivault. De la foundation Singer-Polignace. 4: 279-280, figs.130-132.

1980. *Sinularia peculiaris*, Versveldt, Zool-Verhandle, Leiden, (179): 140-145, figs. 55, pl.34, fig.3.

Material Examined: Locality: Manauli island, Date: 24.12.07.Reg. No: SC-08 Collected by: G. Sivaleela & Party.

Description: Colony encrusted lobes erect and small lobules oblong. The surface layer of the lobes contains clubs, 0.10 to 0.16 mm long, few clubs are up to 0.21 mm long; the clubs have wide heads with blunt warts, some warts are leaf-like with toothed edges; the surface layer of stalk contains many clubs, 0.11 to 0.17 mm long. Interior of the lobes and stalk contains slightly curved and un branched, blunt ended spindles. The stalk contains small multi radiate irregular forms. The internal sclerites are curved, un branched, point or blunt-ended spindles. The lobe sclerites length is 1.80mm and in the sterile stalk is 2.60mm. Colour: Light Grey.

Distribution: India; **Elsewhere:** New Caledonia.

3. *Sarcophyton trocheliophorum* Von Marenzeller, 1886.

1886. *Sarcophyton trocheliophorum* Von Marenzeller, : 359-362, pl.9, fig.5.

1982. *Sarcophyton trocheliophorum* Verseveldt, Zool. Verhand., Leiden, 192: 83-88, figs. 37-39, pl. 12, fig.1, pl.19, fig. 2, pl. 24, figs. 1, 2.

Material Examined: Locality: Hare island, Date: 4.10.09. Reg. No: SC-09, Collected by: G. Sivaleela & Party.

Description: Colonies are mushroom-shaped. The clubs in the surface of the disc and of the stalk have typical shape and size mentioned

above. Spicules are fusiform, a few are thick and oval shaped and bear numerous big warts. The coenenchyme of the disc contains straight or curved spindle. Interior of the stalk is oval shaped sclerites 0.24 mm long. The clubs in the surface layer of the stalk are wider. The spindles in the coenenchyme of the disc are longer, 0.25 mm.

Distribution: Indian Ocean, **Elsewhere:** West Pacific area.

4. *Sarcophyton tortuosum*

Tixier-Durivault, 1958

1958. *Sarcophyton tortuosum* Tixier-Durivault, 25-28, figs, 17, 17, 20, 21.

1982. *Sarcophyton tortuosum*. Versveldt. Zool. verhand, Leiden, (192): 82-83. fig. 36; pl. 23, fig. 1-3.

Material Examined: Locality: Hare island, Date: 4.10.09, Reg. No: SC-11, Collected by: G. Sivaleela & Party.

Description: Colonies are mush room shaped. The disc is hollow with numerous folds. Surface layer of the disc is slender 0.08mm long. Head of the club is warty with spines. Interior of disc contains spiny rods and spindles. Surface layer of stalk contains clubs similar to the disc. Interior of the stalk contains slender and pointed spindles. Colonies are greenish brown.

Distribution: India (South Andaman), **Elsewhere:** Fiji, New Caledonia.

5. *Lobophytum sarcophytoides* Moser, 1919

1919. *Lobophytum sarcophytoides* Moser, Mitt. Zool. Mus., Berlin, 9(2): 267-268, Fig. 13, pl. 6.

1983. *Lobophytum sarcophytoides* Versveldt. Zool. Verhand., Leiden, 200: 86-89, fig. 43, pl. 26-27.

Material Examined: Locality: Vallai island, Date: 25.3.10, Reg. No: SC-15, Collected by: G. Sivaleela & Party.

Description: Colony is cup shaped with raised lobes. The lobes are thin and folded. Surface layer of the lobes contains small clubs size is 0.086 mm. Interior of the lobes contains slender pointed spindles size is 0.26 mm long. Clubs of the surface layer of the stalk are 0.097 mm long. Interior of the stalk contains spindles size is 0.18 mm.

Distribution: India (South Andaman), **Elsewhere:** Philippines, New Caledonia.

6. *Lobophytum crassum*

Von Marenzeller, 1886

1886. *Lobophytum crassum* Von Marenzeller, *Zool. Jahrb (Syst)*, 1: 363-364, pl. 9. figs. 8.

1898. *Lobophytum crassum* Var *Sansibaricum*, May, pl. 5, fig. 28-29.

1971. *Lobophytum cristagalli*: *verseveldt*, *Zool. Verhand, Leiden*, 117: 16-17, fig. 8.

Material Examined: Locality: Vallai island, Date: 25.3.10, Reg. No: SC-13, Collected by: G. Sivaleela & Party.

Description: Colonies are encrusted; the stalk is wider and the capitulum is disc-like; the lobes are crest-like, and have finger-like lobules. Surface layer of the lobes contains clubs, 0.18 mm long. The longer clubs of 0.21 mm long are also common. In addition, numerous shuttles, 0.12 mm long are also present. In the interior of the lobes sub cylindrical sclerites and their length is 0.08 mm. In the surface layer of stalk are clubs and the length is 0.10 mm.

Distribution: Indo-West Pacific tropical area.

7. *Capnella parva* Light, 1913

1913, *Capnella parva* Light, *Philipp. J. Sci*, 8(6): 446-448, Pl. 1, fig. 8.

1976. *Capnella parva* *Verseveldt*, *Rev. Zool. Afr.* 90(3): 509, fig. 5.

Material Examined: Locality: Hare island, Date: 24.12.07, Reg. No: S-10, Collected by: G. Sivaleela & Party.

Description: Colony has numerous lobes and is covered with zooids; sterile stalk longitudinally striped. Spicules of the lobe are clubs have spiny heads; the spines are long and directed one side. Small slender clubs with fewer heads are also present. Surface layer of the stalk has small thick rods and clubs. The rods of 0.12 mm long girdles and clubs of 0.15 mm long spiny head.

Colour: colony light brownish-grey.

Distribution: India (Little Andaman), **Elsewhere:** Comoro Islands.

8. *Dendronephthya hemprichi*,

Klunzinger, 1877

1877. *Spongodes hemprichi* Klunzinger, Berlin, 98 pp.

Material Examined: Locality: Palliarmunai island, Date: 4.10.09, Reg. No: SC-17, Collected by: G. Sivaleela & Party.

Description: Colonies are highly branched or bushy end branches and polyp bunches generally arranged in one of three growth forms. Polyps in small bundles with branching. It has longer tentacles. Polyps of this species contain spindles 2.5 mm. Spindle shaped sclerites are characteristics of genus and the length of the spindle is 5.73 mm.

Distribution: Eastern & Northern Indian Ocean, **Elsewhere:** Tropical Western Pacific Ocean and Great Barrier Reef.

Gorgonids

Sea fans belong to the class **Anthozoa**, subclass **Octocorallia**, order **Alcyonacea** (previously they were considered in an order Gorgonacea). Also the majority of the soft corals belong to the same order (Alcyonacea). Sea fans are colonial animals, made up by polyps. Gorgonids are colonial animals are under the Phylum Coelenterata of the Class Anthozoa. Two major subclasses of anthozoans have been defined; these are the subclass Octocorallia or Alcyonaria and the subclass Hexacorallia or Zoantharia. Gorgonids are popularly called sea fans, sea whips and sea feathers. They are sedentary and most of them are phototropic. Their growth-form may be reticulate or bushy and some in one plane, hence the name 'sea fans'. The body of gorgonid (sea fan) is divided into an axial part comprising of horny material (hence the name horny-coral) and an outer rind (or skin) containing loosely arranged calcareous spicules or sclerites. Most of the gorgonids are beautifully coloured and hence called 'flowers of the sea bottom'. The gorgonid fauna play significant role in the global coral reef ecology and biomedical applications of gorgonids. Studied by Thomas and Rani Mary George (1986, 1987, 1995 & 1998) on the gorgonid resources, including its export of 31 species referable to 19 genera and 9 families form the mainstay of Indian gorgonid fishery. Gorgonids are known to be a rich source of bioactive compounds and many of these compounds or derivatives thereof are now classified under 'Wonder Drugs'.

The sclerites were extracted using 5% sodium hypochlorite (Bayer, 1961) and identified by Bayer et al (1983) Keys.

MATERIALS AND METHODS

Kingdom ANIMALIA

Phylum CNIDARIA

Class ANTHOZOA

9. *Echinogorgia reticulata*

(Ellis & Solander, 1786)

1786. *Annella reticulata*, Ellis & Solander, *Journal of experimental Marine Biology & Ecology*, **273**(2002): 121-130.

1924. *Echinogorgia reticulata* Kukenthal, p. 202.

Material Examined: Locality: Hare island, Date: 26.12.07, Reg. No: G-1, Collected by: G. Sivaleela & Party.

Colony shape: Colonies grow in one plane. The main branches produce very short side branches. The branches are usually not very thick, but colonies can grow quite large. Polyps are monomorphic are completely retractile into spiny calyces. Sclerites: Leaf- clubs. These are petaloid expansion on one side and with tuberculated root-like structures on the other. 0.42 mm. Spindles thesea type, size upto 0.51 mm.

Distribution: India (Tuticorin, Rameswaram and Mandapam & Madras), *Elsewhere:* New Caledonia, Subtropical Australia, Papua New Guinea, Indonesia, Singapore and Red Sea.

10. *Subergorgia suberosa* Pallas, 1766

1766. *Subergorgia suberosa*, Pallas, p. 172.

1924. *Subergorgia suberosa* Kukenthal, *Gorgonaria. Das Tierreich.*, **47**: 1-478.

1937. *Subergorgia suberosa* Stiasny, p. 87, pl. 6, fig. 45

Material Examined: Locality: Vedalai, Date: 26.12.07, Reg. No: G-2, Collected by: G. Sivaleela & Party.

Colony shape: Colonies are often large, growing in one plane, and laterally to dichotomously branched. All species have long, smooth sclerites, partially fused. Sclerites are brownish colour and 0.05 to 0.25 mm in average size. In the outer cortex, the sclerites occur as warty spindles or

ovals. The width of a layer of sclerites is the width of a sclerite or between 20 and 50 μ m. The coenenchyme is a thick layer, about 1 mm thick. Coenenchymal sclerites are amber- coloured spindles, oriented with their long axis parallel to the long axis of the branch. Polyps are medium in size and arranged two sides of the branches.

Distribution: India: Gulf of Manar, Andaman and Nicobar Islands and Gulf of Kachch. *Elsewhere:* Indo-West Pacific, Northern Red Sea, Central Pacific, and Zanzibar, Madagascar, Mauritius, Sri Lanka, Philippines & New Caledonia.

11. *Verrucella umbraculum*

(Ellis & Solanders, 1786)

1786. *Ctenocella umbraculum* Ellis & Solander, *Zool. Meded. Leiden* **63**(3): 27-34.

Family NEPHTHEIDAE

Order GORGONACEA

Family ELLISELLIDAE

Genus *Verrucella* Milne Edwards & Haime, 1857

Species *umbraculum*

Scientific name: *Verrucella umbraculum* (Ellis & Solander, 1786)

Synonymies taxa: *Ctenocella umbraculum* (Ellis & Solander, 1786) & *Gorgonella umbraculum* (Ellis & Solander, 1786).

Material Examined: Locality: Ervadi, Date: 29.12.07, Reg. No: G-9, Collected by: G. Sivaleela & Party.

Description: Colonies fan shaped and closely reticulate. Branchlets divide and redivide and get interconnected in a scalariform pattern producing small meshes of 4 x 5 mm on an average. Branchlets forming the meshes and its diameter, 1.5 to 2.5 mm. Calyces are conical to hemispherical in shape, diameter 1 mm and height 0.7 mm on an average; calyces small at older parts. Coenenchyme granular.

Sclerite: (1) Spindles. Size, 0.084 X 0.025 mm, (2) Dumbbells size, 0.063 X 0.033 mm, (3) Smaller Dumbbells. Size, 0.025 X 0.021 mm.

Distribution: Indian Ocean distributed up to 100 meters depth. Common along the southwest and South East Coasts of India and Andamans; **Elsewhere:** Red Sea.

12. *Junceella juncea* (Pallas, 1766)

1766. *Gorgonia juncea* Pallas, pp. 180.

1905. *Junceella juncea*, Thomson and Henderson, pp. 313, 314, pl. 4, figs. 4,5.

1910. *Junceella juncea* Nutting, C, p. 18, pi. 3, figs. 1-4

1986. *Junceella juncea* Thomas and Rani Mary George, pp.10

Material examined: Locality: Ervadi, Date: 29.12.07, Reg. No: G-21, Collected by. G. Sivaleela & Party.

Description: Colony is whip-like. Diameter of the colony vary from 3 to 7 cm. The surface contains clubs. Surface sclerites are usually coloured. Calyces papillate. Polyps are small. Spicules are Dumbbells size is 0.3 mm, Clubs size is 0.05 mm.

Distribution: Southeast and South west Coast of India (Gulf of Mannar); **Elsewhere:** Indo-Pacific.

DISCUSSION

Soft corals are belonging to seven genera was recorded from these islands. These are *Sinularia*, *Lobophytum*, *Sarcophyton*, *Capnella* and *Dendronephthya*. Among these *Sarcophyton* and *Sinularia* were dominant on Anaipar and Krusadai Island. Soft Corals are found associated with hard coral communities. In terms of diversity, the genus *Sinularia* was the best represented with two species. *Lobophytum* was represented by 3 species

and *Sarcophyton* had two species each. Gorgonian is one of the marine invertebrates that play an important role in the marine ecosystem. Gorgonian diversity in Gulf of Mannar was investigated as basic data for gorgonian conservation and restoration.

Other than soft corals 7 species of fishes 5 species of Echinoderms, 5 Species of Sponges and 13 species of Gastropods were recorded during this survey. Soft corals and extensive sea grass beds were noticed on the western regions of the keelakarai group of islands. Sea cucumber, Sea anemone and gobiid fishes, common reef fishes such as Snapper sp., Parrot fishes, Groupers, Soldier fishes, and Butterfly fishes were found as usual in reef area were commonly observed among the sea grass beds. Soft corals and Sea grass beds were noticed on the south east regions of the Appa Island. The common seaweeds found here are *Ulva*, *Sargassum*, *Gelidiella*, *Gracilaria*, *Caulerpa*, *Halimeda*, *Padina*, *Hypnea*, *Turbinaria*, *Chondrococcus*, etc. At present *Caulerparacemosa* found abundant in Krusadai island. Distribution and growth were affected due to various anthropogenic factors (Venkataraman, 2000). Minimizing the threats to the coral reefs may increase the associated faunal diversity including corals.

ACKNOWLEDGEMENT

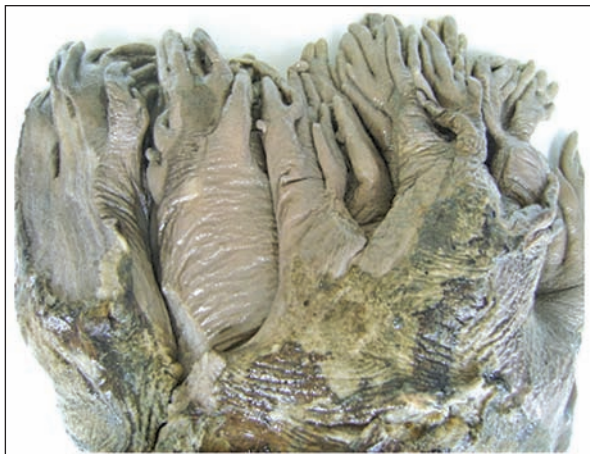
The authors are grateful to the Director, Zoological Survey of India, Kolkata and Officer-in-charge, MBRC, Chennai for the facilities. The co-operation extended by tour party is highly appreciated.

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PLATE - I



1. *Sinularia polydactyla* (Ehrenberg, 1832)



2. *Sinnularia peculiaris* Tixier-Durivault, 1963



3. *Sarcophyton troceliophorum* Von Marenzeller, 1886



4. *Sarcophyton tortuosum* Tixier-Durivault, 1958



5. *Lobophytum sarcophytoides* Moser, 1919



6. *Lobophytum crissum* Von Marenzeller, 1886

PLATE - II



7. *Dendronephthya hemprichi* Klunzinger, 1877



8. *Capnella Parva* Light, 1913



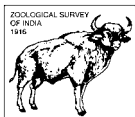
9. *Subergorgia suberosa* Pallas, 1766



10. *Verucella umbraculam* (Ellis & Soalnders, 1786)



11. *Junceella juncea* (Pallas, 1766)



A STUDY ON EARTHWORM POPULATION AND DIVERSITY WITH SPECIAL REFERENCE TO PHYSICOCHEMICAL PARAMETERS IN DIFFERENT HABITATS OF SOUTH 24 PARGANAS DISTRICT IN WEST BENGAL

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INTRODUCTION

The silent role of earthworms in improving soil properties especially role of earthworms in promoting soil fertility, has been known since ancient times. Darwin (1881) was the first to observe and offer a scientific explanation of their true role in the ecosystem and his conclusions led to an upsurge of interest in earthworms from the late nineteenth century onwards (Vejdovsky 1884; Beddard 1895, 1912; Michaelsen 1900; Stephenson 1923, 1930; and Bahl 1950).

Earthworms are widely distributed throughout the world particularly in the temperate and tropical regions and their population contributes about 80% of the total biomass of the soil (Kale 1997; Nainawat and Nagendra 2001). Researchers have identified and named more than 4400 distinct species of earthworms worldwide (Sinha 2009), each with unique physical, biological and behavioural characteristics that distinguish each one of them from the other and Julka *et al.* (2009) reported 590 species of earthworms from India. Earthworms are perhaps the most important soil organisms in terms of their influence on organic matter breakdown, soil structural development and nutrient cycling, especially in productive ecosystems (Kooch *et al.*, 2007). The earthworm cast increases organic compound, cytokinin and auxin concentration in the soil (Krishnamoorthy and Vajranabhaiah 1986) which is considered positive on ecosystems.

Distribution of earthworms is usually irregular (Guild 1952; Satchell 1955; Svendsen 1957) and the numbers vary in relation to the type of soil (Evans and Guild 1947; Curry 1998) and ecological factors especially edaphic factors (moisture and temperature) (Murchie 1958; Kaleemurrahman and Ismail 1981).

The present study was carried out in different habitats in the South 24 Parganas district in West Bengal which include both natural and human managed ecosystems where earthworms are mostly distributed in patches. Regular field estimates of seasonal variation in earthworm populations were made for two consecutive years in different fields of South 24 Parganas. The fields represent different ecological niches. This study was done with the objective to know distribution of earthworms in relation to some soil physico-chemical parameters across different sampling sites.

MATERIALS AND METHODS

Study Area: South 24 Parganas district of the State of West Bengal, India, falls within the great active delta of the river Ganga. The soils are alluvial and contains 15% sand, 69% silt and 18% clay. The direct deposits of the Ganga alluvium are salt free and rich in nutrients (Raychaudhuri *et al.*, 1963).

The present study was conducted at seven different habitats within three locations namely, 1. Budge budge, 2. Pujali and 3. Bamanghata in South 24 Parganas. Climate of the area is tropical

and characterised by mean annual maximum and minimum temperatures 36.3°C and 13.3°C respectively, mean annual rainfall 1760 mm and relative humidity which varied between 71% to 85%. Three distinct seasons generally predominate in this region during the year: Summer (March to May) Monsoon (June to October) and Winter (November to February). Maximum precipitation occurred between July and September.

Study sites: For the survey of population dynamics of earthworms, seven sites each characterized by different habitat were chosen in South 24 Parganas. Three habitats at Budge Budge area, two habitats at Pujali and two habitats at Bamanghata area. The sites were selected from different plots with varied habitat properties, viz. a. cultivated paddy Field, b. ornamental garden (Rose garden), c. side of a clear Ganga water canal; d. settled fly ash land; e. a grassland at the centre of village hut with grazing cows and goats; f. bank of Hooghly river; g. bank of sewage canal.

Earthworm Sampling: Earthworms and soil samples were collected 3 times in a year, i.e. pre-monsoon (summer), monsoon (rainy season) and post monsoon (winter) period for a period of two years during 2011 to 2013. A sampling grid (20 m × 20 m) was marked at each site, containing 16 units of 5 m × 5 m, which were further divided into subunits of 1 m². These 1 m² subunits were selected randomly and no subunit was sampled twice. During each sampling month, for each study site three widely separated subunits were randomly selected for sampling. Earthworms were collected by conventional digging (25 cm x 25

cm x 30 cm) and hand sorting method (Anderson and Ingram 1993) from each quadrat. Earthworms were counted and narcotised by dropping them in 70% ethyl alcohol. They were removed from alcohol after their movement stopped. Then worms were transferred to 5% formalin for fixation and identification.

Soil Sampling and Analysis: Composite soil samples were collected from each site under study and standard methods were followed for analysis. Soil temperature recorded at 0-10 cm. depth using soil thermometer. Moisture content of fresh soil was determined by oven drying the matter at 105°C for 8 hours (Baurman and Velthorst 1996) and expressed as a percentage of weight of the soil samples. Soil pH was measured by digital pH meter. Organic nitrogen was determined by micro Kjeldahl method (Jackson 1962) and organic carbon by wet digestion method (Walkley and Black 1934).

RESULTS AND DISCUSSION

A total of six species of six genera under two families (Megascolecidae, Octochaetidae) found from 505 examples of earthworms collected from South 24 parganas of West Bengal are presented in Table 1. Only two species, viz., *Lampito mauritii* and *Metaphire posthuma* occur in abundance in most of the areas. *E. orientalis* is also found in six habitats, i.e. except one habitat it occurs in most of the areas. In contrast, two species of earthworms are very site specific such as *Amyntas diffringens* in the bank of river Hooghly and *Dichogaster bolau* in rose garden.

Table 1. Systematic position of earthworm species present in South 24 parganas

Order	Family	Genera	Species
Haplotaxidae	Megascolecidae	<i>Metaphire</i>	<i>M. posthuma</i> (Vaillant)
		<i>Perionyx</i>	<i>P. excavatus</i> Perrier
		<i>Amyntas</i>	<i>A. diffringens</i> (Baird)
		<i>Lampito</i>	<i>L. mauritii</i> Kinberg
	Octochaetidae	<i>Dichogaster</i>	<i>D. bolau</i> (Michaelson)
		<i>Eutyphoeus</i>	<i>E. orientalis</i> (Beddard)

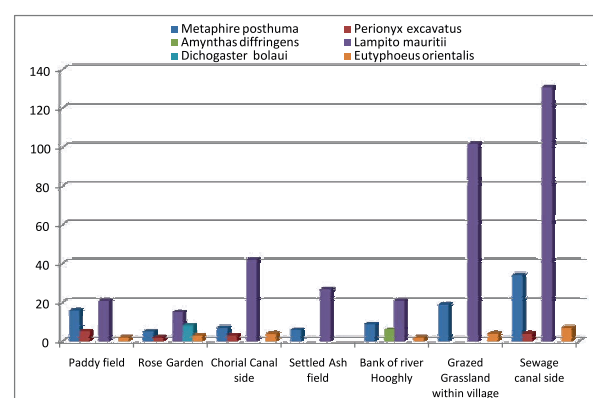
Table 2. Earthworm Population in different habitats

Species Name	<i>Metaphire posthuma</i>	<i>Perionyx excavatus</i>	<i>Amyntas diffringens</i>	<i>Lampito mauritii</i>	<i>Dichogaster bolaui</i>	<i>Eutyphoeus orientalis</i>	Total
Habitat							
Paddy field	16	5	-	21	-	2	44
Rose Garden	5	2	-	15	8	3	33
Chorial Canal side	7	3	-	42	-	4	56
Settled Ash field	6	-	-	27	-	-	33
Bank of river Hooghly	9	-	6	21	-	2	38
Grazed Grassland within village	19	-	-	102	-	4	125
Sewage canal side	34	4	-	131	-	7	176
No. of Examples	96	14	6	359	8	22	505

Habitat wise distribution of different species of earthworms in South 24 Pgs. region is presented in Table-2. Among the species the anecic *Lampito mauritii* is the only species common across all the habitats. Out of these six species *Lampito mauritii* is the dominant (n=359), second ranking is *Metaphire posthuma* (n=96), and third and fourth in the rank respectively are *Eutyphoeus orientalis* (n=22), *Perionyx excavatus* (n=14), *Amyntus diffringens* (n=6) and *Dichogaster bolaui* (n=8) are the rare ones (Table 2). *L. mauritii* and *M. posthuma* are the common inhabitants of all the seven habitats. *A. diffringens* and *D. bolaui* showed exclusive inhabitation in the bank of Hooghly river and rose garden respectively, while *E. orientalis* is most common species in all the habitats except settled ash field. *P. excavatus* restricted to the habitats (paddy field, rose garden, Chorial canal side) of Budge Budge area only.

The population density of earthworm species based on their distribution in different habitats showed in fig. 1. The high population density of earthworm species is found in Sewage canal side, due to high nitrogen (6.10 gm/kg) and high organic carbon (51.71 gm/kg). Steady moisture range (16.5% -24.7%) all over the year with pH range 6.71-7.31 (almost neutral). The high earthworm density (population and distribution) is associated with high C/N ratio reported by Lee (1985). According to Shakir and Dindal (1997),

population density of earthworms is positively correlated with pH and negatively correlated with species diversity. The density of earthworms is dependent on carbon and nitrogen content (Kale and Krisnamoorthy, 1978). Low density are found in rose garden and settled ash field indicative of human interference.

**Fig 1.** No. of species in different study fields

Abundance being an expression of the species richness these measures are appropriate in assessing the domination of a species in a set of species (Table 2). The study revealed that *Lampito mauritii* showed higher abundance and less in *Amyntus diffringens*. *L. mauritii* representing 71% density of total earthworm species population, followed by *M. posthuma* (19%), *E. orientalis* (4%), *P. excavates* (3%), *D. bolaui* (2%) and the lowest is *A. diffringens* (1%). *L. mauritii* showed wide range of tolerance to

edaphic factors, where as *A. diffringens* has low ranges of ecological tolerance.

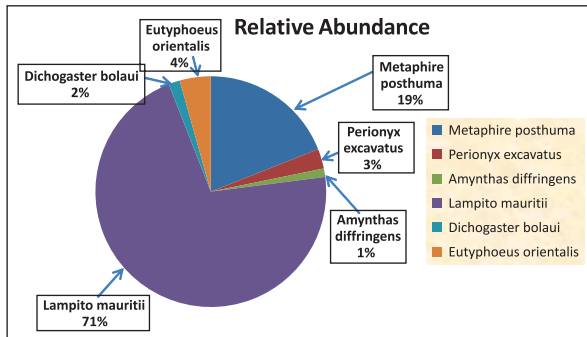


Fig. 2. Abundance of different species indicating diversity

The distribution of earthworms was mainly dependent on the physicochemical characteristics of the soil. Edwards and Lofty (1972) have reported that earthworm activity is influenced of soil parameters besides feed. Influence of

soil conditions on earthworm population is also reported by Chaudhuri and Mitra (1983). Each habitat of South 24 Parganas mainly comprise of alluvial soil. Soil moisture, organic carbon and nitrogen is found to be significantly correlated with the distribution of the earthworms (Ismail and Murthy 1985; Ganihar 1996). Soil pH in this region varied from neutral to slightly acidic. Edwards and Lofty (1977) suggested that earthworm species generally have narrow range of pH to live. Most of them prefer neutral soils, but some can tolerate acidic or alkaline soils to some extent. The pH values recorded in the present study are within the range for the distribution of earthworms.

The seasonal dynamics over an annual cycle showed that the earthworm population are high in the wet period and low in summer and winter. The

Table 3. Inhabitation of earthworm species of South 24 Parganas in relation to physicochemical characteristics of soils from different habitats

Habitat	GPS reading	Species	Moisture of soil (%)	Temperature of soil (°C)	pH	Organic Carbon (gm/kg) Average	Nitrogen (kjeldahl) (gm/kg) Average	C/N ratio
Paddy field	N22°27.443' E088°09.986'	<i>M. posthuma</i> <i>P. excavatus</i> <i>L. mauritii</i> <i>E. orientalis</i>	5.52-18.8	15.3-30.1	7.33-7.4	20.50	1.90	10.78
Rose Garden	N22°27.446' E088°09.883'	<i>M. posthuma</i> <i>L. mauritii</i> <i>D. bolaii</i> <i>E. orientalis</i>	8.9-18.7	15.6-32.3	6-5.-6.8	14.0	1.70	8.23
Chorial Canal side	N22°27.452' E088°09.836'	<i>M. posthuma</i> <i>L. mauritii</i> <i>E. orientalis</i>	12.2-19.9	15.4-29.8	7.40-7.49	13.61	1.65	8.24
Settled Ash field	N22°28.203' E088°09.114'	<i>M. posthuma</i> <i>L. mauritii</i>	4.08-14.4	15.2-31.0	7.20-7.29	6.73	1.45	4.64
Bank of River Hooghly	N22°28.429' E088°09.169'	<i>M. posthuma</i> <i>A. diffringens</i> <i>L. mauritii</i> <i>E. orientalis</i>	8.3-13.7	15.0-30.9	6.29-7.3	8.72	1.06	8.2
Grazed Grassland within village	N22°31.187' E088°28.211'	<i>M. posthuma</i> <i>L. mauritii</i> <i>E. orientalis</i>	8.02-18.3	16.2-31.0	7.11-7.35	9.56	5.79	1.65
Sewage canal side	N22°31.171' E088°28.247'	<i>M. posthuma</i> <i>P. excavatus</i> <i>L. mauritii</i> <i>E. orientalis</i>	16.5-24.7	15.7-31.1	6.71-7.31	51.71	6.10	8.47

Table 4. Simpson Diversity indices of earthworm species in seven different habitats
Simpson Diversity index, $D = \sum n(n-1) / N(N-1)$ (Simpson, 1949)

Habitat	No. of species	D-values
Paddy field	4	0.36
Rose garden	4	0.27
Chorial Canal side	3	0.57
Settled ash field	2	0.69
Bank of river Hooghly	4	0.37
Grazed grassland within village	3	0.68
Sewage canal side	4	0.59

present study showed a preference of earthworms to Sewage canal side, may be related to higher moisture in the soil. A significant decline in abundance of earthworms in summer can be attributed to changes in soil temperature and moisture (Whalen *et al.*, 1998). The temperature and moisture affect on the diversity of earthworms (Edwards, 1996; Blakemore, 2006).

The results obtained show that the density of earthworms is dependant on Carbon and Nitrogen content of soils. The nature of the organic matter affects the abundance and species diversity of earthworms. When nitrogen content is high, C/N ratio reduces and earthworm density falls. It is the relative values carbon and nitrogen that affect the earthworm population. The higher nitrogen content, high organic carbon and corresponding high C/N ratio is found at sewage canal side. The lower nitrogen content and low organic carbon is found at settled ash field, where the minimum occurrence of species found. The occurrence of most of the species in sewage soil shows that earthworms prefer to live in soil rich in organic carbon and nitrogen. The present observations are more or less in agreement to the findings of other workers (Lavelle 1974; Edwards and Lofty 1977; Appelhof 1981; Lee 1985).

To quantify the biodiversity of a habitat, the formula of Simpson Diversity index is used. Here D (Simpson Diversity index) = $\sum n(n-1) / N(N-1)$, where n denotes the total number of organisms of a particular species and N denotes the total number of organisms of all species. Table 4 is calculated

from Table 2. The value of D varies between 0 and 1. With this index 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D , the lower the diversity.

Simpson index of diversity varies in between land use types (rose garden : 0.27 and settled ash field: 0.69) in spite of the large no. of samples. This difference is due to habitats containing many different species but with most individuals belonging to few common species. Table 4 shows the lower value in rose garden (0.27) which means the highest diversity. In rose garden moisture holding capacity ranges from 8.9% to 18.7% with pH of 6 to 6.8, with organic carbon 14.0 gm/kg and total nitrogen is 1.70 gm/kg, appear to be favourable for higher earthworm diversity. Study shows the highest value in settled ash field (0.69) which gives the lowest diversity. This locality attributed to the dry soil with low moisture holding capacity (4.08%-14.4%) in addition to the low availability of carbon (6.73 gm/kg) and nitrogen (1.45 gm/kg). Kale (1998) reported that abundance and diversity of earthworm species affected by carbon and nitrogen content of the soil, and that is why settled ash field gives the lowest diversity. The next higher diversity is paddy field (0.36), whose C/N ratio is 10.78 with moisture content ranges from 5.52% to 18.8%. Then comes bank of river Hooghly (0.37). The C/N ratio is here 8.2 with moisture content 8.3% to 13.7%. The low C/N ratio of Chorial canal side (0.57) is 8.24 with a high moisture range of 12.2% to 19.9% have low diversity than earlier habitat, The sewage canal side (0.59) has high moisture range of

16.5 %to 24.7% with C/N ratio of 8.47, Grazed Grassland within village (0.68) have moisture range of 16.2 to 31.0 with lower C/N ratio of 1.65. The high availability of feed and moisture content maintained in the man made environment (Rose garden) appear to be the positive factors. Fragoso *et al.* (1999) reported that the structural composition in earthworm communities varied depending on the type of agro-ecosystem. Similar observations are evident from the data of the present study. Difference between the earthworm

communities at different localities indicates that environmental heterogeneity is important in promoting earthworm diversity (beta diversity), as it has been shown by (Fragoso and Lavelle, 1987) in the forests of Mexico.

ACKNOWLEDGEMENT

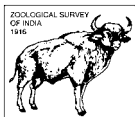
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ROTIFER DIVERSITY OF OSMANSAGAR RESERVOIR, HYDERABAD, TELANGANA, INDIA

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INTRODUCTION

Rotifers are one of the most important components in zooplankton community. They play a crucial role in interlinking food chain in the aquatic ecosystem. They are considered to be one of the most sensitive indicators of water quality (Sladeczek, 1983; Ali *et al.*, 1990; Pontin and Langley, 1993). It is of the opinion of many researchers that the rotifer species composition and their abundance can be used as indicators of trophic status (Berzins and Pejler 1989; Matveeva, 1991; Duggan *et al.*, 2001; Ejsmont-Karabin, 2012).

Osmansagar is a man-made reservoir, constructed across the river Musi in 1920 for controlling flood and water supply to the Hyderabad city, Telangana. The present rapid urbanization, increasing population pressure, sewage and industrial pollutants are deteriorating the aquatic habitats and ground water in the urban areas of Hyderabad leading to a greater threat to the aquatic biodiversity. Keeping in view of the present deteriorating status of the wetlands, the present study has been taken up to assess the rotifer diversity and trophic status of Osmansagar reservoir.

MATERIALS AND METHODS

Osmansagar is located between 17°21'57"N and 78°18'14"E, covering an area of 23.84 km² in the Southwest region of the Hyderabad. It is surrounded by undulating terrain with rocky surface. The study was carried out at monthly

intervals from December 2010 to November 2012.

Rotifer collections were made from the littoral surface of the water column at various localities. Qualitative collections were done by towing surface water column. Quantitative samples were collected by filtering 50Lts of water through a zooplankton net made of bolting silk (No 25), 62 µm mesh size. The collected samples were transferred to a clean plastic container of 100 ml capacity and preserved in 4% neutralized formaldehyde solution. Identification of rotifer species was done with the aid of standard literature Sharma (1992), Segers (1995), Dhanapathi (2000), Sharma and Sharma (2008). Quantitative collection was estimated by using Sedgwick-Rafter cell and the results were expressed in Ind./L (Welch 1948).

The Water samples were collected in clean plastic containers (1 liter) for estimation of the physical and chemical parameters like ambient and subsurface water temperature, electrical conductivity, pH, total dissolved solids, total hardness, total alkalinity, Calcium, Chloride, Phosphate, Nitrate and Nitrite were analysed by using orlab water quality kits following standard method (APHA 1985) and dissolved oxygen content was estimated through Winkler's method.

Species diversity (Shannon diversity index H'), Species richness and abundance (Hill Numbers index), Evenness (Pielou index), dominance (Berger-Parker dominance index) were analysed according to Hayek and Buzas (1997) by using Biodiversity pro software.

RESULTS

Fifty species of rotifers belonging to 24 genera, 16 families were recorded from this reservoir. Brachionidae and Lecanidae have 50% of species, especially the genera *Brachionus* and *Lecane* (Table 1 and Fig. 1). The rotifers, *Brachionus calyciflorus*, *B. caudatus*, *B. forficula*, *B. diversicornis*, *B. quadridentatus*, *Keratella tropica* and *Filinia* sp. are the most common species recorded during the study. The species *Pompholyx* sp., *Mytilina ventralis* and *Tripleuchlanis plicata* are rarely encountered.

Density of the rotifer component varied between 40No/L and 621No/L over the two year period of investigation (Table 2). It was ranging 40-621No/L in 2010-11, maximum was in August and September 2011, 621No/L and 417No/L respectively (Fig. 2). This temporal change was due to the numerical abundance of the species *Keratella tropica* (December), *Brachionus calyciflorus*, *B. quadridentatus* and *K. tropica* (February), *B. calyciflorus*, *B. forficula* (March), *B. calyciflorus*, *B. caudatus*, *T. similis* and *Trichocerca* sp. (April and May), *B. forficula*, *B. diversicornis*, *K. tropica*, *T. similis*, *Trichocerca* sp., *Filinia longiseta* (August and September), *B. calyciflorus*, *K. tropica* (October and November). Similarly, the density was 44-301No/L in 2011-12 due to the abundance of *B. calyciflorus*, *B. caudatus* and *K. tropica* in June, July, October and November, 2012.

The diversity (H') of rotifer was 0.924-2.39 during the entire study period (Table 2 and Fig. 3). It was $H'=1.5-2.39$ in 2010-11 and $H'=0.924-2.18$ in 2011-12. The maximum diversity values have been recorded during the summer. The species richness was 7-20 numbers (Fig. 4), higher in April and May 2011 (19 and 20 numbers respectively). The evenness (J) was 0.547-0.978 over two years (Fig. 5). The overall abundance of rotifer ranged between 5.47 and 94.29% during the study (Fig. 6). It was 22.9-94.29% in 2010-11 and 8.96-33.83% in 2011-12. The abundance increased with the species richness, density and diversity of the rotifers. Berger-Parker dominance index was 10.2-58.8% during the study period (Fig. 7). The highest dominance was during monsoon seasons

due to the numerical abundance of *Brachionus forficula* during the period 2011-12.

SHE information, analysis shows the variance ranging $\text{LnS}=1.95-3.07$, $\text{LnE}= -0.03$ to -0.57 and $\text{LnE/LnS}= -0.01$ to -0.16 in 2010-11 (Fig. 8). The differences in $\text{LnS}= 2.2-3.22$, $H= 2.07-2.59$, $\text{LnE}= -0.12$ to -1.05 and $\text{LnE/LnS}= -0.06$ to -0.33 in 2011-12 (Fig. 9). It shows that the species richness was constant; the diversity and evenness were also constant in 2010-11. But in 2011-12, the species richness was constant, whereas the diversity decreased and evenness.

Physicochemical profile of the reservoir shows (Table 3) that atmospheric temperature between 18 and 31°C. The maximum temperature was in December, 2010 to September, 2011 (22-26°C), minimum in August, 2012 (16°C) and September, 2012 (17°C). The pH value was 8.05 to 9.9 during the study period; highest values are recorded during summer seasons from May, 2012 to August, 2012 (8.7-9.7). Electrical conductivity was 0.41-0.96mS, with marginal variations from December, 2010 to July, 2012 except a sudden increase in August, 2012 (0.96mS). Total dissolved solid content was 233-370ppm, with the highest record during summer seasons. Dissolved oxygen content was (6.68-10.79mg/L) uniform during the entire period of study. Total hardness and alkalinity were 100-205.4mg/L and 102-195mg/L respectively. Chloride content ranged from 45.54 to 87.7mg/L, highest during monsoon seasons in 2010-11, and winter, summer seasons in 2011-12. More concentration of chloride was recorded in October, 2011 (87.71mg/L) and March, 2012 (87.71mg/L). Calcium and Magnesium values varied between 18.96-28.44mg/L and 19.95-43.1mg/L respectively. Phosphate content was 0.08-1.99mg/L, Nitrate 0-70mg/L high in September, 2011, Nitrite 0-0.16mg/L high in February and September, 2011 and Ammonia 0-0.02mg/L.

DISCUSSIONS

The species of *Brachionus* and *Lecane* are more dominant than the species of other rotifer genera. This trend was reported in several water bodies of tropical and subtropical regions (Nogueira,

2001; Cavalli *et al.*, 2001; Sampaio *et al.*, 2002; Neves *et al.*, 2003 and Kudari *et al.*, 2005). The greater species richness genera in Indian rotifera imparts it a general tropical character (Sharma, 1996; 2000). Hutchinson (1967) stated that the genus *Brachionus* is characteristic of hard waters.

The density of the rotifer has changed temporally with different species composition and the high density because of *B. forficula*, *B. diversicornis*, *Keratella tropica* and *Trichocerca* sp. Shannon diversity index of rotifer was found to be moderate in 2010-11 and less in 2011-12. Balloch *et al.* (1976) and Ismael and Dorgham (2003) reported that the diversity index (Shannon's) was found to be a suitable indicator for water quality assessment. The diversity was highest in summer seasons with more species richness, evenness and abundance of individuals like *B. diversicornis*, *B. forficula*, and *Keratella tropica* in the present investigation. Yeole *et al.* (2007) also observed the high diversity during summer season in Yedshi lake, Maharashtra. Sharma (1996) reported the alkaline hard waters in different parts of tropical India are characterized by abundance of *Brachionus* and *Keratella Tropica*. Dominance was highest in August, October and November, 2012, because of the presence of *B. forficula* individuals. Chakaravarty and Kumar (1991) and Bath and Kaur (1998) classified *B. forficula* and *B. calyciflorus* are warm stenothermal forms. Similarly the occurrence of *Anuraeopsis fissa*, *B. forficula*, *Dipleuchlanis propatula* and *Lecane stenroosi* are also represents the warm-stenothermal nature (Sharma 2000). SHE information, analysis reveals that the diversity more depends upon the evenness of the individuals rather than species richness.

The high temperature favours more density, species richness, evenness and diversity. The low temperature and high electrical conductivity decreases the density, species richness, evenness and diversity. The pH shows the alkaline nature of the water body. A similar observation was made in the Krishna sayer in Burdwan by Chattopadhyay (2007). The high content of the dissolved oxygen is an indication of the healthy system (Bilgrami

and Datta Munshi, 1979). It was recorded that the moderate dissolved oxygen content maintains the aquatic life of the Osmansagar reservoir without much variation. The hardness content is within the permissible limit with not much fluctuation. According to the studies earlier made by Sawyer (1960) this reservoir has moderately hard water. Similarly the less total dissolved solids and alkalinity reveals the less influence of the pollution and buffer action of the water body except during monsoon due to runoff. The ionic components like Chloride, Calcium and Magnesium are also in the permissible limits, except fluctuations in the chloride during winter and monsoon periods. The chloride content of the reservoir reveals less to moderate domestic pollution (Unni 1983). The nutrient content such as phosphate is low in concentration throughout the study except in summer 2011-12. Nitrate, Nitrite and Ammonia concentrations are slightly raised during monsoon. The overall physicochemical profile was more or less similar in both the years, except minor fluctuations indicating the acceptable water quality and healthy aquatic ecosystem.

According to Pejler (1957) and Saksena (1987) the presence of species of *Brachionus* and *Keratella* indicates the moderately clean water (mesotrophic). The presence of abundant *B. forficula* is indicating the hard water nature of Osmansagar. Green (1993) and Sampaio *et al.* (2002) reported the predominance of *Brachionus calyciflorus* is considered to be good indicators of eutrophication. But, this trend is not recorded in this Osmansagar reservoir. Statkweather *et al.* (1979) reported the dominance of some species, adapted to the environmental conditions, give low value of diversity index. These species usually belong to family Brachionidae, especially genus *Brachionus*. This was corroborating with present investigation. Hence, the diversity index of Osmansagar reservoir shows mesotrophic nature.

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Table 1. Rotifer species recorded in Osmansagar, Hyderabad

S. No	Family/species name	2010-2011	2011-2012
	Rotifera		
	Class EUROTATORIA		
	Subclass MONOGONONTA		
	Order PLOIMA		
	Epiphanidae		
1	<i>Epiphanes clavulata</i> (Ehrenberg, 1832)	+	+
	Brachionidae		
2	<i>Anuraeopsis fissa</i> Gosse, 1851	+	+
3	<i>Brachionus angularis</i> Gosse, 1851	+	+
4	<i>Brachionus bidentatus</i> Anderson, 1889	+	+
5	<i>Brachionus calyciflorus</i> Pallas, 1776	+	+
6	<i>Brachionus caudatus</i> Barrios & Daday, 1894	+	+
7	<i>Brachionus diversicornis</i> Daday 1883	+	+
8	<i>Brachionus falcatus</i> Zacharias, 1898	+	+
9	<i>Brachionus forficula</i> Wierzejski, 1891	+	+
10	<i>Brachionus quadridentatus</i> Hermann, 1783	+	+
11	<i>Brachionus quadridentatus melhemi</i> Barrios & Daday 1894	+	-
12	<i>Brachionus rubens</i> Ehrenberg, 1838	+	-
13	<i>Brachionus urceolaris</i> Muller, 1773	+	+
14	<i>Keratella tropica</i> (Apstein, 1907)	+	+
15	<i>Plationus patulus</i> (Muller, 1786)	+	-
16	<i>Platylabus quadricornis</i> Ehrenberg, 1832	+	-
	Euchlanidae		
17	<i>Euchlanis dilatata</i> Ehrenberg, 1832	+	+
18	<i>Euchlanis</i> sp.	+	-
19	<i>Dipleuchlanis propatula</i> Gosse, 1886	+	-
20	<i>Tripleuchlanis plicata</i> (Levander, 1894)	+	-
	Mytilinidae		
21	<i>Mytilina ventralis</i> Ehrenberg, 1832	+	-
	Trichotriidae		
22	<i>Trichotria tetractis</i> (Ehrenberg, 1830)	+	-
	Lepadellidae		
23	<i>Colurella obtusa</i> (Gosse, 1886)	+	+
24	<i>Lepadella (Heterolepadella) ehrenbergii</i> Perty, 1850	+	-
25	<i>Lepadella (Lepadella) ovalis</i> Muller 1786	+	-

Table 1. *contd.*

S. No	Family/species name	2010-2011	2011-2012
	Lecanidae		
26	<i>Lecane arcula</i> Harring, 1914	+	+
27	<i>Lecane curvicornis</i> (Murray, 1913)	+	-
28	<i>Lecane leontina</i> (Turner, 1892)	+	-
29	<i>Lecane luna</i> (Muller, 1776)	+	-
30	<i>Lecane papuana</i> (Murray, 1913)	+	+
31	<i>Lecane unguolata</i> (Gosse, 1887)	+	-
32	<i>Lecane bulla</i> (Gosse, 1851)	+	+
33	<i>Lecane hamata</i> (Stokes, 1896)	+	-
34	<i>Lecane lunaris</i> (Ehrenberg, 1832)	+	+
35	<i>Lecane stenroosi</i> (Meissner, 1908)	+	+
36	Notommatidae		
	<i>Cephalodella forficula</i> (Ehrenberg, 1832)	+	+
37	<i>Cephalodella</i> sp.	+	+
38	Trichocercidae		
	<i>Trichocerca</i> sp.	+	+
39	<i>Trichocerca similis</i> (Wierzejski, 1893)	+	+
40	<i>Trichocerca bicristata</i> (Gosse, 1887)		
	Asplanchnidae		
41	<i>Asplanchna brightwellii</i> Gosse, 1850	+	+
	Synchaetidae		
42	<i>Polyarthra</i> sp.	+	+
	Order Flosculariaceae		
	Conochilidae		
43	<i>Conochiloides</i> sp.	+	+
	Hexarthridae		
44	<i>Hexarthra</i> sp.	+	+
	Filiniidae		
45	<i>Filinia</i> sp.	-	+
46	<i>Filinia opoliensis</i> (Zacharias, 1898)	+	+
	Testudinellidae		
47	<i>Testudinella patina</i> (Hermann, 1783)	+	-
48	<i>Pompholyx</i> sp.	+	+
	Subclass Bdelloidea		
	Philodinidae		
49	<i>Rotaria neptunia</i> Ehrenberg, 1832	-	+
50	<i>Rotaria</i> sp.	+	+

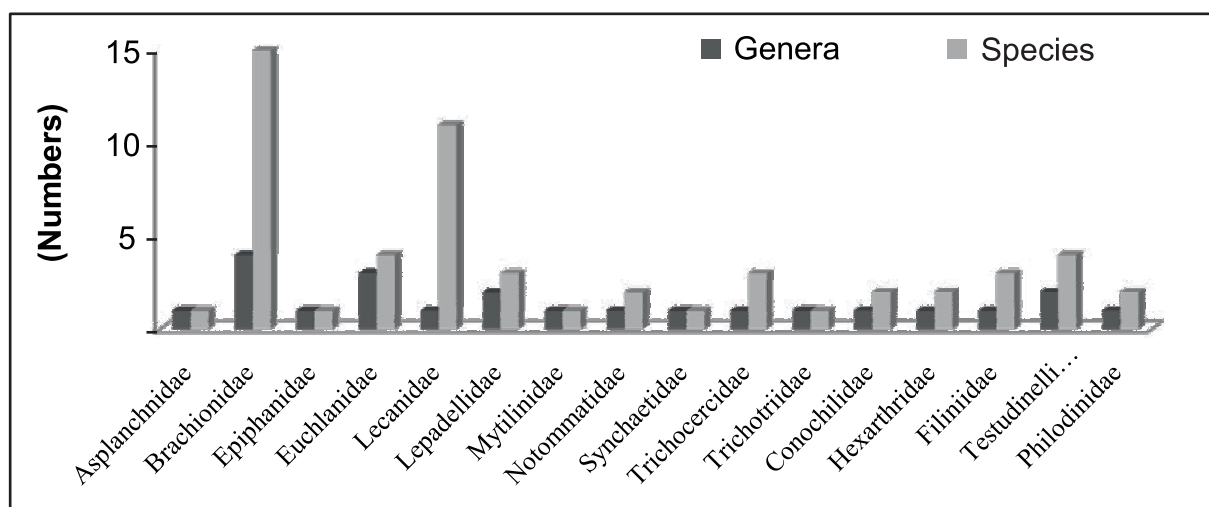


Fig. 1. Family wise species composition of rotifer

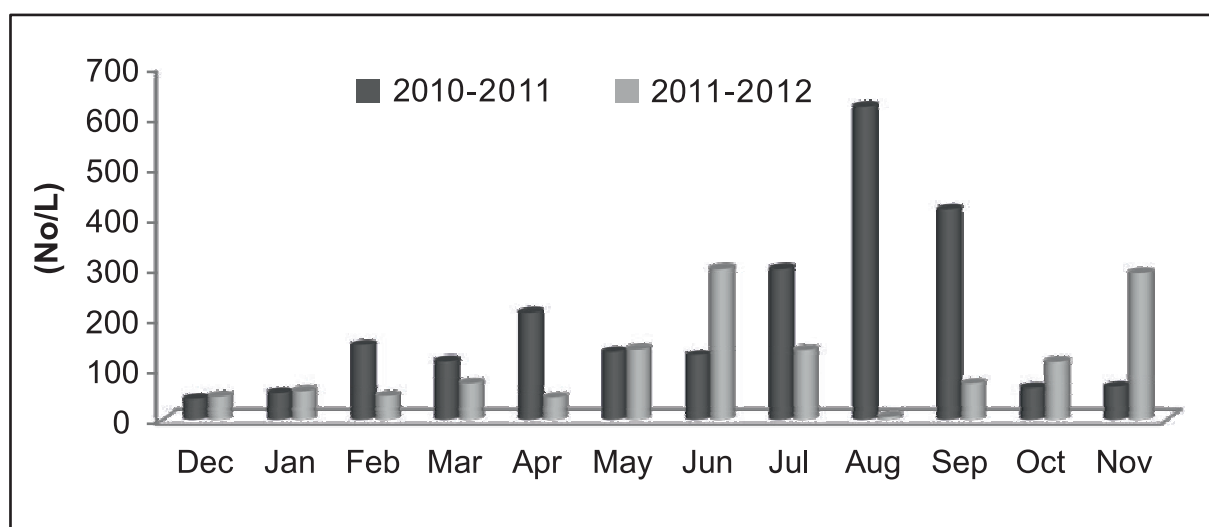


Fig. 2. Monthly variance of rotifer density

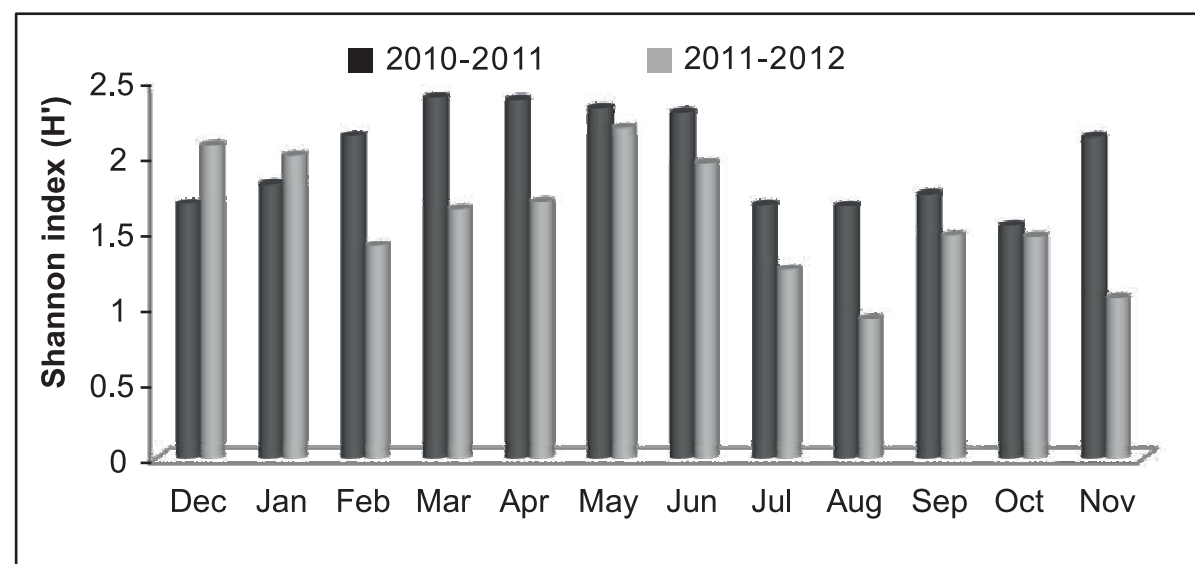


Fig. 3. Monthly variance of rotifer diversity

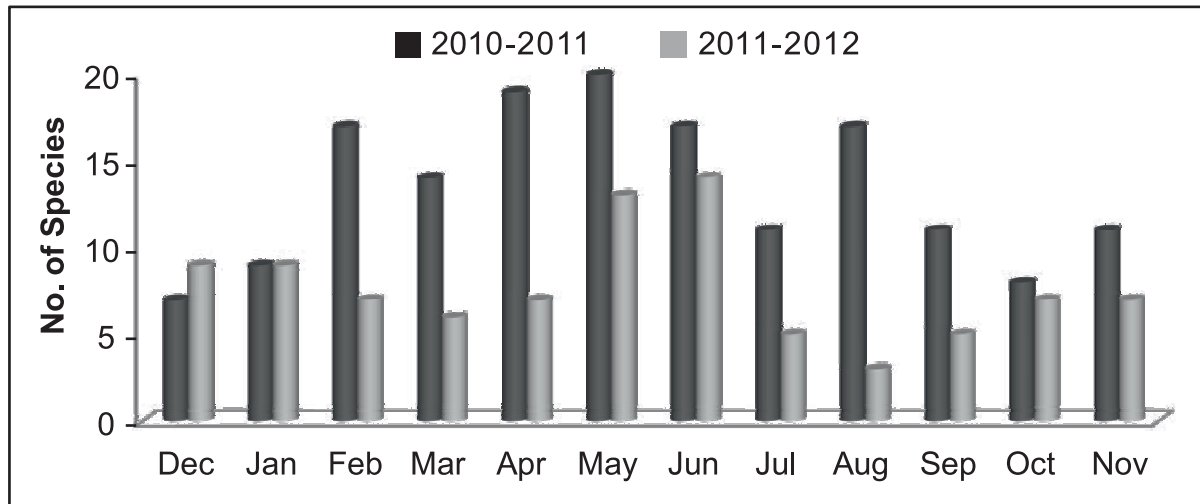


Fig. 4. Monthly variance of rotifer species richness

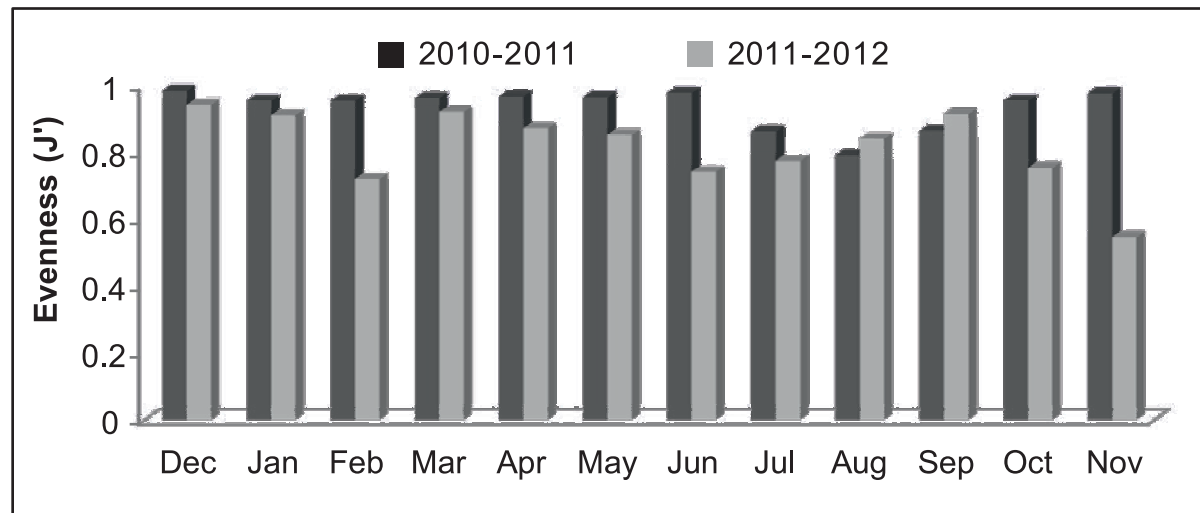


Fig. 5. Monthly variance of rotifer evenness

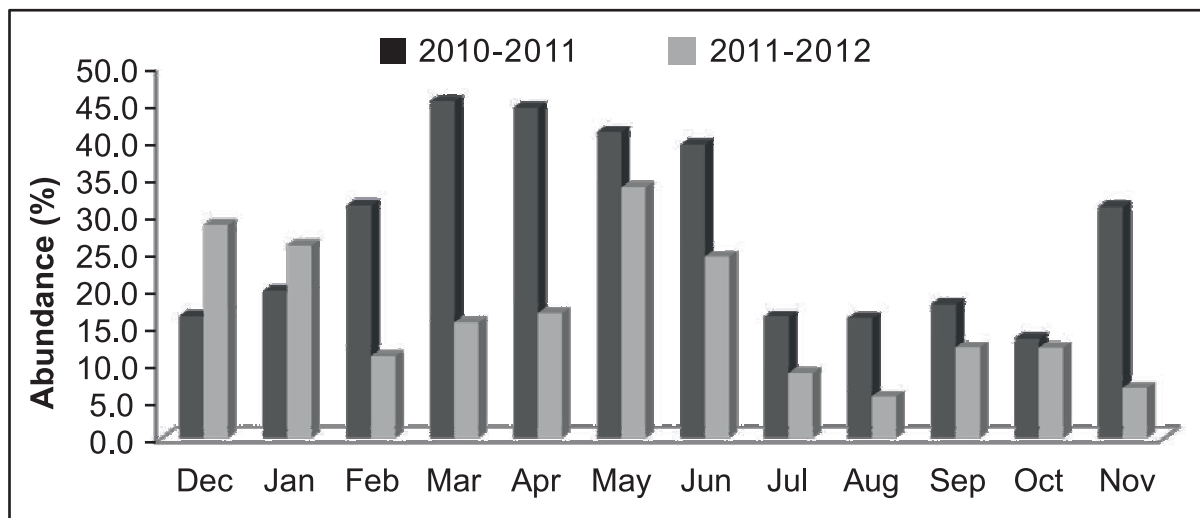


Fig. 6. Monthly variance of rotifer abundance

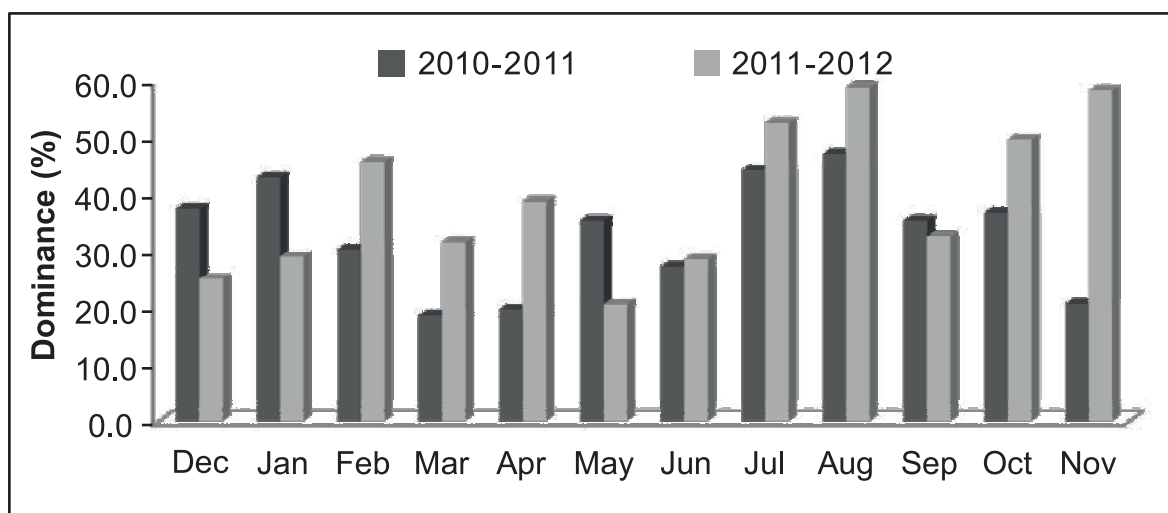


Fig. 7. Monthly variance of rotifer dominance

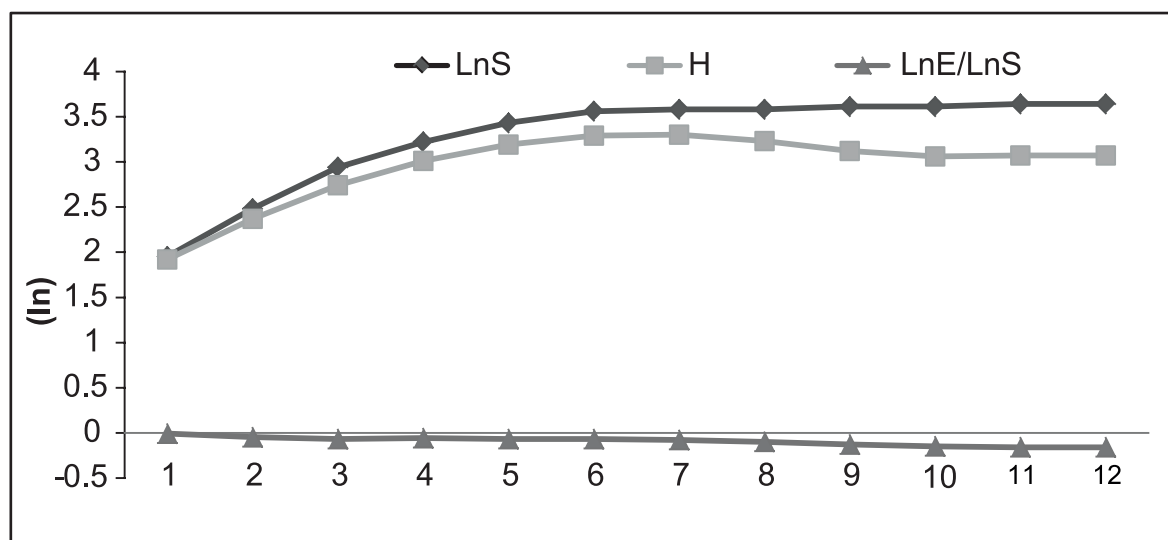


Fig. 8. SHE information analyses of from December 2010 to November 2011

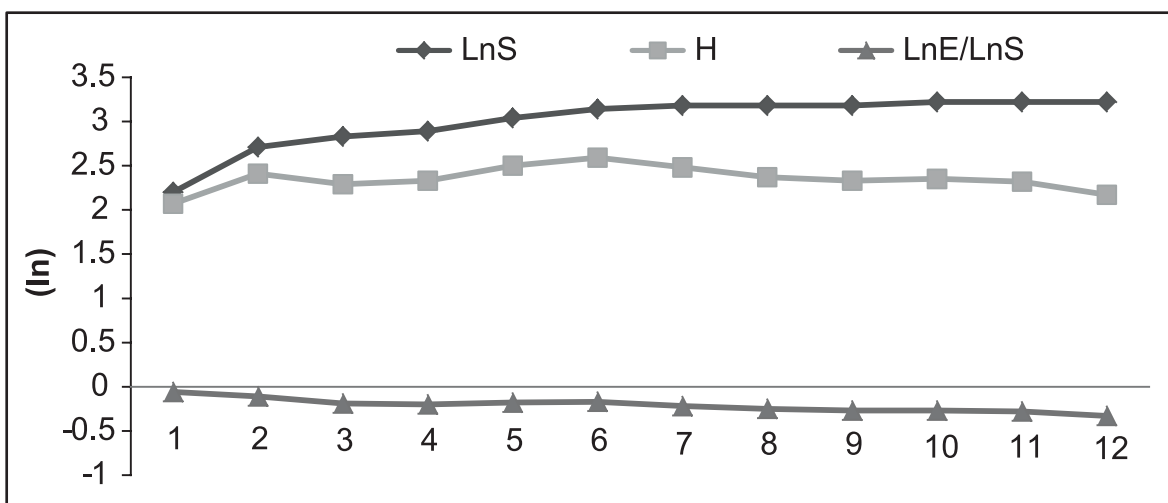
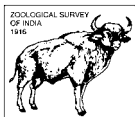


Fig. 9. SHE information analyses of rotifers from December 2011 to November 2012

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AN UPDATED CHECKLIST OF INDIAN PHYTOSEIID MITES (ACARI : MESOSTIGMATA)

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INTRODUCTION

The mites of the family Phytoseiidae have received worldwide attention because of their importance in biological control of mite and some of the soft-bodied insect pests of various crops. This is probably the most explored and exploited among all the predatory mites. In view of their importance, these mites have also been explored in India, from where many new species have been described since 1960. Apart from these, some work has also been carried out in India on their bio-ecology, predator-prey interactions, and the effects of pesticides on these mites, which have been reviewed in Gupta (2003a). Gupta (1986) published a comprehensive account on Indian Phytoseiidae wherein he dealt with 139 species of this family while his review of Oriental Phytoseiidae included 142 species (Gupta, 1987a). Since then, several workers have explored the phytoseiid fauna of India from different parts of the country and raised the total to 207 species. However, after Gupta (1986, 2003a), no effort was made to consolidate the available information in India though many of which has been included in the catalogs of Moraes *et al.*, 2004 and Chant and McMurtry, 2007. Despite those, many other species have been added to the Indian phytoseiid fauna and present

exercise is to collate the available information which indicates 207 species under 21 genera of eight tribes and three subfamilies arranged as per the classificatory scheme of Chant and McMurtry (2007). In addition, another 4 species two under *Euseius* and one each under *Neoseiulus* and *Amblyseius* are described separately Karmakar and Gupta, (2014) and hence the total now comes to 211 species described/reported till date from India.

REVIEW OF INDIAN PHYTOSEIIDAE

The genus *Phytoseius* was established by Ribaga in 1904 with *Gamasus plumifer* Canestrini and Fanzago, 1876, as its type. The name of the family Phytoseiidae is based upon the genus *Phytoseius* Ribaga. The first contribution to Indian phytoseiid fauna came in 1960 when Narayanan and Kaur (1960a) described two new species of the genus *Amblyseius* Berlese. Narayanan and Kaur (1960b) and Narayanan *et al.* (1960) discussed in detail the important taxonomic characters of the family Phytoseiidae. They emphasized the number, arrangement, nature, position, and relative length of the setae together with some other anatomical features being important taxonomic characters of this family. Narayanan *et al.* (1960) reported eight

species under the genus *Typhlodromus* Scheuten and *Phytoseius* which included descriptions of three new species.

Chant (1960) described four new species of the genus *Typhlodromus* and *Amblyseius* from India (Mysore and Assam). Narayanan and Ghai (1963), while investigating the mango malformation, caused by *Aceria mangiferae* Sayed, found some predatory mites associated with the colony of malformation mite which included some Phytoseiids and one of which was described as new to science under the genus *Typhlodromus*.

Ghai (1964) while reviewing work on mites of economic importance from India, listed the 17 phytoseiid species known till then from India. Ghai (1965) in her PhD thesis of Indian Agricultural Research Institute, New Delhi, recorded 35 species of Phytoseiidae from India under 10 genera.

Ghai and Menon (1967) reported 16 species including seven new ones then placed in *Amblyseius*, and provided a key for the first time for the Indian species considered to belong to that genus.

From the material received from India, Muma (1967) described four new species.

Ghai and Menon (1969) established two new genera *Indoseiulus* and *Indodromus* with one new species in each.

Gupta (1969a) described a new species of *Typhlodromus* from West Bengal. Gupta in his subsequent publications (1969b, 1969c, 1970a, 1970b) described 10 new species of the genera *Amblyseius*, *Typhlodromus*, and *Phytoseius*. Besides he recorded 25 other known species of this family.

Rao and Rao (1964) reported two species of Phytoseiidae not hitherto known from India. Bhattacharya (1969) added further to phytoseiid taxonomy by describing two new species, one each of *Amblyseius* and *Phytoseius*.

Later, Gupta, through a series of papers (Gupta, 1974, 1975, 1977a, 1977b, 1977c, 1977d, 1978a, 1978b, 1978c, 1979, 1980a, 1980b, 1980c, 1980d, 1981a, 1981b, 1982a, 1982b), explored Phytoseiid

fauna from different states of India which included descriptions of many new species.

Prasad (1974), in his catalogue of Indian mites, listed the occurrence of 58 species.

Gupta and Dhooria (1974), Dhooria *et al.* (1971), Gupta and Nahar (1981), Gupta and Ray (1981a, 1981b), and Ray and Gupta (1981, 1983) contributed further in this field, bringing the total number of species from India to 139.

Gupta (1986) for the first time made a consolidated account of Phytoseiidae of India, which included 139 species, belonging to 10 genera under three subfamilies, and provided full descriptions and illustrations of all the species along with information on habitats, type localities, type repositories, and distribution in India and abroad. Keys for all those taxa were also provided. He included descriptions and illustrations of 10 new species. General morphological features on which the phytoseiid taxonomy was based were also discussed. He also synonymized some species and indicated doubtful identification in respect of five species. Gupta (1987b) reviewed the phytoseiid fauna from the oriental region and reported 142 species from India. Apart from giving a diagnosis of each species, type localities, type repositories, type habitats, distribution, and keys to all the taxa were provided.

Some of the other important contributions made in the progress of taxonomic research on Indian phytoseiids by different authors and the respective regions were Chatterjee and Gupta (1996) from West Bengal, Gupta (1987b) from North-East India, Gupta (1988) from India as a whole, Gupta (1992a) from West Bengal, Gupta (1992b) from Arunachal Pradesh, Gupta (1995) from Meghalaya, Gupta (1996) from Thor desert of Rajasthan, Gupta (2000) from Tripura, Gupta (2003b) from Sikkim, Gupta and Ghosal (2004) from Sundarbans Biosphere Reserve, Gupta and Chatterjee (1997) from Delhi, Gupta and Chatterjee (1999) from Lakshadwip, Gupta and Chatterjee (2007) from Mizoram, Gupta *et al.* (2007) from Andhra Pradesh, and Gupta and Gupta (1989) from West Bengal, Gupta and Karmakar

(2011), Karmakar and Gupta (2011) reported some mites from different agri-horticultural crops which included some phytoseiids. Through all these publications many new species were described and earlier unrecorded species were reported.

Other works reporting phytoseiid species from agri-horticultural crops of India were Karg (1983) from Bangalore, Sadana *et al.* (1990) and Dhooria (1990) from Punjab, Mathur *et al.* (1995) from Hissar, Haryana, Singh *et al.* (1989) from West Bengal, Singh and Singh (1996) from Varanasi, Uttar Pradesh (including the description of one new species), and Tagore and Putatunda (1995) from Hissar. The phytoseiid fauna of the Kashmir region was studied by Rather and his co-workers (Rishi and Rather, 1983, 1984; Rather, 1984, 1985, 1986, 1987, 1989, 1999; Denmark and Rather, 1988, 1996), with descriptions of several new species, which significantly enhanced our knowledge of Indian phytoseiid fauna.

From Kerala significant contributions about the phytoseiid fauna were made by Anithalatha (2005), Anithalatha Sadanandan (2006a, 2006b) and Anithalatha Sadanandan and Ramani (2007), the latter describing five new species of this family.

Currently, a total of 211 species under 21 genera, three subfamilies of Phytoseiidae are known from India those have been listed hereunder.

CHECKLIST OF INDIAN PHYTOSEIIDAE

Subfamily AMBLYSEIINAE

Muma, 1961: 267–302; Chant and McMurtry, 2007: 12

Tribe NEOSEIULINI

Chant and McMurtry, 2003:6; Chant and McMurtry, 2007: 13

Genus *Neoseiulus* Hughes, 1948

Hughes, 1948: 141; Chant and McMurtry, 2007: 22.

1. *aceriae* (Gupta), 1975:30–31; Gupta, 1986: 102; Gupta, 2003a:48; Moraes *et al.*, 2004: 98; Chant and McMurtry, 2007: 13.
2. *bindrai* (Gupta), 1977c: 34–35; Gupta, 1986: 112; Chant and McMurtry, 2007: 25.

3. *baraki* (Athias-Henriot), 1966: 211–212; Gupta, 1986: 105; Gupta, 2003a: 49; Moraes *et al.*, 2004: 104; Chant and McMurtry, 2007: 25.
4. *cucumeris* (Oudemans), 1930: 69–70; Gupta, 1986: 2; Gupta, 2003a: 50; Moraes *et al.*, 2004: 107; Chant and McMurtry, 2007: 25.
5. *cynodoneae* (Gupta), 1977c: 626–627; Gupta, 1986: 207; Gupta, 2003a: 51; Moraes *et al.*, 2004: 117; Chant and McMurtry 2007: 29.
6. *dhooriai* (Gupta), 1977d: 30–31; Gupta, 1986: 105; Chant and McMurtry 2007: 29.
7. *fallacis* (Garman), 1948: 13; Gupta, 1986: 109; Gupta, 2003a: 51; Moraes *et al.*, 2004: 119; Chant and McMurtry 2007: 29.
8. *ficusi* (Gupta), 1986: 146; Gupta, 2003a: 67; Moraes *et al.*, 2004: 121; Chant and McMurtry 2007:29.
9. *imbricatus* Corpuz-Raros and Rimando), 1966: 127; Gupta, 1986: 114; Gupta, 2003a: 53; Moraes *et al.*, 2004: 124; Chant and McMurtry 2007: 29.
10. *indicus* (Narayanan and Kaur), 1960a: 2–5; Gupta, 1986: 112; Gupta, 2003a: 54; Moraes *et al.*, 2004: 125; Chant and McMurtry 2007: 29.
11. *lablabi* (Ghai and Menon), 1967: 72–73; Gupta, 1986: 154; Gupta, 2003a: 70; Moraes *et al.*, 2004: 127; Chant and McMurtry 2007: 29.
12. *longispinosus* (Evans), 1952:413–416; Gupta, 1986: 116; Gupta, 2003a: 54; Moraes *et al.*, 2004: 129; Chant and McMurtry 2007: 29.
13. *neoghanii* (Gupta), 1986: 174; Gupta, 2003a: 77; Moraes *et al.*, 2004: 219; Chant and McMurtry 2007: 29.
14. *paspalivorus* (De Leon), 1957: 143–144; Gupta, 1986: 119; Gupta, 2003a: 50; Moraes *et al.*, 2004: 137; Chant and McMurtry 2007: 29.
15. *reticulatus* (Oudemans), 1930: 70–71; Gupta, 2003a: 58; Moraes *et al.*, 2004: 141; Chant and McMurtry 2007: 31.

- Tribe KAMPIMODROMINI Kolodochka, 1998
Kolodochka, 1998: 59; Chant and McMurtry, 2007: 33–35.
- Subtribe KAMPIMODROMINA Chant and McMurtry, 2007
- Chant and McMurtry, 2007: 36.
- Genus *Okiseius* Ehara, 1967
- Ehara, 1967a: 67–82; Gupta, 1986: 210; Gupta, 2003a: 93; Chant and McMurtry, 2007: 40.
16. *laaensis* (Gupta, 1986), Moraes *et al.*, 2004: 198; Chant and McMurtry, 2007: 43.
 17. *himalayana* Gupta, 1986: 211; Gupta, 2003a: 93; Moraes *et al.*, 2004: 154; Chant and McMurtry, 2007: 43.
 18. *sikkimensis* Gupta, 1986: 213; Gupta, 2003a: 94; Moraes *et al.*, 2004: 155; Chant and McMurtry, 2007: 43 (erroneously mentioned as *himalayanus*).
 19. *yazuliensis* Gupta, 1986: 215; Gupta, 2003a: 95; Moraes *et al.*, 2004: 156; Chant and McMurtry, 2007: 43.
- Genus *Proprioseius* Chant, 1957
- Chant, 1957a: 357; Chant, 1965: 371 (in part); Gupta, 1986: 138; Gupta, 2003a: 64; Chant and McMurtry, 2007: 45.
20. *kumaonensis* Gupta, 1982a: 28; Gupta, 1986: 138; Gupta, 2003a: 64; Moraes *et al.*, 2004: 193; Chant and McMurtry, 2007: 45.
- Subtribe PARAPHYOTOSEIINA Chant and McMurtry, 2003
- Chant and McMurtry, 2003: 211; Chant and McMurtry, 2007: 47.
- Genus *Amblyseiulella* Muma, 1961
- Muma, 1961: 276; Gupta, 1986: 210; Gupta, 2003a: 93; Chant and McMurtry, 2007: 47–49.
21. *heveae* (Oudemans), 1930: 97; Gupta, 1986: 67; Gupta, 2003a: 29; Moraes *et al.*, 2004: 10; Chant and McMurtry, 2007: 49.
 22. *hyauliangensis* (Gupta), 1986: 69; Gupta, 2003a: 30; Moraes *et al.*, 2004: 11; Chant and McMurtry, 2007: 49.
 23. *nucifera* (Gupta), 1979: 80; Gupta, 1986: 71; Gupta, 2003a: 30; Moraes *et al.*, 2004: 11; Chant and McMurtry, 2007: 49.
- Genus *Paraphytoseius* Swirski and Schechter, 1961
- Swirski and Schechter, 1961: 113; Chant and McMurtry, 2007: 49.
1. *Amblyseius (Paraphytoseius)* Ehara, 1967a
Ehara, 1967a: 77; Gupta, 1986: 122; Gupta, 2003a: 58; Chant and McMurtry, 2007: 49.
 2. *Proprioseius (Paraphytoseius)* Karg, 1983
Karg, 1983: 302; Chant and McMurtry, 2007: 49.
 3. *Ptenoseius* Schuster and Pritchard, 1963
Schuster and Pritchard, 1963: 198
 24. *apocynaevagrans* Chinniah and Mohansundaram, 2001a: 73; Chant and McMurtry, 2007: 53.
 25. *arjunae* Anithalatha Sadanandan, 2006a: 188.
 26. *bhadrakaliensis* (Gupta), 1969a: 127; Gupta, 1986: 123; Gupta, 2003a: 59; Moraes *et al.*, 2004: 160; Chant and McMurtry, 2007: 53.
 27. *horrifer* (Pritchard and Baker) 1962: 205–309; Gupta, 1986: 123; Moraes *et al.*, 2004: 163; Chant and McMurtry, 2007: 53.
 28. *multidentatus* Swirski and Schechter, 1961: 114; Gupta, 1986: 123; Gupta, 2003a: 59; Moraes *et al.*, 2004: 162; Chant and McMurtry, 2007: 53.
 29. *nicobarensis* (Gupta), 1977b: 631; Gupta, 1986: 123; Gupta, 2003a: 59; Moraes *et al.*, 2004: 162; Chant and McMurtry, 2007: 53.
 30. *orientalis* (Narayanan *et al.*) 1960: 394; Gupta, 1986: 123; Gupta, 2003a: 59; Moraes *et al.*, 2004: 162; Chant and McMurtry, 2007: 53.
 31. *scleroticus* (Gupta and Ray), 1981a: 42; Gupta, 1986: 123; Gupta, 2003a: 60; Moraes *et al.*, 2004: 164; Chant and McMurtry, 2007: 53.
- Tribe TYPHLODROMIPSINI Chant and McMurtry, 2005b
- Chant and McMurtry, 2005b: 318; Chant and McMurtry, 2007: 55.

Genus *Scapulaseius* Karg and Ooman-Kalsbeek 1987

Karg and Ooman-Kalsbeek 1987: 132; Chant and McMurtry, 2005a: 331; Chant and McMurtry, 2007: 65.

4. *Newsami* group

Chant, 1959: 95.

5. *markwelli* species group

Schicha, 1987: 25.

6. *oguroi* species group

Wu and Ou, 1999: 103.

32. *andamanicus* (Gupta), 1980c: 213; Gupta, 1986: 198; Gupta, 2003a: 87; Moraes *et al.*, 2004: 206; Chant and McMurtry, 2007: 67.
 33. *asiaticus* (Evans 1953); Moraes *et al.*, 2004: 207; Chant and McMurtry, 2007: 67 (earlier report of this species by Narayannan *et al.*, 1960 and Gupta (1970) appeared to be miss identification however, the present report of this species made from India is based on correct identification and confirmed by Dr. G.J.de Moraes through per.comm. and therefore this is treated as new record from India.)
 34. *arecae* (Gupta), 1977c: 624; Gupta, 1986: 160; Gupta, 2003a: 73; Moraes *et al.*, 2004: 207; Chant and McMurtry, 2007: 67.
 35. *assamensis* Chant 1960: 60; Gupta, 1986: 104; Chant and McMurtry, 2007: 67; Moraes *et al.*, 2004: 208.
 36. *augusta* (Roy *et al.*) 2008: 1.
 37. *daturae* (Gupta), 1975: 34; Gupta, 1986: 185; Moraes *et al.*, 2004: 146; Chant and McMurtry, 2007: 67.
 38. *eucalypticus* (Gupta), 1978a: 330; Gupta, 1986: 144; Gupta, 2003a: 66; Moraes *et al.*, 2004: 177; Chant and McMurtry, 2007: 67.
 39. *hapoli* (Gupta) 1986: 200; Gupta, 2003a: 88; Moraes *et al.*, 2004: 88; Chant and McMurtry, 2007: 67.
 40. *meghalayensis* (Gupta, 1978b: 67); Gupta, 1986: 170; Gupta, 2003a: 76; Moraes *et al.*, 2004: 218; Chant and McMurtry, 2007: 121.
 41. *officinaria* (Gupta), 1975: 39; Gupta, 1986: 176; Gupta, 2003a: 78; Moraes *et al.*, 2004: 219; Chant and McMurtry, 2007: 67.
 42. *polyantheae* (Gupta), 1975: 42; Gupta, 1986: 178; Gupta, 2003a: 79; Moraes *et al.*, 2004: 221; Chant and McMurtry, 2007: 67.
 43. *sapienticola* (Gupta), 1977c: 633; Gupta, 1986: 182; Gupta, 2003a: 80; Moraes *et al.*, 2004: 223; Chant and McMurtry, 2007: 68.
 44. *sorghumae* (Gupta), 1977c: 635; Gupta, 1986: 157; Gupta, 2003a: 72; Moraes *et al.*, 2004: 204; Chant and McMurtry, 2007: 68.
 45. *suknaensis* (Gupta), 1970a: 185; Gupta, 1986: 185; Gupta, 2003a: 81; Moraes *et al.*, 2004: 146; Chant and McMurtry, 2007: 68.
- Genus *Typhlodromips* De Leon, 1965
- De Leon, 1965: Chant and McMurtry, 2007: 63.
46. *syzygii* (Gupta), 1975: 44; Gupta, 1986: 188; Gupta, 2003a: 82; Moraes *et al.*, 2004: 227; Chant and McMurtry, 2007: 63.
- Tribe AMBLYSEIINI Muma, 1961
- Muma, 1961: 273; Chant and McMurtry, 2007: 68.
7. *Amblyseiinae* Muma, 1961
- Muma 1961: 273.
8. *Amblyseiini* Wainstein, 1962
- Wainstein, 1962: 26; Chant and McMurtry, 2007: 68.
- Subtribe AMBLYSEIINA Chant and McMurtry, 2004
- Chant and McMurtry, 2004: 179; Chant and McMurtry, 2007: 69.
- Genus *Transeius* Chant and McMurtry, 2004
- Chant and McMurtry, 2004: 181; Chant and McMurtry, 2007: 69.
47. *bangalorensis* Karg, 320; Gupta, 2003a: 74; Moraes *et al.*, 2004: 209; Chant and McMurtry, 2007: 71.
 48. *tetranychivorus* (Gupta), 1978b: 337; Gupta, 1986: 190; Gupta, 2003a: 83; Moraes *et al.*, 2004: 228; Chant and McMurtry, 2007: 71.

- Genus *Amblyseius* Berlese, 1914
- Berlese, 1914: 143; Gupta, 1986: 33; Gupta, 2003a: 12; Chant and McMurtry, 2007: 73.
9. *Amblysiopsis* Garman, 1948
- Garman, 1948: 17; Gupta, 1986: 33; Chant and McMurtry, 2007: 73.
10. *Amblyseius (Amblyseius)* Muma, 1961
- Muma, 1961: 287; Chant and McMurtry, 2007: 73.
11. *Amblyseius (Amblyseius)* Muma, 1961
- Muma 1961: 287; Chant and McMurtry, 2007: 73.
12. *Amblyseius (Amblyseius)* Muma 1965
- Muma 1965: 245; Chant and McMurtry, 2007: 73.
13. *Proprioseius (Peloiseius)* Karg, 1983
- Karg, 1983: 303; Chant and McMurtry, 2007: 73.
14. *Amblyseius (Multiseius)* Denmark and Muma 1989
- Denmark and Muma 1989: 82; Chant and McMurtry, 2007: 73.
15. *Amblyseius (Pauciseius)* Denmark and Muma 1989
- Denmark and Muma, 1989: 132; Chant and McMurtry, 2007: 73.
49. *adhatodae* Muma, 1967: 50; Gupta, 1986: 37; Gupta, 2003a: 15; Moraes *et al.*, 2004: 12; Chant and McMurtry, 2007: 74.
50. *aerialis* (Muma), 1955: 264; Athias-Henriot 1957: 338; Rao and Rao, 1964: 38; Prasad, 1974: 160; Gupta, 1975: 31; Gupta, 2003a: 15; Moraes *et al.*, 2004: 13; Chant and McMurtry, 2007: 75.
51. *amitae* Bhattacharyya, 1969: 677; Moraes *et al.*, 2004: 28; Chant and McMurtry, 2007: 75.
52. *amtalaensis* Gupta, 1977a: 53; Moraes *et al.*, 2004: 35; Chant and McMurtry, 2007: 75.
53. *andersoni* Chant, 1957b: 296; Gupta, 1986: 180; Gupta, 2003a: 79; Chant and McMurtry, 2007: 75.
54. *apocynae* Chinniah and Mohanasundaram, 2001b: 66; Chant and McMurtry, 2007: 75.
55. *channabasavannai* Gupta and Daniel, 1978: 328 (originally described as *channabasavanni*); Gupta, 1986: 41; Gupta, 2003a: 15; Moraes *et al.*, 2004: 19; Chant and McMurtry, 2007: 78 (mentioned as *Channabasavanni*).
56. *charui* Gupta, 1969c: 126; Gupta, 1986: 180; Moraes *et al.*, 2004: 15; Chant and McMurtry, 2007: 78.
57. *coffae* Sadanandan, 2006: 39.
58. *crotolariae* Gupta, 1977d: 53; Gupta, 1986: 162; Gupta, 2003a: 74; Chant and McMurtry, 2007: 78.
59. *cucurbitae* Rather, 1985: 291; Gupta, 2003a: 17; Moraes *et al.*, 2004: 21; Chant and McMurtry, 2007: 78.
60. *deleoni* Muma and Denmark, 1970: 68; Gupta, 1986: 45; Gupta, 2003a: 20; Moraes *et al.*, 2004: 28; Chant and McMurtry, 2007: 78.
61. *eujeniae* Gupta, 1977c: 627; Gupta, 1986: 164; Gupta, 2003a: 75; Moraes *et al.*, 2004: 197; Chant and McMurtry, 2007: 78.
62. *excelsus* Chaudhri *et al.*, 1979: 68; Rather, 1985: 291–295; Gupta, 2003a: 18; Moraes *et al.*, 2004: 23; Chant and McMurtry, 2007: 78.
63. *fraterculus* Berlese, 1917: 172; Gupta, 1986: 111; Gupta, 2003a: 52; Moraes *et al.*, 2004: 24; Chant and McMurtry, 2007: 78.
64. *giganticus* Gupta, 1981a: 33–35; Gupta, 1986: 45; Moraes *et al.*, 2004: 29; Chant and McMurtry, 2007: 78.
65. *guajavae* Gupta, 1978b: 63; Gupta, 1986: 166; Gupta, 2003a: 75; Moraes *et al.*, 2004: 197; Chant and McMurtry, 2007: 78.
66. *hapoliensis* Gupta, 1986: 43; Gupta, 2003a: 18; Moraes *et al.*, 2004: 213; Chant and McMurtry, 2007: 78.
67. *herbicolus* Chant, 1959: 84–85; Gupta, 1986: 45–47; Gupta, 2003a: 18–20; Moraes *et al.*, 2004: 28; Chant and McMurtry, 2007: 78.

68. *herbiculoides* McMurtry and Moraes, 1984: 27–37; Moraes *et al.*, 2004: 27; Chant and McMurtry, 2007: 78; Seeja and Ramani, 2010: 48.
 69. *indirae* Gupta, 1985: 209; Gupta, 1986: 47; Gupta, 2003a: 20; Moraes *et al.*, 2004: 30; Chant and McMurtry, 2007: 78.
 70. *ipomoeae* Ghai and Menon, 1967: 71; Gupta, 1986: 37; Moraes *et al.*, 2004: 31; Chant and McMurtry, 2007: 78.
 71. *jarooa* Gupta, 1977b: 629; Gupta, 1986: 148; Gupta, 2003a: 68; Moraes *et al.*, 2004: 198; Chant and McMurtry, 2007: 78.
 72. *koothaliensis* Anithalatha, 2005: 83.
 73. *kulini* Gupta, 1978a: 62; Gupta, 1986: 30; Gupta, 2003a: 22; Moraes *et al.*, 2004: 33; Chant and McMurtry, 2007: 78.
 74. *laaensis* (Gupta, 1986): 266; Gupta, 1986: 51; Gupta, 2003a: 22; Moraes *et al.*, 2004: 33; Chant and McMurtry, 2007: 78.
 75. *largoensis* Muma, 1955: 266; Gupta, 1986: 51; Gupta, 2003a: 22; Moraes *et al.*, 2004: 33; Chant and McMurtry, 2007: 78.
 76. *manipurensis* Gupta, 1978b: 66; Gupta, 1986: 156; Gupta, 2003a: 71; Moraes *et al.*, 2004: 201; Chant and McMurtry, 2007: 78.
 77. *mcmurtryi* Muma, 1967: 270; Gupta, 1986: 55; Gupta, 2003a: 23; Moraes *et al.*, 2004: 37; Chant and McMurtry, 2007: 80.
 78. *mohanasundaramai* Anithalatha, 2005: 81.
 79. *mulberricus* Anithalatha Sadanandan and Ramani, 2007: 215.
 80. *muraleedharani* Gupta, 1985: 57; Gupta, 1986: 13; Gupta, 2003a: 25; Moraes *et al.*, 2004: 39; Chant and McMurtry, 2007: 80.
 81. *neocrotalariae* (Gupta), 1978b: 325; Gupta, 1986: 172; Gupta, 2003: 77; Moraes *et al.*, 2004: 219; Chant and McMurtry, 2007: 80.
 82. *neorykei* Gupta, 1977a: 56; Gupta, 1986: 59; Gupta, 2003a: 25; Moraes *et al.*, 2004: 41; Chant and McMurtry, 2007: 80.
 83. *orientalis* Ehara, 1959: 55; Gupta, 1986: 61; Gupta, 2003a: 26; Moraes *et al.*, 2004: 25; Chant and McMurtry, 2007: 80.
 84. *paraaerialis* Muma, 1967: 270; Gupta, 1986: 63; Gupta, 2003a: 27; Moraes *et al.*, 2004: 46; Chant and McMurtry, 2007: 80.
 85. *pseudorientalis* Chinniah and Mohanasundaram, 2001a: 68; Chant and McMurtry, 2007: 81.
 86. *rangatensis* (Gupta), 1977c: 632–633; Gupta, 1986: 121; Gupta, 2003a: 57; Moraes *et al.*, 2004: 222; Chant and McMurtry 2007: 29.
 87. *rosica* Gupta, 1992a: 166; Gupta, 2003a: 71; Moraes *et al.*, 2004: 203; Chant and McMurtry, 2007: 81.
 88. *rubiae* Chinniah and Mohanasundaram, 2001a: 70; Chant and McMurtry, 2007: 81.
 89. *shoreae* Gupta, 1977c: 57; Gupta, 1986: 63; Gupta, 2003a: 28; Moraes *et al.*, 2004: 224; Chant and McMurtry, 2007: 81.
 90. *sijiensis* Gupta, 1986: 183; Gupta, 2003a: 81; Moraes *et al.*, 2004: 225; Chant and McMurtry, 2007: 81.
- Subtribe PROPRIOSEIOPSINA Chant and McMurtry, 2004
- Chant and McMurtry, 2004: 219; Chant and McMurtry, 2007: 85.
- Genus ***Proprioseiopsis*** Muma, 1961
- Muma, 1961: 277; Gupta, 1986: 131; Gupta, 2003a: 62; Chant and McMurtry, 2007: 87.
16. ***Phytoseiulella*** Muma, 1961: 276
 17. ***Amblyseius (Pavlovskius)***
Wainstein, 1962: 12
 18. ***Amblyseius (Skironodronus)***
Wainstein, 1962: 12
 19. ***Amblyseius (Proprioseiopsis)*** van der Merwe, 1968: 161
 20. ***Proprioseiopsis (Amblyseiulus)***
Karg, 1983: 303
91. *arunachalensis* (Gupta), 1986: 132; Moraes *et al.*, 2004: 171.
 92. *keralaensis* (Chinniah and Mohanasundaram), 2001b: 76; Chant and McMurtry, 2007: 78.
 93. *peltatus* (van der Merwe), 1968: 119; Gupta, 1986: 134; Gupta, 2003a: 63; Moraes *et al.*, 2004: 185; Chant and McMurtry, 2007: 89.

94. *punicae* (Gupta), 1980a: 213; Gupta, 1987b: 50; Gupta, Moraes *et al.*, 2004: 186; Chant and McMurtry, 2007: 89.
95. *synachattiensis* (Gupta), 1986: 136; Gupta, 2003a: 63; Moraes *et al.*, 2004: 190; Chant and McMurtry, 2007: 89.
Subtribe ARRENOSEIINA Chant and McMurtry, 2004
Chant and McMurtry, 2004b: 220; Chant and McMurtry, 2007: 94.
Genus *Phytoscutus* Muma, 1961
Muma, 1961: 275; Chant and McMurtry, 2007: 98.
96. *bakeri* (Gupta), 1980b: 214; Gupta, 1986: 202; Gupta, 2003a: 89; Moraes *et al.*, 2004: 165; Chant and McMurtry, 2007: 101.
97. *salebrosus* (Chant), 1960: 58; Gupta, 1986: 128; Gupta, 2003a: 61; Moraes *et al.*, 2004: 166; Chant and McMurtry, 2007: 101.
Genus *Paraamblyseius* Muma, 1962
Muma, 1962: 8; Gupta, 1986: 202; Gupta, 2003a: 89; Chant and McMurtry, 2007: 101.
98. *fragariae* Gupta, 1980a: 215; Gupta, 1986: 204; Gupta, 2003a: 90; Moraes *et al.*, 2004: 157; Chant and McMurtry, 2007: 103.
99. *mumai* Gupta, 1980b: 33; Gupta, 1986: 206; Gupta, 2003a: 90; Moraes *et al.*, 2004: 158; Chant and McMurtry, 2007: 103.
- Tribe INDOSEIULINI Ehara and Amano, 1998
Ehara and Amano, 1998: 48; Chant and McMurtry, 2007: 105
Genus *Gynaeseius* Wainstein, 1962
Wainstein, 1962: 14; Chant and McMurtry, 2007: 105.
100. *eharai* (Gupta), 1986: 193–195; Gupta, 2003a: 85; Moraes *et al.*, 2004: 89; Chant and McMurtry, 2007: 107.
101. *ghaiae* (Denmark and Kolodochka), 1993: 237; Gupta, 2003a: 85; Moraes *et al.*, 2004: 89; Chant and McMurtry, 2007: 107.
102. *ricini* (Ghai and Menon), 1969: 348; Gupta, 1986: 195; Gupta, 2003a: 86; Moraes *et al.*, 2004: 89; Chant and McMurtry, 2007: 107.
- Tribe EUSEIINI Chant and McMurtry, 2005
Chant and McMurtry, 2005b: 191; Chant and McMurtry, 2007: 107.
Subtribe TYPHLODROMALINA Chant and McMurtry, 2005
Chant and McMurtry, 2005b: 195; Chant and McMurtry, 2007: 109.
Genus *Amblydromalus* Chant and McMurtry, 2005
Chant and McMurtry, 2005b: 203; Chant and McMurtry, 2007: 117.
103. *swaga* (Pritchard and Baker), 1962: 73; Gupta, 1986: 184; Moraes *et al.*, 2004: 204; Chant and McMurtry, 2007: 117.
Subtribe EUSEIINA Chant and McMurtry, 2005
Chant and McMurtry, 2005a: 209; Chant and McMurtry, 2007: 118.
Genus *Euseius* Wainstein, 1962
Wainstein, 1962: 15; Gupta, 1986: 78; Gupta, 2003a: 31; Chant and McMurtry, 2007: 118.
104. *ahaiensis* (Gupta), 1992b: 160; Gupta, 2003a: 32; Moraes *et al.*, 2004: 60; Chant and McMurtry, 2007: 120.
105. *alstoniae* (Gupta), 1975: 31; Gupta, 1986: 74; Gupta, 2003a: 32; Moraes *et al.*, 2004: 61; Chant and McMurtry, 2007: 120.
106. *bambusae* (Ghai and Menon, 1967: 66); Gupta, 1986: 76; Gupta, 2003a: 34; Moraes *et al.*, 2004: 62; Chant and McMurtry, 2007: 120.
107. *chikmagalurensis* (Gupta) 1985: 434; Gupta, 1986: 141; Gupta, 2003a: 65; Moraes *et al.*, 2004: 196; Chant and McMurtry, 2007: 120.
108. *chitradurgae* (Gupta), 1985: 435; Gupta, 1986: 146; Gupta, 2003a: 66; Moraes *et al.*, 2004: 196; Chant and McMurtry, 2007: 120.
109. *coccineae* Gupta, 1975: 30; Gupta, 1986: 80; Gupta, 2003a: 35; Moraes *et al.*, 2004: 64; Chant and McMurtry, 2007: 120.
110. *coccosocius* (Ghai and Menon), 1967: 67; Gupta, 1986: 80; Gupta, 2003a: 36; Moraes *et al.*, 2004: 64; Chant and McMurtry, 2007: 120.

111. *concordis* (Chant), 1959: 69; Jagdish *et al.*, 1994: 244; Gupta, 2003a: 37; Moraes *et al.*, 2004: 64; Chant and McMurtry, 2007: 120.
 112. *delhiensis* (Narayanan and Kaur), 1960b: 5; Gupta, 1986: 82; Gupta, 2003a: 37; Moraes *et al.*, 2004: 64; Chant and McMurtry, 2007: 120.
 113. *eucalypti* (Ghai and Menon), 1967: 69; Gupta, 1986: 84; Gupta, 2003a: 39; Moraes *et al.*, 2004: 66; Chant and McMurtry, 2007: 120.
 114. *finlandicus* (Oudemans), 1915: 183; Ghai and Menon, 1967: 70; Gupta, 1986: 86; Gupta, 2003: 39; Moraes *et al.*, 2004: 66; Chant and McMurtry, 2007: 121.
 115. *hibisci* (Chant), 1959: 68; Gupta, 1970b: 98; Prasad, 1974: 165; Gupta, 1986: 86; Moraes *et al.*, 2004: 70; Chant and McMurtry, 2007: 121.
 116. *indica* (Chatterjee and Gupta, 2003: 70, new name proposed in place of *Amblyseius* (*Typhlodromalus*) *mangiferae*, 2003 which is a junior homonym)
 117. *insanus* (Khan and Chaudri), 1969: 52; Rather, 1985: 292; Gupta, 2003a: 41; Moraes *et al.*, 2004: 72; Chant and McMurtry, 2007: 121.
 118. *kalimpongensis* (Gupta), 1969a: 128; Gupta, 1986: 150; Gupta, 2003a: 68; Moraes *et al.*, 2004: 72; Chant and McMurtry, 2007: 121.
 119. *kodaikanalensis* (Gupta), 1978c: 331; Gupta, 1986: 96; Moraes *et al.*, 2004: 80; Chant and McMurtry, 2007: 121.
 120. *macrospatulatus* (Gupta), 1986: 89; Gupta, 2003a: 41; Moraes *et al.*, 2004: 73; Chant and McMurtry, 2007: 121.
 121. *mangiferae* (Ghai and Menon, 1967: 74); Gupta, 1986: 168; Gupta, 2003a: 76; Moraes *et al.*, 2004: 73; Chant and McMurtry, 2007: 121.
 122. *neococcineae* (Gupta, 1978b: 60); Gupta, 1986: 90; Gupta, 2003a: 41; Moraes *et al.*, 2004: 75; Chant and McMurtry, 2007: 121.
 123. *ovalis* (Evans), 1953: 458; Narayanan *et al.*, 1960: 388; Gupta, 1986: 92; Gupta, 2003a: 42; Moraes *et al.*, 2004: 77; Chant and McMurtry, 2007: 121.
 124. *papayensis* Anithalatha Sadanandan, 2006b: 179.
 125. *prasadi* (Chant and McMurtry), 1975: 40; Gupta, 1986: 94; Gupta, 2003a: 43; Chant and McMurtry, 2005b: 187–224; Chant and McMurtry, 2007: 123.
 126. *rhododendronis* (Gupta, 1970b: 187); Gupta, 1986: 96; Gupta, 2003a: 44; Moraes *et al.*, 2004: 79; Chant and McMurtry, 2007: 123.
 127. *sacchari* (Ghai and Menon), 1967: 75; Gupta, 1986: 98; Gupta, 2003a: 45; Moraes *et al.*, 2004: 81; Chant and McMurtry, 2007: 123.
 128. *scutalis* (Athias-Henriot), 1958: 23–43; Rather, 1999: 20; Gupta, 2003a: 46; Moraes *et al.*, 2004: 82; Chant and McMurtry, 2007: 123.
 129. *vignus* (Rishi and Rather), 1983: 303; Gupta, 2003a: 46; Moraes *et al.*, 2004: 86; Chant and McMurtry, 2007: 123.
- Subfamily PHYTOSEIINAE Berlese, 1913
- Phytoseiini** Berlese, 1913: 3
- Phytoseiinae** Vitzthum, 1941: 768; Gupta, 1986: 216; Gupta, 2003a: 95; Chant and McMurtry, 2007: 125.
- Chantiini** Pritchard and Baker, 1962: 211
- Chantiinae** Chant and Yoshida-Shaul, 1986: 2025
- Genus **Phytoseius** Ribaga, 1904
- Ribaga, 1904: 177; Gupta, 1986: 219; Gupta, 2003a: 96; Chant and McMurtry, 2007: 127.
21. **Phytoseius** (**Phytoseius**)
Wainstein, 1959: 1361
22. **Phytoseius** (**Dubininellus**)
Wainstein 1959: 1361
23. **Dubininellus** Muma, 1961: 293
24. **Plumifer** species group Chant and Yoshida-Shaul 1992: 12
130. *bandipurensis* Gupta, 1980d: 53; Gupta, 1986: 229; Gupta, 2003a: 100; Moraes *et al.*, 2004: 233; Chant and McMurtry, 2007: 129.

131. *brevicrinis* Swirski and Shechter, 1961: 106; Gupta, 1987b: 86; Gupta, 2003a: 101; Moraes *et al.*, 2004: 233; Chant and McMurtry, 2007: 129.
132. *coheni* Swirski and Shechter, 1961: 104; Gupta *et al.*, 1971: 298; Gupta, 2003a: 102; Moraes *et al.*, 2004: 235; Chant and McMurtry, 2007: 129.
133. *corniger* Wainstein, 1959: 1362; Gupta, 1981b: 44; Gupta, 1986: 230; Gupta, 2003a: 102; Moraes *et al.*, 2004: 235; Chant and McMurtry, 2007: 129.
134. *crinitus* Swirski and Shechter, 1961: 102; Ray and Gupta 1983: 303; Gupta, 1986: 232; Gupta, 2003a: 103; Moraes *et al.*, 2004: 236; Chant and McMurtry, 2007: 129.
135. *domesticus* Rather, 1985: 14; Gupta, 2003a: 103; Moraes *et al.*, 2004: 237; Chant and McMurtry, 2007: 129.
136. *indicus* Bhattacharyya, 1969: 679; Gupta, 1986: 234; Gupta, 2003a: 104; Moraes *et al.*, 2004: 241; Chant and McMurtry, 2007: 129.
137. *intermedius* Evans and Mcfarlane, 1962: 587; Gupta, 1970b: 98; Gupta, 1986: 236; Gupta, 2003a: 104; Moraes *et al.*, 2004: 242; Chant and McMurtry, 2007: 129.
138. *jaunpurensis*, Gupta 1982b: 367; Gupta, 1986: 252; Moraes *et al.*, 2004: 252; Chant and McMurtry, 2007: 129.
139. *jujuba* Gupta, 1977d: 13; Gupta, 1986: 238; Gupta, 2003a: 105; Moraes *et al.*, 2004: 242; Chant and McMurtry, 2007: 129.
140. *kapuri* Gupta, 1969c: 116; Gupta, 1986: 221; Gupta, 2003a: 97; Moraes *et al.*, 2004: 243; Chant and McMurtry, 2007: 129.
141. *macropilis* Banks, 1909: 136; Narayanan *et al.*, 1960: 386; Gupta, 1986: 240; Gupta, 2003a: 106; Moraes *et al.*, 2004: 244; Chant and McMurtry, 2007: 129.
142. *macrosetosus* Gupta, 1977d: 16; Gupta, 1986: 242; Gupta, 2003a: 107; Moraes *et al.*, 2004: 246; Chant and McMurtry, 2007: 129.
143. *maldahaensis* Gupta, 1992a: 177; Gupta, 2003a: 107; Moraes *et al.*, 2004: 246; Chant and McMurtry, 2007: 129.
144. *meyserae* Gupta, 1977d: 7; Gupta, 1986: 244; Gupta, 2003a: 107; Moraes *et al.*, 2004: 247; Chant and McMurtry, 2007: 129.
145. *minutus* Narayanan *et al.*, 1960: 391; Gupta, 1986: 223; Gupta, 2003a: 98; Moraes *et al.*, 2004: 247; Chant and McMurtry, 2007: 129.
146. *mixtus* Chaudhri, 1973: 83; Ray and Gupta, 1983: 301; Gupta, 1986: 246; Gupta, 2003a: 108; Moraes *et al.*, 2004: 247; Chant and McMurtry, 2007: 129.
147. *namdaphaensis* Gupta, 1986: 225; Gupta, 1986: 225; Gupta, 2003a: 99; Moraes *et al.*, 2004: 248; Chant and McMurtry, 2007: 129.
148. *neglecta* Gupta, 1969c: 117; Gupta, 1986: 234; Moraes *et al.*, 2004: 242; Chant and McMurtry, 2007: 129.
149. *neocorniger* Gupta, 1977a: 13; Gupta, 1986: 248; Gupta, 2003a: 110; Moraes *et al.*, 2004: 249; Chant and McMurtry, 2007: 129.
150. *neoferox* Ehara and Bhandhufalck, 1977: 49; Gupta, 1986: 250; Gupta, 2003a: 110; Moraes *et al.*, 2004: 249; Chant and McMurtry, 2007: 129.
151. *nipponicus* Ehara, 1962: 58; Rather, 1985: 13; Gupta, 2003a: 111; Moraes *et al.*, 2004: 249; Chant and McMurtry, 2007: 129.
152. *punjabensis* Gupta, 1977a: 16; Gupta, 1986: 252; Gupta, 2003a: 111; Moraes *et al.*, 2004: 252; Chant and McMurtry, 2007: 129.
153. *rachelae* Swirski and Shechter, 1961: 108; Gupta, 1980d: 52; Gupta, 1986: 253; Gupta, 2003a: 112; Moraes *et al.*, 2004: 253; Chant and McMurtry, 2007: 129.
154. *roseus* Gupta, 1969b: 119; = *rugulosus* Chaudhri 1973: 82; Gupta, 1986: 255; Gupta, 2003a: 112; Moraes *et al.*, 2004: 254; Chant and McMurtry, 2007: 129.
155. *rugosus* Denmark, 1966: 100; Gupta, 1977c: 7; Gupta, 1986: 257; Gupta, 2003a: 113; Moraes *et al.*, 2004: 255; Chant and McMurtry, 2007: 129.

156. *swirskii* Gupta, 1980c: 210; Gupta, 1986: 259; Gupta, 2003a: 114; Moraes *et al.*, 2004: 257; Chant and McMurtry, 2007: 131.
157. *viscosum* Roy and Saha, 2010: 123.
158. *wainsteini* Gupta, 1981b: 43; Gupta, 1986: 260; Gupta, 2003a: 114; Moraes *et al.*, 2004: 258; Chant and McMurtry, 2007: 131.
159. *woodburyi* De Leon, 1965: 11–21; Gupta, 1986: 242; Moraes *et al.*, 2004: 258; Chant and McMurtry, 2007: 131.
- Genus ***Platysiella*** Muma 1961
- Muma, 1961: 280; Gupta, 1986: 206; Gupta, 2003: 92; Chant and McMurtry, 2007: 131.
160. *mumai* Ray and Gupta, 1981a: 277; Gupta, 1986: 206; Gupta, 2003a: 92; Moraes *et al.*, 2004: 259; Chant and McMurtry, 2007: 125.
- Subfamily TYPHLODROMINAE
Wainstein 1962
- Typhlodromus*** Scheuten, Evans, 1958: 223
- Typhlodromini*** Wainstein, 1962: 26
- Typhlodrominae*** Chant and McMurtry, 2007: 131
- Tribe PARASEIULINI Wainstein, 1976
- Wainstein, 1976: 697; Chant and McMurtry, 2007: 141.
- Genus ***Paraseiulus*** Muma, 1961
- Muma, 1961: 299; Chant and McMurtry, 2007: 141.
- Genus ***Kuzinellus*** Wainstein, 1976
- (Wainstein), 1976: 699; Chant and McMurtry, 2007: 143.
161. *kuzini* Wainstein, 1962: 231; Rather, 1987: 356; Gupta, 2003a: 138; Moraes *et al.*, 2004: 272; Chant and McMurtry, 2007: 144.
162. *neosoleiger* Gupta, 1981a: 41; Gupta, 1986: 310; Gupta, 2003a: 139; Moraes *et al.*, 2004: 273; Chant and McMurtry, 2007: 144.
- Tribe TYPHLODROMINI Wainstein
- Typhlodromini*** Wainstein, 1962: 26; Chant and McMurtry, 2007: 144
- Genus ***Neoseiulella*** Muma, 1961
- Muma, 1961: 295; Chant and McMurtry, 2007: 145.
25. ***Typhloctonus*** Muma, 1961: 299; Chant and McMurtry, 2007: 145
26. ***Typhlodromus (Nesbittius)*** section *Nesbittius* Wainstein 1962: 23
27. ***Typhlodromus*** section ***Kallistoscius*** Wainstein, 1962b: 23
163. *celtis* Denmark and Rather, 1996: 69; Gupta, 2003a: 140; Moraes *et al.*, 2004: 292; Chant and McMurtry, 2007: 147.
164. *nesbitti* (Womersely), 1954: 179; Narayanan and Ghai, 1964: 541; Gupta, 1986: 312; Gupta, 2003a: 141; Moraes *et al.*, 2004: 294; Chant and McMurtry, 2007: 147.
165. *prunus* Denmark and Rather, 1984: 173; Gupta, 2003a: 141; Moraes *et al.*, 2004: 298; Chant and McMurtry, 2007: 147.
166. *transitans* (Gupta), 1981a: 40; Gupta, 1986: 314; Gupta, 2003a: 141; Moraes *et al.*, 2004: 298; Chant and McMurtry, 2007: 147.
- Genus ***Typhlodromus*** Scheuten, 1857
28. ***Typhlodromus*** Scheuten, 1857: 111; Gupta, 1986: 262; Gupta, 2003a: 115; Chant and McMurtry, 2007: 147
- Subgenus ***Anthoseius*** De Leon, 1959: 258; Gupta, 1986: 289; Gupta, 2003a: 131; Chant and McMurtry, 2007: 149
29. ***Amblydromella*** Muma, 1961: 294; Gupta, 1986: 264; Gupta, 2003a: 116.
30. ***Clavidromus*** Muma, 1961: 296
31. ***Typhlodromella*** Muma, 1961: 299
32. ***Chanteius*** (Colchodromus) Wainstein, 1962: 12
33. ***Typhlodromus*** (Neoseiulus) Huges, Wainstein, 1962: 21
34. ***Brethria*** Tuttle and Muma 1973: 35
167. *arunachalensis* Gupta, 1986: 265; Gupta, 2003a: 117; Moraes *et al.*, 2004: 310; Chant and McMurtry, 2007: 152.
168. *bakeri* Garman, 1948: 15; Gupta, 1986: 270; Gupta, 2003a: 118; Moraes *et al.*, 2004: 311; Chant and McMurtry, 2007: 152.
169. *bambusicolus* Gupta, 1977d: 2; Gupta, 1986: 267; Gupta, 2003a: 118; Moraes *et al.*, 2004: 313; Chant and McMurtry, 2007: 152.

170. *channabasavannai* Gupta, 1978c: 50; Gupta, 1986: 298; Gupta, 2003a: 134; Moraes *et al.*, 2004: 317; Chant and McMurtry, 2007: 152.
171. *chrysanthemi* Gupta, 1977c: 11; Gupta, 1986: 269; Gupta, 2003a: 119; Moraes *et al.*, 2004: 318; Chant and McMurtry, 2007: 152.
172. *communis* Gupta, 1978a: 53; Gupta, 1986: 316; Gupta, 2003a: 142; Moraes *et al.*, 2004: 319; Chant and McMurtry, 2007: 152.
173. *dactylifera* Chaudhri *et al.*, 1974: 212; Gupta, 1986: 276; Gupta, 1987: 316; Moraes *et al.*, 2004: 320; Chant and McMurtry, 2007: 152.
174. *dalii* Rather, 1984: 105; Gupta, 2003a: 119; Moraes *et al.*, 2004: 320; Chant and McMurtry, 2007: 152.
175. *darjeelensis* Gupta, 1986: 270; Gupta, 2003a: 120; Moraes *et al.*, 2004: 320; Chant and McMurtry, 2007: 152.
176. *denmarki* (Rather), 1984: 103; Gupta, 2003a: 121; Moraes *et al.*, 2004: 321; Chant and McMurtry, 2007: 152.
177. *divergentis* (Chaudhri *et al.*), 1974: 217; Dhooria, 1982: 4; Gupta, 1986: 276; Gupta, 2003a: 121; Moraes *et al.*, 2004: 321; Chant and McMurtry, 2007: 152.
178. *eharai* Gupta, 1978c: 54; Gupta, 1986: 270; Moraes *et al.*, 2004: 320; Chant and McMurtry, 2007: 152.
179. *fleschneri* Chant, 1960: 60; Gupta, 1986: 272; Gupta, 2003a: 122; Moraes *et al.*, 2004: 323; Chant and McMurtry, 2007: 152.
180. *garhowalicus* Gupta, 1982a: 29; Gupta, 1986: 318; Gupta, 2003a: 143; Moraes *et al.*, 2004: 325; Chant and McMurtry, 2007: 152.
181. *gopali* Gupta, 1969a: 77; Gupta, 1986: 274; Gupta, 2003a: 123; Moraes *et al.*, 2004: 325; Chant and McMurtry, 2007: 152.
182. *hadii* Chaudhri, 1965: 632; Gupta, 1986: 300; Gupta, 2003a: 135; Moraes *et al.*, 2004: 327; Chant and McMurtry, 2007: 155.
183. *himalayensis* Gupta, 1981a: 32; Gupta, 1986: 276; Gupta, 2003a: 123; Moraes *et al.*, 2004: 329; Chant and McMurtry, 2007: 155.
184. *homalii* Gupta, 1970b: 188; Gupta, 1986: 278; Gupta, 2003a: 124; Moraes *et al.*, 2004: 329; Chant and McMurtry, 2007: 155.
185. *kashmiricus* Gupta, 1981b: 37; Gupta, 1986: 300; Moraes *et al.*, 2004: 327; Chant and McMurtry, 2007: 155.
186. *kodaikanelensis* Gupta, 1978c: 47; Gupta, 1986: 280; Gupta, 2003a: 125; Moraes *et al.*, 2004: 334; Chant and McMurtry, 2007: 155.
187. *majumderi* Gupta, 1986: 291; Gupta, 2003a: 131; Moraes *et al.*, 2004: 336; Chant and McMurtry, 2007: 155.
188. *manipurensis* Gupta, 1977c: 1; Gupta, 1986: 302; Gupta, 2003a: 135; Moraes *et al.*, 2004: 336; Chant and McMurtry, 2007: 155.
189. *meerutensis* (Ghai and Menon), 1969: 349; Gupta, 1986: 217; Gupta, 2003a: 96; Moraes *et al.*, 2004: 337; Chant and McMurtry, 2007: 155.
190. *mori* Gupta, 1981a: 39; Gupta, 1986: 282; Gupta, 2003a: 126; Moraes *et al.*, 2004: 338; Chant and McMurtry, 2007: 155.
191. *neorhenanus* Gupta, 1977b: 2; Gupta, 1986: 320; Gupta, 2003a: 144; Moraes *et al.*, 2004: 339; Chant and McMurtry, 2007: 155.
192. *neotransvaalensis* Gupta, 1978a: 49; Gupta, 1986: 296; Gupta, 2003a: 133; Moraes *et al.*, 2004: 339; Chant and McMurtry, 2007: 155.
193. *nilgiriensis* Gupta, 1986: 282; Gupta, 2003a: 126; Moraes *et al.*, 2004: 339; Chant and McMurtry, 2007: 155.
194. *orissaensis* Gupta, 1977c: 4; Gupta, 1986: 304; Gupta, 2003a: 136; Moraes *et al.*, 2004: 340; Chant and McMurtry, 2007: 155.
195. *persicus* Gupta, 1992b: 181; Gupta, 2003a: 127; Moraes *et al.*, 2004: 342; Chant and McMurtry, 2007: 155.

196. *pruni* Gupta, 1970b: 189; Gupta, 1986: 305; Gupta, 2003a: 136; Moraes *et al.*, 2004: 343; Chant and McMurtry, 2007: 155.
 197. *rhenanus* (Oudemans), 1905: 78; Narayanan *et al.*, 1964: 539; Gupta, 1986: 285; Gupta, 2003a: 127; Moraes *et al.*, 2004: 345; Chant and McMurtry, 2007: 155.
 198. *rhododendroni* Gupta, 1978b: 50; Gupta, 1986: 287; Gupta, 2003a: 128; Moraes *et al.*, 2004: 347; Chant and McMurtry, 2007: 155.
 199. *rickeri* Chant, 1960: 62; Gupta, 1986: 307; Gupta, 2003a: 137; Moraes *et al.*, 2004: 348; Chant and McMurtry, 2007: 155.
 200. *sijiensis* Gupta, 1986: 321; Gupta, 2003a: 144; Moraes *et al.*, 2004: 351; Chant and McMurtry, 2007: 155.
 201. *sonprayagensis* Gupta, 1985: 211; Gupta, 1986: 289; Gupta, 2003a: 129; Moraes *et al.*, 2004: 351; Chant and McMurtry, 2007: 155.
 202. *umbratus* (Chaudri), 1974: 215; Rather, 1984: 103; Gupta, 2003a: 129; Moraes *et al.*, 2004: 356; Chant and McMurtry, 2007: 157.
 203. *viniferae* (Rather), 1999: 20; Gupta, 2003a: 130; Moraes *et al.*, 2004: 357; Chant and McMurtry, 2007: 157.
 204. *zafari* Chaudri, 1965: 632; Rather, 1984: 106; Gupta, 2003a: 130; Moraes *et al.*, 2004: 359; Chant and McMurtry, 2007: 157.
- Subgenus TYPHLODROMUS Scheuten, 1857
Scheuten, 1857: 111; Chant and McMurtry, 2007: 157.
205. *confusus* Narayanan *et al.*, 1960: 392; Gupta, 1986: 293; Gupta, 2003a: 132; Moraes *et al.*, 2004: 363; Chant and McMurtry, 2007: 157.
 206. *roshanlali* Narayanan and Ghai, 1964: 539; Gupta, 1986: 294; Gupta, 2003a: 132; Moraes *et al.*, 2004: 369; Chant and McMurtry, 2007: 157.
 207. *torbatejamae* Denmark and Danessshvar 1982; Gupta, 2003: 129; Chant and McMurtry, 2007: 157.
- Additional four new species:**
208. *metaliensis* Karmakar and Gupta, 2014: 687.
 209. *Paranadae* Karmakar and Gupta, 2014: 691.
 210. *Sativum* Karmakar and Gupta, 2014: 689.
 211. *Vikrami* Karmakar and Gupta, 2014: 691.

SUMMARY

This paper provides a review and checklist of Indian Phytoseiidae listing 207 species under 21 genera, eight tribes and three subfamilies besides, another four new species have been mentioned raising the total Indian species to 211.

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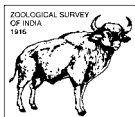
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DIVING BEETLES OF KARNALA BIRD SANCTUARY, MAHARASHTRA, INDIA (COLEOPTERA: DYTISCIDAE)

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INTRODUCTION

Karnala Bird Sanctuary (KBS) with an area of 12.1 square kilometers, inhabits more than 180 species of resident and migratory birds. The sanctuary is located 60 kilometers south of Mumbai, on the Mumbai-Goa highway of Raigad district, Maharashtra, India. The sanctuary is centered on the historic Karnala Fort.

The current knowledge of diving beetles fauna of protected area of Maharashtra state is very limited. To the works Vazirani (1977), Sharma (2002) and Miller & Wewalka (2010) reported diving beetles from this state. The present study is based on a small collection of dytiscid beetles, collected from different parts of the sanctuary by first author in September 2012. This is the first time diving beetles are recorded from this sanctuary. The species *Hydaticus satoi satoi* Wewalka are first report from Maharashtra state. All together 9 species belonging to 6 genera of family Dytiscidae were recorded during this survey.

1. *Sandracottus dejeanii* (Aube, 1938)

1838. *Hydaticus dejeanii* Aube, in *dejean's species Coleopteres*, 6: 165.

1882. *Sandracottus dejeanii*: Sharp, *Sci. Trans. R. Dublin Soc*, 2: 686.

Material examined: 2 exs. (Regd. No. 19898-99/H4A), Karnala Birds Sanctuary (KBS), Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Arunachal Pradesh, Andhra Pradesh, Gujarat, Himachal Pradesh, Jharkhand,

Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Pakistan, Iran, Afrotropical region and Australian region.

2. *Sandracottus festivus* (Illiger, 1801)

1801. *Dyticus festivus* Illiger, *Magazin für Insektenkunde, Braunschweig*, 1(1-2): 166.

1882. *Sandracottus festivus*: Sharp, *Sci. Trans. R. Dublin Soc*, 2: 686.

Material examined: 1ex. (Regd. No. 19900/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Andhra Pradesh, Arunachal Pradesh, Assam, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Punjab and Tamil Nadu. *Elsewhere:* China, Pakistan and Sri Lanka.

3. *Hydaticus luczonicus* Aube, 1938

1838. *Hydaticus luczonicus* Aube, in *dejean's species Coleopteres*, 6: 179.

Material examined: 1ex. (Regd. No. 19901/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Bihar, Delhi, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Indonesia, Philippines, Sri Lanka, Thailand and Vietnam.

4. *Hydaticus satoi satoi* Wewalka, 1975

1975. *Hydaticus satoi* Wewalka, *Koleopterologische Rundschau* 52: 91.

2012. *Hydaticus (Prodaticus) satoi satoi*: Ghosh & Nilsson, *Skorvnopparn Umel supplement* 3: 27.

Material examined: 1ex. (Regd. No. 19902- 04/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Kerala, Sikkim, Tamil Nadu and West Bengal. *Elsewhere:* Bhutan, Myanmar, Nepal, Sri Lanka; China, Indonesia, Japan, Philippines, Saudi Arabia, Taiwan and Thailand.

Remarks: This species is first time recorded from Maharashtra state.

5. *Clypeodytes (s. str.) bufo* (Sharp, 1890)

1890. *Bidessus bufo* Sharp, *Trans. Entom. Soc. Lond.* 344.

1899. *Clypeodytes bufo*: Regimbart, *Ann. Soc. Ent. Fr.* (6) 9: 217.

2012. *Clypeodytes (s. str.) bufo*: Ghosh & Nilsson, *Skorvnopparn supplement* 3: 28.

Material examined: 1ex. (Regd. No. 19905/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Assam, Goa, Jharkhand, Maharashtra, Meghalaya, Odisha, Tamil Nadu and West Bengal. *Elsewhere:* Bangladesh, China, Myanmar, Sri Lanka and Vietnam.

6. *Peschetius toxophorus* Guignot, 1942

1942. *Peschetius toxophorus* Guignot, *Bull. Soc. d'Etude Sci. Nat. Vacluse*, 13(1-2): 20.

Material examined: 1ex. (Regd. No. 19906/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Andhra Pradesh, Bihar, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Rajasthan and Tamil Nadu.

7. *Hyphydrus renardi* Severin, 1890

1890. *Hyphydrus renardi* Severin, *Ann. Soc. Entom. Belg.* 34, CXCI.

Material examined: 5 exs. (Regd. No. 19907-08/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Bihar, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere: Bangladesh, Bhutan, Myanmar, Nepal, Pakistan and Sri Lanka.

8. *Laccophilus inefficiens* (Walker, 1859)

1859. *Hydroporus inefficiens* Walker, *Ann. Mag. Nat. Hist.*, 3: 51.

1882. *Laccophilus inefficiens*: Sharp, *Sci. Trans. R. Dublin Soc.*, 2: 287.

Material examined: 13 exs. (Regd. No. 19909-12/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Bangladesh, Bhutan, Indonesia, Iran, Malaysia, Myanmar, Nepal, Pakistan and Sri Lanka.

9. *Laccophilus sharpi* Regimbart, 1889

1889. *Laccophilus sharpi* Regimbart, *Ann. Soc. Ent. Fr.* (6) 9: 151.

Material examined: 1ex. (Regd. No. 19913/H4A), KBS, Raigad district, 18°89'N, 073°11'E, 15.IX.2012.

Distribution: India: Andaman & Nicobar Islands, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Pondicherry, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Myanmar, Nepal, Pakistan, Sri Lanka, China, Hong Kong, Indonesia, Iran, Iraq, Japan, Philippines, Saudi Arabia, South Korea, Taiwan, Vietnam, African region and Australian region.

SUMMARY

The present study reports identification of 26 examples of Dytiscidae beetles pertaining to 9 species of 6 genera from Karnala Bird Sanctuary of Maharashtra state. One species is reported for the first time from the state and all the species are first record from the sanctuary.

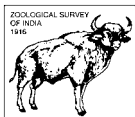
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are also Dr. Kailash Chandra, Scientist- 'F' & Divisional-in-Charge of Ent. Div. (A) for his useful suggestions and valuable guidance.

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**DIVING BEETLES OF GOVIND SAGAR WILDLIFE
SANCTUARY, HIMACHAL PRADESH, INDIA (COLEOPTERA:
ADEPHAGA: DYTISCIDAE)**

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INTRODUCTION

The current knowledge of diving beetles fauna of protected area of Himachal Pradesh state is very limited. Biswas (2000) and Ghosh & Hegde (2013) reported aquatic beetles from Renuka Wildlife Sanctuary of this state. The Govind Sagar Wildlife Sanctuary (GSWS) is located in district Bilaspur and Mandi of Himachal Pradesh and the area of this sanctuary is about 10,000 hectares.

The present study is based on 35 examples of dytiscid beetles, collected from GSWS, Bank of Satlej River near the town Bilaspur. All the collection was made by the author in April 2012 and September 2013. An annotated checklist of the nine species belonging to seven genera of family Dytiscidae occurring in sanctuary is presented. All species are widespread in South-East Asia. This is the first time diving beetles are recorded from this sanctuary. The species *Hydaticus luczonicus* Aube is first report from Himachal Pradesh. For all species the locality data and distribution are also provided.

1. *Sandracottus dejeanii* (Aube, 1838)

1838. *Hydaticus dejeanii* Aube, in *Dejean's Species Coleopteres*, **6**: 165.
1882. *Sandracottus dejeanii*: Sharp, *Sci. Trans. R. Dublin Soc*, **2**: 686.
1980. *Sandracottus dejeanii*: Vavirani, *Bull. zool. Surv. India*, **3**(1 & 2): 30.
2000. *Sandracottus dejeanii*: Biswas, *Wetland Eco, zool. Surv. India*, **2**: 101.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex. (Reg. No. 20257/H4A).

Distribution: India: Andhra Pradesh, Arunachal Pradesh, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal; *Elsewhere*: Pakistan, Iran, Afrotropical region and Australian region.

Remarks: Vavirani (1980) recorded this species from district Bilaspur and Sirmour. In the year 2000, Biswas also reported this species from Sirmour district of Himachal Pradesh.

2. *Cybister sugillatus* Erichson, 1834

1834. *Cybister sugillatus* Erichson, *Beitrage zur Zoologie, Supplement* **28**: 227.
2011. *Cybister (Melanectes) sugillatus*: Ghosh, *Bionotes* Vol. **13**(3): 125.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex. (Reg. No. 20277/H4A).

Distribution: India: Assam, Bihar, Himachal Pradesh, Madhya Pradesh, Maharashtra, Manipur, Odisha, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal; *Elsewhere*: Afghanistan, Bhutan, China, Indonesia, Japan, Myanmar, Nepal, Pakistan, Philippines and Sri Lanka.

Remarks: Ghosh (2011) recorded this species from district Kangra of Himachal Pradesh.

3. *Cybister tripunctatus lateralis*

(Fabricius, 1798)

1798. *Dytiscus lateralis* Fabricius, *Suppl. Entom. Syst.* 64.
 1980. *Cybister tripunctatus* (*Meganectes*) *asiaticus*: Vavirani, *Bull. zool. Surv. India*, 3(1 & 2): 30.
 2001. *Cybister tripunctatus lateralis*: Nilsson, *World cat. Insects*, Apollo Books, 3: 90.
 2011. *Cybister* (*Cybister*) *tripunctatus lateralis*: Ghosh, *Bionotes* Vol. 13(3): p 125.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, 31°20'42"N, 076°45'19"E, 17.IV.2012, 1ex. (Reg. No. 19794/ H4A).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Assam, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal; *Elsewhere:* Afghanistan, Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Cyprus, Iran, Iraq, Japan, Kyrgyzstan, Mongolia, Russia, Syria, Tajikistan, Turkmenistan, Turkey, Uzbekistan and Europe.

Remarks: This species recorded by Vavirani (1980) as *Cybister tripunctatus asiaticus* from Solan district and Ghosh (2011) recorded from Kangra district of Himachal Pradesh.

4. *Eretes griseus* (Fabricius, 1781)

1781. *Dytiscus griseus* Fabricius, *Species Ins*, 1: 293.
 1980. *Eretes sticticus* (Linn.): Vavirani, *Bull. Zool. Surv. Ind.* 3(1 & 2): 30.
 2011. *Eretes griseus*: Nilsson, *Cat. Palearct. Dytiscidae*, p. 21.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'42"N, 076°45'19"E, 17.IV.2012, 5 exs. (Reg. No. 19778-82 / H4A); 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 4 exs. (Reg. No. 20280-83/H4A).

Distribution: India: Himachal Pradesh, Jammu & Kashmir and Uttar Pradesh; *Elsewhere:* Afghanistan, Bhutan, Nepal, Pakistan, China, Iran,

Iraq, Japan, Kuwait, Oman, Russia, Sinai, South Korea, Syria, Turkey, Yemen, Afrotropical region, Australian region, Europe and North Africa.

Remarks: This species reported from Himachal Pradesh by Nilsson (2012) and earlier, Vavirani (1980) recorded as *Eretes sticticus* (Linn.) from Solan district of the state.

5. *Hydaticus luczonicus* Aube, 1838

1838. *Hydaticus luczonicus* Aube, in *Dejean's species Coleopteres*, 6: 179.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex. (Reg. No. 20292/H4A).

Distribution: India: Bihar, Delhi, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal; *Elsewhere:* Indonesia, Philippines, Sri Lanka, Thailand and Vietnam.

Remark: This species is first time recorded from Himachal Pradesh.

6. *Hydroglyphus flammulatus* (Sharp, 1882)

1882. *Bidessus flammulatus* Sharp, *Sci. Trans. R. Dublin Soc*, 2: 359.
 1988. *Hydroglyphus flammulatus*: Bistrom, *Acta Zool. Fenn*, 165: 12.
 2011. *Hydroglyphus flammulatus*: Ghosh, *Bionotes*, Vol. 13(3): 125.

Material examined: District Bilaspur, Govind Sagar WLS, Luhana Ground, Bank of Satlej river, alt. 600 m, 17.IV.2012, 6ex (Reg. No. 19854-55/ H4A); 31°20'59"N, 076°45'19"E, 28.IX.2013, 12 exs. (Reg. No. 20358-63/H4A).

Distribution: India: Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal; *Elsewhere:* China and Pakistan.

Remarks: Ghosh (2011) recorded this species from Kangra district of Himachal Pradesh.

7. *Hyphydrus renardi* Severin, 1890

1890. *Hyphydrus renardi* Severin, *Ann. Soc. Entom. Belg*, CXCI.

1980. *Hyphydrus renardi*: Vazirani, *Bull. zool. Surv. India*, 3(1 & 2): 27.

2011. *Hyphydrus renardi*: Ghosh, *Bionotes*, 13(3): 125.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex (Reg. No. 20340/H4A).

Distribution: India: Bihar, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal; **Elsewhere:** Bangladesh, Bhutan, Myanmar, Nepal, Pakistan and Sri Lanka.

Remarks: Vazirani (1980) and Ghosh (2011) recorded this species from Himachal Pradesh.

8. *Laccophilus flexuosus* Aube, 1838

1838. *Laccophilus flexuosus* Aube, in Dejean's *Species Coleopters*, 6: 430.

1980. *Laccophilus flexuosus*: Vazirani, *Bull. Zool. Surv. India*, 3(1 & 2): 27.

1983. *Laccophilus flexuosus*: Brancucci, *Ent. Arb. Mus. Frey* 31/32: 318.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej river, Luhana Ground, alt. 600 m, 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex (Reg. No. 20411/H4A).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal; **Elsewhere:** Bangladesh, Myanmar, Nepal, Pakistan, Sri Lanka, Cambodia, China, Hong Kong, Indonesia, Iran, Iraq, Japan, Taiwan and Vietnam.

Remarks: This species recorded from Himachal Pradesh by Vazirani (1973, 1980), Brancucci (1983) and Biswas (2000).

9. *Laccophilus inefficiens* (Walker, 1859)

1859. *Hydroporus inefficiens* Walker, *Ann. Mag. Nat. Hist.* 3: 51.

1882. *Laccophilus inefficiens*: Sharp, *Sci. Trans. R. Dublin Soc*, 2: 287.

1980. *Laccophilus inefficiens*: Vazirani, *Bull. zool. Surv. India*, 3(1 & 2): 27.

Material examined: District Bilaspur, Govind Sagar WLS, Bank of Satlej River, Luhana Ground, alt. 600 m, 17.IV.2012, 1ex. (Reg. No. 19937/H4A); 31°20'59"N, 076°45'19"E, 28.IX.2013, ex-ditch, 1ex (Reg. No. 20406/H4A).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal; **Elsewhere:** Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Indonesia, Iran and Malaysia.

Remarks: Vazirani (1980) reported this species from Sirmour district of Himachal Pradesh.

SUMMARY

The present study records 35 examples of Dytiscidae beetles pertaining to 9 species of 7 genera from Govind Sagar Wildlife Sanctuary of Himachal Pradesh. Of these, 1 species is reported for the first time from the state and all the species are first record from the sanctuary.

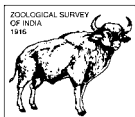
ACKNOWLEDGEMENTS

Author is thankful to the Director, Zoological Survey of India, for providing necessary facilities and encouragement. Thanks are also Dr. Kailash Chandra, Scientist-'F' & Divisional in charge of Ent. Div. (A) for his useful suggestions and valuable guidance. Author is grateful to Dr. V.D. Hegde, Scientist-'D' & Officer-in-charge of Coleoptera Section for his constant support.

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FURTHER CONTRIBUTION ON DIVING BEETLES FROM MAHARASHTRA, INDIA (COLEOPTERA: DYTISCIDAE)

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INTRODUCTION

Two hundred fifty one species belong to diving beetles of India pertaining to 48 from Maharashtra state (Ghosh & Nilsson, 2012). Knowledge on these beetles are quite insufficient. The species described from Maharashtra are *Peschetius quadricostatus* & *Laccophilus parvulus* by Aube (1838). *Microdytes belli* described by J.Balfour-Browne (1946). Vazirani (1968, 1977) described *Clypeodytes hemani*, *Microdytes sabitae* and *Lacconectus lambai*. *Yola indica* described by Bistrom (1983). This century, K.B. Miller & Wewalka (2010) described *Microdytes whitingi*. Further, some species reported from Maharashtra by our experts like Vazirani (1977), Brancucci (1986), Sharma (2002) and Ghosh & Hegde, in press.

The present study is based on a small collection of dytiscid beetles, collected from fresh water bodies of different parts of Maharashtra State by the workers of Zoological Survey of India. Author studied 48 examples of Dytiscidae beetles under 14 species of 12 genera from Maharashtra State. Two species are first time recorded from the state i.e. *Hydaticus ricinus* Wewalka and *Herophydrus musicus* (Klug). Recently, Ghosh & Hegde (in press) recorded *Hydaticus satoi satoi* Wewalka from this state. Altogether, the recorded species from Maharashtra state are 51.

1. *Rhantus taprobanicus* Sharp, 1890

1890. *Rhantus taprobanicus* Sharp, Trans. Entom. Soc. Lond, 1890: 346.

Material examined: Dist. Ahmadnagar, Dongergaon, alt. 2345ft, 19.2433N, 74.7514E, 07.IX.2012, coll. M.E. Hassan & party, 5 exs (Reg. No. 20490-94/H4A); Dist. Satara, Kaas valley, 28.VIII.2013, coll. K. Chandra & B. Mitra, 4ex (Reg. No. 20486-89/H4A).

Distribution: India: Delhi, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Maharashtra, Manipur, Meghalaya, Pondicherry, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Nepal, Pakistan and Sri Lanka.

2. *Lacconectus lambai* Vazirani, 1977

1977. *Lacconectus lambai* Vazirani, Rec. Zool. Surv. India, 73: 127.

1986. *Lacconectus rossi* Brancucci, Entom. Basiliensia 11: 155.

Material Examined: Dist. Satara, Kaas valley, 28.VIII.2013, coll. K. Chandra & B. Mitra, 5ex (Reg. No. 20495-20500 /H4A).

Distribution: India: Maharashtra.

3. *Sandracottus dejeanii* (Aube, 1838)

1838. *Hydaticus dejeanii* Aube, in Dejean's Species Coleopteres, 6: 165.

1882. *Sandracottus dejeanii*: Sharp, Sci. Trans. R. Dublin Soc, 2: 686.

Material examined: Dist. Chandrapur, Samrapet, 07.IX.2013, coll. M.E. Hassan & party, 3ex (Reg. No. 20501-503 /H4A); Dist. Yavatmal, Mohagaon, 20.43379N, 78.39848E, 11.IX.2013, coll. M.E. Hassan & party, 1ex (Reg. No. 20504 /H4A).

Distribution: India: Arunachal Pradesh, Andhra Pradesh, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Pakistan, Iran, Afrotropical region and Australian region.

4. *Cybister tripunctatus lateralis*

(Fabricius, 1798)

1798. *Dytiscus lateralis* Fabricius, *Supp. Entom. Syst.* 64.

1980. *Cybister tripunctatus* (*Meganectes*) *asiaticus*: Vavirani, *Bull. zool. Surv. India*, 3(1 & 2): 30.

2001. *Cybister* (*Cybister*) *tripunctatus lateralis*: *World cat. Insects*, Apollo Books, 3: 90.

Material Examined: Dist. Raigad, Virsali Sea beach, 21.IX.2013, coll. Chotelal Das, 1ex. (Reg. No. 20505/H4A).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Assam, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Afghanistan, Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Cyprus, Iran, Iraq, Japan, Kyrgyzstan, Mongolia, Russia, Syria, Tajikistan, Turkmenistan, Turkey, Uzbekistan and Europe.

5. *Hydaticus luczonicus* Aube, 1838

1838. *Hydaticus luczonicus* Aube, in *Dejean's species Coleopteres*, 6: 179.

Material examined: Dist. Chandrapur, Samrapet, 07.IX.2013, coll. M.E. Hassan & party, 2 exs (Reg. No. 20506-07 /H4A); Dist. Yavatmal, Mohagaon, 20.43379N, 78.39848E, 11.IX.2013, coll. M.E. Hassan & party, 1ex (Reg. No. 20508 /H4A); Dist. Wardha, Sewagram, 20.25805N, 78.09284E, 14.IX.2013, coll. M.E. Hassan & party, 5 exs (Reg. No. 20509-13 /H4A).

Distribution: India: Bihar, Delhi, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Indonesia, Philippines, Sri Lanka, Thailand and Vietnam.

6. *Hydaticus ricinus* Wewalka, 1979

1979. *Hydaticus ricinus* Wewalka, *Koleop. Runds.* 54: 128.

Material examined: Dist. Sangii, Tasgaon, 6.15622N, 73.42564E, 21.VI.2014, coll. M.E. Hassan & party, 1ex (Reg. No. 20514/H4A).

Distribution: India: Assam, Himachal Pradesh (Ghosh & Hegde, 2013), Tamil Nadu. *Elsewhere:* Afghanistan, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, China, Laos, Thailand, Vietnam.

Remarks: This species is first time recorded from Maharashtra.

7. *Hydaticus satoi satoi* Wewalka, 1975

1975. *Hydaticus satoi* Wewalka, *Koleop. Runds.* 52: 91.

2012. *Hydaticus* (*Prodaticus*) *satoi satoi*: Ghosh & Nilsson, *Skorvnoopparn Umel supplement* 3: 27.

Material examined: Dist. Solapur, Hipparange, alt. 1521 ft, 17.42290N, 75.54568E, 17.VI.2014, coll. M.E. Hassan & party, 1ex (Reg. No. 20515 /H4A); Dist. Sangii, Tasgaon, 16.15622N, 73.42564E, 21.VI.2014, coll. M.E. Hassan & party, 1ex (Reg. No. 20516/H4A).

Distribution: India: Kerala, Maharashtra (Ghosh & Hegde, in press), Sikkim, Tamil Nadu and West Bengal. *Elsewhere:* Bhutan, Myanmar, Nepal, Sri Lanka, China, Indonesia, Japan, Philippines, Saudi Arabia, Taiwan and Thailand.

Remarks: This species recorded from Karanala Birds Sanctuary, Maharashtra by Ghosh & Hegde (in press).

8. *Hydroglyphus flammulatus* (Sharp, 1882)

1882. *Bidessus flammulatus* Sharp, *Sci. Trans. R. Dublin Soc.* 2: 359.

1988. *Hydroglyphus flammulatus*: Bistrom, *Acta Zool. Fenn.* 165: 12.

Material examined: Dist. Ahmadnagar, Dongergaon, alt. 2345ft, 19.2433N, 74.7514E, 07.IX.2012, coll. M.E. Hassan & party, 2ex (Reg. No. 20517-18 /H4A).

Distribution: India: Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal. *Elsewhere:* China and Pakistan.

9. *Peschetius toxophorus* Guignot, 1942

1942. *Peschetius toxophorus* Guignot, *Bull. Soc. et. Sci. nat. Vaucluse*, 13(1-2): 20.

Material examined: Dist. Chandrapur, Samrapet, 07.IX.2013, coll. M.E. Hassan & party, 1ex (Reg. No. 20519/H4A); Dist. Sindhudurg, Bijlinagar, 16.15622N, 73.42564E, 28. VI. 2014, coll. M. E. Hassan, 2 exs (Reg. No. 20520-21/H4A).

Distribution: India: Andhra Pradesh, Bihar, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Rajasthan and Tamil Nadu.

10. *Herophydrus musicus* (Klug, 1834)

1834. *Hydroporus musicus* Klug, *Symb. Physicae*, 3: 12.

1895. *Herophydrus musicus*: Regimbart, *Mem. Soc. Entom. Belg.* 4: 43.

Material examined: Dist. Solapur, Hipparange, alt.1521 ft, 17.42290N, 75.54568E, 17.VI.2014, coll. S. K. Chakraborty, 6 exs (Reg. No. 20522-27/H4A).

Distribution: India: Andhra Pradesh, Delhi, Gujarat, Jharkhand, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttar Pradesh. **Elsewhere:** Afghanistan, China, Europe, Iran, Iraq, Israel, Kazakhstan, Myanmar, Nepal, North Africa, Pakistan, Sri Lanka, Syria, Tajikistan, Turkey, Uzbekistan and Yemen.

Remarks: This species is first time recorded from Maharashtra.

11. *Hyphoporus aper* Sharp, 1882

1882. *Hyphoporus aper* Sharp, *Sci. Trans. R. Dublin Soc.* 2: 390.

Material examined: Dist. Wardha, Sewagram, 20.25805N, 78.09284E, 14.IX.2013, coll. M.E. Hassan & party, 1ex (Reg. No. 20528/H4A).

Distribution: India: Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Uttarakhand, Uttar Pradesh and West Bengal. **Elsewhere:** Pakistan and Iran.

12. *Hyphydrus intermixtus* (Walker, 1858)

1858. *Hydroporus intermixtus* Walker, *Ann. Mag. Nat. Hist.* (3)2: 204.

1936. *Hyphydrus intermixtus*: Balfour-Browne, *Entom. Month. Mag.* 72: 129.

Material examined: Dist. Chandrapur, Samrapet, 07.IX.2013, coll. M.E. Hassan & party, 1ex (Reg. No. 20529/H4A); Dist. Wardha, Sewagram, 14.IX.2013, 20.25805N, 78.09284E, coll. M.E. Hassan & party, 1ex (Reg. No. 20530/H4A).

Distribution: India: Gujarat, Kerala, Maharashtra, Rajasthan and Tamil Nadu. **Elsewhere:** Sri Lanka.

13. *Laccophilus inefficiens* (Walker, 1859)

1859. *Hydroporus inefficiens* Walker, *Ann. Mag. Nat. Hist.* 3: 51.

1882. *Laccophilus inefficiens*: Sharp, *Sci. Trans. R. Dublin Soc.* 2: 287.

Material examined: Dist. Ahmadnagar, Dongergaon, alt. 2345ft, 19.2433N, 74.7514E, 07.IX.2012, coll. M.E. Hassan & party, 1ex (Reg. No. 20531/H4A).

Distribution: India: Andaman & Nicobar Islands, Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Rajasthan, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. **Elsewhere:** Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka, Indonesia, Iran and Malaysia.

14. *Laccophilus sharpi* Regimbart, 1889

1889. *Laccophilus sharpi* Regimbart, *Ann. Soc. Entom. Fra.* (6)9: 151.

Material examined: Dist. Ahmadnagar, Dongergaon, alt. 2345ft, 19.2433N, 74.7514E, 07.IX.2012, coll. M.E. Hassan & party, 1ex (Reg. No. 20532/H4A); Dist. Solapur, Hipparange, alt.1521 ft, 17.42290N, 75.54568E, 17. VI. 2014, coll. M.E. Hassan & party, 1ex (Reg. No. 20533/H4A).

Distribution: India: Andaman & Nicobar Islands, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Pondichery, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. **Elsewhere:** Myanmar, Nepal, Pakistan, Sri Lanka, China, Hong Kong, Indonesia, Iran, Iraq, Japan, Philippines, Saudi Arabia, South

Korea, Taiwan, Vietnam, African region, and Australian region.

SUMMARY

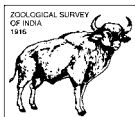
The present study records 48 examples of Dytiscidae beetles under 14 species of 12 genera from Maharashtra State. Two species are first time record from the state i.e. *Hydaticus ricinus* Wewalka and *Herophydrus musicus* (Klug).

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DERMAPTERA FAUNA OF CHHATTISGARH WITH SOME NEW RECORDS

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INTRODUCTION

Chhattisgarh state is located in the central part of India surrounded by 05 states, viz; Jharkhand, Madhya Pradesh, Maharashtra, Odisha and Andhra Pradesh and occupying an area of about 1,35,000 sq. k. m. A perusal of literature reveals that 103 species of different groups of insects are reported from Chhattisgarh (Ramakrishna *et al.*, 2006). Recent reference (Srivastava, 2014) on Dermaptera of Achanakmar Amarkantak Biosphere Reserve of Chhattisgarh state reveals the record of 05 species only. Hence, an attempt has been made to explore the Dermaptera fauna of this state by studying the collections made during the recent surveys conducted by different survey parties of the Zoological Survey of India.

METHODOLOGY

The present paper is based on the field work carried out mainly in 09 districts of Chhattisgarh state viz; Raipur, Dhamtari, Durg, Kabirdham, Sarguja, Koriya, Korba, Raigarh and Jagdalpur. The materials collected are sorted out, set- pinned, identified and classified. The identification is mainly based on the differences in the morphological characters and the structure of the male genitalia. The species records, other than India, are also included in the distribution. All the identified collection is deposited in National Zoological Collection of Zoological Survey of India, Kolkata.

Check List of Dermaptera from Chhattisgarh

*** Species Reported Earlier

** Species Reported First Time from the Area

Superfamily PYGIDICRANOIDEA

Family PYGIDICRANIDAE

Subfamily DIPLATYINAE

Genus *Haplodiplatys* Hincks, 1955

Species: **1. *H. rufescens* (Kirby, 1886)

Superfamily ANISOLABOIDEA

Family ANISOLABIDIDAE

Subfamily ANISOLABIDINAE

Genus *Euborellia* Burr, 1910

Species : **2. *E. annulipes* (Lucas, 1847)

Species ***3. *Euborellia femoralis*
(Dohrn, 1863)

Subfamily NALINAE

Genus *Nala* Zacher, 1910

Species:***4. *N. lividipes* (Dufour, 1820)

Family LABIDURIDAE

Subfamily LABIDURINAE

Genus *Labidura* Leach, 1815

Species:*** 5. *L. riparia* (Pallas, 1773)

Genus *Forcipula* Bolivar, 1897

Species***6. *F. quadrispinosa* (Dohrn, 1863)

Superfamily FORFICULOIDEA

Family CHELISOCHIDAE

Subfamily CHELISOCHINAE

Genus *Proreus* Burr, 1907

Species: **7. *P. decipiens* (Kirby, 1891)

Family FORFICULIDAE

Subfamily OPISTHOCOSMIINAE

Genus *Hypergus* Burr, 1907

Species ***8. *H. humeralis* (Kirby, 1891)

Subfamily FORFICULINAE

Genus *Elaunon* Burr, 1907

Species **9. *E. bipartitus* (Kirby, 1891)

1. *Haplodiplatys rufescens* (Kirby, 1886)

1886. *Cylindrogaster rufescens* Kirby, *J. Linn. Soc. (Zool.)*, **25**: 524, pl. 20, fig. 2 (♂ not ♀; North India).

1904. *Diplatys rufescens*; Kirby, *Syn. Cat. Orth.*, **1**: 2.

1910. *Diplatys falcatus* Burr, *Fauna Brit. India Dermaptera*: 40, 42 (partim), fig. 3A, pl. 1, fig. 4.

1974. *Haplodiplatys rufescens*; Steinmann, *Acta. zool. Acad. Sci. Hung.*, **20**(1-2): 203, fig. 84.

Material examined: 1♂, Chhattigarh, Raipur, Barnawapara WLS, Dulli Bahal forest, 06.viii.2012, S. Gupta and party.

Distribution: INDIA: All along the Himalayas, West Bengal and Chhattisgarh (Raipur). **Elsewhere:** Nepal and Bhutan.

2. *Euborellia annulipes* (Lucas, 1847)

1847. *Forficesila annulipes* Lucas, *Annals. Soc. Ent. Fr.*, (2) **5**: 84 (Type ♀; France).

1853. *Forficula (Labidura) annulipes*; Fischer, *Orthoptera Europa*, Leipzig, **69**, pl. 6, figs. 6a-c.

1863. *Anisolabis annulipes*; Fuentes, *Boln. Mus. nac. Chile*, **7**: 313.

1915. *Euborellia annulipes*; Burr, *J. R. micr. Soc.*, **1915**: 527, 528 and 545.

1936. *Anisolabis (Euborellia) annulipes*; Bey-Bienko, *Fauna de L'URSS, Dermaptera*: 218.

Material examined: 1♂, Chhattigarh, Surguja, Tamorpingla WLS, Tara rest house, 19.xi.2011, A. Raha and party.

Distribution: INDIA: Uttarakhand, West Bengal, Himachal Pradesh, Bihar, Manipur, Tripura, Mizoram, Gujarat, Arunachal Pradesh, Punjab, Rajasthan, Andaman Islands, Assam, Madhya Pradesh, Maharashtra, Odisha, Meghalaya, Tamil Nadu, Chhattisgarh (Surguja) and Uttar Pradesh. **Elsewhere:** Nepal, Bhutan, Bangladesh, Myanmar, Pakistan, Sri Lanka and China.

3. *Euborellia femoralis* (Dohrn, 1863)

1863. *Labidura femoralis* Dohrn, *Stettin. Ent. Ztg.*, **24**: 321 (♀; Ceylon); Scudder, 1876, *Proc. Boston Soc. Nat. Hist.*, **18**: 552 (nec Dubrony).

1915. *Landex femoralis*: Burr, *J. R. micr. Soc.*, **1915**: 446 (partim).

1954. *Euborellia femoralis*: Hincks, *Verh. Naturf. Ges. Basel*, **65**(1): 11, fig. 2 (♂ genitalia).

Material examined: 1♂, Chhattigarh, Raipur, Barnawapara WLS, Barnawapara camp, 4.iv.2012, 1 female, 14.vi.2012, 1♂, Marer forest, 27.vii.2012, 1♀, Dullibahal forest, 6.viii.2012, 1♂, Dhamtari, Sitanadi WLS, Bhiragaon, 18.x.2012, S. Gupta & party; 1♂ Raipur, Barnawapara WLS, 26.ix.2011, Sunil & party.

Distribution: INDIA: Arunachal Pradesh, Odisha, Madhya Pradesh, Uttar Pradesh, Tamil Nadu and Chhattisgarh (Raipur, Dhamtari). **Elsewhere:** Sri Lanka, Myanmar, Malaya, Sumatra, Sumba, China and Java.

4. *Nala lividipes* (Dufour, 1829)

1820. *Forficula pallipes* Dufour, *Ann. Gener. des. Phys. de Bruxelles*, **4**: 316, pl. 116, figs. 7, 7a & 7b (♂, ♀; Lower Catalonia, Spain-Location of Type unknown).

1900. *Labidura lividipes*: Bormans and Krauss, *Das Tierreich*, **11**: 36.

1911. *Nala lividipes*: Burr, *Genera Insect.*, **122**: 36.

1829. *Forficula lividipes*, Dufour, *Annls Sci. Nat.*, **340** (new name proposed).

Material examined: 1♂ Koriya, GGNP. Kotadol forest, 12.v.2013, 2♂♂ Kotadol rest house, 10.v.2013, 1♂ Kamarjee, Bagridarur 22.ix.2013, A. Raha and party. 2♂♂ Durg, Gudardehi, 3.i.2013, 1♂ Tallpuri, Bhilai, 1.x.2012, 1♂ Madiapar, 31.xii.2012, 1♂ Balod, 27.xii.2012, 1♂ Khuteri, 30.xii.2012, Baratiya Nala, 12.ii.2012, S. Gupta & party. 3♂♂, Raipur, Barnawapara WLS, Barnawapara camp, 21.v.2013; 1♂ Thad ghat 12.ii.2012, 2♂♂ Domarpani 8.ii.2012, 1♂ Aamagaon 25.v.2013, 1♂, Dheba, 19.viii.2012, 2♂♂, Balamdehi river, 20.v.2013, 1♂, Mahada, 14.vi.2012, 2♂♂, Hardipathar, 23.v.2013, 1♂, Bar village, 28.v.2013, coll. S. Gupta and party. 1♂, 1♀, Bar village, 14.vii.2011, 3♂♂, 2♀♀, Bar village, 5.vii.2011, 1♂, Barnawapara, 10.ix.2011, 1♂, 1♀, 18.vii.2011, 1♂, 24.vii.2011, 4♂♂, 2♀♀, 20.vii.2011, 1♂, 1♀, Lalband nala, 15.vii.2011,

1 ♀, Barnawapara camp, 4.viii.2011, 2 ♂♂, 2 ♀♀, Charida village, 19.viii.2011, 4 ♂♂, 4 ♀♀, Barnawapara camp, 8.viii.2011, 1 ♂, Tartura forest, 24.vii.2011, 2 ♂♂, 1 ♀, Navapara village, 28.vii.2011, 2 ♂♂, 1 ♀, Barnawapara camp, 14.viii.2011, 2 ♀♀, 6.vii.2011, 2 ♀♀, 15.viii.2011, 1 ♂, 3 ♀♀, 10.viii.2011, 1 ♂, 2 ♀♀, 17.vii.2011, 6 ♂♂, 2 ♀♀, 23.vii.2011, 3 ♀♀, 15.vii.2011, 3 ♂♂, 2 ♀♀, 19.vii.2011, 1 ♂, 2 ♀♀, 9.viii.2011, Sunil Kumar and party. 1 ♂, 7 ♀♀, Raipur rest house, 3.vii.2011, K. Chandra and party. 1 ♂, Dhamtari, Sitanadi WLS, Panchpedi nahar, 20.x.2012, 1 ♂ Sankra rest house, 14.x.2011, 2 ♂♂, 22.x.2011, 1 ♂, 12.x.2011, 1 ♂, Barailli, 25.x. 2012, 2 ♂♂, Mechoka, 22.x.2012, 1 ♂, Sheleybhat village, 21.x.2011, 1 ♂, Nawapara, 30.v.2013, S. Gupta and party. 4 ♂♂, Korba, Lemru water fall, 26.ix.2013, 2 ♂♂, Lalpur, Saroda dam, 22.ix.2012, 3 ♀♀, Bhoramdeo WLS, Ragraghat watch tower, 29.ix.2013, 1 ♂, Sakari river, 30.ix.2013, A. Raha and party. 1 ♂, Kabirdham, Chilpi R.H., 28.viii.2011, Sunil and party.

Distribution: INDIA: Throughout the country including Chhattisgarh. *Elsewhere:* Worldwide.

5. *Labidura riparia* (Pallas, 1773)

1773. *Forficula riparia* Pallas, *Reise Russ, Reichs*, 2: 727 (Sex ?; Shores of Irtysh River, Western Siberia Location of type unknown).

1863. *Labidura riparia*; Dohrn, *Stettin. Ent. Ztg.*, **24**: 313

Material examined: 1 ♂, Raipur, Barnawapara WLS, Barnawapara camp. 15.vi.2012; 3 ♀♀, 19.vi.2013; 3 ♂♂, 2 ♀♀, 15.vi.2013; 1 ♂, 17.v.2013; 1 ♂, 06.x.2011; 1 ♀, 13.vi.2012; 1 ♂, 26.iii.2012; 1 ♂, 15.vi.2012 and 1 ♂, 3 ♀♀, Balamdehi river, 15.vi.2013; 1 ♀, Baratiya nala, 15.vi.2013; 1 ♂, Valmiki ashram, 01.vi.2013; 1 ♀, Bar village, 21.i.2013; 2 ♂♂, Parasapani, 16.v.2013; 1 ♀, Dhamtari, Sitanadi WLS, Baraini dam, 23.x.2012; 1 ♂, Bhaissa Sankra, 06.x.2012; 1 ♂, Sankra rest house. 12.x.2011; 1 ♂, Aamagaon, 25.v.2013; 1 ♀, Bar forest, 14.v.2013 all coll. S. Gupta and party. 1 ♂, 1 ♀, Koriya, GGNP, Kotadol R.H. 10.v.2013; 1 ♂, 1 ♀, Beliya forest, 17.v.2013; 3 ♂♂, 1 ♀, Jelhapani forest, 18.v.2012; 1 ♂, 3 ♀♀, Subudu nala, 12.v.2012 all coll. S.Gupta and party. 5 ♂♂, 4 ♀♀, Kabirdham, Bhoramdeo WLS, Lalpur, Saroda dam, 22.ix.2012; 1 ♀,

Sakari river, 30.ix.2013; 1 ♂, Ragra ghat watch tower, 29.ix.2013 all coll. A. Raha and party. 1 ♀, Jagadalpur Bastar, Karpaband vill., 02.viii.2012 A. Raha and party. 1 ♂, Durg, Balod, 27.xii.2012; 2 ♂♂, 24.vi.2012; S. Gupta and party.

Distribution: INDIA: Throughout the country including Chhattisgarh (Raipur, Dhamtari, Koriya, Kabirdham, Durg, Jagadalpur). *Elsewhere:* Worldwide.

6. *Forcipula quadrispinosa* (Dohrn, 1863)

1863. *Labidura quadrispinosa* Dohrn, *Stettin. Ent. Ztg.*, **24**: 311 (♂; Tranquabar, India and Ceylon).

1897. *Forcipula quadrispinosa*: Bolivar, *Annals. Soc. Ent. Fr.*, **66**: 283.

Material examined: 2 ♂♂, 1 ♀, Surguja, Mainpat Sankarghat, 12.ix.2012; 3 ♂♂, 1 ♀, Korba, Lemru water fall, 26.ix.2013; 1 ♂, 22.ix.2013; 1 ♀, Surguja, Tamarpingla WLS, Jajawal camp, 17.v.2013; 2 ♂♂, Durg, Balod, 01.ix.2013, all coll. A. Raha and party. 1 ♂, Jagadalpur, Bastar, Karpaband vill. 03.viii.2012, R.P. Gupta and party. 1 ♂, Kabirdham, Grivmar Nala, 29.viii.2011, Sunil and party.

Distribution: All over India below 3000 ft. in Himalayas and Chhattisgarh (Surguja, Durg, Korba, Kabirdham). *Elsewhere:* Java, Philippines Island, Nepal, Bhutan, Myanmar, Sri Lanka, South China, Thailand, Indo-China and Mauritius.

7. *Proreus decipiens* (Kirby, 1891)

1910. *Forficula simulans* (nèc Stål, 1860); Burr, *Fauna British India, Dermaptera*: 137 (India: Pusa, Calcutta; excluding Burma fig. 85).

1891. *Labidura decipiens* Kirby, *J. Linn. Soc. (Zool.)*, **23**: 511 (♂: Assam)

1987. *Proreus decipiens*; Brindle, *Courier Forsch.-Inst. Senckenberg*, **93**: 344, 346 (notes on the Type ♂ of the species).

Material examined: 1 ♂, Raipur, Barnawapara WLS, Barnawapara camp, 14.vi.2013, S. Gupta and party.

Distribution: INDIA: Himachal Pradesh, Maharashtra, Assam, Tripura, Odisha, Uttar Pradesh, West Bengal, Karnataka, Chhattisgarh (Raipur) and Tamil Nadu. *Elsewhere:* Oriental Region.

8. *Hypergus humeralis* (Kirby, 1891)

1891. *Opithocosmia humeralis* Kirby, *J. Linn. Soc. Zool.*, **23**: 523 (♀; Ceylon); Kirby, 1904, *Syn. Cat. Orthoptera*, **1**: 38, pl. B, fig. 9.
1907. *Hypergus humeralis*; Burr, *Trans. ent. Soc. Lond.*, **1907**: 101.

Material examined: 2♂♂, 2♀♀, Durg, Umerdah, 20.xii.2012, S. Gupta and party; 3♂♂, Jagdalpur, Bastar, Karpavand vill. 03.viii.2012, R.P. Gupta and party; 1♂, Dhamtari, Sitanadi WLS, Pachpedi Nahar, 20.x.2012, S. Gupta and party; 1♂, Kabirdham, Grivmar Nala, 29.viii.2011, Sunil and party; 1♀, Raigarh, Gomarda WLS, Kotal dam, 17.ii.2012, S. Gupta and party.

Distribution: INDIA: Karnataka, Assam, Manipur, Meghalaya, West Bengal, Uttarakhand, Madhya Pradesh, Odisha, Kerala, Chhattisgarh (Durg, Jagdalpur, Kabirdham, Raigarh) and Andaman and Nicobar Islands. *Elsewhere:* Nepal, Sri Lanka, Myanmar, China (Yunnan), Thailand, Borneo and Vietnam.

9. *Elaunon bipartitus* (Kirby, 1891)

1891. *Sphingolabis bipartita* Kirby, *J. Linn. Soc. Zool.*, **23**: 526 (♂, ♀; India)
1907. *Apterygida bipartita* var. *macrolabia*; Burr, *Rec. Indian Mus.*, **1**: 209 (India: Uttarakhand, Mussoorie).

1910. *Elaunon bipartitus*; Burr, *Fauna British India, Dermaptera*: 163, pl. 6, fig. 53, 53a, pl. 10, fig. 102.

Material examined: 1♂, Chhattisgarh, Durg, Dhamdha, 20.viii.2011, Sunil and party.

Distribution: INDIA: Almost throughout the country including Chhattisgarh (Durg) and in plains and hills. *Elsewhere:* Nepal, Myanmar, China (Yunnan), Sri Lanka, Vietnam, Laos, Philippine Isls, Indonesia (Flores Isl.), New Guinea, Australia and Samoa.

SUMMARY

This paper deals with nine species of Dermaptera under eight genera pertaining to 05 subfamilies collected from nine districts of Chhattisgarh state. Four species are reported for the first time from this state. During the course of present study, it has been observed that maximum number of species are reported from Raipur district.

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Short Communication

NEW RECORD OF *BOTHYNOGRIA RUFICOLLIS* (COLEOPTERA: TENEBRIONIDAE) FROM INDIA

INTRODUCTION

The Lagriine genus *Bothynogria* was named by Borchmann (1915) and 06 species has been described till date. A perusal of literature reveals that three species of *Bothynogria* namely *himalayana* Borchmann, 1936, *bicolor* (Kollar and Redtenbacher, 1848) and *meghalayana* (Merkel, 1990) were reported from Nilgiri Hills, Tamil Nadu; Sikkim and West Bengal (Darjeeling-Lebong and Lopchu) and Meghalaya respectively. The occurrence of the 4th species *Bothynogria ruficollis* from Uttarakhand state increases the number of Lagriine species in India and extends its distribution from eastwards and southwards to western Himalayan ecosystem.

SYSTEMATIC POSITION

Order COLEOPTERA

Family TENEBRIONIDAE

Subfamily LAGRIINAE Latreille, 1825 (1820)

Tribe LAGRIINI Latreille, 1825 (1820)

Genus *Bothynogria* Borchmann, 1915.

Species *ruficollis* (Hope, 1831)

Lagria ruficollis Hope, 1831: 32; Borchmann, 1910: 13; 1915: 86, 87; Chujo, 1966: 549.

Cerogria ruficollis: Borchmann, 1936: 137.

Diagnostic characters: Body elongate, brownish red, elytra with sutural border sometimes

infusate. Antennae relatively long, 8th and 9th segments distinctly elongate, and last segment longest. Pronotum slightly wider than long, impression shallow, punctures large. Elytra distinctly flattened, hardly widening posteriorly, punctures deeply impressed, elytral pubescence sparse, short reclinate. Legs strong, middle and hind legs with tooth like structure in *B. ruficollis*. The inner edge of the middle leg with denticles, prominent tooth last in the series.



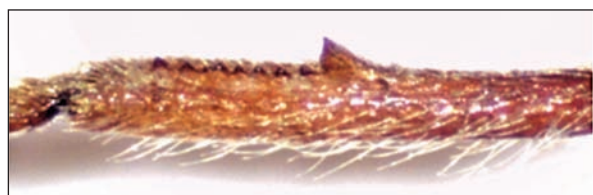
Bothynogria ruficollis (Hope, 1831)



Elytra showing punctation and Pubescence



Last antennal segment



Right hindleg showing the presence of tooth



Right middle leg showing the presence of tooth

Material examined: Uttarakhand, Trijugi Narayan, Rudra Prayag, 1.vii.2004, (1ex.) coll.: S.K. Chakraborty and party; deposited in NZC, Zoological Survey of India, Kolkata. Reg. No. 19967/ H4A.

Distribution: INDIA; (Uttarakhand-Rudra Prayag), Nepal (Merkl, 1990).

Remarks: In case of *B. himalayana*, elytral pubescence relatively long and semierect. In *B. bicolor*, the inner edge of the middle leg with few denticles having prominent tooth first in the series. These characters differentiate the *B. ruficollis* from these two related species. The report of *Bothynogria ruficollis* (Hope, 1831) constitutes the first record from India.

ACKNOWLEDGEMENT

I am thankful to the Director, Zoological Survey of India, Kolkata for the facilities. I am indebted to Dr. Kailash Chandra, Addl. Director for his valuable suggestions in preparing the manuscript.

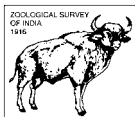
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Short Communication

NEW RECORDS OF THREE MINUTE GASTROPODS FROM WEST COAST OF INDIA

INTRODUCTION

In this article most of the species are very minute, tiny and difficult to identify but bold with minute sculptures which are collected and dredged from the deep sea shell sand along the coast of Karnataka mainly from West Coast of India.

Attempts have been made here to elucidate some large complicated family of algal feeder or parasitic gastropods bearing elongate and tapering, often minute and usually glossy shells. Some animals, which lack a radula, feed by sucking blood and fluids from the bodies of its invertebrate host with which it is always closely associated when alive. Most of the species are recorded from the west coast of India are known from empty shell, their hosts being unknown, the differences between species are often slight, so their identification is often a matter for the specialists. Morphological characters are here reckoned for confirmation up to species level.

The species which are documented here are all new records from India.

During the identification of unnamed collections of the National Zoological Collections, the authors encountered with these minute shells which are dredged and collected from the coast of Karnataka near Gongoli estuary about 20 km within the sea.

MATERIALS AND METHODS

All the samples were collected by bottom trawlers at an average depth of 100m off the Karnataka coast ($13^{\circ} 37' N$ and $74^{\circ} 28' E$ to $13^{\circ} 39' N$ and $74^{\circ} 28' E$), India. Morphometric measurements were recorded to the nearest millimetre using a digital Vernier calliper. All the specimens are deposited in Zoological Survey of India as National Zoological Collection specimens. The materials were identified following the criteria of Bosch (1995).

STUDY AREA:



Family CHILODONTIDAE

Extensive, worldwide family of small deep water species with conical or globose shells having a flat or convex base and an oval aperture. Often brightly coloured and boldly patterned. These shells are predominantly sand dwellers browsing algae. This family previously in the superfamily Neritoidea in the order Neritopsina and the superorder Neritaemorphi. This species also previously under the family-Trochidae (Bosch,1995) but later on it was placed on the above mentioned family by (Bouchet & Rocroi, 2005). This family represented by 18 genera and 21 species worldwide of which *Vaceuchelus angulatus* (Pease) is the new record from Indian waters.

Class GASTROPODA

Subclass VETIGASTROPODA

Superfamily SEQUENZIOIDEA

Family CHILODONTIDAE

Genus *Vaceuchelus* Iredale1. *Vaceuchelus angulatus* (Pease)

1868. *Euchelus angulatus* Pease, *Am. J. Conch.* 3(4): pl. 23.

2006. *Vaceuchelus angulatus*: Poppe, Tagaro and Dekker. *Visaya Supplement*, 2: 47.

2012. *Vaceuchelus angulatus*: Herbert. *African Invertebrates*, 53(2): 381–502.



Fig. 1. & Fig. 2. *Vaceuchelus angulatus* (Pease)

Material Examined: 3 examples; Karnataka: Gangoli Estuary, Station S1: 13° 37' 31.26" N and 74° 28' 58.83" and Station S2: 13° 36' 3.24" N and 74° 29' 1.94" E about 20 km inside the sea; Date Of collection: 25.02.2007; Name of Collector: A.K. Mukhopadhyay and party.

Measurements (in mm):

Length	Width
10.10	4.30
8.55	4.00
8.00	3.85

Distribution: India: Karnataka. *Elsewhere:* North West Gulf, South West Gulf, Gulf of Oman, Mascot, Central and east Indian Ocean, French Polynesia (Tauamotu Archipelago), Philippines, Fiji, New Zealand : Kesmerder Island.

Remarks: 10-8 mm thick, ovate-conical, about 5 whorls, almost circular aperture and no umbilicus. Keeled spiral cords crossed by strong axial ribs produce series of deep, elongate pits; columella smooth. White; aperture white. Habitat: under rocks.

Subclass CAENOGASTROPODA

Order LITTORINIMORPHA

Superfamily RISSOIDEA

Family RISSOINIDAE

Genus *Stosicia* Brusina

Family RISSOINIDAE

Rissoinidae is a large family. Small or tiny gastropods with conical shells, smooth or variously sculptured, having an aperture usually shorter than the spire. The operculum is usually oval, may be thin or thick and may bear a peg on its inner surface. This marine gastropods are very minute sea snails in the clade Littorinimorpha. 20 species has been recorded from the world of which 4 are fossil. The animals feed on algae and diatoms and are common intertidal land beached. Indian members of this family have been little studied and identification of this family is very difficult.

2. *Stosicia annulata* (Dunker)

1860. *Rissoina annulata* Dunker, *Neuejapanische Mollusken. Malakozoologische Blätter*, 6: 235.

1995. *Stosicia annulata*: Donald Bosch, Peter Dance, Robert Moolenbeek and Oliver, *Sea shell of Eastern Arabia*: 48, pl. 136.



Fig. 3 & 4. *Stosicia annulata* (Dunker)

Material Examined: 4 examples; Karnataka; Gangoli Estuary, Station S3: 13° 34' 12.90" N and 74° 28' 57.36 E and S4: 13° 39' 41.17 N and 74° 24' 51.22 E about 20km inside the sea, Date Of collection: 25.02.1007; Name of Collector: A.K. Mukhopadhyay and party.

Measurements (in mm):

Length	Width
4.40	1.50
3.85	1.00
2.00	0.50

Distribution: India: Karnataka. *Elsewhere:* Eastern Arabia, North West Gulf, South East Gulf, Gulf of Oman, Mascot, Indo-China, Central and East Indian Ocean, East Africa.

Remarks: 4 to 2 mm thick, semi translucent, elongate-ovate, outer lip thickened behind, flat topped protoconch of about 3 smooth whorls. Bold, sharp spiral keels (6 on the last whorl), white. Habitat: intertidal pools and in shell sand. (Bosch, 1995)

Superfamily EPITONIOIDA

Family EPITONIDAE

Genus *Epitonium* Roeding

Members of this large family of warm water, parasitic species, popularly known as wentle traps, occur on or under sea-anemones and other coelenterates and within the sponges. Males when young but becoming female ultimately, they lay strings of eggs. Some are known to emit a purple dye for defensive purposes. Most of them colourless, translucent shells with round aperture

and high spire, the whorls often buttressed by thin or thick.

3. *Epitonium lyra* (Sowerby, 1844)

1844. *Scalaria lyra* Sowerby, *Thes. Conch.* 4: pl. 33. figs. 38, 39.

1995. *Epitonium lyra*: Donald Bosch, Peter Dance, Robert Moolenbeek and Oliver, *Sea shell of Eastern Arabia*: 48, pl. 136.



Fig. 5 & 6. *Epitonium lyra* (Sowerby)

Material Examined: 3 examples; India: Karnataka: Gangoli Estuary station S3: 13° 34' 12.90" N and 74° 28' 57.36" E about 20km inside the sea. Date Of collection: 25.02.2007; Name of Collector: A.K. Mukhopadhyay and party.

Measurements (in mm):

Length	Width
7.80	3.00
7.00	2.90
6.80	2.50

Distribution: India: Karnataka. *Elsewhere:* Gulf of Oman.

Remarks: 8 to 7mm, high spire, broad based; with deep sutures; Spire whorls bear fragile, often worn Oblique ribs from 25 and above on last whorls, strongly reflected at sutures where they interleave; fine irregular spiral threads between ribs. Reflected inner lip partly obscures deep umbilicus. White with two strong spiral, pale brown bands; ribs and base white. Habitat: offshore within sponges.

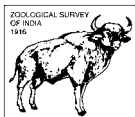
ACKNOWLEDGEMENT

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Short Communication

NEW RECORDS OF ACRIDOIDEA (INSECTA : ORTHOPTERA) FROM HARYANA, INDIA

The Superfamily Acridoidea includes short-horned grasshoppers and is one of the most sought after superfamilies of the order Orthoptera. They constitute an interesting and agriculturally important group of insects. They are moderate in size, but range from less than 10 mm to 65 mm. The form of body shape, head and thorax are diverse; antennae are filiform but sometimes ensiform; tarsi three segmented; hind femora long, slender and thick towards base and adapted for leaping; wings are either fully developed or reduced or absent; forewings in the form of leathery tegmina; hind wings fan like; male external genitalia complex, symmetrical and concealed, when not in use, by the enlarged ninth abdominal sternum (Subgenital plate). Male of most of these insects produce sound by different methods; female, generally, do not produce sound. They are also well adapted for flight since both direct and indirect muscles work together during flight movements thus explaining the reason that these insect can cover long distances during swarming conditions that mainly result from overcrowding and scarcity of food.

The most notable work on Indian grasshoppers was made by Kirby (1914) in "Fauna of British India, including Ceylon and Burma" wherein 329 species belonging to 124 genera under 8 subfamilies were dealt with.

The Acridoidea fauna of Haryana has not been studied yet except Sharma (2013). The latter author gave an account of 27 species belonging to 2 families and 23 genera from Kalesar National Park & Wildlife Sanctuary.

The present paper deals with 2 new records

of Acridoidea under 2 genera and 1 family from the state, Haryana. Classification followed here is according to Uvarov (1966) and Shishodia *et al.* (2010).

ABBREVIATIONS USED

Coll.— Name of the Collector.

SYSTEMATIC ACCOUNT

Order ORTHOPTERA

Superfamily ACRIDOIDEA

Family ACRIDIDAE

Key to Subfamilies

1. Prosternal process usually absent; if present, then antenna ensiform and body strongly elongate.....**Acridinae**
- Prosternal process always present; antenna and body variable.....**Eyprepocnemidinae**

Subfamily ACRIDINAE

1. *Ceracris fasciata* (Brunner)

1893. *Parapleurus fasciatus* Brunner von Wattenwyl, *Ann. Mus. Civ. Stor. Nat. Giacomo Doria Genova, Ser 2*, **13**(33): 127.

1951. *Ceracris fasciata*, Willems, *Publities naturrh. Genoot Limburg*, **4**: 66.

1990. *Ceracris fasciata*, Ingrisch, *Spixiana*, **13**: 178.

Material examined: Gurgaon, Sultanpur NP: 2 males, 24-26.ix.2013 (Coll. N. Sharma & party).

Diagnosis: Medium-sized insects; general colour of the body dark brown, lateral carinae of pronotum broken, a little divergent anteriorly

in prozona and strongly divergent in metazona; antennae with white tips; tegmina dark-brown or blackish, except radial and anal areas; hind femora dark brown with black knee and a pale pre apical ring; hind tibiae black at base, followed by a white ring, rest blackish blue to dark brown.

Distribution: India: Assam, Haryana, Manipur, Meghalaya, Tripura, Uttar Pradesh and Uttarakhand. *Elsewhere:* Myanmar, S. China, and Thailand.

Subfamily EYPREPOCNEMIDINAE

2. *Cataloipus himalayensis* Singh & Tandon

1978. *Cataloipus himalayensis* Singh & Tandon, *Bull. Zoo. Surv. India*, **1**(1): 61.

Material examined: Gurgaon, Sultanpur NP: 3 male, 3 female, 24-26.ix.2013 (Coll. N. Sharma & party).

Diagnosis: Size medium to large; head smooth, vertex horizontal passing smoothly into the frontal

costa; pronotum with a well median carina, cut by three transverse sulci, principal sulcus placed well behind the middle; prosternal process spatulate, with broadly rounded apex, inclined backwards; tegmina slightly shorter than abdomen; in female subgenital plate almost truncated behind.

Distribution: India: Haryana, Himachal Pradesh, Panjab, Uttarakhand, Uttar Pradesh.

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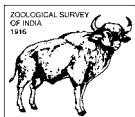
Author is thankful to the Director, Zoological survey of India, Kolkata for encouragement throughout. My sincere thanks are also due to Dr. P.C. Tak, Officer In-charge, Northern Regional Centre, Zoological Survey of India, Dehradun for facilities. Thanks are also due the Chief Wildlife Warden, Haryana for necessary permission to undertake the General Faunistic Survey work and DFO, Gurgaon for various courtesies.

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Short Communication

NEW RECORD OF *MOUNDINOTHRIPS ROBUSTUS* BHATTI (THYSANOPTERA: THRIPIDAE) FROM HIMACHAL PRADESH STATE OF INDIA

INTRODUCTION

Moundinothrips robustus is a rare species and was described based on one female specimen collected from dead twigs at Java, Indonesia (Bhatti 1995). Subsequently this species was reported from Punjab state of India based on single female collected on fern (Bhatti *et al.*, 2006). A female specimen was collected on fern from Himachal Pradesh state of India in our recent survey (2014-2015). The objective of this paper to report this species first time from Himachal Pradesh of India with DNA barcode data. The female are compared with the original description provided by Bhatti 1995.

Moundinothrips resembles *Taeniothrips* but can be separated by presence of dorsal apical setae on antennal segment I, elongate head with constriction behind eyes, heavily setose legs, strongly developed postocular III, number of setae on cheeks, pronotum with one pair of median setae at posterior margin between two pairs of major angulars, mesothoracic sternopleural sutures absent, spinula present on both pterygosterna, abdominal sternite VII with 2 pairs of posteromarginal setae and abdominal tergite IX with 2 pairs of well-developed setae across middle.

The photographs were taken through a Leica Trinocular Microscope (Leica DM-1000) and using Leica software application suite (LAS EZ 2.1.0).

MOLECULAR DATA

Specimen collection, DNA isolation and amplification of partial fragment of mtCOI gene

were performed as earlier protocol (Buckman *et al.*, 2013). Voucher specimen was retrieved and slide mounted in Canada balsam for morphological examination. PCR product was purified from the Agarose gel using Macherey Nagel Gel Purification Kit as per manufacturer's instructions. Sequencing of purified PCR product was carried out in both directions using 48-capillary Genetic Analyzer (Applied Bio Systems ABI 3730) using BigDye® Terminator Cycle Sequencing Kit (v3.1) at sequencing facility of Zoological Survey of India, Kolkata. The generated forward and reverse COI fragments of *Moundinothrips robustus* were analysed with SeqScape software version 2.7 (Applied Biosystems) and consensus sequences were obtained after checking deletion, insertion and stop codons. The generated sequence was submitted to NCBI Genbank to get accession numbers (KP120982) and BOLD (Barcode of Life Database) under the project titled "DNA Barcoding Thrips of India".

Moundinothrips robustus Bhatti

1995. *Moundothrips robustus* Bhatti: 65–72.

Female macroptera. Body dark brown including legs except yellow tarsi. Antennal segments I–II and proximal ½ of VI brown, remaining segments pale. Fore wing brown with subbasal and apical area unshaded; ½ part of clavus brown proximally. Head longer than broad, constricted behind eyes; ocellar setae III longer than postocular III. Antennal segments III and IV each with forked sense cone. Pronotum with dark and thick transverse lines at posterior half, one

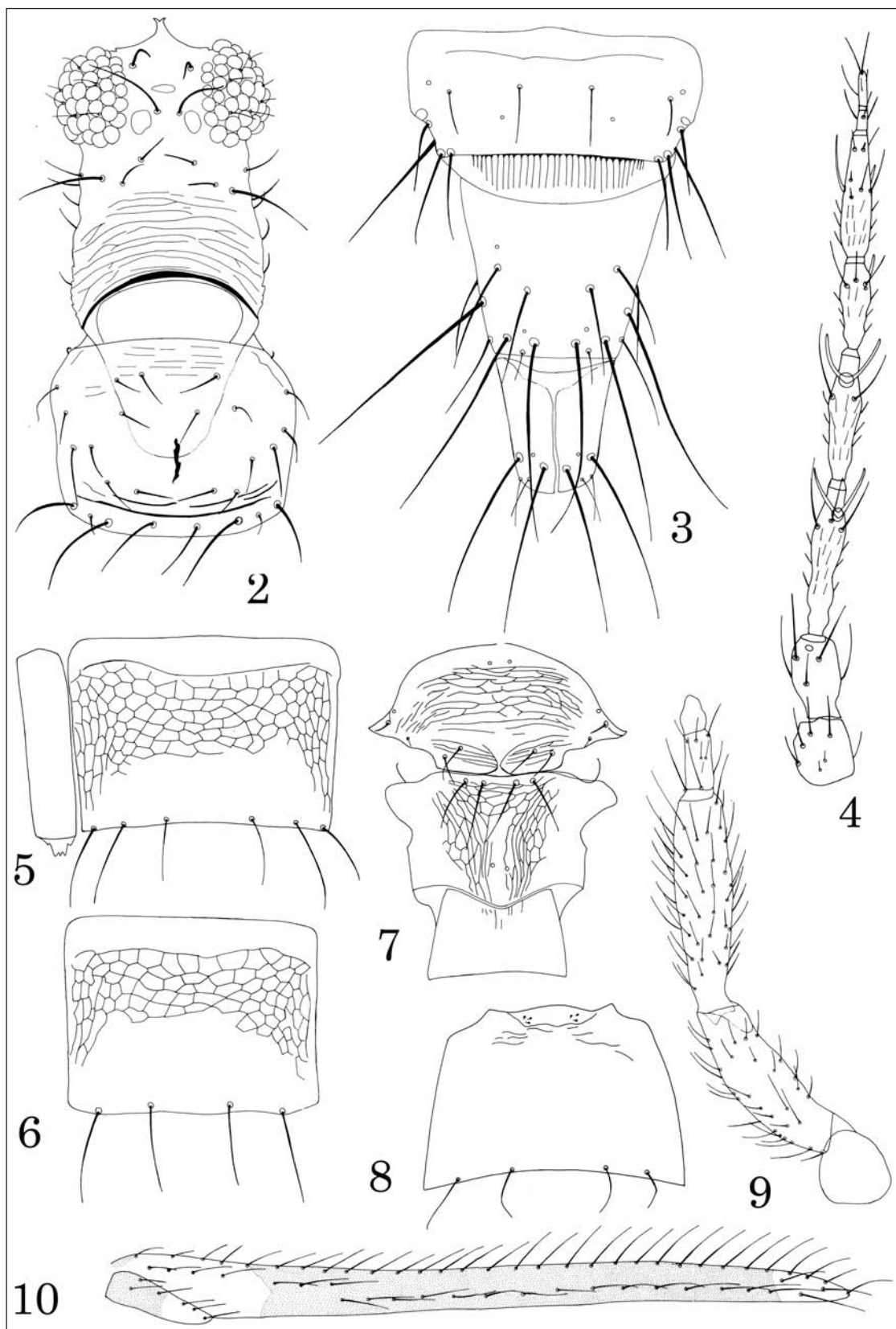


Fig. 2-10. *Moundinothrips robustus*, Female. (2) Head & pronotum; (3) Tergites VIII-X; (4) Antenna; (5) Sternite VI; (6) Sternite VII; (7) Meso-metanota; (8) Sternite II; (9) Fore leg; (10) Fore wing.

pair of median pair of setae between two pairs of well-developed major angulars. Mesonotum with transverse anastomosing striae. Metanotum with reticulate sculpture but faint sculpture medially,



Fig. 1. *Moundinothrips robustus*, Female.

campaniform sensilla present. Fore wing costa with 31 setae, first vein with 4+3+2 setae, second vein with 16 setae. Abdominal tergite I–VII with transverse anastomosing striae in anterior half. Tergite VIII with complete microtrichia at posterior margin. Sternites II with 2 pairs of posteromarginal setae and 3 pairs of minute setae at the anterior

margin, III–VI with 3 pairs of posteromarginal setae, VII with 3 pairs of posteromarginal setae.

Material studied: INDIA, Himachal Pradesh, Shimla, fern, 1 female, (31°11' 99.3" N 077°23' 11.8"E, 2500 m), 13.vi.2014, Vikas, Kaomud & Biswatosh.

Distribution: India (Punjab). *Elsewhere:* Indonesia.

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Short Communication

NEW RECORDS OF ROVE BEETLES (COLEOPTERA: STAPHYLINIDAE: PAEDERINAE) FROM UTTAR PRADESH, INDIA

INTRODUCTION

The family Staphylinidae commonly known as Rove beetles is one of the largest family of the superfamily Staphylinoidea. The family is divided into 14 subfamilies of which members of the subfamily Paederinae can be easily distinguished by its head being more or less constricted behind. Major workers dealt the group are Motschulsky (1858), Fauvel (1895), Bernhauer (1915) etc. prior to Cameron's work on the fauna of India Series (1930-1939).

The present study is based on the collection w.s.r. to the subfamily Paederinae brought from different districts of Uttar Pradesh by various survey parties of Zoological Survey of India. The collection of five species viz. 1. *Paederus atrocyaneus* Champ. 2. *Paederus birmanus* Fauv. 3. *Paederus pubescens* Cam. 4. *Paederus nigricornis* Bernh 5. *Paederus fuscipes* Curt. from Uttar Pradesh constitutes the new record from Uttar Pradesh.

SYSTEMATIC ACCOUNT

Family STAPHYLINIDAE

Subfamily Paederinae

Tribe Paederini

Genus *Paederus* Fab.

1775. *Paederus* Fab., Syst. Ent.,: 268.

1931. *Paederus*: Cameron, *The Fauna of British India, incl. Ceylon & Burma* (Col.: Staphylinidae) 2: 33-63.

Key to the species of the Genus *Paederus* recorded from Uttar Pradesh.

1. Species entirely dark blue
.....*atrocyaneus* Champ.
- Species bicolorous..... 2
2. Head black..... 3
- Head blue or blue black..... 4
3. Species larger (8mm); last segment of antennae black..... *nigricornis* Bernhauer
- Species smaller (6.5-7mm); last segment of antennae concolorous*fuscipes* Curt.
4. Elytra blue, with whitish pubescence.....
.....*birmanus* Fauv.
- Elytra blue-black with thick grey pubescence.....*pubescens* Cam.

1. *Paederus atrocyaneus* Champ. (Fig. 1)

1927. *Paederus atrocyaneus* Champion, *Ent. Month. Mag.*, 63: 50.



Fig. 1. *Paederus atrocyaneus* Champ

1931. *Paederus atrocyaneus*: Cameron, *The Fauna of British India, incl. Ceylon & Burma* (Col.: Staphylinidae) 2: 36-37.

1995. *Paederus atrocyaneus* Biswas & Biswas, *Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal*, part 6(A): 274.

1895. *Paederus birmanus* Fauvel, *Rev. d'Ent.* **14**: 233.

Material examined: 2 exs., Dudhwa National Park, Lakhimpur-Kheri, 22.xi.2011, V.D. Hegde and party coll, ex. "Under dung".

Distribution: INDIA: Uttar Pradesh (Dudhwa National Park) and West Bengal.

2. *Paederus birmanus* Fauvel. (Fig. 2)

1895. *Paederus birmanus* Fauvel, *Rev. d'Ent.* **14**: 233.

1931. *Paederus birmanus* Cameron: *The Fauna of British India, incl. Ceylon & Burma* (Col.: Staphylinidae) **2**: 46-47.

1995. *Paederus birmanus* Biswas & Biswas, *Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal*, part 6(A): 274.

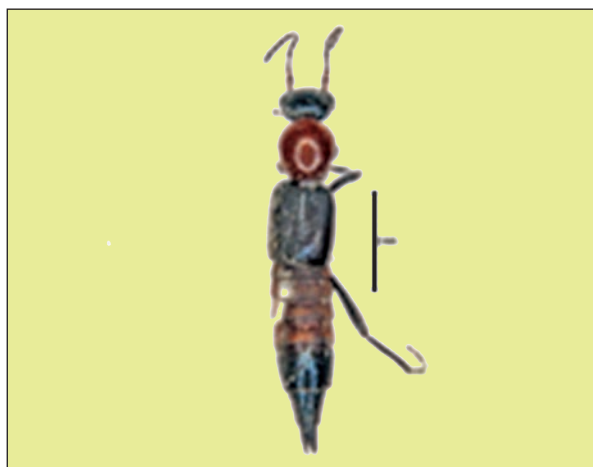


Fig. 2. *Paederus birmanus* Fauv.

Material examined: 3 exs, Allahabad dist., Fapamore, 4.ii.2009, V.D. Hegde & Party coll., ex. "bank of river Ganga"; 1 ex., Allahabad dist., Ramghat, 3.ii.2009, V.D. Hegde & Party coll, ex. "Under leaf litter."

Distribution: INDIA: Uttar Pradesh (Allahabad – Fapamore, Ramghat) Uttarakhand and Nagaland. *Elsewhere:* Myanmar.

3. *Paederus pubescens* Cameron (Fig. 3)

1914. *Paederus pubescens* Cameron, *Trans. Ent. Soc. Lond.*: 539.

1931. *Paederus pubescens* Cameron, *The fauna of British India, inc. Ceylon & Burma* (Col : Staphylinidae), **2**: 44-45.

1995. *Paederus pubescens* Biswas & Biswas, *Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal*, part 6(A): 274.



Fig. 3. *Paederus pubescens* Cam.

Material examined: 10 exs., Allahabad dist., Fapamore, 4.ii.2009, V.D. Hegde & Party coll, ex., "bank of Ganga."; 7 exs., Allahabad dist., Ramghat, 3.x.2009, V.D. Hegde & Party coll, "Under leaf litter."

Distribution: INDIA: Uttar Pradesh (Allahabad – Fapamore, Ramghat), West Bengal and Assam. *Elsewhere:* Bangladesh and Pakistan.

4. *Paederus nigricornis* Bernhauer (Fig. 4)

1911. *Paederus nigricornis* Bernhauer, *Ent. Blatt.*, **7**: 61.



Fig. 4. *Paederus nigricornis* Bernh.

1931. *Paederus nigricornis* Cameron, *The Fauna of British India, incl. Ceylon & Burma* (Col : Staphylinidae), **2**: 47-48.

1995. *Paederus nigricornis* Biswas & Biswas, *Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal*, part 6(A): 273.

Material examined: 2 exs., Allahabad, Ramghat, 3.xi.2009, Dr. V.D. Hegde & Party coll, ex., "Under leaf litter."

Distribution: INDIA: Uttar Pradesh (Allahabad-Ramghat) Uttarakhand, Sikkim, Himachal Pradesh and West Bengal. *Elsewhere*: Nepal.

5. *Paederus fuscipes* Curtis (Fig. 5)

1823. *Paederus fuscipes* Curtis, *Ent. Brit.*, 3: 108.

1931. *Paederus fuscipes*: Cameron; *The Fauna of British India, incl. Ceylon & Burma (Col.: Staphylinidae)* 2: 40-41.



Fig. 5. *Paederus fuscipes* Curt.

1995. *Paederus fuscipes* Biswas & Biswas, *Zoological Survey of India, State Fauna Series 3, Fauna of West Bengal*, part 6 (A): 274-275.

Material examined: 5 exs., Rampur dist., bank of Kosi river, 4.xi.2007, P. Mukkopadhyaya & Party coll, exs., "river bed of Kosi"; 3exs, Ballia dist, bank of river Ganga, 13.ii.2009, V.D. Hegde & Party coll, ex., "soil on river bed of Ganga"; 3 exs., Mirzapur dist., Pataulighat, 7.ii.2009, V.D. Hegde & Party coll, ex., "river bed of Ganga."; 1 ex., Allahabad dist., Ramghat, 3.ii.2009, V.D. Hegde & Party coll. Ex." Under leaf litter."

Distribution: INDIA: Uttar Pradesh (Rampur, Ballia, Mirzapur, Allahabad), Uttarakhand, Bihar, Karnataka, Madhya Pradesh, West Bengal, Meghalaya and Tripura.

SUMMARY

All the 5 species collected from Uttar Pradesh are new record to the State, Since all the rove beetles collected either from cow dung or under leaf litter or from the paddy field all are soil associated beetles.

ACKNOWLEDGEMENTS

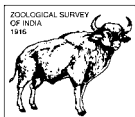
The authors are grateful to the Director, Zoological Survey of India, Kolkata for providing necessary facilities. Thanks are also due to Dr. Kailash Chandra, Scientist-"F", and O/C Entomology Division for encouragement and suggestion.

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Short Communication

NEW RECORD OF EXOTIC SPECIES OF SLUG, *LAEVICAULIS HAROLDI* IN INDIA

INTRODUCTION

Molluscs found in all types of habitat and are most successful in terms of their ecology and adaptations. Over recent decades there has been an increasing interest in exploring systemic, biodiversity and ecology of molluscs as these are being used by various countries as food, medicine, ornamentation, etc. In India gastropods have been studied by, Subba Rao and Ghose, 2001; and Magare (2006) Magare (2013) studied on terrestrial molluscs of Satpuda ranges in India. Studies on land molluscs have been carried out by, Forcart, L. (1953) and Herbert, & Kilburn, (2004).

Arionid & Limacid slugs retain their internal shell and the organs grow instead into the cavity of the foot. It is therefore possible to conjecture that the slugs arose by a process of neoteny; the retention of early developmental characters by the adult. (Runham & Hunter, 1970).

MATERIAL METHOD

Laevicaulis haroldi is a terrestrial slug recorded only from Table Mountain, southwestern Cape, South Africa and are native from KwaZulu-Natal area. Species authority of the slug is Dundee, 1980. It is commonly known as Purcell's Hunter Slug, Generally Known as caterpillar slug, as it appears like caterpillars of Arthropods. While collecting molluscs towards western zone of Taloda city at the foot of Satpuda Mountains, Author found a slowly moving irregularly banded slug on the leaves of calatropis plants and stumps of wood

at the roadsides during September (11/09/2005). Since 2005 till today I have observed many slugs around Taloda zone. Author also found these slugs around Nasik district and in Ahmedabad road near Maharashtra boundary at roadside vegetation near old small temples.

SYSTEMATIC ACCOUNT

Laevicaulis haroldi Dee Saunders
Dundee (1980)

Kingdom ANIMALIA

Phylum MOLLUSCA

Class GASTROPODA

Order STYLOMMATOPHORA

Family VERONICELLIDAE

Genus *Laevicaulis*

Species: *haroldi*

RESULTS

Slugs were found on leaves of Calotropis plant or on congress grass mostly. They were observed in the field with lens and data of length, size, weight, etc. is collected.

Measurement: Length: Length of adult slug is about 50-70 mm and about 10 mm wide. *Size:* Extended length: up to 85 mm. Width is about 10 mm in normal resting position.

MATERIAL EXAMINED

The largest specimen recorded is about 74 mm long as an adult Specimen. They were photographed by author, and measured size of

body and sole. These slugs prefer to move on leaves and stem of varieties of vegetation. In very rare case they were observed on land. They are herbivores and feed on leaves, flowers and fruits. The slug is creamy white in colour with white irregularly arranged bands on dorsal body wall gives wrinkled appearance. The body contract as central oval mass and when extends for movement becomes narrow and dorsoventrally flat at anterior body parts. Body is pale creamy or ivory coloured appearance with shining on dorsal body surface. Both ends of the slug are black, comparatively anterior end is darker than posterior end. At anterior end upper large and lower small pair of tentacles are sensory organs. Tentacles are faint gray coloured. Sole of the slug is very narrow and translucent at midventral line from anterior to posterior end. Lateral sides of sole gives creamy white patches on translucent creamy skin. (Fig. 1)



Fig. 1. A land slug, *Laevicaulis haroldi*.

DISCUSSION

Distribution: They are found to be distributed in base line of Satpuda Mountains from Maharashtra to Gujarat. These slugs were recorded from different habitats of Nasik, Dhule, Nandurbar and Ahmedabad districts of India. They prefer marshy lands or habitat around watershed area. Slugs, *L. haroldi* are predominant in and around agricultural and horticultural land area. I found more than 56 individuals in three square meters area around Vanyavihir place at the foot of Satpuda Mountains

in Taloda (District - Nandurbar) of Maharashtra, India. (Fig. 2).

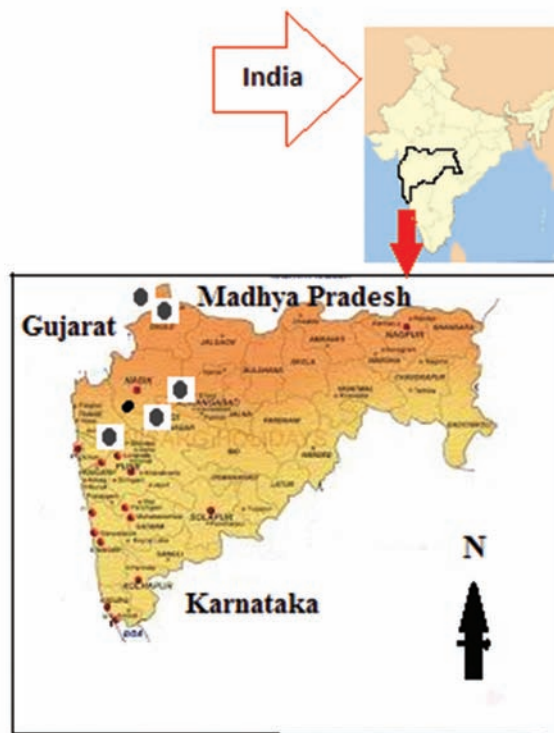


Fig. 2. Map of Maharashtra [India] showing localities of collection and observation of slug, *L. haroldi*.

REMARKS

These slugs are creamy white or ivory coloured with wrinkled patches on dorsal body surface. Anterior tip is very dark gray or black coloured. The anterior dark colour spreads posteriorly and becomes faint towards posterior side. Posterior dark end is very limited. In some specimens the darker shade is continuous at the base of lateral body surface. Anterior pair of antenna is larger with eyes on the tip. (Fig. 1)

Activities of the slug are very slow as compared to other slugs recorded in India. These slugs are delicate and harmless to any other organism in ecosystem. They lay eggs inside the stones, decaying vegetation's or in burrows of soil. These slugs are able to withstand in varied nature as they were found to be recorded on plants like, Papaya, Calatropis, Congress grass, *Azadiracta indica*, etc. They feed on ripen or decaying leaves of plants. These slugs are mostly found isolated and rarely in groups.

This slug is recorded in Africa only and now first time in India.

SUMMARY

[Diagnostic characters]

1. Body colour is creamy white to ivory with both ends black.
2. Body gives wrinkled appearance due to alternating bands of white and cream coloured.
3. The foot is narrow, translucent and midventral and extends from anterior to posterior end of the body.
4. Pedal gland secretes very limited thread like saliva.
5. Upper and lower pair of tentacles are organs of sense.
6. At the tip of upper tentacles, eyes are present.

7. Mostly found on herbs, shrubs or on trees, Very rarely found on ground.
8. They reside in termite mounds under dense vegetation.

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Short Communication

FIRST REPORT OF TWO JAWFISHES (PERCIFORMES: OPISTOGNATHIDAE) FROM NORTHERN EAST COAST OF INDIA

INTRODUCTION

The jawfishes family Opistognathidae represents total 81 species throughout the world under 3 genera, of which genus *Opistognathus* Cuvier, 1816 comprises 65 species (Biswas *et al.*, 2013). In Indo-Pacific region comprises about 40 species of jawfishes some of them unidentified (Smith-Vaniz and Yoshino, 1985). In Indian coastal water only 7 species were reported (Smith-Vaniz, 2009, 2011 and Biswas *et al.*, 2013): *O. albicaudatus* Smith-Vaniz, 2011; *O. annulatus* (Eibl-Eibesfeldt and Klauswitz, 1961); *O. cyanospilotus* Smith-Vaniz, 2009; *O. nigromarginatus* Rüppell, 1830; *O. rosenbergii* Bleeker, 1856; *O. macrolepis* Peters, 1866; and *O. pardus* Smith-Vaniz *et al.*, 2012. Jawfishes are benthic marine fishes found at depths ranging from 0.3 to at least 375 m in most tropical seas but are absent from the Pacific Plate (except the islands of Belau and Samoa), eastern Atlantic Ocean, and Mediterranean Sea (Smith-Vaniz, 1997). Jawfishes are obligate burrow dwellers and male orally incubate their eggs (Hess, 1993). Due to their low dispersal ability and high level of regional endemism capability make them biologically very interesting and ideal for biogeographical study (Smith-Vaniz, 1997). Literature review indicates (Manna and Goswami, 1985; Goswami, 1992; Talwar *et al.*, 1994; Chatterjee *et al.*, 2000; Das *et al.*, 2007, Mohapatra *et al.*, 2007, Barman *et al.*, 2007) that no fishes of the family Opistognathidae was reported from Northern east coast (West Bengal and Odisha) of India. During local survey around Digha coast of West Bengal authors collected some specimens of *Opistognathus* and identified as *Opistognathus rosenbergii* Bleeker, 1856 (7 ex; 70.08-98.74 mm SL) and *Opistognathus macrolepis* Peters, 1866

(3 ex; 63.63-52.71 mm SL). This paper reports first record of the family Opistognathidae along with report of the species *Opistognathus rosenbergii* Bleeker, 1856 and *Opistognathus macrolepis* Peters, 1866 from northern east coast of India.

MATERIALS AND METHOD

Specimens were collected from Shankarpur fishing harbour. Fishes were collected by trawl net at 65 nautical miles far (20.11 N & 088.46 E) from Digha coast of West Bengal at a depth of 62-65 m. Measurements and counts follow Smith-Vaniz, 2009. Measurements were carried out with a digital caliper with resolution of 0.01 mm. Abbreviations SL and HL represents standard length and head length. After identification fresh photograph was taken and specimens deposited to MARC, ZSI, Digha with registration details as MARC/ZSI/F2768 (seven specimens of *Opistognathus rosenbergii* Bleeker, 1856) and MARC/ZSI/F3471 (Three specimens of *Opistognathus macrolepis* Peters, 1866).

1. *Opisthognathus rosenbergii* Bleeker, 1856

1856. *Opisthognathus rosenbergii* Bleeker, Nat. Tijds. Ned. Indie, **12**: 220 Nias; de Beaufort, 1951, Fishes Indo-Austr. Arch., **9**: 38.
1876. *Opisthognathus rosenbergii* Day, Fishes of India, Part II, p. 267.



Fig. 1. *Opisthognathus rosenbergii* Bleeker, 1856

DESCRIPTION

D: X, 14; A: II, 13; P: 21; V: I, V.

Small fish with elongate and tapering body (Fig. 1.), its depth at dorsal fin origin 21.78%-23.62% of SL and at anal fin base 11.46%-12.12.49% of SL. Head bulbous and large its length 33.63%-35.78% of SL. Eye large, 27.44%-28.61% of HL and its position high on head; interorbital space narrow, 8.44%-8.59% of HL. Post orbital jaw length 8.91%-10.5% of SL and post orbital head length 19.39%-20.79% of SL. Mouth large, maxilla extending well behind eye, maxilla 60.81%-62.89% of HL and 21.06%-23.06% of SL; snout blunt and short, 2.37-2.44 times to HL. Both jaws with a row of small curved teeth, behind it a band of anterior directed pointed conical teeth present. Single continuous dorsal fin 62.15%-64.72% of SL; its spinous part lower than soft part. Anal fin similar to dorsal and its base 34.38%-35.43% of SL. Pectoral fin 16.28%-16.92% of SL and ventral fin 20.04%-21.36% of SL. Caudal fin rounded; depth of caudal peduncle 10.06%-10.79% of SL and its length 8.54%-9.57% of SL. Lateral line incomplete, lateral line scales 68-69; Gill rakers 32-34 (9-11+23).

Colour: In fresh grayish yellow in colour with dorsal, anal and caudal fin margin black. Dorsal fin base with five dark blotches; caudal fin with middle white band; ventral fin tip black and base white; Opercle membrane and pectoral fin light yellow. In preserve colour become brownish.

Distribution: Indo West Pacific: Indonesia, Thailand and India. In Indian coast this specimen previously reported from Andhra Pradesh (Barman, *et al.*, 2004), Tamil Nadu (Krishnan *et al.*, 2007) and Andaman and Nicobar Island (Rao *et al.*, 2004).

2. *Opistognathus macrolepis* Peters, 1866:

Big scales Jawfish

Opistognathus macrolepis Peters, 1866, *Monatsbericht der Koniglich Preussischen*

Akademie der Wissenschaften zu Berlin: 520 (Bangkok, Thailand).

DESCRIPTION

D: XI, 12; A: II, 10; P: 21; V: I, 5.

Small, moderately elongate fish with posterior end tapering (Fig. 2). Body depth at dorsal fin origin 25.11%- 26.52% of SL and at anal fin origin 23.9%-24.03% of SL. Head bulbous and large its length 37.34%-38.30% of SL. Eye very large 29.1%-29.7% of HL, position of eye high on head; interorbital space 6.9%-7.8% of HL. Post orbital jaw length 25.2 %-25.7% of HL and post orbital head length 61.8%-62% of HL. Mouth large, maxilla reaching well behind eye, maxilla 23.2%-23.5% of SL and 62.3-62.4% of HL; snout blunt and short 17.28%-17.63% HL. A outer row of enlarge conical teeth present on both jaws, behind it a band of anterior directed pointed conical teeth present, no teeth on vomer. Dorsal fin single and continuous, its base 63.1%-63.6% of SL; anal fin base 25.2%-25.4% of SL; pectoral fin 20.4%-20.6% of SL; ventral fin 22.5%-22.8% of SL. Caudal fin rounded; depth of caudal peduncle 11%-11.3% of SL. Scale cycloid, lateral line incomplete; Gill rakers 30 (10+20).



Fig.2. *Opistognathus macrolepis* Peters, 1866

Colour: Body yellowish and darker on head region. Dorsal, anal and caudal fin blackish; pectoral and ventral fin pale. No ocellus or any spot on dorsal fin, opercle and chin.

Distribution: Indo-west Pacific, from east coast of India to Gulf of Thailand and Gulf of Carpentaria, Australia. In Indian coast this species was only reported from Tamil Nadu (Biswas *et al.*, 2013).

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Short Communication

NEW RECORD AND REDESCRIPTION OF *ODONTOMUTILLA SPECIOSA* SMITH, 1855 (HYMENOPTERA: MUTILLIDAE) FROM THE INDIAN SUBCONTINENT

INTRODUCTION

The genus *Odontomutilla* was described by Ashmead in 1899 based on the type species *Mutilla saussurei* Sichel et Radoszkowski. Thirty four valid species of this genus are reported from the Oriental Region of which eleven species from the Indian subcontinent (Lelej, 2005). The species *Odontomutilla speciosa* (Smith) is so far recorded from China. In this paper, we report *O. speciosa* for the first time from the Indian subcontinent based on the specimen collected from Maharashtra, India. Since the original description is not sufficient for the proper identification of the species, detailed redescription with sufficient photographs is provided here. A checklist of the species of the genus *Odontomutilla* from the Indian subcontinent is also provided.

MATERIAL AND METHODS

All the photographs were taken by Leica Stereozoom microscope with LAS software version 3.8 (Build: 878) and the morphology was studied by Leica EZ4HD microscope. The specimen is added to the 'National Zoological Collections' of the Hymenoptera Section of the Zoological Survey of India, Kolkata (NZC).

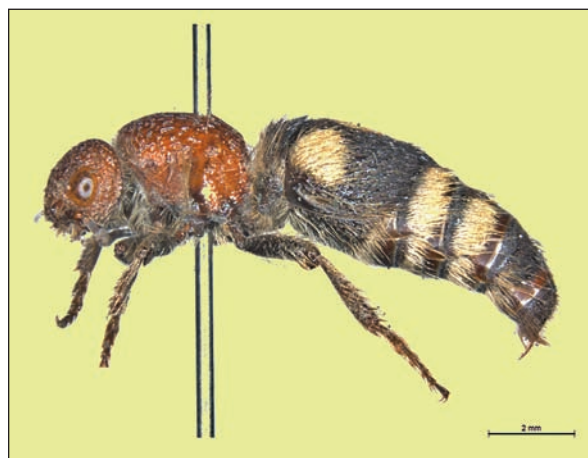
Abbreviations: BMNH = Natural History Museum, London, UK; F1-F10 = Flagellomeres 1 to 10; T1-T5 = Metasomal terga 1 to 5; S1-S5 = Metasomal sterna 1 to 5.

Odontomutilla speciosa (Smith, 1855) (Figs. 1-6)

1855. *Mutilla speciosa* Smith, 40. Holotype ♀, type locality: "Hong Kong" (BMNH).

2005. *Odontomutilla speciosa*; Lelej, 117.

Redescription: Female (Figs. 1 & 2): Length 12 mm. Head, scape, pedicel, clypeus, mandible except apex and mesosoma reddish brown; apical



1. Body profile

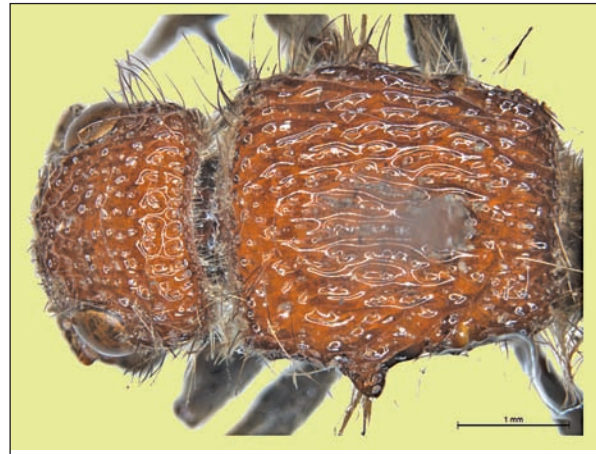
part of mandible, upper side of flagellomeres, coxae, femur and lower side of pleurae dark brown; palps pale brownish; metasoma black; head covered with erect sparse brown setae; frons, scape, pedicel, basal part of mandible with moderately dense golden setae; posterior margin of head with fringe of golden yellow setae; F1 and F2 with sparse golden setae; F3-F10 covered with golden micropubescence; dorsal side of mesosoma with erect brown setae; metapleural carina covered with tuft of erect long golden setae; propleura



2. Body dorsal view

and metapleura with less golden setae; femur with moderately dense and rest of the legs with sparse erect golden setae; tibial and tarsal spines brown; T1 above with closely packed black setae; T1 having a spot with golden hairs at the centre; T2-T6 above with sparse, erect black setae; T2 above with one middle, and two lateral ovate spots of golden pubescence placed transversely; T3 and T4 covered with interrupted broad band of golden pubescence; T5 and T6 covered with erect black setae; apical margins of S2-S5 with erect, dense golden setae; two lateral sides of apical margin of pygidium with tuft of long, brown setae.

Head (Figs. 3 & 4): Coarsely rugose; smaller than mesosoma; elongated, slightly convex behind compound eyes, dorsally almost flattened; posterior margin straight; postero-lateral margin of head rounded; eyes small, oval; distance between two



4. Head and mesosoma dorsal view

eyes 1.40 mm; clypeus weakly elevated basally with anterior margin slightly curved towards outside; ratio of longitudinal eye diameter to distance between eye and mandibular base 1.69; mandible stout, bidentate, narrower at apex.



5. Metasoma dorsal view



3. Head frontal view



6. Pygidium

Mesosoma (Fig. 4): Mesonotum distinctly broader than pronotum and propodeum; pronotum slightly wider than propodeum; dorsal surface coarsely rugose; mesopleura with strong lateral carina; metapleura smooth and shiny; propleura with micropunctures and short pubescence; scutellar scale absent; mesosoma concave dorsally; femur with small punctures; tibia with three rows of tibial spines; tarsal spines present apically.

Metasoma (Fig. 5): Elongate, longitudinally rugose; T1 wide, not constricted posteriorly, narrower than T2; T2 with deep antero-lateral pubescent fovea; dorsal part of T2 somewhat flat; anterior part of T3-T6 with micropunctures; S2 with distinct median carina; S2-S6 having micropunctures; pygidium with well defined lateral carina; apical 1/3 pygidial area (Fig. 6) with irregular striations and rest with small tooth-like projections.

Measurements: Pedicel length 0.18 mm; F1 length 0.28 mm; F2 length 0.26 mm; F3 length 0.29 mm; longitudinal eye diameter 0.91 mm; malar space 0.71 mm; mesosoma width (maximum width of mesonotum) 3.18 mm; mesosoma length 2.92 mm; T2 length 3.57 mm.

Male: Unknown.

Material examined: 1 ♀, INDIA: Maharashtra, Satara district, Khandala (72° 37' E 18° 75' N), 19.iv.1983, Coll. A.R. Lahiri & Party, NZC Regd. No. 15032/H3.

Distribution: India (New record): Maharashtra. *Elsewhere*: China: SE (Xianggang, Guangdong).

Discussion: The specimen which we studied differs from the original description of Smith (1855) by having: (1). Size 12 mm (4 lines [=8.8 mm] in original description); (2). Coxa and femur of legs dark brown and rest brown (Rufo-piceous in original description); (3). One golden small spot on the basal part of T1 (This spot is not mentioned in the original description).

Checklist of species of the genus *Odontomutilla* Ashmead, 1899 from the Indian Subcontinent

1. *Odontomutilla assamensis* Hammer, 1962 - India (Meghalaya).

2. *Odontomutilla aurifex* (Smith, 1879) - India (Maharashtra).
3. *Odontomutilla buddha* (Cameron, 1892) - India (Maharashtra).
4. *Odontomutilla familiaris trimaculata* Hammer, 1962 - India (Assam).
5. *Odontomutilla indiga* (Bingham, 1908) - India (Uttar Pradesh).
6. *Odontomutilla miranda* (Smith, 1855) - India (exact locality not known).
7. *Odontomutilla perelegans* (Cameron, 1897) - Sri Lanka, India (Punjab), Pakistan.
8. *Odontomutilla pulchrina* (Smith, 1855) - India (Tamil Nadu, Kerala, Karnataka).
9. *Odontomutilla sikkimensis* André, 1904 - India (Sikkim).
10. *Odontomutilla speciosa* (Smith, 1855) - India (Maharashtra - new record). *Elsewhere*: China.
11. *Odontomutilla spectra* (Bingham, 1908) - India (Uttar Pradesh).
12. *Odontomutilla trichocondyla* (André, 1894) - India (Karnataka), Sri Lanka.

SUMMARY

Odontomutilla speciosa (Smith, 1855) reported here for the first time from the Indian subcontinent. With this addition of one species, the genus *Odontomutilla* is now represented by twelve species from the Indian subcontinent. The species *O. speciosa* (Smith) is redescribed here and a checklist of the species of the genus *Odontomutilla* Ashmead from the Indian Subcontinent is also provided.

ACKNOWLEDGEMENT

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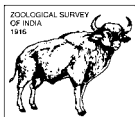
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Short Communication

RECORD OF THE EYE SPOTTED ARANEID SPIDER *ARANEUS* *BILUNIFER* POCKOCK, 1900 FROM WEST BENGAL

INTRODUCTION

Araneid Taxonomy in India was actually started with Westwood (1835). Many other workers like Pocock (1895), Tikader (1970, 1973, 1977, 1982 & 1987) Tikader & Biswas (1981); Biswas 1985; Majumder & Talukdar (2006) and Talukdar & Majumder (2008) and many more contributed in this field of study. But the first comprehensive literature regarding the same was *The fauna of British India including Ceylon and Burma: Araneae* published by Pocock in 1900 and after the publication of the Hand book of Indian spiders by Tikader in 1987 studies in this group has got special impetus among the budding taxonomist in India and adjacent countries. Studies on Araneid spiders of India also were well studied by Tikader (1982) along with some other worker contributing several descriptions.

The genera *Araneus* of the family Araneidae Simon, 1895 can be distinguished with the moderately convex Carapace with no horny out growths; thoracic groove transverse in female, but In male longitudinal, often having lateral prolongations. Ocular quad forming a trapezium, not much longer than wide; median eyes slightly unequal in size; laterals close and usually situated on prominent tubercles; both rows of eyes recurved.

Spider fauna of Bibhuti Bhusan Wildlife Sanctuary at Parmadan in North 24 Parganas District of West Bengal has not yet been studied

in a comprehensive manner. *Fauna of the order Araneae from the state of West Bengal has been described by Biswas & Biswas, 1992. Although there are several published record from the state of West Bengal as well as from India regarding taxonomy of this fauna (Tikader, 1970, 1977, 1977, 1980 & 1982; Tikader & Biswas 1981; Tikader; Biswas 1985) and there are several published papers on the spiders on West Bengal (Pocock, 1900 & 1901; Gravely 1931; Sinha 1951(a,b); Tikader 1970; Tikader 1980 & 1982; Sethi & Tikader 1988; Majumder & Tikader 1991; Biswas & Biswas 1992, Talukdar & Majumder, 2007) and many more but in their account there is no mention of the Orb weaving Spider *Araneus bilunifer* Pocock, 1900 from any other state of India except Tamil nadu and Gujarat.*

In recent years the authors had covered the areas of this Wildlife Sanctuary in different seasons in search of the habitats and behaviors of spider along with the faunal diversity as an approach to prepare an inventory from this environment towards the goal of conservation. *During their survey, the authors came across some 20-21 mm *Araneus bilunifer* spiders belonging to the family Araneidae Simon, 1895 from bushes near the Forest rest house of Parmadan at an altitude of 68 ft. between the GPS co-ordinate of 23°11'18.26" E and 88°45'53.45" N of the state of West Bengal. and conducted taxonomic studies on this fauna.*

MATERIALS & METHOD

The Study Area: The present work was initiated from Spread out over 640 hectares of forestland with a variable altitudes between 50-90 ft. from sea level, the man made forest lies on the banks of Ichhamoti River. The sanctuary is also known as Parmadan Deer Park and is around 150 km North-East from Kolkata between the GPS Co-ordinates of 88°46'03.03"-88°45'13.18"E in East-West direction and 23°11'22.62"-23°10'46.87"N in North to South. More than 65 % of the sanctuary is encircled by the River Ichhamoti along the North-West to South-East boundary. The nearest major town is Bongaon, which is around 30 kms away. The vegetation of these virgin forests are with about 209 species of angiosperms Altogether cover the floral biodiversity containing about 59 trees, 98 herbs, 34 shrubs, 15 climbers and three creepers.

Climate: The climate observed in this sanctuary is tropical, like the rest of the Gangetic West Bengal. The hallmark is the Monsoon, which lasts from early June to mid September. The weather remains dry during the winter (mid November to mid February) and humid during summer. Annual Rainfall is about 150–200 cm which is Normal in Southern Bengal (Climate of West Bengal, Wikipedia), Atmospheric temperature ranges between 41°C in May (Max) and 10°C in January (Min) and Relative Humidity Between 50% in March & 90% in July.

Instruments: Collections were made by an inverted umbrella, forceps with soft-tension, small brush and with a standard hand sweeping net (129cm in diameter) and Sunca electronic emergency lamp. Taxonomic studies have been made by an Olympus dissecting type binocular microscope with ocular micrometer while photography performed by a Digital SLR.

Collections: Spiders were collected from the study areas directly from the webs by hand picking method, by the sweeping net and by beating the furniture's in to an inverted umbrella.

Preservation: Collected spider specimens were anaesthetized, killed in a killing jar and finally

preserved in Oudman's preservative (90 parts 70% ethanol, 5 parts glycerol and 5 parts glacial acetic acid) in glass vials.

Identification: Well preserved spider specimens were sorted transferred in ethyl alcohol and studied under binocular microscope in a Petri dish. Identification was done by following Tikader (1982a & b). The specimens were identified up to species level.

OBSERVATION

Type Species *Araneus bilunifer* Pocock 1900.

Type Locality: Chingleput, Tamil Nadu.

SYNONYMS

1900. *Araneus bilunifer* Pocock, *Fauna Brit. India, Arachn.*, 227.

1975. *Araneus bilunifer*: Patel, Vidya, J. Gujarat Univ., 18(1): 162.

Diagnostic Characters: General: Carapace and legs light brownish, abdomen yellowish grey. Total length 20-21mm. Carapace 8.50 mm. long, 7.20 mm. wide; abdomen 14.00 mm. long, 12.00 mm. wide.

Cephalothorax: Longer than wide, narrowing in front, clothed with pubescence and hairs. Thoracic region provided with a conspicuous transverse groove. Ocular quad longer than wide and much wider in front than behind. Anterior median eyes larger than the posterior medians. Lateral eyes close and each situated on a tubercle. Both the rows of eyes recurved but anterior row strongly recurved. Sternum heart-shaped, pointed behind, dark brown, clothed with pubescence and hairs, mid-longitudinally provided with a broad black band. Labium wider than long, brown with pale distal border. Maxillae nearly pentangular, brown with pale outer margin, provided with distinct scopulae. Chelicerae strong, brown, provided with medium boss. Legs long and strong, distal ends of all segments having dark brown bands, clothed with pubescence, hairs and spines.

Abdomen: Sub-oval, longer than wide, clothed with pubescence and hairs, provided with two small, low shoulder humps and one pair of

conspicuous chalk white large spots, margined by black rings on the dorsum. Three pairs of sigilla arranged mid-longitudinally on the dorsum. A few chalk white patches present anteriorly on the dorsum of the abdomen. Ventral side provided with a large brown patch guarded laterally by a pair of chalk white dumble shaped patches in between the epigastric furrow and the spinnerets. Epigyne provided with a short, broad and bent scape.

MATERIALS STUDIED

Observed 4 specimens in the field at their original habitat measuring total length of 20-21mm. long in living posture while the body length of the preserved specimen measured female: 20-21mm and no male found at Bibhuti Bhusan Wildlife Sanctuary, Parmadan, Bongaon, North 24 Parganas, West Bengal 26.xi.2010. coll and Examined: S. Talukder.

Distribution: India: Chingleput, Tamil Nadu; Vallabh Vidyanagar, Napad, Gujarat.

Remarks: Description and illustrations are based on the description of Tikader, 1982.

Habit & Habitat: This species builds a moderate, tangled disc web on the bushes of the garden only at night often found nearby, the web also serving as a retreat. They are generally nocturnal hunter and found on roaming over the twigs and leaves while hunting their prey insects from nearby areas.

Common Name: Eye Spotted Orb Weaving Spider.

Economic importance: Like all other spiders (Except Ulborid Spiders) particularly the Araneid spiders *Araneus bilunifer* Pocock also have neurotoxin poisons in their lively uses and are considered to be medicinally important to human

being. This comb-legged Spiders are used by the tribals of rural areas of the hills as drug for the of Dysmenorrhoea and pain removing purposes as their traditional medicines. The absolute insect predating feeding behavior of these group of animal naturally control the pest insects in IPM and play causative function in agriculture and domestic hygiene.

DISCUSSION AND CONCLUSION

As spider from this genus have never been collected or reported from this geographical area of India proved to be significant towards the zoo-geographical point of view. Identification of their habitat in the particular Gangetic Plane -ecosystem from which it has been first time recorded in this Subcontinent also note worthy. Description and taxonomic record of this spider species highlighted in this paper for future data base and use. Occurrence of this spider is significant from the view point of *biodiversity* and distributional pattern as hither to unrecorded from the same habitat of this geographical area. Socio-Economic importance and possibilities as a bio-medicinal resource and factor in IPM for exploitation enlighten the importance of conservation of this Biodiversity.

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Short Communication

NEW RECORD OF TWO SPECIES OF *ACENTROGOBIUS* (TELEOSTEI: PERCIFORMES: GOBIIDAE) FROM ANDAMAN ISLANDS

INTRODUCTION

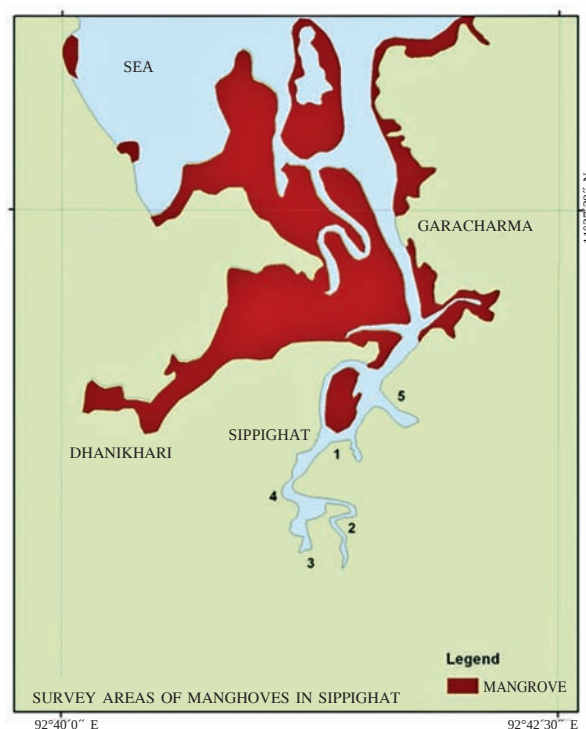
Andaman Nicobar Islands situated in the Bay of Bengal between 6°45'–13°45' N and 92°10'–94°15' E consist of 352 islands 220 islets and rock. It covers a distance of almost 470 km over North South, with a coastline of 1962 km, and brings in for India an Exclusive Economic Zone (EEZ) of 600 thousand sq km. The coast is under the influence of a diverse set of oceanographic and ecological conditions. The shelf topography of these islands show frequent rises supporting coral reefs, which are characterized as fringing reefs on the eastern side and barrier reefs off west coast; the depressions are known as passages and straits. Besides coral reefs, the shore is composed of rocky and sandy areas and vast stretches of mangrove swamps, also few freshwater rivers and streams.

A comprehensive and authoritative account of fishes of the Indian region including Andaman and Nicobar Islands was published by Francis Day (1870, 1875-78 and 1888). Herre (1941) listed 490 species of fishes. Talwar (1990) prepared a comprehensive list of fishes consisting of 724 species, followed by a supplementary list by Kamla Devi (1991), Rao (2009), Ramakrishna *et al.*, 2010 and Rajan *et al.*, 2013 listed a total of 1434 species of fish.

MATERIALS AND METHODS

The new records of fishes were made by fish

sampling during the field surveys in mangrove habitats of Sippyghat, South Andaman. The identified fishes were deposited in the reference collection of Zoological survey of India, Port Blair. Taxonomic classification follows Nelson (2006).



RESULTS AND DISCUSSION

The last few years represent a significant increase of knowledge about the fishes of Andaman and Nicobar Islands. During this study two new records of fishes were recorded as *Acentrogobius madraspatensis* (Day, 1868) and *Acentrogobius suluensis* (Herre, 1927) of the family gobiidae.

SYSTEMATICS

Class ACTINOPTERYGII

Order PERCIFORMES

Family GOBIIDAE

1. *Acentrogobius madraspatensis* (Day, 1868)

Many band Goby

1868. *Gobius madraspatensis*, Day, *Proc. Zool. soc. London* **1868**(pt 1): 152. (Madras, India).

1993. *Acentrogobius madraspatensis*, Rema Devi, *Rec. Zool. surv. India* v. **90**(nos 1-4): 161-189.

Material examined: Sippighat, South Andaman; 1 ex; 6.2 cm; P.T. Rajan

Diagnostic characters: Dorsal fin with VII spines and 10 soft rays; Anal fin I spine and 9 rays; Pectoral fin 17 rays; Longitudinal scale series 29; Predorsal scales 18. Body elongate and compressed; eyes moderate; cheeks and operculum naked. Body olivaceous with irregular, ill defined brownish blotches and dots; five to eight very narrow vertical black lines from head to belly, between base of pelvic fins and caudal peduncle; first dorsal fin with 2-3 rows of black blotches; caudal fin minutely dotted in rows.

Habitat: Inhabits estuaries and mangroves.

Distribution: Indo-west Pacific; Sippighat, South Andaman (Andaman Islands).

Remarks: First report from Andaman Islands.



Acentrogobius madraspatensis (Day, 1868)
(Photo Rajan)

2. *Acentrogobius suluensis* (Herre, 1927)

Sulu Goby

1927. *Rhinogobius suluensis* Herre, *Monographs, Bureau of Science Manila Monogr.* **23**: 193, Pl. 14 (fig. 3). Bungau, Sulu Province, Philippines.

2012. *Acentrogobius suluensis*, Allen and Erdmann, *Reef fishes of the East Indies*, V. **III**: 954.

Material examined: Sippighat, South Andaman; 1 ex; 5.5 cm; P.T. Rajan.

Diagnostic characters: Dorsal fin with VI spines and I spine and 9 soft rays; Anal fin I spine and 9 rays; Pectoral fin 18 rays; Longitudinal scale series 28. First three spines of first dorsal may have filamentous tips; caudal fin lanceolate, longer than head; no scales on head. Pale grey with brown band below eye, dark brown streak and blue margin on gill cover, irregular, brown spots and blotches on head and upper half of body and chain link pattern at level of upper pectoral fin base to caudal base, composed of five rectangular blotches between two brown stripes, with 2-3 blue spots between each blotch.

Habitat: Silty sand and mud bottoms of brackish waters, but occasionally near reefs.

Distribution: Western Pacific: Ryukyu Islands, Philippines, Indonesia, Papua New Guinea and Andaman Islands.

Remarks: First report from India.



Acentrogobius suluensis (Herre, 1927) (Photo Rajan).

SUMMARY

It seems that the Andaman and Nicobar Islands coast has a regular connectivity with the south-

eastern coast of Indonesia and north-eastern coast of Burma as observations of tropical affinity species. The fish diversity in these waters also receives special interest in terms of marine zoogeography because of the confluence of Andaman Sea fishes with Western Pacific and the Eastern Indian Ocean. Long-term monitoring studies will allow a better understanding of connectivity patterns along the coast of Andaman and Nicobar Islands as well as the possible establishment of new populations of species. The present paper

reports that *Acentrogobius madraspatensis* (Day, 1868) and *Acentrogobius suluensis* (Herre, 1927) are new additions to Andaman Islands and the later species is first record from India.

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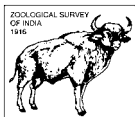
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Short Communication

NEW RECORDS OF HAIRY WASPS (HYMENOPTERA: SCOLIIDAE) FROM DIU, INDIA

INTRODUCTION

The family Scoliidae is a group of solitary fossorial aculeate wasps commonly known as hairy wasps. Adults are usually black, commonly marked with yellow, white or red. Their wings are usually dark with metallic reflections. Vestiture varies from entirely black or black mixed with white to entirely golden or reddish. Body length may vary from 5 mm to 35 mm (rarely up to 50 mm). Sexual dimorphism is distinct. They are world wide in distribution but predominantly found in tropical region and consist of about 560 species, 220 subspecies distributed among 43 genera, 28 subgenera in two subfamilies: Proscoliniinae and Scoliinae (Osten, 2005). The larvae of scoliid wasps are ectoparasitic on the larvae of Coleoptera, usually Scarabaeoidea but rarely Curculionoidea.

The members of this family are readily distinguished from other wasps by having (1). Wing membranes finely and longitudinally wrinkled apically (2). Metacoxae widely separated (rarely less so) by wide flat metasternum at same level as mesosternum; metacoxa partly concealed basally by a wide lamina (3). Propodeum divided into three by 2 longitudinal grooves traversing both disc and declivity.

Seventy nine species under 14 genera have been reported from Indian subregion till date (Gupta & Jonathan, 2003; Schulten *et al.*, 2011). There is no record of scoliid fauna from Diu so far. In this paper, we are reporting two species of Scoliidae from Diu for the first time.

MATERIAL AND METHODS

Diu Island (20.71° N 70.98° E) is situated off the southern tip of the Saurashtra (Kathiawad) peninsula of Gujarat. Diu is bounded by Junagadh and Amreli districts of Gujarat in the north and by the Arabian Sea from other three sides. The altitude is about 6 meters above sea level.

The specimens were collected from Nagoa beachside by using sweeping net specially made for the purpose. The specimens were studied and photographed by using a Leica Stereo microscope with LAS software version 3.6.0. All the specimens were properly preserved and added to the 'National Zoological Collections' of the Hymenoptera Section of the Zoological Survey of India, Kolkata (NZC).

The following abbreviations used in the text for the Museums: NZC = National Zoological Collections of Zoological survey of India, Kolkata, India; UZMC = Universitetets Zoologiske Museum, Copenhagen, Denmark; ZMB = Zoologisches Museum der Humboldt Universität, Berlin, Germany.

RESULTS

Two species of Scoliidae reported for the first time from Diu as details given below.

1. *Micromeriella marginella marginella*

(Klug, 1810)

(Images 1 & 2)

1810. *Scolia marginella* Klug, 214. Type Male, India- Orient (ZMB).

1897. *Scolia marginella*: Dalla-Torre, 169.

1974. *Micromeriella marginella marginella*; Bradley, 443.

Material examined: 2♀, INDIA: Diu, Nagoa beachside, 14.vii.2014, Coll. Gaurav Sharma & Party, NZC Regd. Nos. 14991/H3 & 14992/H3.

Diagnosis: Female (Image 1): Length 9-9.5 mm. Integument black; mandibles, about anterior half of clypeus, antennal flagellum, mid and hind tibia, all tarsal segments and abdominal sternites reddish brown; basal four abdominal tergites with a narrow yellow apical bands. Erect vestiture white and sparse, white fringes at the apices of first five tergites, pygidium with reddish setae. Wings clear with yellowish anterior margin. Clypeus impunctate in the middle (Image 2); frontal spatium with coarse and close punctures; front impunctate and sub polished; around ocellar triangle with close punctures; vertex with a few scattered punctures, except for a row of close punctures along eye margin, its declivous portion with scattered punctures; mesoscutum, scutellum and metanotum impunctate in the middle; metapleuron impunctate; dorsal side of propodeum with close punctures except an impunctate area anteriorly along the inner margin of dorsolateral area of propodeum.

Distribution: India: Andhra Pradesh, Bihar, Delhi, Diu (new record), Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Odisha, Pondicherry, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Sri Lanka.

2. *Scolia (Discolia) binotata binotata*

Fabricius, 1804

(Images 3-6)

1804. *Scolia binotata* Fabricius, 244. Type Male, Tranquebar (UZMC).

1978. *Scolia (Discolia) binotata binotata*: Krombein, 41- 43, Female, Male; Sri Lanka.

Material examined: 3♂, INDIA: Diu, Nagoa beachside, 14.vii.2014, Coll. Gaurav

Sharma & Party, NZC Regd. Nos. 14993/H3 to 14995/H3.

Diagnosis: Male (Image 3): Length 10-11 mm. Integument black, usually third and fourth tergites with paired, rounded, light red spots. Vestiture black mixed with white. Wings dark brown at base and paler at apices with bluish purple reflections; forewing membrane beyond cells devoid of microtrichiae except for a small patch adjacent to apex of marginal cell. Frontal spatium contiguously punctate; flagellum clavate towards apex; front with subcontiguous to contiguous punctate (Image 4); mesoscutum with large, deep punctures; dorso-median area of propodeum with moderately large punctures, dorso-lateral area similarly punctate at its posterior two-thirds, anterior third being impunctate; first abdominal tergite with a weak antero-median tubercle, surface with moderate sized punctures; second tergite sparsely punctate; second sternite with a weak median tubercle near the base.

Variations: The paired light red spots on the abdominal tergites highly varying. In one specimen (Image 5), 3rd, 4th & 5th tergites with paired spots. In another specimen (Image 3), 2nd & 3rd with paired spots. In yet another specimen (Image 6), 2nd & 3rd with paired spots but the spot on second tergite highly reduced.

Distribution: India: Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Diu (new record), Karnataka, Kerala, Maharashtra, Manipur, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh and West Bengal. *Elsewhere:* Sri Lanka.

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PLATE - I

Micromeriella marginella marginella (Klug) Female



1. Body profile



2. Head frontal view

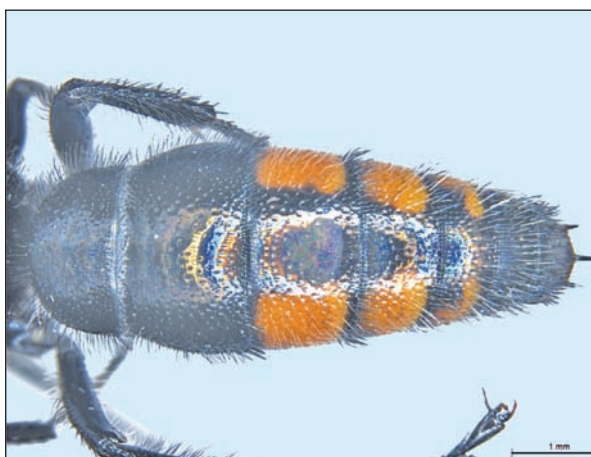
Scolia (Discolia) binotata binotata Fabricius Male



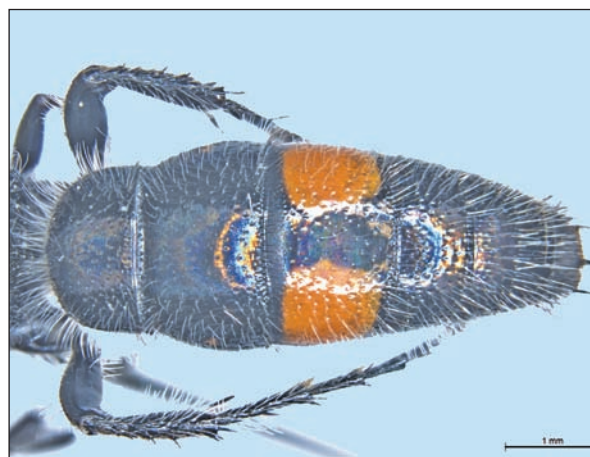
3. Body profile



4. Head frontal view



5. Abdomen in different specimens



6. Abdomen in different specimens

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