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COMPUTERISED DATA ON NATIONAL ZOOLOGICAL COLLECTION

The National Zoological Collections comprising nearly 15,000 types are housed in the Zoological Survey of India, Calcutta and are properly maintained. All these specimens have Registration numbers and are readily available for study as and when required. Data pertaining to locality, date of collection, name of collector, sex, up to date valid species name, name of the host (for parasite) etc., of each *type of collection* have already been computerised. The computerised data are stored in the computer centre of Zoological Survey of India. Scientists/Naturalists interested for any information on type species present in Zoological Survey of India may contact the *Director, Zoological Survey of India, 'M' Block, New Alipore, Kolkata-700 053.*

Dr. J. R. B. ALFRED

Director

Zoological Survey of India

AN APPEAL

In order to enrich the “*National Zoological Collection*” (NZC) and to up date information on the occurrence and distribution of animal species in India Scientists/Naturalists and researchers working on animal taxonomy/systematics are requested to deposit their identified specimens to the Zoological Survey of India at the following address :

Officer in Charge, Identification and Advisory Section,
Zoological Survey of India, 2nd M. S. O. Building, Nizam Palace,
234/4, A. J. C. Bose Road, Kolkata-700 020.

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

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



Rec. zool. Surv. India : **105** (Part 1–2) : 1-4, 2005

MOLLUSCAN EGG CAPSULES FROM DIGHA BEACH

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Zoological Survey of India, New Alipore, M-Block, Kolkata-700 053

INTRODUCTION

During the course of investigation on marine invertebrates of Digha coast of West Bengal and adjoining areas, the authors came across a good number of molluscan egg capsules of different varieties, majorities of which are identified as gastropod egg capsules and few egg capsules of cephalopods.

Bharati Goswami (1992) first described the marine invertebrates from Digha coast of West Bengal. But there is no mention on occurrence of egg capsules from this beach, however few of the molluscan egg capsules described by Subba Rao *et al.*, (1995) from Hugli-Matla estuary of West Bengal.

Gravelly (1942) described a number of gastropod egg capsules from Madras beach, few of those were unidentified. Chhapgar (1991) also mentioned few molluscan egg cases from Indian coast.

The present paper based on the observation, collection and captive study (1996–2003) on 14 types of molluscan egg capsules.

STUDY AREAS

The geographical position of Digha is between 21° 36' 30" N lat. and 87° 32' E long. The egg capsules are collected chiefly from lower range of intertidal zone of Digha beach including mudflat area near Digha mohana and New Digha upto West Bengal-Orissa border and also from extended part of the beach upto Jaldha khoti, accrossing Shankarpur beach on east.

MATERIALS AND METHODS

The collection, observation and study of the specimen during this work were made by multidisciplinary way viz.,

*Sunderban Field Research Station, Zoological Survey of India, Canning

**Champsara Satish Chandra Vidyaniketan, Baidyabati, Hooghly

1. Collection of specimens from drag net during offshore netting.
2. From discarded bycatch materials of dragnet and trawl net.
3. Collections from “Bagda net” (triangular bag net exclusively made for fishing post larva of tiger prawn).
4. Collection from actual site of egg laying during across and vertical survey of shore in different tidal times from intertidal zone and mudflat areas.
5. Freshly layed eggs are also collected during captive study of respective species in laboratory.

Collected egg capsules are fixed and preserved in 4% formalin solution after removing sand particles by washing with sea water.

RESULT AND DISCUSSION

A total of 18 varieties of molluscan egg capsules are collected (Figs. 1-18) of which 14 are identified.

List of the species of molluscan egg-capsules, their habitat and seasonal occurrence (on the basis of the ovservation during study period) are shown in Table-1.

From recent survey on occurrence of varieties of egg-capsules from this areas, it is revealed that majorities are obtained during December to March and occationally found in between October-April. But no examples are obtained during May-September.

From this observation it is assumed that majorities of the species congregate to spawn at this estuarine zone during December to March.

Table 1.

Fig.	Species of Egg capsules	Locality	Habitat	Seasonal occurrence
1.	<i>Natica</i> sp.	Entire Digha Coast	Intertidal	October–April
2.	<i>Polinices</i> sp.	Digha Mohona	Mudflat areas	October–April
3.	<i>Murex</i> sp.	Aquarium (Hospital) Ghat	Found attached on the surface of dry coconut	January–March
4.	<i>Conus</i> sp.	New Digha Ghat	On a wooden piece	January–March
5.	<i>Pugilinus</i> sp.	Digha Mohona	Mudflat areas	November–March
6.	<i>Cymbium melo.</i>	Old Digha beach	Collected from bycatch material of fishing net	December–February

Table 1. (Cont'd.).

Fig.	Species of Egg capsules	Locality	Habitat	Seasonal occurrence
7.	<i>Acrilla</i> sp.	Digha Mohona	Intertidal zone	November–March
8.	<i>Onchidium</i> sp.	New Digha Ghat	Collected from fishing net	February–March
9.	<i>Nassarius</i> sp.	–do–	–do–	November–March
10.	<i>Melanochlamys</i> sp.*	Aquarium/Hospital Ghat	Intertidal zone	December–March
11.	<i>Cymia</i> sp.	–do–	Intertidal zone	December–March
12.	<i>Loliolus investigatoris</i>	–do–	Found to attached in cluster (5-7 capsules) with sand particles by thread like extention from each capsule	December–March
13.	<i>Sepiella inermis</i>	–do–	From fishing net	December–March
14.	<i>Sepia</i> sp.	–do–	From fishing net	December–March
15-18.	Unidentified	–do–	From fishing net	December–March

*Collected during captive study at Marine Aquarium & Research Centre, ZSI, Digha.

ACKNOWLEDGEMENT

Authors are grateful to Dr. J.R.B. Alfred, Director, Zoological Survey of India, Dr. T.K. Chatterjee, Officer-in-Charge, Zoological Survey of India, Digha, for providing facilities for the work and Sri Shankar Talukdar, Zoological Survey of India for his help for specimen collection and captive study.

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- Subba Rao, N. V., Dey, A. and Barua, S. 1995. Molluscs. *Hugli-Matla Estuary, Estuarine Ecosystem Series*, No. **2** : 41-91. *Zool. Surv. India*.

PLATE I



Fig. 1 : Sand collar (Egg case of *Natica* sp.)



Fig. 2 : Egg case of *Polinices* sp.



Fig. 3 : Egg-capsules of *Murex* sp.



Fig. 4b : Number of eggs inside the single egg-capsule of *Conus* sp.



Fig. 4a : Egg-capsules of *Conus* sp.

PLATE II



Fig. 5 : Egg case of *Pugilinus* sp.

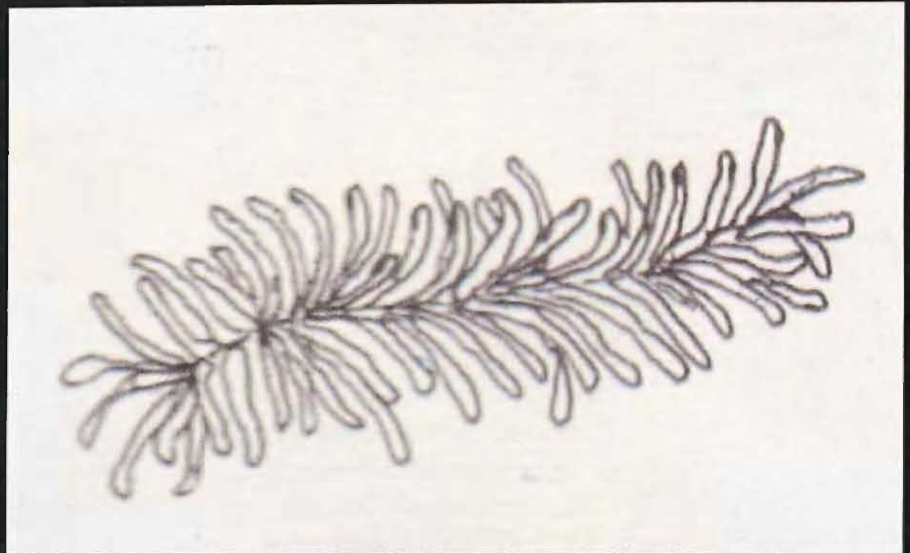


Fig. 6 : Sea pineapple (Egg-mass of *Cymbium melo*)



Fig. 7 : Egg-case of *Acrilla*

PLATE III



Fig. 8 : Egg-ribbon of *Onchidium* sp.



Fig. 9 : Egg-capsules of *Nassarius* sp.

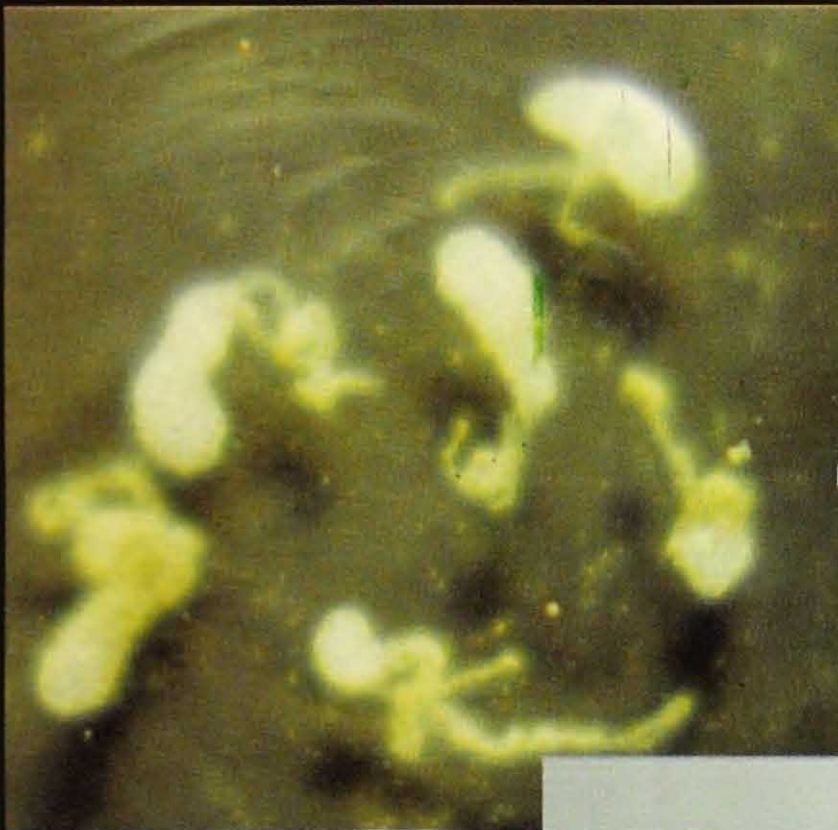


Fig. 10 : Egg capsules of *Melanochlamys* sp.



Fig. 11 : Egg-capsule of *Cymia* sp.

PLATE IV



Fig. 12 : Egg-cases of *Loliolus investigatoris* with juveniles inside each.



Fig. 13 : Egg-capsule of *Sepiella innermis* with single juvenile inside each.



Fig. 14 : Egg-capsule of *Sepia* sp. with single juvenile inside each.

PLATE V



15



16

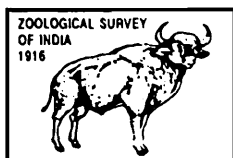


17



18

Fig. 15-18 : Unidentified egg capsules, collected from Digha beach.



Rec. zool. Surv. India : **105** (Part 1–2) : 5-24, 2005

AQUATIC AND SEMI-AQUATIC HEMIPTERA (HETEROPTERA : INSECTA) OF KARAIKAL AND PONDICHERRY

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INTRODUCTION

The information available on aquatic and semi-aquatic Hemiptera indicate that not much is known about the group from Karaikal and Pondicherry except for recording a few species by Distant (1903, 06, 10b). While studying Gerromorpha of India, Thirumalai (2002) recorded 7 species accommodated under 3 families. The present study material has been collected from diverse habitats such as ponds, pools, puddles, river and other wetlands of the State collected by the Southern Regional Station of Zoological Survey of India during 1991-1992. In the present report the authors have studied 20 species and 15 genera accommodated under 9 families. The descriptive account of each species includes the synonymy, other accompanying work necessary to understand the taxon, the diagnostic characters and the details of their distribution. A key to the families of aquatic and semi aquatic Hemiptera from Karaikal and Pondicherry so far known is also given. A systematic index is provided below to all the species so far known.

KEY TO THE FAMILIES OF AQUATIC AND SEMI-AQUATIC HETEROPTERA OF PONDICHERRY STATE

1. Antenna conspicuous and visible in dorsal view; inserted in front of eyes, and longer than head; lives on the surface of water, walking or skating; wingless & winged forms (semi-aquatic) 2
- Antenna hidden, not visible in dorsal view; very much shorter than head; lives in submerged water; always winged forms... (aquatic) 4
2. Claws of atleast front tarsi inserted before its tip; hind femora long, surpassing end of abdomen GERRIDAE
- Claws of all legs inserted at the tip; hind femora short, never surpassing end of abdomen 3

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3. Stick like insect with thread liked legs, body long, head as long as entire thorax; antenna and legs thread like, always winged form, simple ovipositor and not saw like
..... HYDROMETRIDAE
- Small, slender, body short, head shorter than thorax; antenna and legs not thread like, saw like ovipositor, winged and wingless forms MESOVELIIDAE
4. Rostrum short, triangular, not distinctly segmented; front tarsi single segmented, scoop-like, fringed with setae CORIXIDAE
- Rostrum long, cylindrical, distinctly segmented; fore tarsi one or more segmented, simple without setae 5
5. Oblong, oval or elongate forms without abdominal appendages, swims upside down 6
- Flattened forms with or without abdominal appendages, swims normally with back towards the water surface 7
6. Elongate forms with long ore-like hind legs; hind tibia and tarsi ciliated, abdomen with a mid ventral keel NOTONECTIDAE
- Oval forms, all legs simple and alike, hind tibia and tarsi not ciliated, abdominal ventral with out keel PLEIDAE
7. Tip of the abdomen without a long and slender siphon;a distinctive pair of flat retractile strap-like appendages at the apex of abdomen; size ranges from 15 to 100 mm
..... BELOSTOMATIDAE
- No distinctive appendages at the apex of abdomen; fore leg raptorial, size less than 15 mm
..... *Naucoridae*

A SYSTEMATIC INDEX TO THE AQUATIC AND SEMI-AQUATIC HEMIPTERA OF KARAIKAL AND PONDICHERRY

Class INSECTA
Order HEMIPTERA
Suborder HETEROPTERA
Infraorder NEPOMORPHA (Aquatic)
Family CORIXIDAE
Subfamily CORIXINAE
Tribe Agraptocorixini

1. **Agraptocorixa* (*Agraptocorixa*) *hyalinipennis* (Fabricius)

Family PLEIDAE

2. *Paraplea frontalis* (Fieber)
3. *Paraplea buenoi* Kirkaldy

Family NOTONECTIDAE

Subfamily NOTONECTINAE

Tribe Nychiini

4. **Nychia sappho* Kirkaldy

Subfamily ANISOPINAE

Tribe Anisopini

5. **Anisops bouvieri* Kirkaldy
6. **Anisops cavifrons* Brooks

Family NEPIDAE

Subfamily NEPINAE

Tribe Nepini

7. **Laccotrephes griseus* (Guerin)
8. **Laccotrephes ruber* (Linnaeus)

Subfamily RANATRINAE

Tribe Ranatrini

9. *Ranatra elongata* Fabricius
10. **Ranatra filiformis* Fabricius
11. **Ranatra varipes* Stål

Family BELOSTOMATIDAE

Subfamily BELOSTOMATINAE

12. **Diplonychus rusticus* (Fabricius)

Family NAUCORIDAE

Subfamily NAUCORINAE

13. *Naucoris scutellaris* Stål

INFRAORDER GERROMORPHA (Semi-aquatic)

Family MESOVELIIDAE

Subfamily Mesoveliinae

14. **Mesovelia vittigera* Horvath

Family GERRIDAE

Subfamily GERRINAE

Tribe **Gerrini**

15. **Limnogonus (Limnogonus) fossarum fossarum* (Fabricius)

16. *Limnometra fluviorum* (Fabricius)

17. **Neogerris parvula* (Stål)

Subfamily RHAGADOTARSINAE

18. **Rhagadotarsus (Rhagadotarsus) kraepelini* Breddin

Subfamily TREPOBATINAE

Tribe **Naboandelini**

19. **Naboandelus signatus* Distant

Family HYDROMETRIDAE

Subfamily HYDROMETRINAE

20. **Hydrometra greeni* Kirkaldy, 1898.

*Species actually collected.

SYSTEMATIC ACCOUNT

Family CORIXIDAE

Subfamily CORIXINAE

1. *Agraptocorixa (Agraptocorixa) hyalinipennis* (Fabricius)

1803. *Sigara hyalinipennis* Fabricius, Syst. Rhyn Brusvigae, 105.

1926. *Agraptocorixa hyalinipennis* (Fabricius) : Jaczewski, Ann. Zool. Mus. Polon. Warsaw, 5 : 18.

1989. *Agraptocorixa hyalinipennis* (Fabricius) : Thirumalai, Rec. zool. Surv. India, Occ. Pap. No. 18 : 11.

1994. *Agraptocorixa hyalinipennis* (Fabricius) : Thirumalai, Rec. zool. Surv. India, Occ. Pap. No. 165 : 8.

This species can be very easily recognized by its uniform hyaline brown coloration, unmarked elytra and pronotum. The abdominal sixth dorsum bearing the strigil, produced backwards as a well-defined peduncle (Fig. 2A). *A. hyalinipennis* is the only species of the genus so far known from India and commonly found to inhabit the ditches, puddles and stagnant pools in various parts of the country including Eastern and Western Ghats.

Material examined : 13♂, 23♀ and 6 immature stages from Ammankulam, Kombakkam, Pondicherry, 25.III.1992, Coll. K. R. Rao.

Distribution : India; Myanmar; New Guinea; Pakistan; Taiwan.

Family PLEIDAE

2. *Paraplea buenoi* Kirkaldy

1904. *Plea buenoi* Kirkaldy, *Wien. Ent. Zeit.*, **28** : 128.
1910b. *Plea buenoi* Kirkaldy : Distant, *Fauna British India*, **5** : 48.
1933. *Plea buenoi* Kirkaldy : Lundblad, *Arch. Hydrobiol. Suppl.*, **12** : 126.
1844. *Paraplea frontalis* (Fieber) : Thirumalai. 1999, *IAAB*, **7** : 34.

P. buenoi is almost entirely confined to Pondicherry state and not so far recorded outside this State. The body is strongly rather coarsely punctate; head with a very short longitudinal streak, like a spot on the front.

Distribution : India : Pondicherry.

3. *Paraplea frontalis* (Fieber)

1844. *Plea frontalis* Fieber, *Entomologische Monographien, Leipzig*, **18**.
1947. *P. (Paraplea) frontalis* (Fieber) : Hafiz & Pradhan, *Rec. Indian Mus.*, **45** : 349.
1910b. *Plea pelopea* Distant, *Fauna British India*, **5** : 336.
1999. *Paraplea frontalis* (Fieber) : Thirumalai. *IAAB*, **7** : 34.

The head with a small dark reddish-brown longitudinal stripe. Elytra with very fine hairs, coarsely and reticulately punctate; thoracic keels with spine like protuberance. This species is restricted to Oriental region. In India *P. frontalis* is recorded from Andaman & Nicobar Islands, Bihar, Orissa, Pondicherry, Tamil Nadu, Uttar Pradesh and West Bengal.

Distribution : India; China; Indonesia; Malaysia; Taiwan.

Family NOTONECTIDAE

Subfamily NOTONECTINAE

4. *Nychia sappho* Kirkaldy

1901. *Nychia sappho* Kirkaldy, *Ann. Mus. Genova*, **15** : 809.
1985. *Nychia sappho* Kirkaldy : Lansbury, *Beagle*, **2** : 4.

1991. *Nychia sappho* Kirkaldy : Nieser & Chen, *Tijdschrift Voor Entomol.*, **134** : 64.
 1910b. *Nychia marshalli* (Scott, 1872) : Distant, *Fauna British India*, **5** : 334.
 2001. *Nychia prox marshalli* (Scott) : Thirumalai, *Fauna of conservation area*, **11** : 116.
 1933. *Nychia malayana* Lundblad, *Arch. Hydrobiol. Suppl.*, **12** : 148.

This genus is with only a few, poorly known species. The species can easily be identified by the structure of the eyes, which is united basally (Fig. 2B). The fore tarsus in male is two segmented.

Material examined : 1 ♂, from a pond at Mulliar, near T. R. Pattinam, Karaikal, 23.III.1992, Coll. K. R. Rao.

Distribution : India, Australia; Indonesia; Malaysia; New Guinea; Sri Lanka.

Remarks : *Nychia marshalli* (Scott) is strictly African species and the Indian species must be called *Nychia sappho* Kirkaldy. *N. infusata* Paiva is a synonym (Polhemus, 1998 – personal communication).

Subfamily ANISOPINAE

5. *Anisops bouvieri* Kirkaldy

1904. *Anisops bouvieri* Kirkaldy, *Wiener Ent. Zeit.*, **23** : 116.
 1951. *Anisops bouvieri* Kirkaldy : Brooks, *Kans univ. Sci. Bull.*, **34** : 430.
 1989. *Anisops bouvieri* Kirkaldy : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. **118** : 23.

The male of *A. bouvieri* have more or less acuminate and longer cephalic projection that extends one fifth of its ventral length beyond the anterior margin of the eyes (Fig. 3C). The chaetotoxy of male fore femur is as in Fig. 3D. This is one of the most common species of the genus found in India. The habitat includes freshwater pools, lakes, ponds, and forest streams.

Material examined : 2 ♂, from Thengaithittu, 19.III.92; 1 ♂, 2 ♀ & 2 immature stages from Ammankulam, Kombakkam, 25.III.1992; 1 ♂, from Nadukolam, Bahor, Pondicherry, 26.III.1992, Coll. K. R. Rao.

Distribution : India; Bangladesh; China; Malaysia; Myanmar; New Guinea; Thailand.

6. *Anisops cavifrons* Brooks

1951. *Anisops cavifrons* Brooks, *Kans. Univ. Sci. Bull.*, **34** : 418.
 1989. *Anisops cavifrons* Brooks : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. **118** : 24.
 1989. *Anisops cavifrons* Brooks : Thirumalai, 1994, *Rec. zool. Surv. India, Occ. Pap.* No. **165** : 16.

The cephalic horn of this species is as in Fig. 3A. The male of *A. cavifrons* have a procumbent spine (Fig. 3B) on the fore tibia and there are three closely arranged small setae near the base of tarsus. This species is also recorded from backwaters.

Material examined : 1 ♂, from Nadukolam, Bahor, Pondicherry, 26.III.1992, Coll. K. R. Rao.

Distribution : India; Pakistan.

Family NEPIDAE

Subfamily NEPINAE

7. *Laccotrephes griseus* (Guerin)

1844. *Nepa griseus* Guerin, Mexeville, *Iconoogr. Regne. Anim. Ins.*, 352.
1910b. *Laccotrephes griseus* (Guerin) : Distant, *Fauna British India*, 5 : 314.
1988. *Laccotrephes griseus* (Guerin) : Ravishankar and Venkatesan, *Entomon*, 13 : 227.
1989. *Laccotrephes griseus* (Guerin) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 118 : 28.
1994. *Laccotrephes griseus* (Guerin) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 165 : 21.

This species can be identified by the presence of slightly hooked and symmetrical parameres, abdominal appendages shorter than the body, presence of an obtusely rounded tooth at the base of the anterior femora. This species is commonly found in Peninsular India. It is a very sluggish species often found under weeds or at the bottom of slow or stagnant waters.

Material examined : 2♂, from Sankaraparani River, Villandor, 20.III.1992; 1♀, from a pond at Mulliar, near T. R. Pattinam (Karaikal), 23.III.1992; 1♂, from Velarampet, 25.III.1992, Coll. K. R. Rao.

Distribution : India; Malaysia; Myanmar; Seychelles; Sri Lanka; Thailand.

8. *Laccotrephes ruber* (Linnaeus)

1764. *Nepa ruber* Linnaeus, *Mus. Lud. ulr.*, 165.
1906. *Laccotrephes ruber* (Linnaeus) : Distant, *Fauna British India*, 3 : 18.
1989. *Laccotrephes ruber* (Linnaeus) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 118 : 29.
1994. *Laccotrephes ruber* (Linnaeus) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 165 : 22.

This is a common species with wide distribution in the Indo – Australian region and is largely found in habitats like rivers, streams, tanks, *etc.* The abdominal appendices are distinctly longer than the body, the prosternum is convex in the middle and has a curved and hook shaped male paramere.

Material examined : 2♀, from a pond at Mulliar, near T. R. Pattinam, Karaikal, 23.III.1992; 2♂, 1♀, from Kuyavansavdi, 23.III.1992; 1♂, from Kanapettai pond, 25.III.1992, Coll. K. R. Rao.

Distribution : India; China; Japan; Nepal; Pakistan; Taiwan.

Subfamily RANATRINAE

9. *Ranatra elongata* Fabricius

1790. *Ranatra elongata* Fabricius, *Skrif. Nat. Selesk.*, 1 : 228.
1906. *Ranatra elongata* Fabricius : Distant, *Fauna British India*, 3 : 20.
1972. *Ranatra elongata* Fabricius : Lansbury, *Trans. R. Ent. Soc. Lond.*, 124 : 306.

1989. *Ranatra elongata* Fabricius : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 118 : 30.

1994. *Ranatra elongata* Fabricius : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 165 : 22.

This genus is cosmopolitan in distribution and contains more than 120 species all over the world. It is reported to be feeding on tadpoles, nymph of mayflies and other aquatic hemipteran groups and during dry seasons it is known to migrate in search of suitable areas. This species can be identified by the structure of the anterior femur, which is provided with a triangular tooth beyond the middle of its length, and the metasternal process, which is sub triangular, and centrally longitudinally foveately sulcate. The forecoxae are two-thirds the length of prothorax and anterior lobe of prothorax less than twice the length of posterior lobe. This species can also be distinguished by large body size (40–60 mm) and the length of the respiratory siphon that is equal or longer than the body.

Distribution : India; Australia; Nepal; Sri Lanka.

10. *Ranatra filiformis* Fabricius

1790. *Ranatra filiformis* Fabricius, *Skrif. Nat. Selesk.*, 1 : 228.

1906. *Ranatra filiformis* Fabricius : Distant, *Fauna British India*, 3 : 21.

1972. *Ranatra filiformis* Fabricius : Lansbury, *Trans. R. Ent. Soc. Lond.*, 124 : 320.

1989. *Ranatra filiformis* Fabricius : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 118 : 31.

1994. *Ranatra filiformis* Fabricius : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 165 : 22.

1997. *Ranatra filiformis* Fabricius : Bal & Basu, *Fauna of Delhi, State Fauna Series*, 6 : 266.

The males of this species can be identified by the absence of a tooth and presence of several small spines on the inner margins of distally hook shaped paramere and presence of wide interocular space. This species is smaller in size (20–30 mm) than *R. elongata*. This species is mostly found among vegetation, fringing the shallower parts of water, clinging to submerged vegetation and feeds on nymphs of dragonflies and mosquito pupae.

Material examined : 1 ♀, from Velarampet, 25.III.1992; 1 ♂, from a pond, Ammankulam, Kombakkam, 25.III.1992.

Distribution : India (Widely distributed); Nepal; Pakistan; Philippines; Sri Lanka.

11. *Ranatra varipes varipes* Stål

1861. *Ranatra varipes* Stål, *Ofvers. K. Vetensk. Akad. Forh.*, 18 : 203.

1972. *Ranatra varipes* Stål, Lansbury, *Trans. R. Ent. Soc. Lond.*, 124 : 316.

1998. *Ranatra varipes varipes* Stål : Nieser & Polhemus, *Amemboa*, 2 : 22.

Small body size 20–33 mm; respiratory siphon shorter than body; fore femora are broad with irregular brown markings. However, the most reliable diagnostic characters are the parameres which is hatchet shaped distally.

Material examined : 1 ♂ and 1 immature stage from Sankaraparani River, Villiandor, 20.III.1992, Coll. K. R. Rao.

Distribution : India; Australia; Indonesia; Malaysia; Myanmar; Taiwan.

Family BELOSTOMATIDAE

Subfamily BELOSTOMATINAE

12. *Diplonychus rusticus* (Fabricius)

1794. *Nepa rustica* Fabricius, *Ent. Syst.*, 4 : 62.
1906. *Sphaerodema rusticus* (Fabricius) : Distant, *Fauna British India*, 3 : 36.
1961. *D. rusticus* (Fabricius) : Lauck & Menke, *Ann. Entomol. Soc. Amer.*, 54 : 649.
1989. *D. rusticus* (Fabricius) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 118 : 28.
1994. *D. rusticus* (Fabricius) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. 165 : 25.
1981. *Diplonychus indicus* Venkatesan & Rao, *J. Bombay nat. Hist. Soc.*, 88 : 299.

D. rusticus can easily be identified by the smaller size (Less than 20 mm), pale lateral basal margins of pronotum, head length is shorter than the width between the eyes, single segmented fore tarsus and a smaller claw. This species commonly found in fishponds and is a voracious feeder on fish larvae. It is also known to feed on a wide variety of aquatic organisms including mosquito larvae.

Material examined : 6♂, 4♀, from Veerampattinam, 19.III.1992, 1 immature stage from Thengaithittu, 19.III.1992; 4♂, 3♀ & 2 immature stages from Neravy, Karaikal, 23.III.1992; 7♂, 4♀ from Kanaapettai pond, 25.III.1992; 2♂, 1♀ from Velarampet, 25.III.1992; 1♀ from Nadukolam, Bahor, 26.III.1992, Coll. K. R. Rao.

Distribution : India; Australia; China; Indonesia; Japan; Malaysia; Myanmar; New Guinea; New Zealand; Sri Lanka; Thailand.

Family NAUCORIDAE

Subfamily NAUCORINAE

13. *Naucoris scutellaris* Stål

1859. *Naucoris scutellaris* Stål, *Kongl. Svenska. Sugenises*, 4 : 266.
1910b. *Naucoris scutellaris* Stål : Distant, *Fauna British India*, 5 : 325.
1933. *Naucoris scutellaris* Stål : Lundblad, *Arch. Hydro Biol. Suppl.*, 12 : 63.
1971. *Naucoris scutellaris* Stål : La Rivers, *Biol. Soc. Nev.*, 72.
1991. *Naucoris scutellaris* Stål : Nieser & Chen, *Tijds., Entomol.*, 134 : 53.
1910b. *Naucoris sordidus* Distant, *Fauna British India*, 5 : 325.
1910b. *N. vividus* Distant, *Fauna British India*, 5 : 326.
1904. *Thurselius greeni* Distant, *Entomologist*, 37 : 259.
1910b. *T. clathratus* Distant, *Fauna British India*, 5 : 327.

The femur (raptorial) is largely enlarged at its inner apical two-thirds; inner margin deeply serrated. *N. scutellaris* (Fig. 2C), a widespread species, found from India to Sri Lanka, Thailand to Indonesia. The genus is poorly known from India.

Distribution : India : (Kerala, Pondicherry, West Bengal); Indonesia; Sri Lanka; Thailand.

Family MESOVELIIDAE

Subfamily MESOVELIINAE

14. *Mesovelgia vittigera* Horvath

1895. *Mesovelgia vittigera* Horvath, *Rev. Entomologie*, **14** : 160.
 1989. *Mesovelgia vittigera* Horvath : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. **118** : 35.
 1994. *Mesovelgia vittigera* Horvath : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. **165** : 28.
 1901. *M. orientalis* Kirkaldy, *Ann. Mus. Civ. Genova*, **20** : 808.
 1933. *M. orientalis* Kirkaldy : Lundblad, *Arch. Hydrobiol. Suppl.*, **12** : 186.
 1903. *M. mulsanti* White : Distant, *Fauna British India*, **2** : 169.
 1980. *M. vittigera* Horvath : Andersen & Polhemus, *Ent. Scand.*, **11** : 290.

The ventral abdominal segment in males possesses a group of median spines (Fig. 4A) and two sets of brush like hairs laterally. The middle femur in females is spiny below. They prefer stagnant or slow running water covered by emergent or floating vegetation.

Material examined : 1 ♀ (apterous) from Thengaithittu, 19.III.1992, Coll : K. R. Rao.

Distribution : India (Very widely distributed); Africa; Australia; Egypt; Indonesia; Malaysia; Palestine; Philippines; Syria; Samoa Islands; Sri Lanka.

Family GERRIDAE

Subfamily GERRINAE

15. *Limnogonus (Limnogonus) fossarum fossarum* (Fabricius)

1775. *Cimex fossarum* Fabricius, *Syst. Ent.*, 727.
 1903. *Gerris fossarum* (Fabricius) : Distant, *Fauna British India*, **2** : 178.
 1868. *Limnogonus fossarum* Stål, *K. Svenska Vetensk. Akad.*, **7** : 133.
 1960. *L. (L.) fossarum* (Fabricius) : Matsuda, *Kans. Univ. Sci. Bull.*, **41** : 198.
 1975. *L. (L.) fossarum* (Fabricius) : Andersen, *Ent. Scand. Suppl.*, **7** : 30.
 1989. *L. (L.) fossarum* (Fabricius) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap.* No. **118** : 40.

A median yellow line on the anterior pronotal lobe extending to its entire length separates this species from all the known species (Fig. 1C). The connexivum does not terminate in a prominent spine. A very common species of Gerrinae in Indo-Australian regions, found in wide variety of habitats including hot springs, brackish pools, from Sea level to about 1000 meters.

Material examined : 2 ♂, 5 ♀ (apterous), 3 ♀ (macropterous) and 5 immature stages from Nadukolam, Bahor, Pondicherry, 26.III.1992, Coll : K. R. Rao.

Distribution : China; Hong Kong; India; Indonesia; Japan; Malaysia; Myanmar; Philippines; Singapore; Taiwan; Thailand; Vietnam.

16. *Limnometra fluviorum* (Fabricius)

1798. *Cimex fluviorum* Fabricius, *Ent. Syst. Suppl.*, 543.
 1903. *Gerris fluviorum* (Fabricius) : Distant, *Fauna British India*, 2 : 177.
 1958. *L. fluviorum* (Fabricius) : Hungerford & Matsuda, *Kans. Univ. Sci. Bull.*, 39 : 401.
 1960. *Tenagogonus (Limnometra) fluviorum* (Fab.) : Matsuda, 1960. *Kans. Univ. Sci. Bull.*, 41 : 206.
 1989. *Tenagogonus (Limnometra) fluviorum* (Fab.) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap. No. 118* : 43.
 1995. *Limnometra fluviorum* (Fab.) : Andersen, *Steenstrupia*, 21 : 118.
 1903. *Gerris armata* Spinola : Distant, *Fauna British India*, 2 : 180.

L. fluviorum can easily be identified by the presence of a spine –like projection on the dorsolateral rear margin of middle coxa (Fig. 1A). This is a very common species found throughout Southern India and also recorded from a wide variety of freshwater habits.

Distribution : India; Philippines; Sri Lanka.

17. *Neogerris parvula* (Stål)

1859. *Gerris parvula* Stål, *Zoology*, 4 : 265.
 1939. *Limnogonus parvulus* (Stål) : Hafiz & Riberio, *Rec. India Mus.*, 41 : 427.
 1958. *L. (Limnogonellus) parvulus* (Stål) : Hungerford & Matsuda, *J. Kans. Ent. Soc.*, 32(1) : 41.
 1960. *L. (Neogerris) parvulus* (Stål) : Matsuda, *Kans. Univ. Sci. Bull.*, 41 : 114.
 1975. *Neogerris parvula* (Stål) : Andersen, *Ent. Scand. Suppl.*, 7 : 86.
 1989. *Neogerris parvula* (Stål) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap. No. 118* : 40.
 1994. *Neogerris parvula* (Stål) : Thirumalai, *Rec. zool. Surv. India, Occ. Pap. No. 165* : 34.
 1903. *G. tristan* Kirkaldy : Distant, *Fauna British India*, 2 : 179.

N. parvula is easily separated from all the known species of this genus by the presence of a large round or quadrangular yellow spot on the pronotum (Fig. 1B). A very common species found, in slow running streams, reservoirs, ponds and rain-fed pools, throughout Indian subcontinent.

Material examined : 1 ♂ (macropterous) from Nadukolam, Bahov, Pondicherry, 26.III.1992, Coll. K. R. Rao.

Distribution : China; India; Indonesia; Iran; Japan; Malaysia; Myanmar; New Guinea; Oman; Pakistan; Philippines; Solomon Island; Sri Lanka; Taiwan; Thailand; Vietnam.

Subfamily RHAGADOTARSINAE

18. *Rhagadotarsus (Rhagadotarsus) kraepelini* (Breddin)

1905. *Rhagadotarsus kraepelini* Breddin, *Mitt. Nat. Mus. Hamburg*, 22 : 137.
 1933. *R. kraepelini* Breddin : Lundblad, *Arch. Hydrobiol. Suppl.*, 12 : 412.
 1960. *R. (Rhagadotarsus) kraepelini* Breddin : Matsuda, *Kans. Univ. Sci. Bull.*, 41 : 322.

1992. *R.. (Rhagadotarsus) kraepelini* Breddin : Anderson & Foster, *J. nat. Hist.*, **26** : 549.
1993. *R.. (Rhagadotarsus) kraepelini* Breddin : Polhemus & Karunaratne, *Bull. Raffles Mus (Zoology)*, **41**(1) : 100.
- 1910a. *Nacebus dux* Distant, *Ann. Mag. Nat. Hist.*, **5** : 153.

The body colour is black. The eighth abdominal segment in males is cylindrical, strongly longitudinally depressed ventrally. The female genitalia is having a well formed saw-like ovipositor (Fig. 1D). This species is always found on the calm surface of ponds and lakes. Anderson & Foster (1992) has recorded *R. kraepelini* on the surface of sheltered ponds of brackish water in Kerala.

Material examined : 1 ♂, 2 ♀ (apterous), 1 immature stage from a pond at Mulliar, near T. R. pattinam, 23.III.1992, Coll. K. R. Rao.

Distribution : China; India; Indonesia; Malaysia; Myanmar.

Subfamily TREPOBATINAE

19. *Naboandelus signatus* Distant

- 1910a. *Naboandelus signatus* Distant, *Ann. Mag. Nat. Hist.*, **5** : 152.
- 1910b. *Naboandelus signatus* Distant, *Fauna British India*, **5** : 164.
1960. *Naboandelus signatus* Distant : Matsuda, *Kans. Univ. Sci. Bull.*, **41** : 357.
2002. *Naboandelus signatus* Distant : Thirumalai, *Rec. zool. Surv. India*, **100** : 71.

Body short and somewhat oval. Size male (apterous) 1.9 to 2.1 mm; female (apterous) 2.1 to 2.4 mm. There is a large black spot surrounded by brownish area on dorsal side of the head (Fig. 1E). Pronotum is with a median yellow spot. Second genital segment with lateral process prominent (Fig. 1F) and the endosoma as in Fig. 1G. This species has been reported from stagnant pond. However, this species was also recorded from a perennial river from South India by the senior author.

Material examined : 4 ♂, 8 ♀ (apterous) from a pond at Mulliar, near T. R. Pattinam, Karaikal, 23.III.1992, Coll. K. R. Rao.

Distribution : India : (Chandigarh, Karnataka, Pondicherry, Tamilnadu, Tripura, Uttar Pradesh, West Bengal).

Family HYDROMETRIDAE

Subfamily HYDROMETRINAE

20. *Hydrometra greeni* Kirkaldy

1898. *Hydrometra greeni* Kirkaldy, *Entomologist*, **31** : 2.
1994. *Hydrometra greeni* Kirkaldy : Thirumalai, *Rec. zool. Surv. India, Occ. Pap. No.* **165** : 29.
1995. *Hydrometra greeni* Kirkaldy : Polhemus & Polhemus, *Bishop. Occ. Pap.*, **43** : 22.
1903. *Hydrometra vittata* (Stål) : Distant, *Fauna British India*, **2** : 170.

Anteclypeus conical, seventh abdominal sternite in male with a deep depression, fringed with short stiff hairs (Fig. 4B). In India this species occurs from near sea level to over 1500 metres elevation. Its habitats include ponds, swampy areas, rocky, up and low land streams, lakes and flooded paddy fields.

Material examined : 2♂ from Thengaithittu, 19.III.1992 : Coll. K. R. Rao.

Distribution : India (Very Widely distributed); Bangladesh; China; Nepal; Sri Lanka; Sumatra; Thailand; Vietnam.

SUMMARY

The aquatic and semi-aquatic Heteroptera of Pondicherry State collected during the state faunal survey undertaken by the Southern Regional Station of Zoological Survey of India during March-April, 1991-1992, was studied in depth. The study revealed the presence of 15 genera and 20 species belonging to 9 families. In addition to the worldwide distribution of each species, brief remarks facilitating identification of taxa is also given. Key to the families is also provided.

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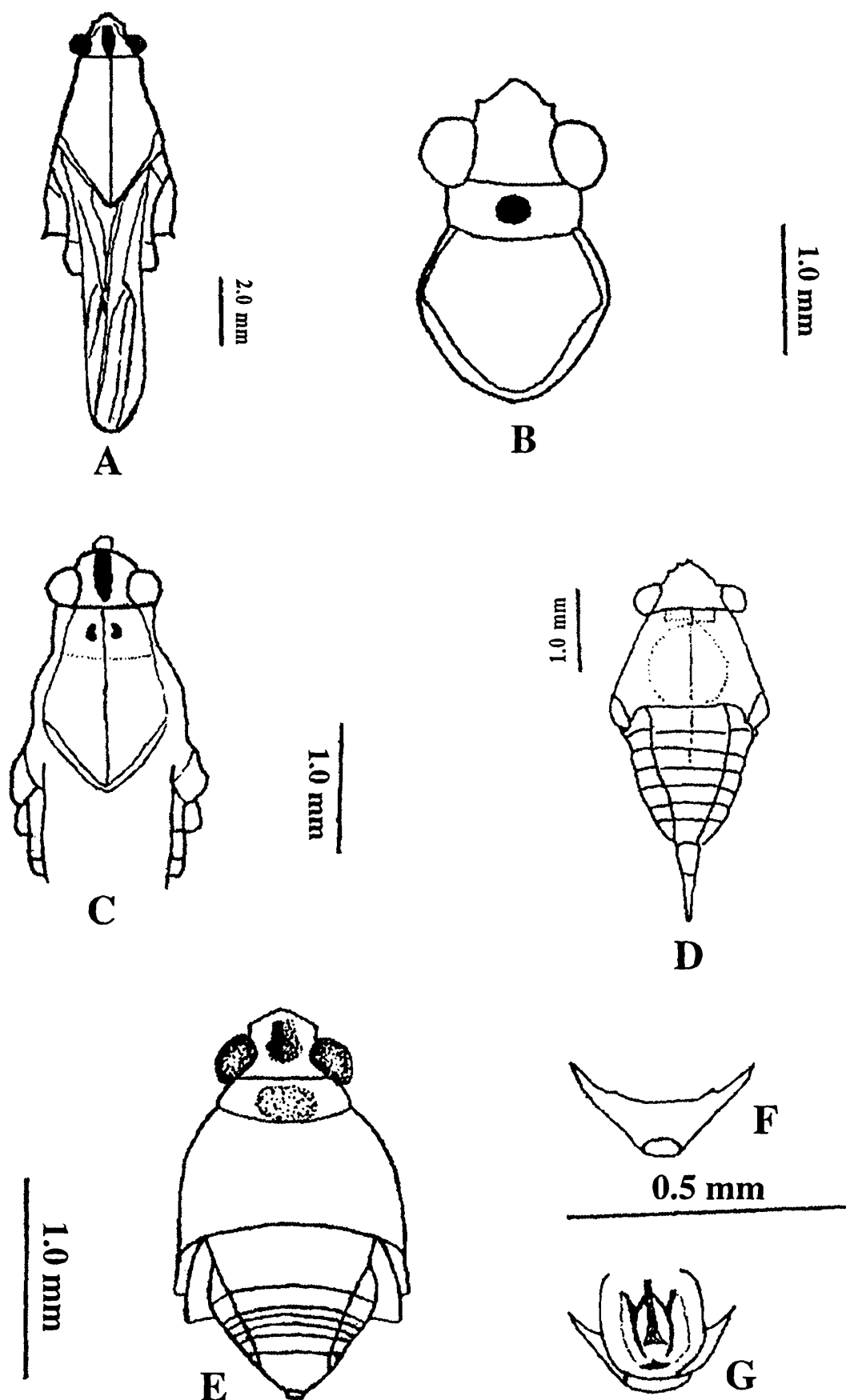


Fig. 1. : (A) *Limnometra fluviorum* (Fabricius)-Winged male; (B) Dorsal view of head and thorax of *Neogerris parvula* (Stål)-Winged male; (C) Dorsal view of head and pronotum of *Limnogonus (L.) fossarum* (Fab.)-Winged female; (D) *Rhagadotarsus (R.) kraepelini* Breddin (Apterous female dorsal view); (E) *Neboandelus signatus* Distant (apterous male dorsal view); (F) Second genital segment of male *N. signatus*; (G) Dorsal view of endosoma of *N. signatus*.

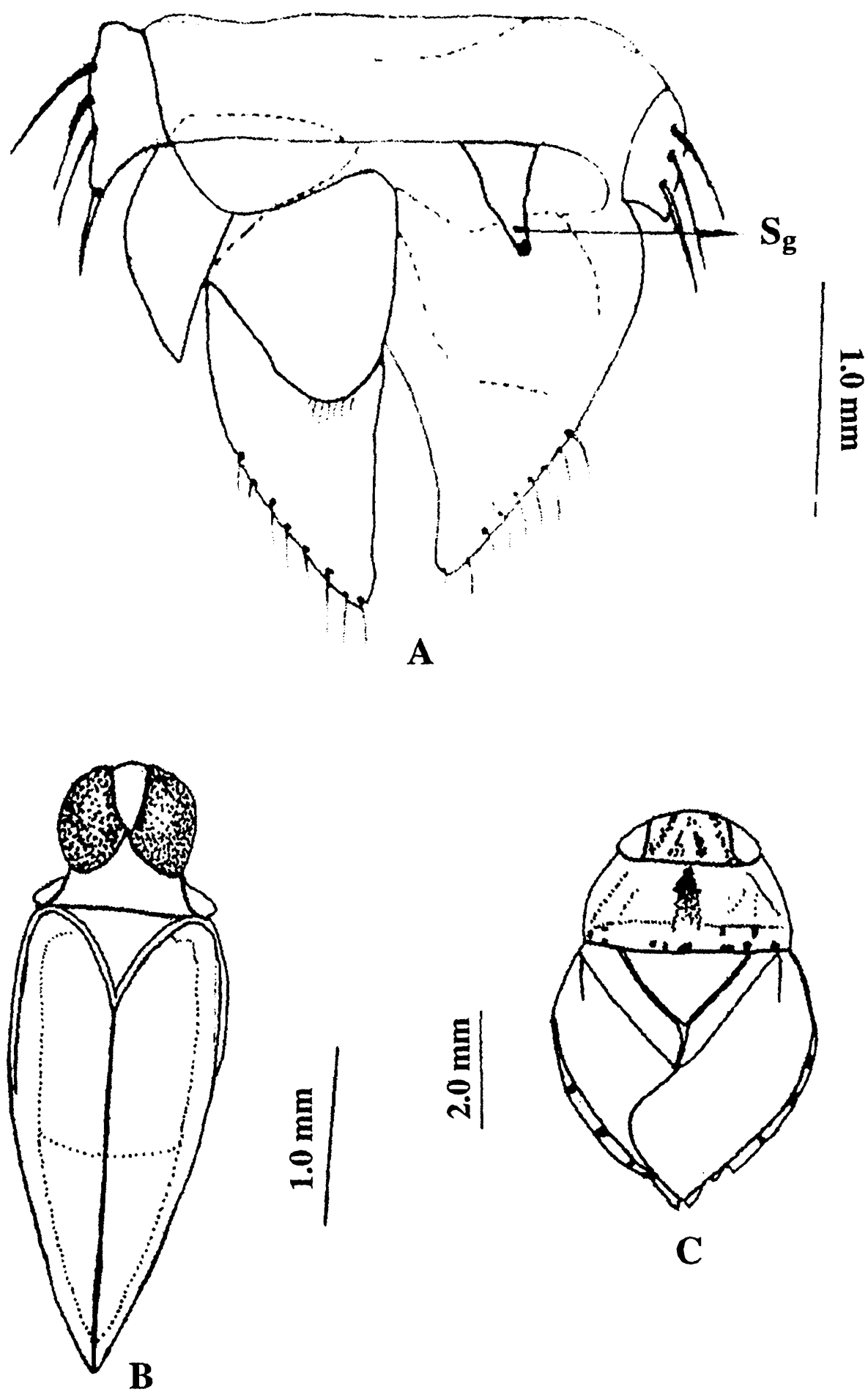


Fig. 2. : (A) *Agraptocorixa (A.) hyalinipennis* (Fab.) sixth to eight dorsal abdominal segments (Sg. Strigil); (B) *Nychia sappho* Kirkaldy-Dorsal view; (C) *Naucoris scutellaris* Stål-Dorsal view.

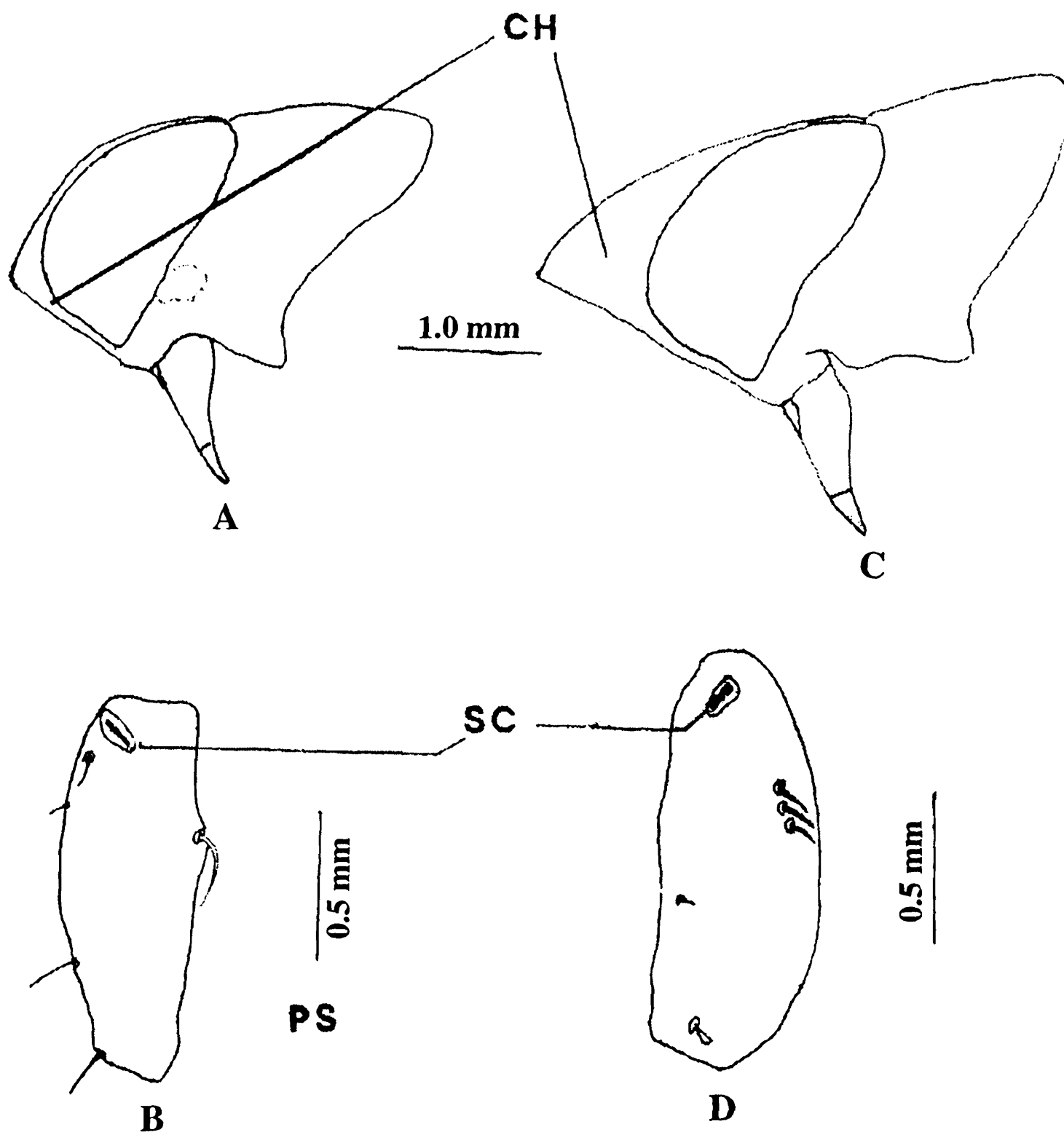


Fig. 3. : (A) *Anisops cavifrons* Brooks Head and pronotum lateral view (CH–Cephalic horn); (B) Male fore femur of *A. cavifrons* Brooks (PS–Procumbent spine; Sc–Stridulatory comb); (C) *Anisops bouvieri* Kirkaldy-Head and pronotum lateral view (CH–Cephalic horn); (D) Male fore femur of *A. bouvieri* Kirkaldy (Sc–Stridulatory comb).

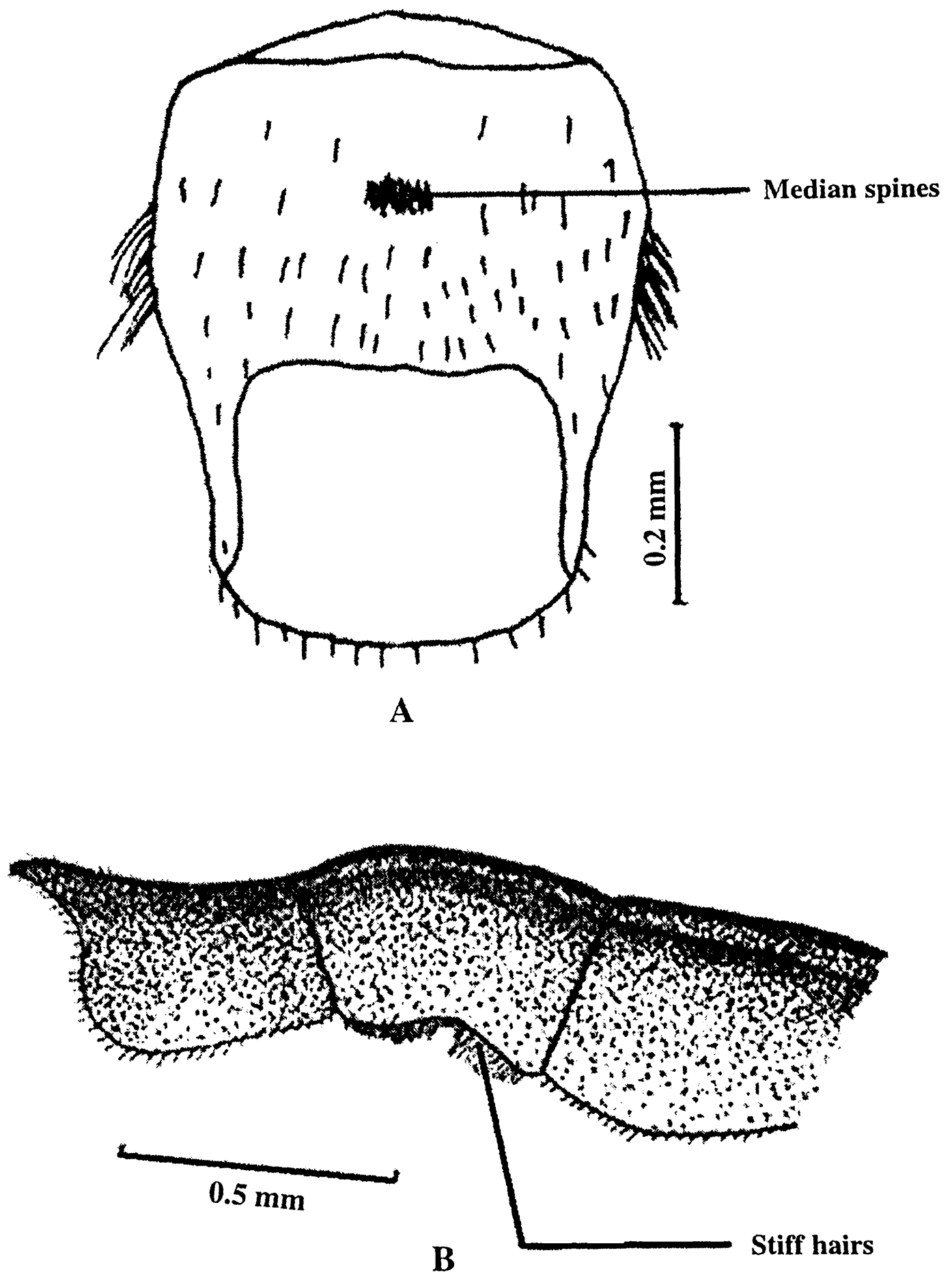
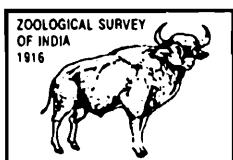


Fig. 4. : (A) *Mesovelis vittiger* Horvath Male abdominal segment-Ventral view; (B) *Hydrometra greeni* Kirkaldy-Male abdominal sternites-Lateral view.



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DISTRIBUTION OF INTERTIDAL MALACOFUNA AT SAGAR ISLAND

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INTRODUCTION

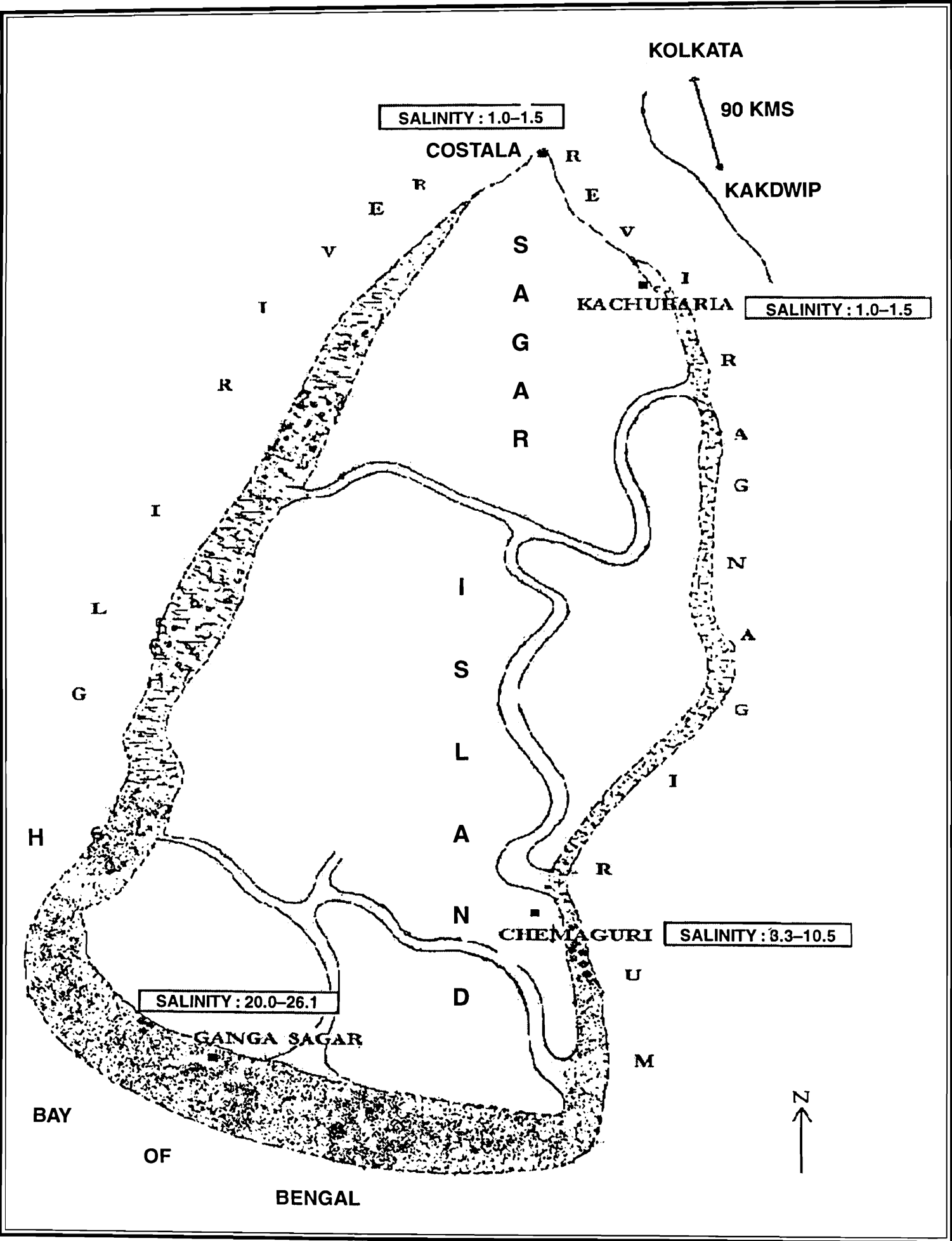
Sagar Island, the largest island of Indian Sunderban is about 105 kms south from the city of Kolkata. It is surrounded by the river Hugli on the north and north-western side and the river Muriganga on the eastern side. The southern part of the island faces the open sea, Bay of Bengal. Its geographical location is between 21°31' N to 21°53' N latitudes and 88°02' E to 88°15' E meridians.

The island has an area of about 300 sq km and is criss-crossed by twelve large and small tidal creeks strewn with mangrove vegetation, all connected with the principal estuarine water bodies, either on the east or on the west coast. Chemaguri creek is the principal creek in this island with flourishing mangrove vegetation at the bank. The island has an old light house on the south-west corner which offers settlement of a variety of bivalve and gastropod species. In addition, mangrove patches present on the southern part of the island are unique beds for *Telescopium telescopium*, *Cerithidea cingulata*, *Cerithidea obtusa* etc. The hard substrata of the broken light house also provide sites for attachment of various molluscan species like *Saccostrea cucullata*, *Thais lacera*, *Littorina scabra scabra* etc. The present article aims to throw light on the molluscan spectrum of the island with relation to major environmental variables like surface water salinity, pH and dilution factor during 2003. These parameters were collected from the data bank of Dept. of Marine Science, University of Calcutta.

MORPHOLOGICAL FEATURES OF THE ISLAND

Sagar Island is the largest island of Indian Sunderban. With a considerable degree of marine characteristics in southern portion of the island, the important morphotype of the island are beaches,

MAP OF SAGAR ISLAND (SHOWING FOUR SELECTED STATIONS)



mud flats, coastal dunes, sand flats, estuaries, creeks, inlets and mangrove swamps. The different morphological features of Sagar Island may be broadly divided into three headings :

- i. Marginal marshy areas above mean tide level.
- ii. Channel and tidal island with intertidal flats and dune areas.
- iii. Subtidal channel areas.

The marginal parts of the island are affected practically all times by wave and tidal currents and are best to depict the details of various morphological and structural characteristics. The sand and silt flats of these zones are sculptured complexly by different types of primary and secondary sedimentary structures. There exists considerable degree of variation of physico-chemical variables as one approach from southern to northern tip of the island (Table I). This is the main cause of malacofaunal diversity witnessed in Sagar Island (Table II).

Four stations were selected to study the distribution of molluscs. These are :

- I. Kachuberia
- II. Costala
- III. Chemaguri
- IV Gangasagar

STATION I : Kachuberia

The station is situated on the northern tip of the island. A passenger jetty present at this station offers the settlement of oysters (*Saccostrea cucullata.*) and gastropods like *Littorina scabra scabra*,

Table I. : Mean seasonal variations of salinity, pH and dilution factor (df) at different sampling station in the Sagar Island during 2003.

Station	Pre monsoon			Monsoon			Post monsoon		
	Salinity (%)	pH	df	Salinity (%)	pH	df	Salinity (%)	pH	df
Sagar light house area (south-western tip of the Sagar Island)	28.2	8.34	0.17	16.8	8.30	0.42	24.1	8.31	0.24
Chemaguri (south-eastern part of the Sagar Island)	23.7	8.21	0.30	10.1	8.20	0.65	19.6	8.22	0.39
Kachuberia (northern most tip of the Sagar Island)	12.8	8.01	0.62	2.5	8.00	0.91	8.8	8.10	0.73

TABLE II. : LIST OF SPECIES OCCURING IN SAGAR ISLAND.

NAME OF THE SPECIES	STATION			
	I	II	III	IV
Gastropoda				
1. <i>Nerita articulata</i> (Gould)	+	—	—	+
2. <i>Pseudonerita sulculosa</i> (von Martens)	+	—	—	+
3. <i>Nerita (Dostia) violacea</i> (Gmelin)	+	+	+	—
4. <i>Littorina (Littorinopsis) scabra scabra</i> (Linnaeus)	+	—	—	+
5. <i>L.(Littoraria) melanostoma</i> Gray	+	+	+	+
6. <i>Stenothyra deltae</i> (Benson)	—	+	+	+
7. <i>Assiminea brevicula</i> Pfeiffer	+	+	+	+
8. <i>A. beddomeana</i> Nevill	+	+	+	+
9. <i>Cerithidea (Cerithideopsis) cingulata</i> (Gmelin)	—	—	+	+
10. <i>Cerithidea (Cerithidea) obtusa</i> (Lamarck)	—	—	+	+
11. <i>Telescopium telescopium</i> (Linnaeus)	—	+	+	+
12. <i>Acrilla acuminata</i> (Sowerby)	—	—	—	+
13. <i>Natica tigrina</i> (Roeding)	+	—	—	+
14. <i>N. gualteriana</i> Recluz	—	—	—	+
15. <i>Thais lacera</i> (Born)	+	—	+	+
16. <i>Nassarius stolatus</i> (Gmelin)	—	—	—	+
17. <i>N. foveolatus</i> (Reeve)	—	—	+	+
18. <i>Amalda ampla</i> (Gmelin)	—	—	—	+
19. <i>Haminea crocata</i> Pease	—	—	—	+
20. <i>Onchidium tenerum</i> (Stoliczka)	—	+	+	—
21. <i>O. tigrinum</i> Stoliczka	+	—	—	—
22. <i>Pythia plicata</i> (Gray)	—	—	—	+
23. <i>Larina burmana</i> Blanford	—	—	—	+
24. <i>Auricula translucens</i> Annandale and Prashad	—	—	—	+
Bivalvia				
1. <i>Crassostrea cuttackensis</i> (Newton and Smith)	—	—	—	+
2. <i>Saccostrea cucullata</i> (Born)	+	—	+	—
3. <i>Sanguinolaria (Soletellina) acuminata</i> (Philippi)	—	—	—	+
4. <i>Strigilla splendida</i> (Anton)	—	—	—	+
5. <i>Macoma birmanica</i> (Philippi)	—	—	+	—
6. <i>Theora opalina</i> (Hind)	—	—	+	+
7. <i>Siliqua albida</i> Dunker	—	+	—	—
8. <i>Meretrix meretrix</i> (Linnaeus)	—	—	—	+
9. <i>Glaucanome sculpta</i> (Sowerby)	—	+	—	+
10. <i>Donax incarnatus</i> Gmelin	—	—	—	+
11. <i>Solen kempfi</i> Preston	—	—	—	+
12. <i>Barnea candida</i> (Linnaeus)	—	—	—	+
13. <i>Bankia rochi</i> Moll	—	—	—	+

Nerita articulata and *Thais lacera* (Pl. IV, figs. C, E). The first two species were dominant in the region. Occasionally empty shells of *Littorina melanostoma*, *Natica tigrina* and *Nerita articulata* inhabited by hermit crabs were also seen. The terrain on either side of the jetty is hard, interspersed with brick pieces, stones etc. and devoid of vegetation. *Onchidium tigrinum* was found crawling on the bricks of this terrain.

STATION II : Costala

The station is situated 3 kms northwest of Kachuberia and the river bank is protected by mud bund. About 0.5 km of bed gets exposed during the low tide. Small patch of mangrove plants locally called as Baen (*Avicennia* sp.) and Haraguja, (*Acanthus illicifolius*) was observed. Most of the bed is covered with grass extending upto mid water mark and gradually decreases towards low water mark.

The terrain is hard to semi-hard between high to mid water mark and semi hard to soft mud between mid to low water mark, intersected by few small creeklets. At the high water mark large numbers of ditches are present, where the water comes only during spring tide.

The dominant malacofauna in this station are *Assiminea brevicula* (Pl. IV, fig. F) that extends from mid to low water mark with gradual increase in numbers and *Telescopium telescopium* found crawling on mud banks along the creeklets and ditches near the bed. The others are *Assiminea beddomeana*, *Stenothyra deltae* and *Onchidium tenerum*.

The mangrove plants often provide shelters to *Littorina melanostoma* which cling to their branches (Pl. IV, fig. B). Bivalve *Glaucanome sculpta*, *Siliqua altida* were collected from exposed bed during the low tide period.

STATION III : Chemaguri

Chemaguri is situated 11 kms northeast of Gangasagar. A creek flowing through this station opens into the main river. The banks of the creek are studded with mangrove vegetation all along upto the river mouth, with salt marsh grass patches (*Porteratia coarctata*) from mid to low water mark. The terrain is hard to semi hard with loose slushy patches at the low water marks. The common malacofauna are *Assiminea brevicula*, *Assiminea beddomeana*, *Telescopium telescopium*, *Cerithidea cingulata*, *Cerithidea obtusa*, *Littorina melanostoma*, *Stenothyra deltae*, *Onchidium tenerum*. Among them *Cerithidea obtusa* and *Littoraria melanostoma* found clinging to the branches of mangrove trees.

The jetty pilers are thickly coated with sea anemones (*Metridium* sp.) barnacles, oysters (*Saccostrea cucullata*), *Littorina scabra scabra* and *Thais lacera*.

The mud flats of creek near the river mouth get exposed during the spring tides. The substratum consists of very loose mud with slushy pockets, criss-crossed by small creeklets. The slushy pockets are knee-deep to waist deep. The malacofauna on the mudflat in order of dominance are *Cerithidea cingulata* > *Telescopium telescopium* > *Theora opalina* > *Macoma birmanica* > *Nassarius foveolatus*. The first two species were concentrated in the centre of the mud flat, whereas the last three near the bank. The two bivalve species were found to occur at a depth of 10–30 cms in the slushy pockets. Presence of *Macoma birmanica* inside the burrows, were indicated by their protruding siphon that spread out on the slushy mud surface.

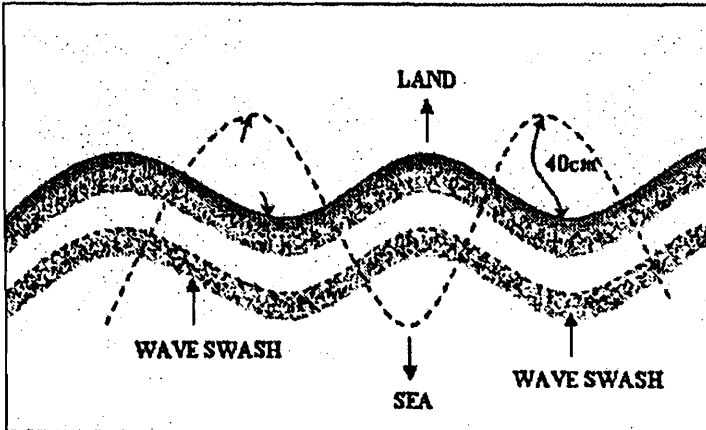
STATION IV : Gangasagar

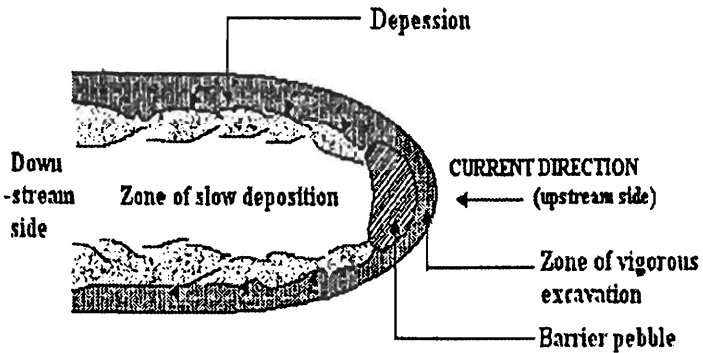
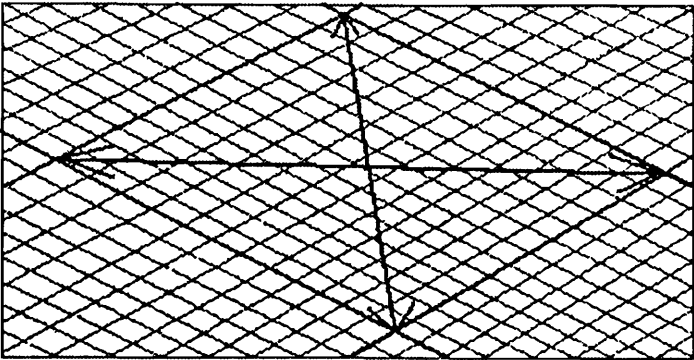
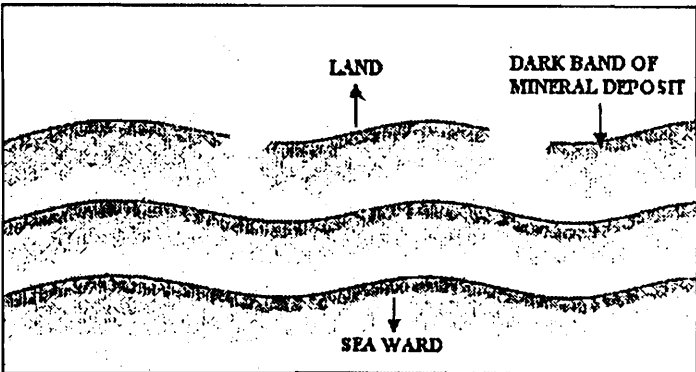
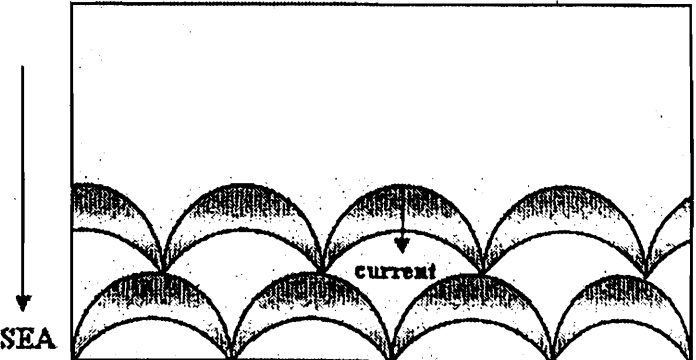
This is the southern tip of the island facing the Bay of Bengal. The beach is confined between two river mouths. A creek runs into the sea about 0.5 kms east of the Irrigation Bungalow, which flows north-west after separating in two branches. For a better scanning of the ambient environment, the area was grouped into three zones :

- A. Gangasagar beach
- B. The creek and their branches
- C. Mangrove forest

A. Gangasagar beach

The beach is mostly sandy admixed with fine mud and interspersed with mudflats. There are many surface structures recorded in the Gangasagar beach.

Surface structures in the Gangasagar beach	Description	Diagrammatic representation
Swash Mark	They are thin wavy ridge lines in the intertidal swash zone formed by upward movement of the wave swash. The forward edge of the wave tends to carry particles of sand and silt, sizes along with the caught up debris by the process of surface tension.	 SWASH MARK

Current crescent	They are V-shaped marks produced by currents against shell of organisms or clay pellets placed on the intertidal ridges. These broaden in the direction of flow and are produced by the back flow of tidal currents.	 CURRENT CRESCENT
Rhombic ripple marks	These are diamond shaped structures that develop in the swash zone of the intertidal ridges. These structures are developed by back-wash wave where the slope of the beach face is relatively steep.	 RHOMBOID MARKS
Backwash ripples	They are symmetrical structures which migrate down slope by wave backwash. The crestal part of the ripples becomes flat by backwash.	 BACKWASH RIPPLE
Crescentic ripples	These are cusped-shaped structure and lunate or linguoid in nature. The concave faces are toward the sea and convex sides are toward the land.	 CRESCENTIC RIPPLE

Besides these there are sand dykes of variable thickness, which are transgressive into parallel laminations in many areas of swash zone of the Gangasagar.

Air temperature : 25–36°C

Soil temperature : 26–35.5°C

Salinity : 18.6‰–29.2‰

Dissolve oxygen : 0.4–3.9 ml/l

For the study of the malacofauna three zones have been identified on the beach :

- a. **Supralittoral zone**
- b. **Littoral zone**
- c. **Eulittoral zone**

Supralittoral zone is mainly sandy with sand dunes extending upto the Kapilmuni temple. Beyond the temple there are hard mudflats. *Ipomoea pescaprae*, the common sand binders are found on the sand dunes and on the west of the mangrove forest. The region between high to mid water marks is sandy towards east and interspersed by mud flats in the west. The terrain is semi hard on sandy patches due to admixture of silt with sand. The mud flats are hard, slippery, corrugated and criss-crossed with small canals. Several dead shells are observed at mangrove vegetation and their roots. The mudflats near the mid water mark support few population of *Glaucanome sculpta*. Further down towards low water mark beach is hard to semi hard with patches of mudflats between. During spring tides a vast area of the beach is exposed, often extending for about a kilometer from supralittoral zone. The malacofauna observed are *Nassarius stolatus*, *Natica tigrina*, *Natica gualteriana*. Occasionally *Acrilla acuminata*, *Amalda ampla*, *Donax incarnatus* are also observed. The mudflats support rich population of *Barnea candida*, *Glaucanome sculpta*, *Solen kempii*, *Strigilla splendida* and *Theora opalina*. The mangrove swamps on the mud flats are inhabited by *Littorina scabra scabra*, *Larina burmana* and oysters (*Saccostrea cucullata*).

B. The Creek and their branches at Gangasagar

The creek has a wider mouth opening in the sea. The mouth is shallow and sandy; upstream the banks are steeper and muddy supporting mangrove vegetation.

The malacofauna near the mouth includes *Cerithidea cingulata*, *Nassarius stolatus*, *Meretrix meretrix*. The banks of the creek are inhabited by *Assimineia brevicula*, *Assimineia beddomeana* and *Haminea crocata*. Small population of *Littorina melanostoma* is found clinging to the plants on the bank. In the upper most part of creek where the water remains in ditches *Pseudonerita sulculosa* is also seen.

Table III. : Showing different ecological niches with dominant malacofauna

MUD BANKS AND MUD FLATS	MANGROVE FOREST	SANDY BEACH	MUD FLAT ON THE BEACH	JETTY, PILES, MANGROVE STEM AND DYKES
1. <i>Assiminea brevicula</i> Pfeiffer 2. <i>A. beddomeana</i> Nevill 3. <i>Telescopium telescopium</i> Linnaeus 4. <i>Cerithidea (Cerithideopsilla)</i> <i>cingulata</i> (Gmelin) 5. <i>Stenothyra deltae</i> (Benson) 6. <i>Onchidium tenerum</i> Stoliczka 7. <i>O. tigrina</i> Stoliczka 8. <i>Nassarius stolatus</i> (Gmelin) 9. <i>Haminea crocata</i> Pease 10. <i>Macoma birmanica</i> (Philippi) 11. <i>Theora opalina</i> (Hind) 12. <i>Strigilla splendida</i> (Anton)	1. <i>Cerithidea (Cerithidea)</i> <i>obtusa</i> Lamarck 2. <i>Nerita articulata</i> (Gould) 3. <i>Littorina (Littorina)</i> <i>melanostoma</i> Gray 4. <i>Pythia plicata</i> (Gray) 5. <i>Auricula translucens</i> Annandale and Prashad	1. <i>Nassarius stolatus</i> (Gmelin) 2. <i>Natica tigrina</i> (Roeding) 3. <i>N. gualteriana</i> Recluz 4. <i>Acrilla acuminata</i> (Sowerby) 5. <i>Amalda ampula</i> (Gmelin) 6. <i>Donax incarnatus</i> Gmelin 7. <i>Meretrix meretrix</i> (Linnaeus)	1. <i>Glaucanome sculpta</i> (Sowerby) 2. <i>Barnea candida</i> (Linnaeus) 3. <i>Solen kemp</i> Preston	1. <i>Littorina scabra scabra</i> (Linnaeus) 2. <i>Thais lacera</i> (Born) 3. <i>Onchidium tigrinum</i> Stoliczka 4. <i>O. tenerum</i> Stoliczka 5. <i>Saccostrea cucullata</i> (Born)

C. Mangrove forest

The mangrove forest extends from the sides of the Irrigation Bungalow to west towards the mouth of the river Hugli. The major constituents are Hital (*Phoenix paludosa*). Others include Baen (*Avicennia* spp.), Genwa (*Excoecaria agallocha*) and Haraguja (*Acanthus illicifolius*)

The terrain is muddy with puddes and ditches. During the spring tide water enters in this region, but at other times it is semi dry. The ditches are with soft mud and small amount of water. The common malacofaunain this zone are *Telescopium telescopium* (Pl. IV; fig. A), *Cerithidia cingulata*, *Cerithidea obtusa* (Pl. IV fig. D), *Pythia plicata* and *Auricula translucens*.

DISCUSSION

A total of 37 species of molluscs have been recorded from the intertidal zone of Sagar Island, of which 24 species are gastropods and 13 bivalves (Table II). 31 species have been recorded from Sagar South(Gangasagar), followed by 14 species from Chemaguri, 11 from Kachuberia and 9 species from Costala. Gangasagar is in the immediate vicinity of the sea thus having the maximum influence of marine species. Chemaguri is nearer to Gangasagar has more species than other stations which are not primarily marine in nature.

Depending upon the ecological niches the intertidal malacofauna of Sagar Island can be grouped into five categories : the fauna of mud banks and mud flats, mangrove forest, sandy beach, mudflat on the beach and the fauna of jetty pillars and mangrove swamps and dykes (Table III). Among these the maximum species recorded from the mud banks and mud flats. The species common on these areas are *Assiminea brevicula*, *Assiminia beddomeana*, *Telescopium telescopium*, *Cerithidea cingulata*, *Stenothyra deltae*, *Nassarius stolatus*, *Haminea crocata*, *Onchidium tenerum*, *Macoma birmanica*, *Theora opalina* and *Strigilla splendida*.

The malacofauna of mangrove area include *Cerithidea cingulata*, *Nerita articulata*, *Littorina melanostoma*, *Pythia plicata* and *Auricula translucens* occurs at the base of the plant or in the crevices or attached to the mangrove stems. *Nerita articulata* observed attached to mangrove plant up 1.5 meters height.

In the sandy beach the malacofauna observed from mid tidal zone to low tide mark and the common species were *Nassarius stolatus*, *Natica tigrina*, *Natica gualteriana*, *Acrilla acuminata*, *Amalda ampla*, *Donax incarnatus* and *Meretrix meretrix*. On the mudflat of the sea beaches the *Glaucanome sculpta* were observed as the dominant malacofauna. Others are *Barnea candida* and *Solen kempi*.

In the pillar of jetty, dykes *Littorina scabra scabra* was observed as the dominant malacofauna followed by *Saccostrea cucullata*, *Thais lacera*, *Onchidium* spp.

The malacofauna recorded show more or distinct zonations with maximum densities at certain levels. In the uppermost zone of mud and mud flats the *Telescopium telescopium*, *Cerithidea cingulata*, *Assiminea brevicula*, *Assiminea beddomeana* were very common. *Haminea crocata* is observed in the ditches with soft mud and grasses, on the bank. In the middle region *Assiminea brevicula*, *Nassarius stolatus*, *Natica tigrina* and in the lowest zone mainly the *Macoma birmanica*, *Theora opalina* and *Strigilla splendida* were recorded.

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We are grateful to Department of Marine Science, Calcutta University for the field excursion to Sagar Island which initiated us to work on this subject. Authors are grateful to Molluscan Section, Zoological Survey of India, for identification of the molluscan specimen.

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PLATE I



Fig. 1 : A view of Muriganga at Kachuberia (Station I).



Fig. 2 : A view of Chemaguri (Station III).

PLATE II



Fig. 1 : A view of Gangasagar Beach (Station IVA).

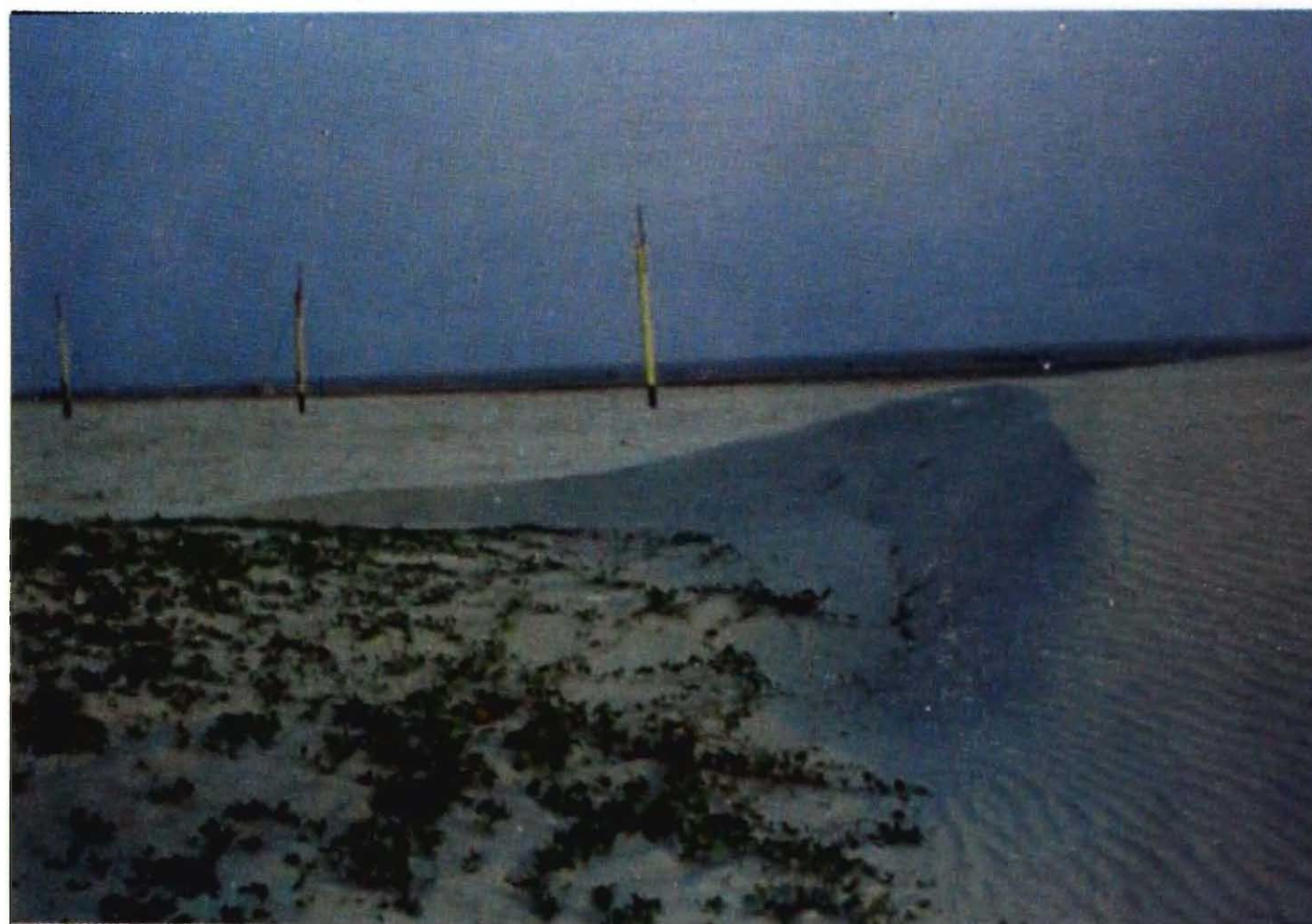


Fig. 2 : Showing different surface structures at Gangasagar Beach.

PLATE III



Fig. 1 : A view of Creek with Associated Mangrove Forest at Gangasagar (Station IVB & IVC).

PLATE IV



A : *Telescopium telescopium* on the mudflat at Gangasagar creek



B : *Littorina scabra scabra* clinging on the mangrove plant



C : *Thais lacera* on jetty at Kachuberia



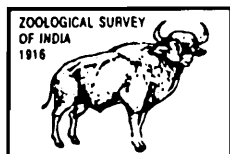
E : *Nerita articulata* on the brick wall at achuberia



D : *Cerrithedia obtusa* climbing on the Mangrove plant at Chemaguri



F : *Assimineea brevicula* at Costala



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DESCRIPTION OF THREE NEW SPECIES OF THE GENUS *PEUCETIA* AND GENUS *OXYOPES* (FAMILY : OXYOPIDAE : ARANEAE) FROM INDIA

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INTRODUCTION

Spiders of the family Oxyopidae have received attention by Tikader (1970), Tikader & Biswas (1981), Biswas & Biswas (1992), Biswas & Majumder (1995), Gajbe (1992, 1999), Gajbe & Gajbe (2000) after the fauna of British India, Arachnida by Pocock (1900) where the family Oxyopidae was not included, though the oxyopid spiders are abundant in our country. While examining the spider collection from Silent Valley Expedition, we came across three new species of the genera *Peucetia* Thorell and *Oxyopes* Latreille (Family : Oxyopidae) which are described in this paper.

The types are deposited in the National Zoological Collection of the Zoological Survey of India, Kolkata.

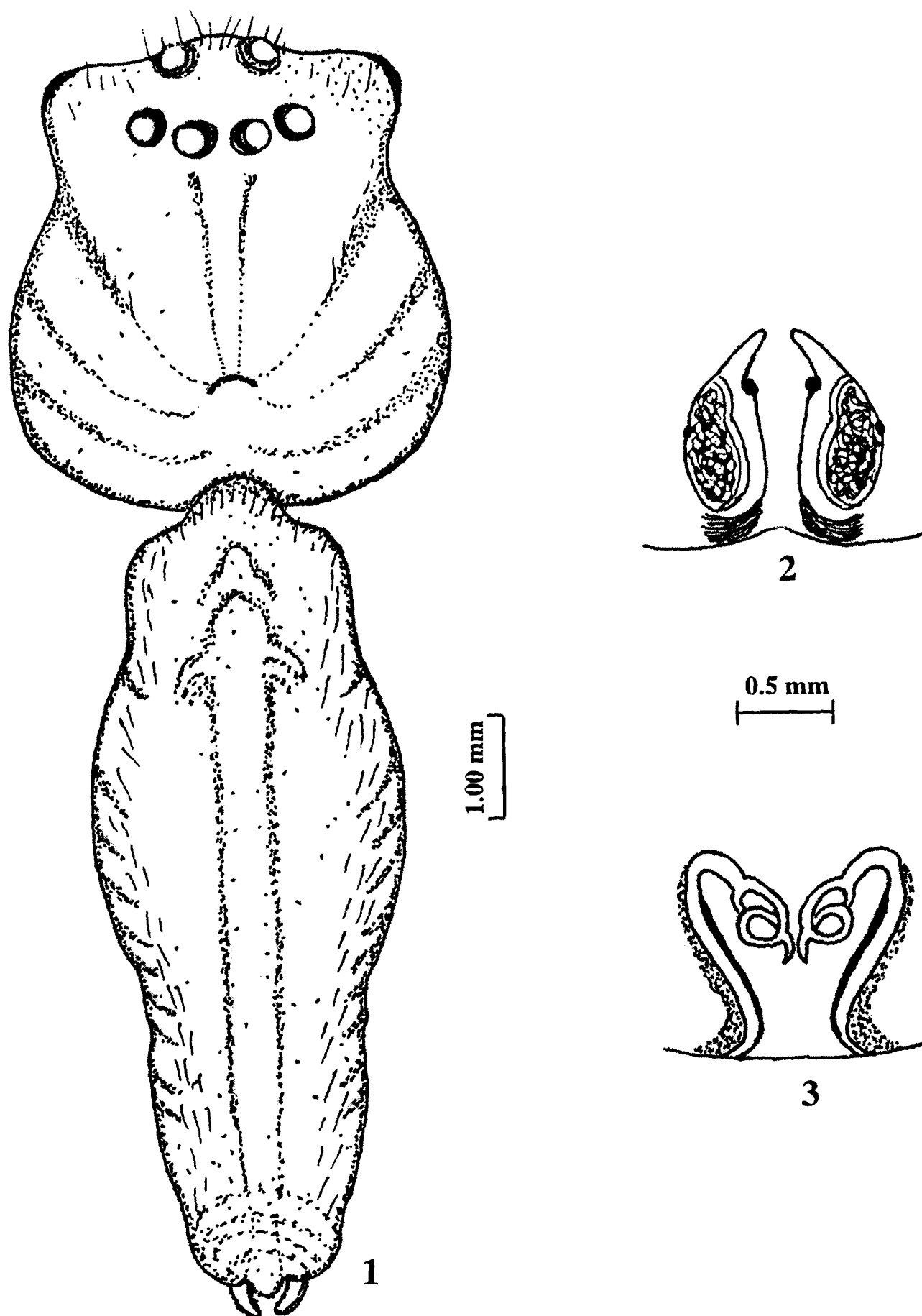
1. *Peucetia rangathanani* sp. nov.

(Figs. 1-3)

General : Cephalothorax brownish yellow, abdomen olive green with brown ornamentation and legs are yellowish. Total length 13'50 mm. Carapace 5'50 mm. long, 4'00 mm. wide ; abdomen 8'50 mm. long, 3'00 mm. wide.

Cephalothorax : Longer than wide, moderately high at the anterior part; centre provided with the sharp fovea. Few white rays are radiating anteriorly from fovea. Eyes are three rows. Anterior and middle rows are with two eyes and posterior with four eyes. Four eyes are heterogeneous in nature. Anterior two eyes are elevated. Posterior row of eyes are slightly recurved. Clypeus is long. Sternum heart-shaped, greenish in colour. Legs are slender with spine like hair and two claws. Leg formulae are 1/2/4/3.

*40/5, Fakir Para Road, Behala, Kolkata-700 034



Figs. 1-3. *Peucetia rangathanani* sp. nov.;

1. Dorsal view of Holotype (Female) legs are omitted; 2. Epigyne; 3. Internal genitalia.

Abdomen : Elongated, longer than wide; first half of dorsum of abdomen is wider than the second half. Colour olive green with valvate in appearance. Mid-dorsal with longitudinal brown band giving branches which is more prominent than posterier half. Ventral side is also olive green in colour. Male unknown.

Type-specimen : Holotype female preserved in rectified spirit (70%). Registration number is 5571/18.

Type locality : Road to Valliapara Thodar, Silent Valley, Kerala, India, 5.xii.1980, coll. R. S. Pillai.

Remarks : *Peucetia rangathanai* is compared with *P. latikae* Tikader which differs in the following characters (1) There is no black spots in the cephalic region of *P. rangathanai* (2) Pattern of ornamentation of dorsum of the abdomen of *P. rangathanai* is completely different from *P. latikae* (3) Epigyne and internal genitalia are also structurally different.

Distribution : India : Kerala (New record).

2. *Oxyopes kumarae* sp. nov.

(Figs. 4-6)

General : Cephalothorax and legs are brownish-green, abdomen deep brown in colour. Total length 6'00 mm. Carapace 2'50 mm. long, 2'00 mm. wide; abdomen 3'50 mm. long, 2'50 mm. wide.

Cephalothorax : Slightly longer than wide, high, clothed with short and small hair. Eyes of posterior row is recurved and situated at equal distance; anterior row procurved, middle eyes are small in size. Ocular area with conspicuous black patches. Clypeus is long. Sternum is heart-shaped pointed behind, clothed with fine hair. Legs are long and strong, clothed with hair and long spines. No deep brown line present on each femora. Leg formulae are 1/2/4/3.

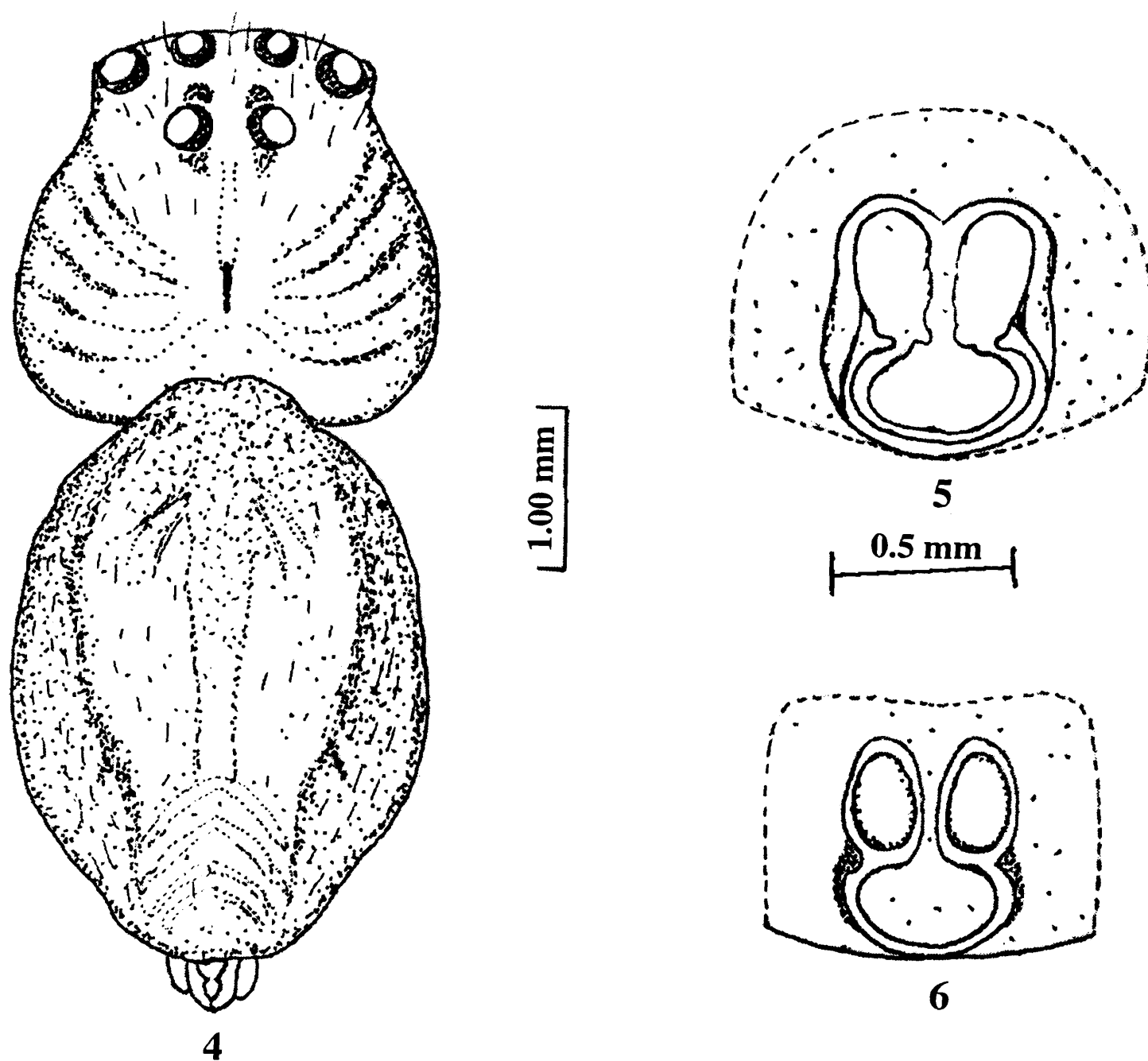
Abdomen : Short and stout, clothed with fine grey and brown hair. Dorsum of the abdomen provided with broad grey brown patch extending from anterior to the base of the spinnerets laterally. Ventral side provided with blackish brown bands. Male unknown.

Type-specimen : Holotype female preserved in rectified spirit (70%). Registration number is 5572/18.

Type locality : Road to Valliapara Thodar, Silent Valley, Kerala, India, 5.xii.1980, coll. R. S. Pillai.

Remarks : *Oxyopes kumarae* is compared with *O. sikkimensis* Tikader which differs in the following characters (1) There is no deep brown line present on each femora in *O. kumarae* (2) No dirty white and deep brown bars present on the dorsum of the abdomen on *O. kumarae* but broad grey brown patches are present on *O. sikkimensis* (3) Epigyne and internal genitalia are also structurally different.

Distribution : India : Kerala (New record).



Figs. 4-6. *Oxyopes kumarae* sp. nov.;

4. Dorsal view of Holotype (Female) legs are omitted; 2. Epigyne; 3. Internal genitalia.

3. *Oxyopes saradae* sp. nov.

(Figs. 7-9)

General : Cephalothorax and legs are light brown, abdomen blackish brown in colour. Total length 10'00 mm. Carapace 4'00 mm. long, 3'00 mm. wide; abdomen 4'50 mm. long, 3'50 mm. wide.

Cephalothorax : Longer than wide, high, clothed with fine hair. Posterior half of thorax provided with blackish brown patch which extending from the posterior to the base of eyes. Two longitudinal bar-like fine hair extending from the base of thorax to the posterior eyes on the middle. Fovea is also present. Posterior row of eyes are recurved and base covered with black patches. Anterior row is procurved. Anterior laterals are larger than that of middle eyes. Clypeus long and provided with two black lines which extending from anterior median eyes to near the base of fang of chelicerae. Sternum heart-shaped, pointed behind, clothed with fine hair. Legs are long and strong, clothed with fine hair and spines. Ventral side of the femora of all legs provided with a longitudinal black line. Leg formulae are 1/4/3/2.

Abdomen : Long, narrowing behind covered with small fine hair. Middle of dorsum of the abdomen with chalk-white broad line extending anteriorly to the base of spinnerets. Few long irregular lines present on the dorsum laterally. Ventral side with deep broad black patches extending from epigastric furrow to the base of spinnerets. Male unknown.

Type-specimen : Holotype female preserved in rectified spirit (70%). Registration number is 5573/18.

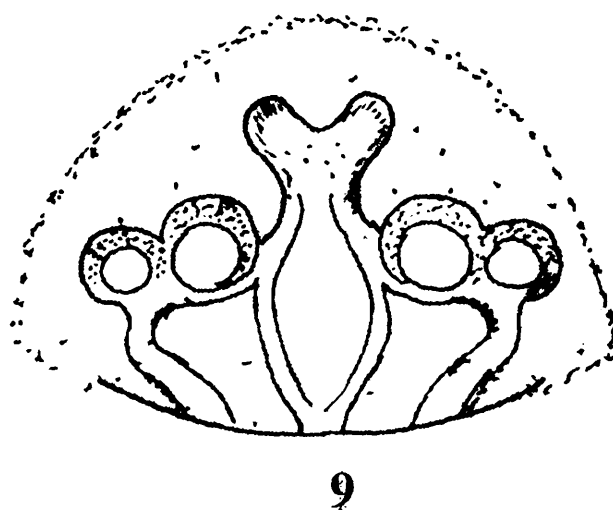
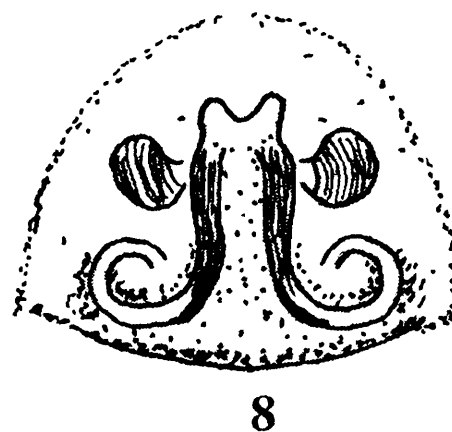
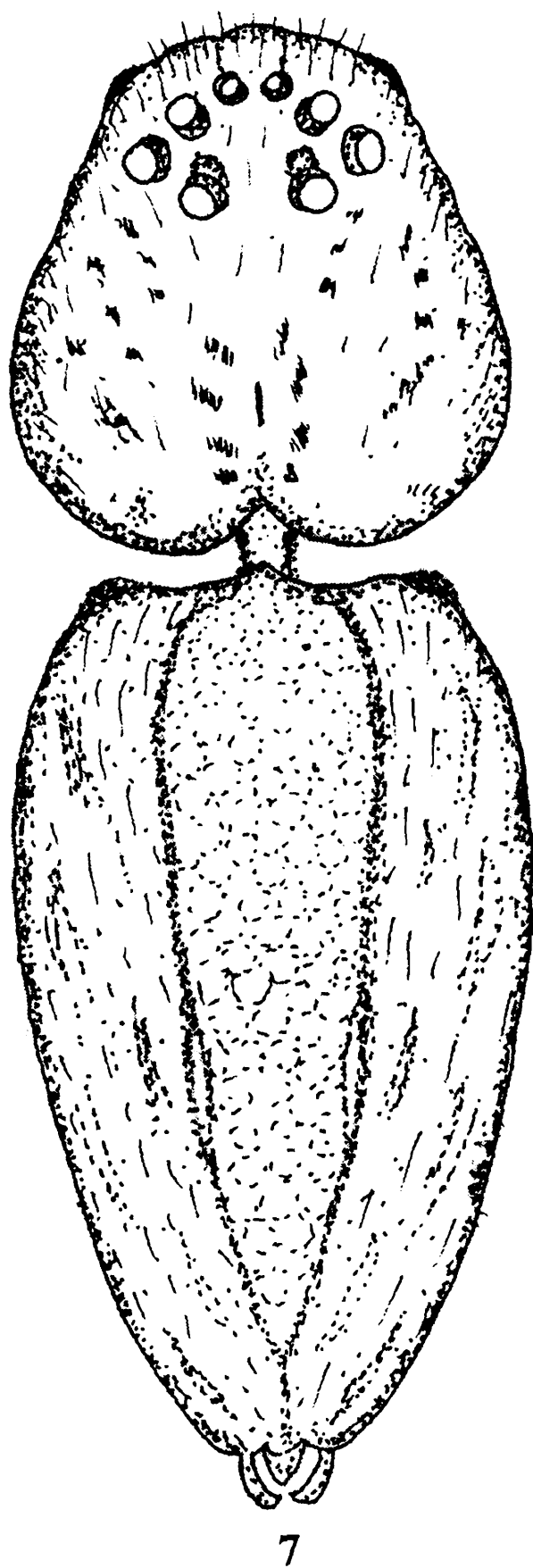
Type locality : Road to Valliapara Thodar, Silent Valley, Kerala, India, 5.xii.1980, coll. R. S. Pillai.

Remarks : *Oxyopes saradae* is compared with *O. shweta* Tikader which differs in the following characters (1) Two longitudinal black lines on either side of cephalic region present in *O. shweta* but in *O. saradae* bar like fine hair present on the middle line of cephalic region (2) Middle of dorsum of the abdomen with chalk-white broad line present longitudinally in *O. saradae* which extending from epigastric furrow to the spinnerets but there is no such characters present in *O. shweta* and (3) Epigyne and internal genitalia are also structurally different.

Distribution : India : Kerala (New record).

SUMMARY

Three new species under the genera *Peucetia* Thorell and *Oxyopes* Latreille (Family : Oxyopidae) described and illustrated in this paper.



Figs. 7-9. *Oxyopes saradae* sp. nov.;

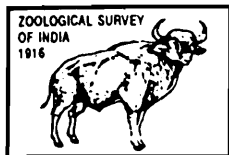
1. Dorsal view of Holotype (Female) legs are omitted; 2. Epigyne; 3. Internal genitalia.

ACKNOWLEDGEMENTS

Our sincere thanks to Dr. J. R. B. Alfred, Director, Zoological Survey of India for providing proper facilities during the preparation of this paper. Our heartiest thanks to Dr. R. S. Pillai for his valuable collection.

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Rec. zool. Surv. India : **105** (Part 1–2) : 45-60, 2005

STUDIES ON SOME SPIDERS OF THE FAMILY ARANEIDAE (ARANEAE : ARACHNIDA) FROM MADHYA PRADESH, INDIA

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INTRODUCTION

The araneids are typical-orb-weaving spiders, distributed all over the world. In general they prefer to live in moist places and very rarely found in arid regions. Almost all the species construct orb-webs in the foliage, either high upon the trees or in shrubs, herbs or grass, but they are not ground dwellers. They built their orb-webs having geometrical precision and beauty. Their finished projects are incomparable in terms of the craftsmanship. Many of them build a nest like retreat by folding a leaf or bunch of leaves which is little away from the web but directly connected with the web-centre by threads. The araneids having no retreat, merely run away from the web or drop to the ground when disturbed, if undisturbed they will climb upto the web by means of thread they pulled out while falling. Generally the male araneids are much smaller than females and are not commonly seen in the web unlike females.

The characteristic feature of an orb-web is the central portion. It is lying within the supporting frame work, consists of series of radiating threads of non-viscid and non-elastic silk. These threads support a continuous thread or viscid and elastic silk which is spun spirally from periphery to the web-centre. The web-centre and pattern of viscid spiral are highly variable and often specific to different genera. It is also noticed that as the spiderlings become mature they go on changing their web-building patterns.

Since the araneid spiders are nocturnal in habit they are not seen on the web in day time with a few exceptions as tropical *Argiope*, *Cyclosa*, *Gastercantha*, *Leucage* etc. Usually after every few days the sticky silk dries up or becomes torn and is replaced and repaired in the evening by the spider. Some spiders roll up their webs in the morning before leaving the web to take shelter under bark or retreat of leaves. Again the web is reconstructed in the evening for trapping the prey at night.

The araneids devour all sorts of arthropods which entangled in their webs. Since these spiders have very poor vision, they locate their prey by feeling the vibration and tension of threads of the web. Then they quickly turn their prey with legs and simultaneously their IVth legs pull out from spinnerets and wrap the victim. The prey is bitten before dragged to the hub or to the retreat in a corner, where prey is sucked. In edible objects are cut out of web and dropped to the ground.

Since orb-weavers have poor vision, the male reveal their presence by plucking the threads of the female web. A female generally does not feast on her mate as many people believe but usually the male die soon after mating. Araneid spiders, in general, mature and breed in the monsoon only and die in the winter.

Some *Araneus* enclose their eggs in a fluffy mass of silk having no definite outline. Egg sac of *Argiope* is a silken cup which is surrounded by a thick layer of flossy silk which is enclosed in the firm, closely woven pear like outer covering. And the whole thing is held by folded leaves in the vegetation.

In the winter many female araneid spider lay several hundred of eggs in egg sacs and then die. In some cases the spiderlings are hatched out soon, but sometimes not until the next spring.

The spiders of the family Araneidae are little known in the Indian Fauna. Scanty informations are available on Indian forms of araneid spiders from the reports of Stoliczka (1869), Simon (1884, 1889, 1892), Thorell (1895) and Pocock (1900) who were the pioneer workers on this group of spiders. They described many species from India, Burma and Sri Lanka. Afterwards Gravely (1922) recorded some species of araneid spiders.

Tikader (1960, 1961, 1962, A, B, C, 1965, 1966, 1970, 1975, 1977), Tikader & Bal (1981) and Tikader & Biswas (1981) reported so many species from India.

Tikader (1982) reported a few species of Araneid spiders from Madhya Pradesh.

All type specimens are deposited in the National Zoological Collections, Zoological Survey of India, Kolkata.

SYSTEMATICS

Family ARANEIDAE Latreille

1806. *Araneids* Latreille, *Genera crustaceorum et Insectorum*, **1** : 82.

1815. *Araneides* : Leach, *Zoological Miscellany*, **2** : 134-137.

Characters : Carapace variable, thoracic region separated from cephalic region by oblique depression. Eyes less variable in size in different genera, eight in number and arranged usually in two rows, median eyes forming a quadrangle, either a square or a trapezium, lateral eyes usually

close and often projecting on angular tubercles. Sternum heart-shaped or triangular, narrowing behind, thus coxae IV nearly contiguous, labium with swollen distal edge. Maxillae widest distally and generally not longer than wide. Chelicerae strong, vertical and not divergent, provided with a boss on each, fang furrow armed with two sets of strong teeth. Leg long and strong, clothed with hairs and spines, three claws and auxillary foot claws not provided with trichobothria on femora or tarsi. Pedipalp with a single claw in female, paracymbium of male palpus attached to proximal end of cymbium. Abdomen variable in size and shape, epigastric furrow nearly straight, six spinnerets. Most of the spiders construct orb-webs, spiders hang in the web head down.

Type-genus : *Araneus* Clerk.

Distribution : Cosmopolitan.

Key to the Sub-families and genera of the Family ARANEIDAE

1. Tarsus and metatarsus together longer than patella and tibia 2
- Tarsus and metatarsus together not longer than patella and tibia ARANEINAE
2. Labium longer than wide; abdomen two and one-half to three times as long as wide; tarsus IV not provided with sustentaculum Sub-family NEPHILINAE 3
- Labium wider than long; abdomen not longer than two and one-half times of its width; tarsus IV provided with sustentaculum 4
3. Carapace with cephalic region convex and elevated; abdomen elongated or oval, non-lobate *Nephila* Leach
- Carapace flat; abdomen flat dorsally, lobate laterally *Herennia* Thorell
4. Posterior row of eyes strongly procurved; anterior lateral eyes smaller than posterior lateral Sub-family ARGIOPINAE 5
- Posterior row of eyes nearly straight or recurved; lateral eyes subequal Sub-family ARANEINAE 6
5. Eyes of anterior row not evenly spaced or medians closer to each other than to laterals; adult female longer than 9 mm.; tibia I of male straight and unmodified *Argiope* Audouin
- Eyes of anterior row evenly spaced; or medians closer to laterals than to each other; adult female smaller than 6 mm. tibia I of male curved and bearing strong spines *Gea* C. L. Koch
6. Posterior median eyes very close, nearly touching carapace provided with a U-shaped junction between cephalic and thoracic region *Cyclosa* Menge
- Posterior median eyes not very close, carapace not having any U-shaped junction between cephalic and thoracic region 7

7. Abdomen more than twice longer than wide 8
 — Abdomen less than twice longer than wide 9
8. Abdomen a little pointed mid-longitudinally over the carapace and no caudal projection; ventral side of abdomen with a white median longitudinal band framed by black *Larinia* Simon
 — Abdomen not pointed mid-longitudinally but provided with a pair of very prominent shoulder humps thus bifurcated anteriorly and a caudal projection, at the tip of which having three tubercles, ventral side of abdomen dirty brown *Arachnura* Vinson
9. Thoracic groove transverse; epigyne with distinct scape, often wrinkled, not provided with any lateral lobes *Araneus* Clerck
 — Thoracic groove longitudinal, epigyne with unwrinkled scape and provided with one or two pairs of lateral lobes *Neoscona* Simon

Genus 1. *Nephila* Leach

1815. *Nephila* Leach, *Zoological Miscellany*, : 133.

1894. *Nephila* : Simon, *Hist. Nat. Araign.*, 1(3) : 755.

Characters : Carapace with cephalic region convex, more elevated than thoracic region and usually armed posteriorly with one pair of tubercles. Labium longer than broad. Ocular quad nearly square or slightly wider behind. Legs very long and strong, spinulose; tarsi and metatarsi together longer than tibiae and patellae together. Epigyne heavily sclerotised.

Type-species : *Nephila maculata* (Fabricius).

Distribution : Tropical and rarely sub-tropical countries of the world.

1. *Nephila maculata* (Fabricius)

1793. *Aranea maculata* Fabricius, *Ent. Syst.*, 2 : 425.

1922. *Nephila maculata* : Gravely, *J. Bombay nat. Hist. Soc.*, 28 : 1946.

Specimen examined : 1 ♀, Rani Durgavati Samadhi, Jabalpur district, Madhya Pradesh, Coll. V V Rao, 19.XI.1970, (Reg. No. A/1683). 29 ♀♀, Garampani kund on Jabalpur-Mandla Road, Mandla district, Madhya Pradesh, Coll. U. A. Gajbe, 22.XII.1981, (Reg. No. A/1684). 7 ♀♀, Garampani kund on Jabalpur Mandla Road, Mandla district, Madhya Pradesh, Coll. U. A. Gajbe, 22.X.1981.

Distribution : Trinneveli, Trivandrum, Ootacamund, Tamil Nadu, Karnataka, Dehra Dun, Hardwar, Uttar Pradesh, Madhya Pradesh, Tezpur, Darrang, Assam, Gazing Rongli, Sikkim, Kalimpong, Darjeeling, West Bengal, Thana, Poona, Maharashtra, Dongs, Gujarat, Andaman &

Nicobar Islands, MYANMAR : Therrawaddy, Tounghoo, Rangoon; SRILANKA : Peradeniya, Trinomali; CHINA, AUSTRALIA, MALAYSIA, JAPAN, NEW GUINEA.

Remarks : This species is being reported here for the first time from the Mandla and Jabalpur district of Madhya Pradesh.

2. *Nephila kuhlii* Doleschall

1859. *Nephila kuhlii* Doleschall, *Acta. Soc. Ind. Neerl.*, 5(5) : 27.

Specimen examined : 9 ♀ ♀, Garampani kund on Jabalpur-Mandla Road, Mandla district, Madhya Pradesh, Coll. U. A. Gajbe, 14.IX.1983 (Reg. No. A/1686).

Distribution : INDIA : Gobardanga, 24 Parganas, Darjeeling, West Bengal, Mandla, Madhya Pradesh, BURMA, Bhamo and eastwards to celebes.

Remarks : This species being reported here for the first time from Madhya Pradesh.

Genus 2. *Herennia* Thorell

1877. *Herennia* Thorell, *Annali Mus. Civ. Genova*, 10 : 370.

1894. *Herennia* : Simon, *Hist. Nat. Araign.*, 1(3) : 759.

Characters : Carapace flat, thickly covered with white pubescence. Ocular quad nearly as long as wide and slightly wider behind than in front, anterior median eyes larger than posterior medians, lateral eyes close and subequal insize, posterior row of eyes nearly straight. Legs long and slender clothed with hairs and spines, tarsi and metatarsi together longer than tibiae and patellae together. Abdomen flat above and lobate laterally, impressed with radically arranged lines of spots.

Type-species : *Herennia ornatissima* (Deleschall).

Distribution : INDIA, SRILANKA, MALAYSIA.

3. *Herennia ornatissima* (Doleschall)

1859. *Epeira ornatissima* Doleschall, *Act. Soc. Ind. Neeri.*, 5 : 32.

1877. *Herennia multipunctuata* : Thorell, *Annali, Mus. Genova*, 10 : 371.

Specimen examined : 1 ♀, Gudari village, near Orcha, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 27.XII.1983, (Reg. No. A/1687). 1 ♀, Orcha, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 28.XII.1983, (Reg. No. A/1638). 1 ♀, Garhbengal village near Narayanpur Tahsil, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 30.XII.1983, (Reg. No. A/1689).

Distribution : INDIA : Trivandrum, Ootacamund, Tamil Nadu, Shillong, Meghalaya, Ponda, Goa, Bastar, Madhya Pradesh, SRI LANKA : Peradeniya, Kanthalai, MYANMAR : Tharrawaddy, Rangoon, Tenasserri, AUSTR0-MALAYSIA.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

Genus 3. *Argiope* Audouin

1826. *Argiope* Audouin, in Savigny, *Description del' Egypte.*, 1(4) : 121.

1829. *Argiopes* : Latreille, *Les Arachnids, Regne Animal*, 4 : 248.

Characters : Carapace remarkably flat, clothed with thick layer of white pubescence. Ocular quad forms a trapezium, longer than wide and wider behind than in front, posterior row of eyes strongly procurved, anterior lateral eyes smaller than posterior laterals, lateral eyes close and situated on conspicuous tubercles. Chelicerae small, weak and provided with small boss. Legs long and strong, metatarsus and tarsus together longer than patella and tibia together. Abdomen generally flat with variable shape. Adult females larger than 9 mm. Epigyne provided with thin or thick median septum. Web provided with a stabilimentum or two stabilimenta crossing.

Type-species : *Argiope lobate* (Thorell).

Distribution : Tropical and temperate countries of the world.

Key to the species of the genus *Argiope* Audouin

1. Abdomen broadly oval and conspicuously truncated anteriorly; dorsum provided with black transverse stripes and forming a net work on the posterior half. *aemula* (Walckenaer)
- Abdomen elongated oval with no truncation anteriorly, dorsum with no net work of black stripes 2
2. Anterior edge of the epigyne provided with a broad and conspicuous lip; median epigynal spetum abruptly wide posteriorly *anasuja* Thorell
- Anterior edge of the epigyne provided with very thin and inconspicuous lip; median epigynal spetum gradually wider posteriorly *pulchella* Thorell

4. *Argiope aemula* (Walckenaer)

1841. *Epeira aemula* Walckenaer, *Hist. Nat. Ins. Ant.*, 2 : 118.

1877. *Argiope aemula* : Thorell, *Annali. Mus. Civ. Genova*, 25 : 164.

Specimen examined : 1 ♀, Gariapahar Kanker, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 4.I.1984, (Reg. No. A/1690). 1 ♀, Tewar village, near Shahpura, Jabalpur district, Madhya Pradesh, Coll. V S. Durve, 15.VII.1969, (Reg. No. A/1691).

Distribution : INDIA : Trivandrum, Nilgiri Hills, Tamil Nadu, Eastern Region of Maharashtra, Poona, Maharashtra, Darjeeling, West Bengal, Gujarat, Andaman & Nicobar Islands, Jabalpur, Bastar, Madhya Pradesh. SRI LANKA : Trincomali, Punduloya, MYANMAR : Rangoon, Tharrawaddy, Bhamo, INDO and AUSTRAL-MALAYSIA.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

5. *Argiope anasuja* Thorell

1887. *Argiope anasuja* Thorell, *Annali. Mus. Civ. Genova*, **25** : 162.

1900. *Argiope anasuja* : Pocock, *Fauna Brit. India, Arachn.*, : 222.

Specimen examined : 2 ♀ ♀, Hatkachora village, near Jagdalpur, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 2.I.1984. (Reg. No. A/1692). 8 ♀ ♀, Chitrakote, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 26.XII.1983, (Reg. No. A/1693).

Distribution : INDIA : Ramnampuram, Chingleput, Oatacamund, Tuticorin, Tamil Nadu, Bangalore, Karnataka, Nasik, Maharashtra, Barkuda Islands (Chilka Lake) Orissa, Chota Nagpur, Chakradharpur, Bihar Kolkata, West Bengal, Bastar, Madhya Pradesh. SRI LANKA : Colombo, PAKISTAN : Karachi.

Remarks : This species is being reported here for the first time from the Bastar district of Madhya Pradesh.

6. *Argiope pulchella* Thorell

1881. *Argiope pulchella* Thorell, *Annali Mus. Civ. Genova*, **18** : 74.

1884. *Argiope pulchella* : Simon, *Annali. Mus. Civ. Genova*, **20** : 346.

Specimen examined : 1 ♀, Chotedongar village, Narayanpur Tahsil, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 26.XII.1983, (Reg. No. A/1694).

Distribution : INDIA : Andaman and Laccadiv Islands, Palta, 24 Parganas, Kalimpong, Darjeeling, West Bengal, Bastar, Madhya Pradesh, Orissa, Assam, Poona, Maharashtra, Tamil Nadu, MYANMAR : Rangoon, Tharrawaddy, Moulmeing, Pegu. MALAYA PENNINSULA.

Remarks : This species is being reported here for the first time from Bastar district of Madhya Pradesh.

Genus 4. *Cycloa* Menge

1866. *Cyclosa* Menge, *Schrift nat. Ges. Danzig. (N.F.)*, **1** : 73.

1895. *Cyclosa* : Simon, *Hist. Nat. Araign.*, **1(4)** : 783.

Characters : Carapace with anteriorly narrow cephalic region, cephalic region distinctly separated from thoracic region by an oblique groove forming a U-shape, ocular quad trapezium like, much narrower behind than in front, anterior median eyes usually larger than posterior medians, posterior median very close, almost touching, laterals close and situated on prominent tubercles, both rows of eyes recurved. Palpal patella of male with one large strong and curved spines. Abdomen provided with humps, both paired and median unpaired. Epigyne having a small, weak scape which may be straight, wrinkle, bent, pointed or circular.

Type-species : *Cyclosa conia* (Pallas).

Distribution : Cosmopolitan.

7. *Cyclosa hexatuberculata* Tikader

1982. *Cyclosa hexatuberculata* Tikader, *Fauna of India, Spiders*, 2(1) : 197.

Specimen examined : 1 ♀, Chitrakote, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 1.I.1984, (Reg. No. A/1695). 3 ♀ ♀, Forest Rest House, Geedam, Dantewada Tahsil, Bastar district, Madhya Pradesh, Coll. P. D. Gupta, 24.I.1987, (Reg. No. A/1695).

Distribution : INDIA : Poona, Maharashtra, Chitrakote, Bastar, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Bastar district of Madhya Pradesh.

8. *Cyclosa moonduensis* Tikader

1963. *Cyclosa moonduensis* Tikader, *J. Univ. Poona, Sci. & Tech.*, 25 : 46.

1982. *Cyclosa moonduensis* : Tikader, *Fauna of India, Spiders*, 2(1) : 191.

Specimen examined : 1 ♀, Hulki village on Jabalpur-Nagpur Road, Jabalpur district, Madhya Pradesh, Coll. U. A. Gajbe, 30.XI.1985.

Distribution : INDIA : Ahmednagar, Mundhva village, (Type-locality), Poona, Maharashtra, Jabalpur district, Madhya Pradesh.

Genus 5. *Larinia* Simon

1874. *Larinia* Simon, *Af. Fr.*, 1 : 115.

1970. *Larinia* : Grashoff, *Senkenberg biol.*, 51(3-4) : 220.

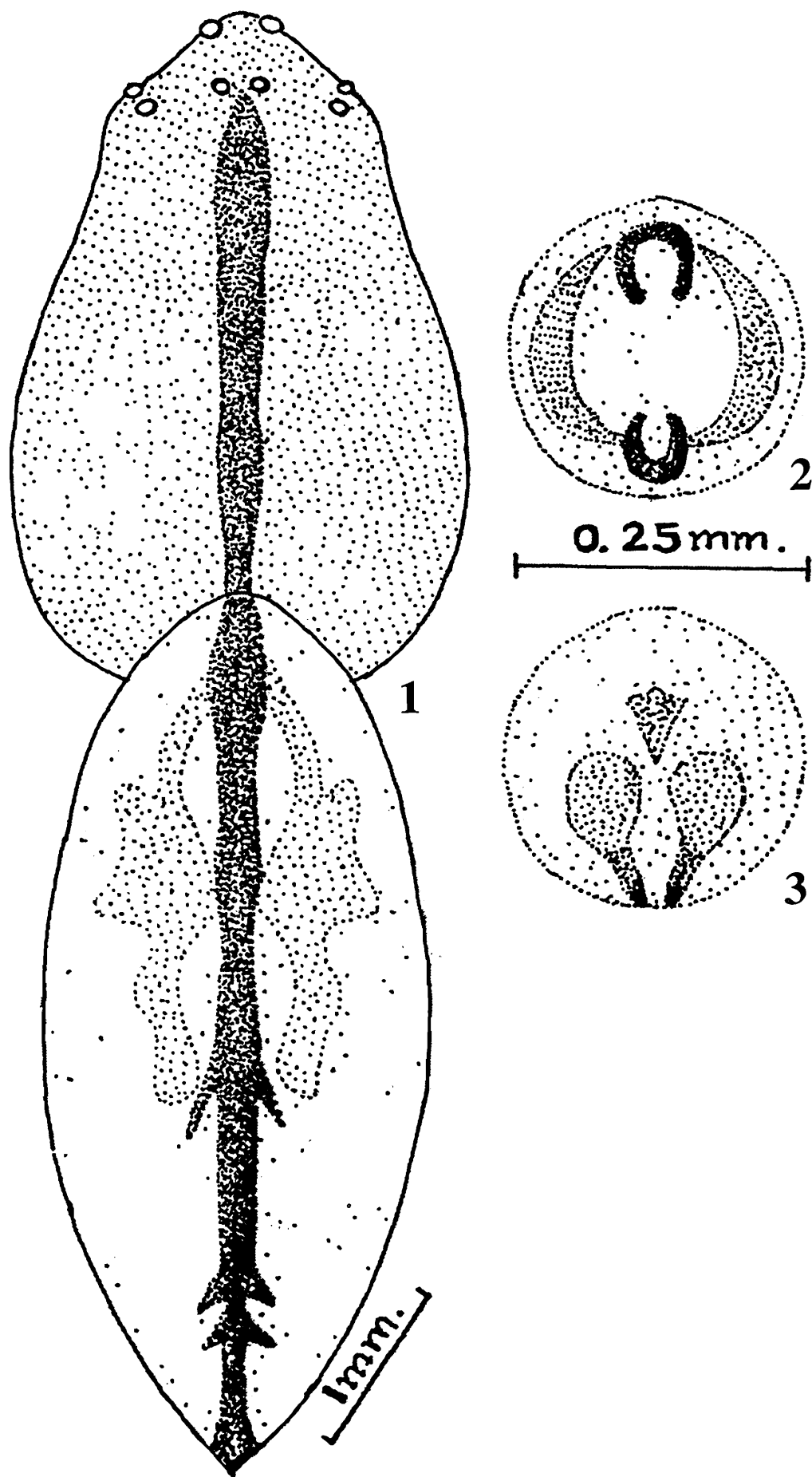
Characters : Carapace rather long, scarcely convex posteriorly ocular quad forming a trapezium, nearly twice as wide in front than behind, lateral eyes subequal in size and very close. Maxillae longer than wide. Legs long and slender. Abdomen elongated with a single median blunt point in front and no caudal process, ventral side with a longitudinal white band guarded laterally by black patches between epigastric furrow and spinnerets. Males with palpal patella bearing two heavy curved spines at the apex.

9. *Larinia mandlaensis* sp. nov.

(Figs. 1-3)

General : Cephalothorax and legs reddish-green, abdomen silvery white. Total length 8.30 mm. Carapace 3.80 mm. long, 2.50 mm. wide; abdomen 5.00 mm. long, 2.10 mm. wide.

Cephalothorax : Nearly one and half times longer than wide, narrowing in front, clothed with pubescence, cephalic region not clearly distinct from thoracic region, black longitudinal mid-dorsal band extending from the posterior median eyes to the deep longitudinal thoracic furrow as in fig. 1. Ocular quad forming a trapezium, more than three times wider in front than behind as in fig. 1.



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

Anterior median eyes much larger than the posterior median eyes, posterior medians closely situated, laterals subequal, closed and situated on distinct tubercles, both rows of eyes recurved but posterior row very slightly recurved than the anterior row. Sternum rather elongated, heart-shaped, pointed behind, light dark shades with pale median area, clothed with pubescence. Labium as long as wide, light brown with pale distal border, maxillae slightly longer than broad, light brown provided with distinct scopulae. Chelicerae strong and stout, brownish, provided with distinct boss, anterior margin of each chelicerae armed with two teeth. Legs long and slender, clothed with hairs and spines.

Abdomen : Elongated, nearly two times longer than wide, pointed anteriorly over the carapace, clothed with pubescence. Dorsum of abdomen silvery white with black mid-longitudinal band extending from anterior to the posterior and laterally with light red band as in fig. 1. Ventral side slightly lighter than the dorsal. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

Type-specimen : *Holotype* ♀, (in spirit), other details as above. Registration No. 5434/18.

Type-locality : INDIA : Madhya Pradesh, Narayanganj village, Mandla district, Coll. U.A. Gajbe, 23.1.1985.

Remarks : This species resemble *Larinia phthisica* (L. Koch) but differs from it as follows :
 (i) Cephalothorax provided with a black mid-dorsal band but in *L. phthisica* no such band is present.
 (ii) Chelicera provided with two teeth but in *L. phthisica* chelicera provided with four teeth.
 (iii) Abdomen mid-dorsally provided with black band but in *L. phthisica* abdomen provided with a mid longitudinal pale lines and two sub-median pale lines on each side. (iv) Epigyne and internal genitalia also structurally different.

Genus 6. *Araneus* Clerck

1757. *Aranelus* Clerck, *Argn. Suec.*, : 15.

1758. *Aranea* : Linnaeus, *Systema Naturae*, **10** : 619.

1921. *Araneus* : Gravely, *Rec. Indian Mus.*, **22**(4) : 414.

Characters : Carapace moderately convex 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. Males with a hook on coxa I and a groove on femur II; tibia II armed with spines on prolateral side and often bent. Epigyne with a prominent scape which may be long, wrinkle and winding or in some straight and short, epigynal openings situated in to the grooves at the base. Palpus of male with a large terminal apophysis, palpal patella with two strong, long curved spines.

Type-species : *Araneus angulatus* Clerck.

Distribution : Cosmopolitan.

10. *Araneus mitifica* Simon

1886. *Epeira mitifica* Simon, *Act. Soc. Linn. Bordeaux*, **40** : 150.

1906. *Araneus mitifica* : Bosenberg & Stand, *Abh. senckenb. naturforsch. Ges.*, **39**(1-2) : 22.

Specimen examined : 1♂, Chitrakote, Bastar district, Madhya Pradesh, Coll. U.A. Gajbe, 1.1.1984, (Reg. No. A/1702).

Distribution : INDIA : Poona, Maharashtra, Karnataka, West Bengal, Madhya Pradesh, Punjab, PAKISTAN : Lahore, BANGLADESH, MYANMAR, MALAYSIA.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

11. *Araneus bastarensis* sp. nov.

(Figs. 4-7)

General : Cephalothorax and legs light reddish-green, abdomen silvery white. Total length 8.00 mm. Carapace 3.00 mm. long, 2.20 mm. wide; abdomen 5.10 mm. long, 3.60 mm. wide.

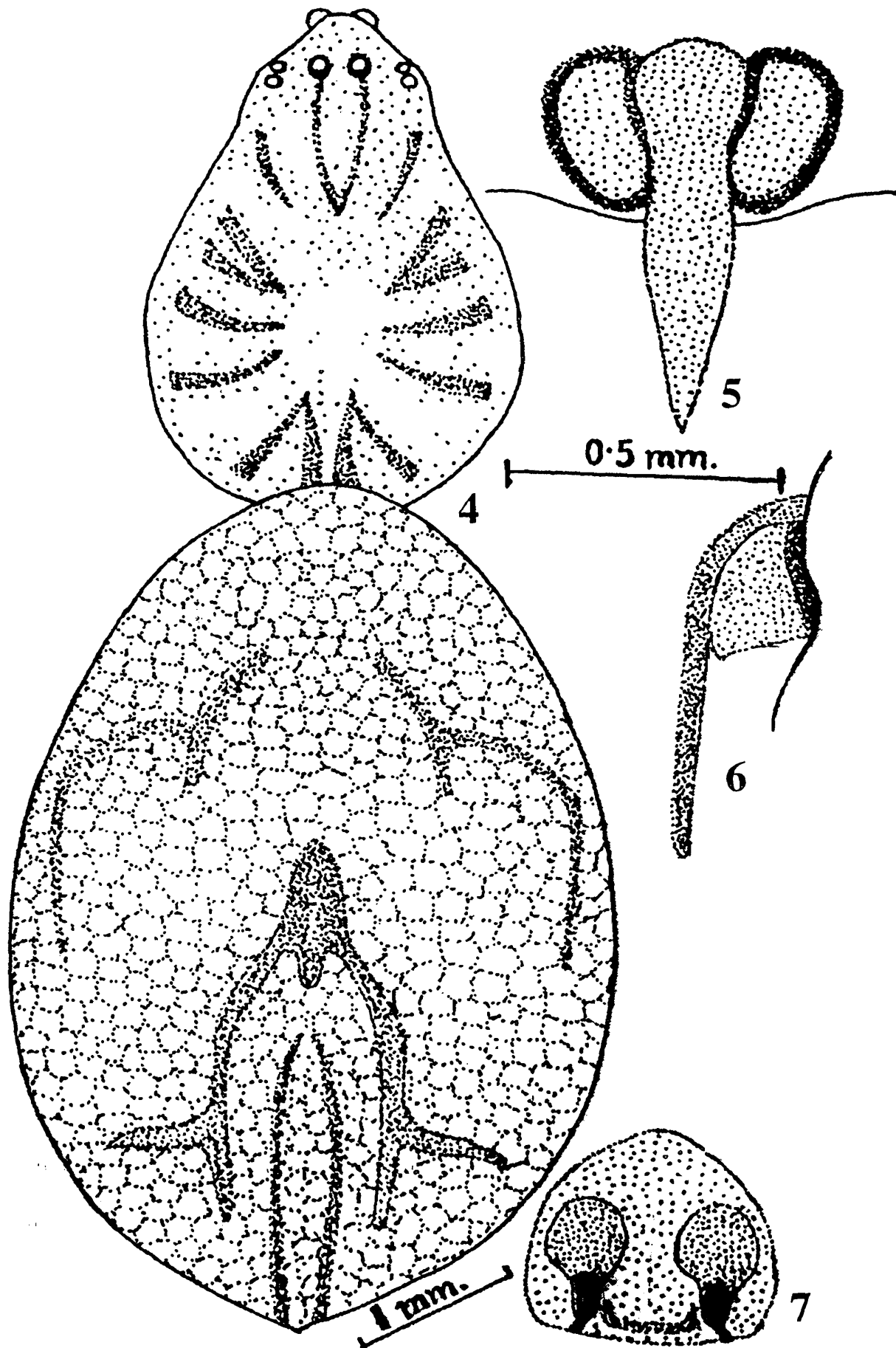
Cephalothorax : Longer than wide, narrowing in front, clothed with pubescence, uniform in colour with brownish patches radiates towards the lateral side as in fig. 4. Thoracic region having a distinct transverse groove. Ocular quad longer than wide and wider in front than behind. Median eyes subequal in size. Posterior median eyes encircled by black rings. Lateral eyes close and each situated on tubercle. Both rows of eyes recurved but posterior row less recurved than the anterior row. Sternum heart-shaped, pointed behind, light yellowish-green in colour, clothed with pubescence. Labium nearly as long as wide, light brown in colour with yellowish outer margin, provided with distinct scopulae. Chelicerae strong, yellowish, provided with inconspicuous boss. Legs long and strong, uniform in colour and provided with pubescence, hairs and spines.

Abdomen : Longer than wide, globular, clothed with pubescence, provided with brown reticulations and brown patches as in fig. 4. Ventral side same in colour as dorsal with brown reticulations. Epigyne provided with a long unwrinkled scape as in fig. 5 & 6. Internal genitalia as in fig. 7.

Type-specimen : *Holotype* : ♂, in spirit, other details as above. Registration No. 5435/18.

Type-locality : INDIA : Madhya Pradesh, Chitrakote, Bastar district, Coll. U. A. Gajbe, 1.1.1984.

Remarks : This species resembles with *Araneus pahalgaonensis* Tikader & Bal but differs from it as follows : (i) Cephalothorax without any patches but in *A. pahalgaonensis* cephalothorax provided with a median and two lateral longitudinal black patches. (ii) Sternum light yellow-green in colour but in *A. pahalgaonensis* sternum black in colour. (iii) Abdomen dorsally provided with brown patches and brown reticulations, but in *A. pahalgaonensis* abdomen dorsally provided with six pairs of sigilla, olive green and chalk white patches. (iv) Epigyne and internal genitalia also structurally different.



Figs. 4-7. *Araneus bastarensis* sp. nov.; 4. Dorsal view of female, legs omitted; 5. Epigyne, ventral view; 6. Epigyne lateral view; 7. Internal genitalia, posterior view.

Genus 7. *Neoscona* Simon

1864. *Neoscona* Simon, *Hist. Nat. Araign.*, 1 : 261.

1940. *Neoscona* : Comstock, *The Spider Book*, : 509.

Characters : Presence of longitudinal thoracic groove in female separates *Neoscona* from all members of the genus *Araneus*. Ocular quad forming a trapezium and slightly longer than wide, anterior medians largest or subequal to the posterior medians, lateral eyes close and not situated on prominent tubercles, posterior laterals smallest, both rows of eyes recurved. In male, coxa I ventrally provided with a hook on the distal rim, tibia II having macrosetae (spines) on prolateral surface. Abdomen may be oval suboval, triangular or sub-triangular in shape. Epigyne is a simple tongue like, scape completely fused to the base and provided with one or two pairs of lateral lobes, epigynal openings situated on the underneath of scape. Palpal patella of male provided with two strong, curved and long spines, cymbium of male palp broad but it is rather narrow stripe like in *Araneus*.

Type-species : *Neoscona arabesca* (Walckenaer).

Distribution : Species of *Neoscona* distributed all over the world.

Key to the species of genus *Neoscona* Simon

1. Abdomen triangular or sub-triangular 2
- Abdomen not triangular or sub-triangular. Abdomen rather tapering at both the anterior and posterior ends *molemensis* Tikader & Bal
2. Abdomen triangular, epigynal scape short, broad and triangular *nautica* (L. Koch)
- Abdomen sub-triangular, epigynal scape long narrow 3
3. Cephalic region provided with a conspicuous dark brown V-shaped patch, epigynal scape with a deep construction *mukerjei* Tikader
- Cephalic region not having any V-shaped patch, epigynal scape without a deep construction. Lateral lobes of epigyne very distinct and horn like and visible from ventral side of abdomen *rumpfi* (Thorell)

12. *Neoscona molemensis* Tikader & Bal

1981. *Neoscona molemensis* Tikader & Bal, *Rec. zool. Surv. India, Occ. Pap.* No. 24 : 22.

1982. *Neoscona molemensis* : Tikader, *Fauna of India, Spiders*, 2(1) : 257.

Specimen examined : 1 ♀, Tondabeda village near Orccha, Bastar district, Madhya Pradesh, Coll. U. A. Gajbe, 29.XII.183, (Reg. No. A/1701).

Distribution : INDIA : Molem, Goa, Bastar, Madhya Pradesh.

Remarks : This species is reported here for the first time from Madhya Pradesh.

13. *Neoscona nautica* (L. Koch)

1875. *Epeira natutica* L. Koch, *Aegypt, Abssin Arachn. Jickell* : 17.

1877. *Epeira pullata* : Thorell, *Annali Mus. civ. Genova*, **10** : 385.

Specimen examined : 1 ♀, Budhagar village, Jabalpur district, Madhya Pradesh, Coll. U. A. Gajbe, 10.X.1979, (Reg. No. A/1696). 1 ♀, On the bank of Gajana Nalla near Bargi village, Jabalpur district, Madhya Pradesh, Coll. U. A. Gajbe, 30.X.1985, (Reg. No. A/1697). 2 ♀ ♀, Narayanganj village, Mandla district, Madhya Pradesh, Coll. U. A. Gajbe, 23.I.1985, (Reg. No. A/1698).

Distribution : INDIA : Poona, East Khandesh, Maharashtra, Darjeeling, West Bengal, Rajkot, Gujarat, Riblong, Shillong, Meghalaya, Jabalpur, Mandla, Madhya Pradesh. MYANMAR : Rangoon, Tharrawaddy, Bham. PAKISTAN : Karachi, NORTH AMERICA.

Remarks : This species is being reported for the first time from Madhya Pradesh.

14. *Neoscona muckerjei* Tikader

1980. *Neoscona muckerjei* Tikader, *Proc. Indian Acad. Sci.*, **89**(3) : 247.

1981. *Neoscona muckerjei* : Tikader & Bal, *Rec. zool. Surv. India, Occ. pap. No. 24* : 17.

Specimen examined : 1 ♀, Madan Mahal, Jabalpur district, Madhya Pradesh, Coll. U. A. Gajbe, 12.1.1982.

Distribution : INDIA : Poona, Maharashtra, West Bengal, Jabalpur, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

15. *Neoscona rumpfi* (Thorell)

1887. *Araneus rumpfi* Thorell, *Annali Mus. civ. Genova*, **13** : 296.

1900. *Araneus rumpfi* : Pocock, *Fauna Brit. India, Arachn.*, : 228.

Specimen examined : 1 ♀, Garampani kund, on Jabalpur-Mandla Road, Mandla district, Madhya Pradesh, Coll. U. A. Gajbe, 22.XII.1981, (Reg. No. A/1699). 1 ♀, Madan Mahal, Amanpur, Jabalpur district, Madhya Pradesh, Coll. U. A. Gajbe, 25.V.1979.

Distribution : INDIA : Chingleput, Ootacammund, Tamil Nadu, Bangalore, Karnataka, Wagar Karoor, Andhra Pradesh, Poona, Maharashtra; Orissa, Jabalpur, Mandla, Madhya Pradesh. MYANMAR : Rangoon, Tharrewaddy, Bhamo. PAKISTAN : Karachi. INDO and AUSTRAL- MALAYSIA.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

SUMMARY

This paper deals with 15 species under 7 genera out of which two species are described as new to science.

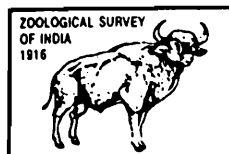
ACKNOWLEDGEMENTS

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Rec. zool. Surv. India : 105 (Part 1–2) : 61-72, 2005

STUDIES ON SOME SPIDERS OF THE FAMILY PHILODROMIDAE (ARANEAE : ARACHNIDA) FROM MADHYA PRADESH, INDIA

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INTRODUCTION

Philodromid spiders are small to medium size (2.50 to 8.00 mm. body length), the body generally flattened and coloured with subdued red-brown, or yellow shades of grey, body covering of soft, recumbent hair, through which longer, scattered, erect, fillform setae emerge. Carapace as wide as long, or nearly so, with the sides smoothly narrowed towards the front; eyes in two recurved rows, the posterior row wider and less curved than the anterior, and posterior median eyes situated closer to the posterior laterals than to each other. Eye tubercles small or absent. Legs moderately laterigrade, long and slender, longer and more slender in males than in females; legs II longest and both I and II slightly longer than III or IV; legs often speckled and ringed with dark pigment and sometimes longitudinally banded with black, tibiae I with 1 to 5 pairs of ventral macrosetae, usually 3 pairs. Abdomen slender to broad, usually smoothly rounded at sides but sometimes distinctly angular, widest in posterior half and tapered to blunt posteriorly. Tibia of male palpus as long as wide or longer, nearly always bearing a retrolateral apophysis with 1, 2 or 3 points, and in most cases also a ventral apophysis which may be free or be closely appressed to the ventral point of the retrolateral apophysis; embolus a slender spine, usually arising on the prolateral side or on the base of the tegulum and passing to the distal end of the later, occasionally arising retrolaterally or terminating there; tegulum with distinct suture, or fold, at point of origin of embolus. Epigynum usually with broad, flat median septum, beside which the copulatory openings are located; copulatory tubes usually visible in dorsal view often bearing spermathecal organ at point of junction with spermatheca; variable in shape, well sclerotized.

Amongst Philodromid spiders we also find the long and narrow bodied crab-spider like *Dieta* and *Tmarus*. The spider of the genus *Dieta* are green in colour with spots on the body and they sit in postures so that their long body and legs assume a long shape on the branch and they are difficult to see. They catch ants and small flies. Spiders of the genus *Philodromus* live on plants

and they attach two leaves together to form a hiding place in which they rest. If any insect approaches nearby, they come out from the retreat to catch it. Since they are dorsoventrally flattened, this flat retreat suits them. Some species of *Philodromus* prefer the brightly coloured leaves, under which they attach their egg sacs. The members of *Tibellus* are directly brown and straw coloured and frequent grass meadows and lie parallel to and close against the stem to keep themselves unnoticed.

The tarsi of the first and second pair of legs furnished with scopulae. Legs approximately equal in length; except *Ebo*. The upper margin of the furrow of the chelicerae armed with one or two teeth. These spiders are very active and pursue their prey with great rapidity. Most of the species live on plants; when at rest, the body is closely applied to the supporting objects, with the legs stretched out separate or in pairs.

The majority of Philodromid spiders thus wait for their prey to come within their reach and for this they can even change their colour to become inconspicuous. However members of some genera like *Tibellus*, *Thanatus* and *Philodromus* are fast runners and catch their prey with the help of the sense of touch as well as by sight.

Pocock (1900) in his 'Fauna of British India Arachnida', volume has dealt with spiders which are common and conspicuous. Apart from Scorpions, Uropygi, Amblypygi, Solifugae he recorded two hundred species of spiders from India. Burma and Sri Lanka. Many common and well known families like Philodromidae were not reported from India. Basu (1973), Tikader (1962a, b, 63, 65a, b, 66a, b, 71, 80) described many species of Philodromid spiders from India. Recently Gajbe and Rane (1992) described one species from Madhya Pradesh.

All the type specimens are deposited in National Zoological Collections, Zoological Survey of India, Kolkata.

Family PHILODROMIDAE Thorell

1870. *Philodromidae* Thorell, *Nova, Acta R. Soc. Scient. Upsal.*, **3**(7) : 1-108.

1975. *Philodromidae* : Haman, *Z. Morph. Tiere*, **80** : 182.

Type-genus : *Philodromus* Walckenaer.

Distribution : All over the world.

Key to the Genera of the Family PHILODROMIDAE

1. Anterior lateral eyes nearer to the anterior median eyes than to the posterior median eyes. Cephalothorax not much longer than wide *Philodromus* Walckenaer
- Anterior lateral eyes nearer to the posterior median eyes than to the anterior median eyes. Cephalothorax much longer than wide. Posterior lateral eyes conspicuously removed behind. 2

2. Cephalothorax much longer than wide. Posterior lateral eyes conspicuously removed behind. *Tibellus* Simon
- Cephalothorax not much longer than wide. Posterior lateral eyes not removed behind.
..... *Dieta* Simon

Genus 1. *Philodromus* Walckenaer

1825. *Philodromus* Walckenaer, *Ent. Fr. Ar.*, 86.

1895. *Philodromus* : Simon, *Hist. Nat. Ar.*, 1(4) : 1063.

1980. *Philodromus* : Tikader, *Fauna of India, Spiders*, 1(1) : 1-181.

Characters : Cephalothorax broader than long, relatively narrow in front. Eyes small and uniform in size and in smaller crescent-shaped group with the anterior row shortest, posterior strongly recurved, the medians further from each other than from the laterals. Abdomen usually oval, not appreciably widened or truncated behind. Legs relatively long, II pairs of legs generally longer than I pair, III and IV pairs a little shorter than I and II pairs.

Most of the species of this genus live on plants over which they can run very rapidly and their flat bodies enable them to get under cracks in bark. They are protectively coloured and difficult to see except when they move.

Type-species : *Philodromus aureolus* (Clerck).

Distribution : All over the world.

Key to species of the genus *Philodromus* Walckenaer

1. Carapace without patches. Clypeal margin provided with small hairs. Abdomen not pentagonal *pawani* sp. nov.
- Carapace with patches. Clypeal margin without small hairs or with spines. Abdomen pentagonal. 2
2. Tibiae and metatarsi of I leg provided with two pairs of ventral spines. 3
- Tibiae and metatarsi of I leg provided with three pairs of ventral spines. 4
3. Abdomen laterally and middorsally provided with brownish patch. *ketani* sp. nov.
- Abdomen brown with whitish patches. *durvei* Tikader
4. Cephalothorax without a hammer-shaped white band. Abdomen dorsally and laterally with black longitudinal incontinuous patches. *rajani* sp. nov.
- Cephalothorax with a hammer-shaped white band. Abdomen dorsally with three faint chevrons. *domesticus* Tikader

1. *Philodromus pawani* sp. nov.

(Figs. 1-3)

General : Cephalothorax and legs yellowish-green, abdomen light yellowish-green. Total length 7.80 mm. long, Carapace 3.00 mm. long, 2.80 mm. wide; abdomen 4.90 mm. long, 3.00 mm. wide.

Cephalothorax : Depressed, longer than wide, posterior region slightly over-lapped by the abdomen. Clypeus narrow margin provided with small hairs directed forward. Eyes eight in two rows, round and black, ringed with white tubercles. Anterior row of eyes slightly recurved (as seen from in front), anterior medians slightly larger than the laterals and closer to adjacent laterals than to each other. Posterior row of eyes recurved, posterior medians smaller than the posterior laterals and closer to adjacent laterals than to each other. Median ocular quadrangle broader than long and wider behind than in front. Sternum oval, pointed behind, clothed with fine hairs. Legs relatively long, II leg slightly longer than I, clothed with fine pubescence, dorsal side of I femur provided with pairs of spines directed outwards. Tibiae and metatarsi of I leg provided with two pairs of ventral spines each. Tarsal scopulae well developed and claw tuft prominent.

Abdomen : Longer than wide, depressed, clothed with very fine pubescence, posterior end pointed and dorsally provided with pigmented irregular brown spots as in fig. 1. Ventral side slightly lighter than the dorsal. Epigyne as in fig. 2. Internal genitalia as in fig. 3.

Type-specimens : *Holotype* : ♀, *Paratype* 1 ♀, in spirit, other details as above. Registration Nos. 5444-5445/18.

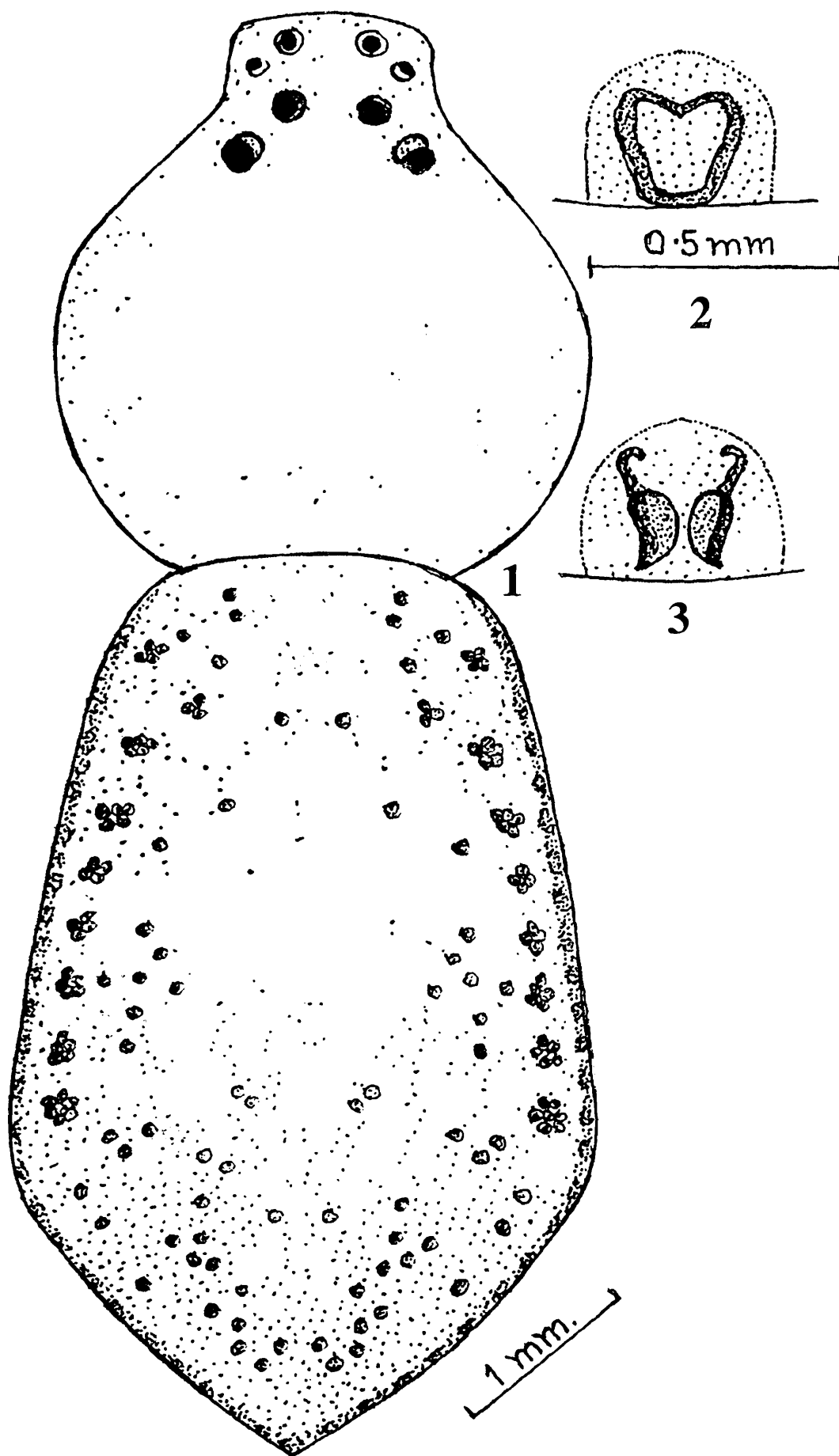
Type-locality : INDIA : Madhya Pradesh, Narayanganj, Mandla district, Coll. U.A. Gajbe, 23.1.1985. *Paratype* : INDIA : Madhya Pradesh, Chiraidongari village, Mandla district, Coll. U.A. Gajbe, 15.IX.1981.

Remarks : This species closely resembles *Philodromus shillongensis* Tikader but differs from it as follows : (i) Cephalothorax without patches, but in *P. shillongensis* cephalothorax laterally provided with pigmented patches. (ii) Dorsal side of femur I provided with two pairs of spines directed outward but in *P. shillongensis* dorsal side of femur I provided with one pair of spines directed outward. (iii) Abdomen provided with pigmented irregular brown spots but in *P. shillongensis* dorsum pigmented with irregular brown dots, antero-medially with a spear shaped light brown marking. (iv) Epigyne and internal genitalia also structurally different.

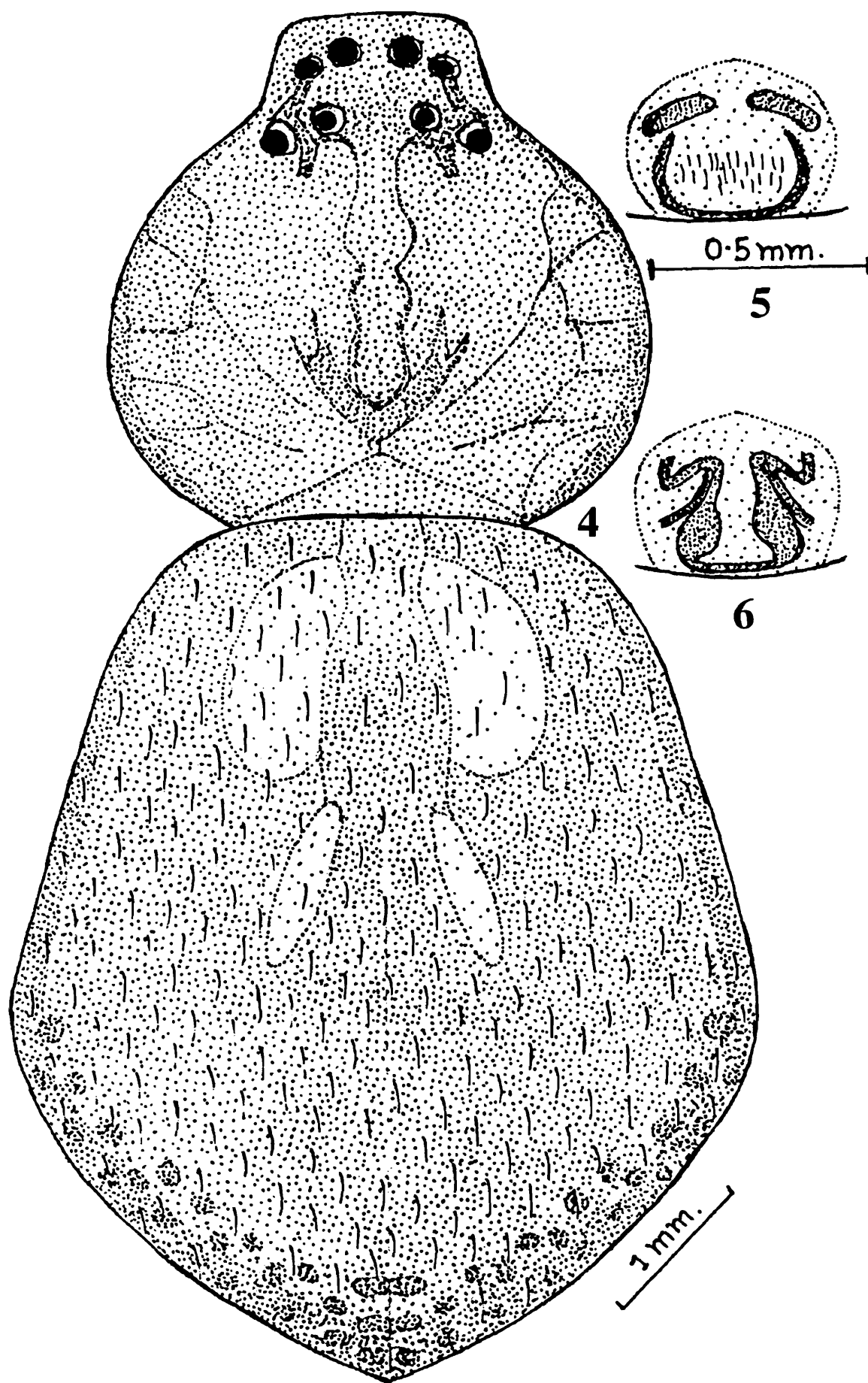
2. *Philodromus ketani* sp. nov.

(Figs. 4-6)

General : Cephalothorax reddish-green, legs brownish-green, abdomen brown. Total length 8.60 mm. Carapace 3.40 mm. long, 3.40 mm. wide; abdomen 5.40 mm. long, 4.50 mm. wide.



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



Figs. 4-6. *Philodromus ketani* sp. nov.;

4. Dorsal view of female, legs omitted; 5. Epigyne; 6. Internal genitalia.

Cephalothorax : Depressed but cephalic region slightly high, as long as wide, narrowing in front, laterally provided with brownish patch and at the posterior half V-shaped brownish patch as in fig. 4 Clypeus medium and margin provided with spines directed forward. Eyes eight in two rows, round and black, ringed with white tubercles. Anterior row of eyes slightly recurved (as seen from in front), anterior medians are larger than the anterior laterals and closer to adjacent laterals than to each other. Posterior laterals are closer to adjacent laterals than to each other. Median ocular quadrangle broader than long and broad behind than in front. Sternum oval, clothed with fine hairs. Legs relatively long and strong, II leg slightly longer than I clothed with fine pubescence and spines. Femur I dorsally provided with two pairs of spines directed forwards. Tibiae and metatarsi of I leg provided with two pairs of ventral spines each. Tarsal scopulae well developed and claw tuft prominent.

Abdomen : Longer than wide, nearly pentagonal, widest behind the middle, clothed with hairs, posterior end obtusely pointed, laterally provided with brownish patch and middorsally provided with brownish patch and two whitish patches. Ventral side slightly lighter than the dorsal. Epigyne as in fig. 5. Internal genitalia as in fig. 6.

Type-specimen : *Holotype* : ♀, in spirit, other details as above. Registration No. 5446/18.

Type-locality : INDIA : Madhya Pradesh, Barela village, Jabalpur district, Coll. U.A. Gajbe, 22.XII.1981.

Remarks : This species resembles *Philodromus devhutai* Tikader but differs from it as follows : (i) Cephalothorax laterally provided with patch and middorsally V-shaped brownish patch but in *P. devhutai* cephalothorax laterally with conspicuous pigmented patch. (ii) Abdomen laterally with brownish patch and mid-dorsally with two whitish patches but in *P. devhutai* abdomen with very prominent black bands. (iii) Epigyne and internal genitalia also structurally different.

3. *Philodromus durvei* Tikader

1980. *Philodromus durvei* Tikader, *Fauna of India, Spiders*, 1(1) : 204.

Specimen examined : 1 ♂, Supkhar, Chilpura tank, Kanha National Park, Mandla district, Madhya Pradesh, Coll. R.K. Singh, 1.XII.1986, (Reg. No. A/1771).

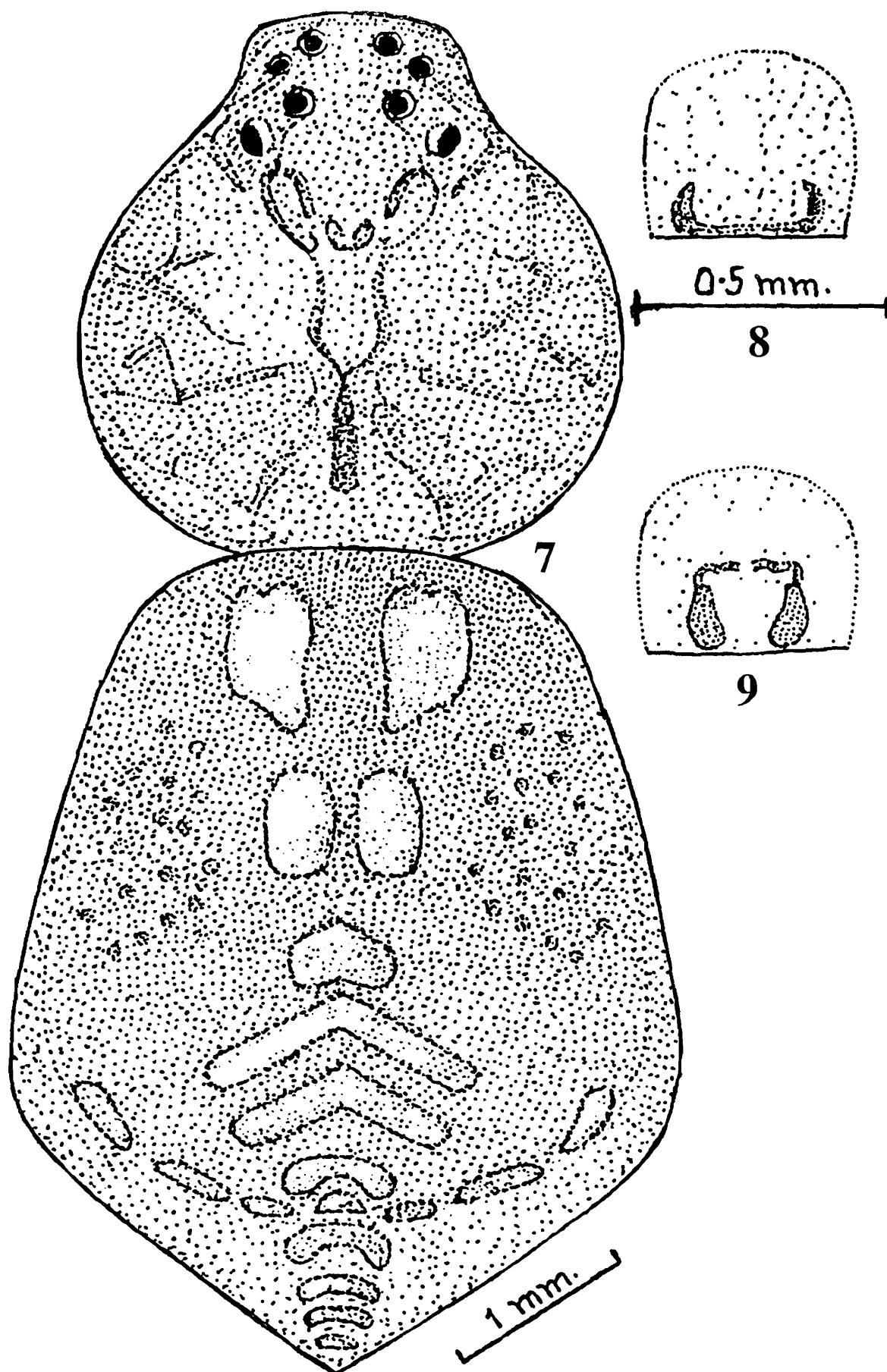
Distribution : INDIA : Jabalpur, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Mandla district of Madhya Pradesh.

4. *Philodromus rajani* sp. nov.

(Figs. 7-9)

General : Cephalothorax and legs deep yellowish-green, abdomen brown. Total length 7.40 mm. Carapace 3.10 mm. long, 2.90 mm. wide; abdomen 4.40 mm. long, 3.50 mm. wide.



Figs. 7-9. *Philodromus rajani* sp. nov.;
7. Dorsal view of female, legs omitted; 8. Epigyne; 9. Internal genitalia.

Cephalothorax : Depressed, longer than wide, posterior region slightly over-lapped by the abdomen, clothed with fine hairs, laterally and middorsally provided with brown reticulations. Clypeus narrow. Eyes eight in two rows, round and black, ringed with white tubercles. Anterior row of eyes slightly recurved, anterior medians slightly larger than the laterals and close to laterals than to each other. Posterior row of eyes strongly recurved, medians very smaller than the laterals and closer to lateral than to each other. Median ocular quadrangle broader than long and broader behind than in front. Sternum oval, pointed behind, clothed with fine hairs. Legs relatively long, II leg slightly longer than I, clothed with fine pubescence, dorsal side of I femur provided with two pairs of spines directed outwards. Tibiae and metatarsi of I leg provided with three pairs of ventral spines each. Tarsal scopulae developed and claw tufts prominent.

Abdomen : Nearly pentagonal, longer than wide, widest behind the middle, clothed with hairs, posterior end obtusely pointed and provided with silvery white patches as in fig. 7. Ventral side lighter than the dorsal and laterally provided with black longitudinal incontinuous patches. Epigyne as in fig. 8. Internal genitalia as in fig. 9.

Type-specimen : *Holotype* : ♀, in spirit, other details as above. Registration No. 5447/18.

Type-locality : INDIA : Madhya Pradesh, Bangal village, Patan Tahsil, Jabalpur district, Coll. U.A. Gajbe, 19.X.1981.

Remarks : This species resembles *Philodromus betrabatai* Tikader but differs from it as follows : (i) Cephalothorax mid-dorsally and laterally provided with brown reticulations but in *P. betrabatai* lateral margins with pigmented patches. (ii) Abdomen dorsally provided with silvery white patches but in *P. betrabatai* abdomen provided with pale triangular patch on either side of the median line and faint pale chevrons. (iii) Epigyne and internal genitalia also structurally different.

5. *Philodromus domesticus* Tikader

1962. *Philodromus domesticus* Tikader, *Proc. zool. Soc. Calcutta*, **15**(1) : 39.

1980. *Philodromus domesticus* : Tikader, *Fauna of India, Spiders*, **1**(1) : 183.

Specimen examined : 2 ♀ ♀, Ajoygarh forest, Panna district, Madhya Pradesh, Coll. R.K. Singh, 13.II.1987, (Reg. No. A/1772).

Distribution : INDIA : Shillong, Meghalaya, Panna, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

Genus 2. *Tibellus* Simon

1875. *Tibellus* Simon, *Ar. Fr.*, **2** : 307.

1895. *Tibellus* : Simon, *Hist. Nat. Araign.*, **1**(4) : 1065.

Characters : Cephalothorax appreciably longer than wide. The change in position of the eyes have gone further than in the genus *Thanatus*, and the eyes of the anterior row, with the posterior

median pair, form a small compact hexagonal group from which the posterior laterals conspicuously removed. Abdomen long and cylindrical or cigar-shaped. Legs relatively long, bearing scopulae on both tarsi and metatarsi. These spiders are found in grass and on bushes; when at rest the legs are stretched out longitudinally, two pairs forward and two pairs backward.

Type-species : *Tibellus oblongus* (Walckenaer).

Distribution : EUROPE, AMERICA, AFRICA and ASIA.

6. *Tibellus poonaensis* Tikader

1962. *Tibellus poonaensis* Tikader, *J. Univ. Poona Sci. & Tech.*, **22** : 135.

1980. *Tibellus poonaensis* : Tikader, *Fauna of India, Spiders*, **1**(1) : 215.

Specimen examined : 1 ♀, Mura village, Betul district, Madhya Pradesh, Coll. H.S. Sharma, 24.II.1990, (Reg. No. A/1773).

Distribution : INDIA : Poona, Maharashtra, Betul, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

7. *Tibellus elongatus* Tikader

1960. *Tibellum elongatus* Tikader, *J. Bombay nat. Hist. Soc.*, **57**(1) : 177.

1980. *Tibellus elongatus* : Tikader, *Fauna of India, Spiders*, **1**(1) : 217.

Specimen examined : 3 ♀ ♀, Singhpur, Panna district, Madhya Pradesh, Coll. R.K. Singh, 16.II.1987, (Reg. No. A/1774). 1 ♀, Shikara village, Lakhnadon Tahsil, Seoni district, Madhya Pradesh, Coll. U.A. Gajbe, (Reg. No. A/1775).

Distribution : INDIA : Kolkata, West Bengal, Panna, Seoni, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

Genus 3. *Dieta* Simon

1880. *Dieta* Simon, *Ann. Soc. ent. Fr.*, **10**(5) : 108.

1980. *Dieta* : Tikader, *Fauna of India, Spiders*, **1**(1) : 233.

Characters : Cephalothorax flat, longer than wide and abruptly narrowing anteriorly on the ocular area. Eyes prominently tuberculated, lateral eyes larger than medians, both rows recurved but anterior row more recurved than the posterior row. The four median eyes form a rectangular area as wide behind as in front. Legs I and II remarkably long and spinnerets situated at the posterior end of abdomen.

Type-species : *Dieta parnassia* Simon.

Distribution : AFRICA, ASIA, Oriental regions and JAPAN.

8. *Dieta elongata* Tikader

1980. *Dieta elongata* Tikader, *Fauna of India, Spiders*, 1(1) : 234.

Specimen examined : 2 ♀ ♀, on the bank of Megha river, 7 km. from Forest Rest House, Kukru, Betul district, Madhya Pradesh, Coll. H.S. Sharma, 1.IV.1990, (Reg. No. A/1776). 1 ♀, Patehi village on Katawadi, Shahpur road, Betul district, Madhya Pradesh, Coll. H.S. Sharma, 21.III.1990, (Reg. No. A/1777).

Distribution : INDIA : Poona, Maharashtra; Betul, Madhya Pradesh.

Remarks : This species is being reported here for the first time from Madhya Pradesh.

SUMMARY

This paper deals with 8 species under 3 genera of the family Philodromidae out of which 3 species are described as new to science.

ACKNOWLEDGEMENTS

I am thankful to the Director, Zoological Survey of India, Kolkata for providing necessary facilities.

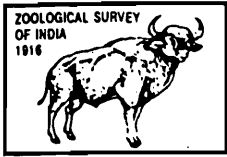
I am also thankful especially to Dr. Mrs. A. S. Dippenaar Schoeman, Department of Agricultural Technical Services, Plant Protection Research Institute, Private Bag, 134, PRETORIA, AFRICA and Dr. H. Ono, Department of Zoology, National Science Museum, 3-23-1, Hyakunin-che, Shinjuku-ku, TOKYO-169 JAPAN for help with literature on Philodromid spiders.

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Rec. zool. Surv. India : 105 (Part 1–2) : 73-81, 2005

CHECKLIST OF TERRESTRIAL GASTROPODS OF KERALA, INDIA

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INTRODUCTION

Leaf litter and soil form an arena for diverse interactions in tropical rain forests. It harbours many minute organisms, which play an important role in nutrient recycling. Molluscs belong to this ecological niche forming the epigeic species, which live and feed on the soil surface. Unfortunately, for the last 75 years or so, in South India, no attention has been paid for this important group with exceptions of some localized reviews and publications (Satyamurthy, 1960; Tonapi and Mulhekar, 1963; Tonapi 1971; Subba Rao and Mitra, 1979, 1986; Madhyastha *et al.*, 2003, 2005; Mavinkurve *et al.*, 2004b, in press; Sandhya *et al.*, submitted). This report is in continuation of the list of the land snails present in the southern states that is being formulated (Mavinkurve *et al.*, 2004a) so that it will be helpful for any worker in the future to file new reports and carry further ecological studies.

KERALA STATE

Kerala described, as gods own country having an area of 38,863 sq km is tucked away in the southwest corner of India. It is geographically divided into the highlands, midlands and lowlands. The highlands slope down from the Western Ghats, which rise to an average height of 900 m, with a number of peaks well over 1,800 m in height. The Silent Valley and Periyar are important protected areas of the state, forming mega diversity centres at micro scales. The Wynaad area is home for major plantations like tea, coffee, teak, rubber, cardamom and other spices. The midlands, lying between the mountains and the lowlands, are made up of undulating hills and valleys. The lowlands or the coastal area is made up of the river deltas, backwaters and the shore of the Arabian Sea.

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Kerala is a land of rivers and backwaters. Forty-four rivers (41 west-flowing and 3 east-flowing) cut across Kerala with their innumerable tributaries and branches. The temperature is hot and humid in the low lands, whereas in the highlands it is on the cooler side.

LIST OF LAND MOLLUSCS FROM KERALA BASED ON FAUNA OF BRITISH INDIA AND EXISTING LITERATURE

Class GASTROPODA

Sub Class PROSOBRANCHIA

Order MESOGASTROPODA

Super Family CYLOPHOROIDEA

Family CYCLOPHORIDAE

Genus *Alycaeus* Gray 1850

1. *Alycaeus expatriatus* (Blanford 1860)*
2. *Alycaeus footei* (Blanford 1861)*

Genus *Craspedotropis* Blanford 1864

3. *Craspedotropis bilirata* Beddome 1875*

Genus *Cyathopoma* Blanford 1861

4. *Cyathopoma anamullayanum* Beddome 1875*
5. *Cyathopoma atrosetosum* Beddome 1875*
6. *Cyathopoma imperforatum* (Nevill 1888)*
7. *Cyathopoma latilabre* Beddome 1875*
8. *Cyathopoma nitidum* Beddome 1875*
9. *Cyathopoma procerum* (Blanford 1868)*
10. *Cyathopoma travancoricum* Beddome 1875*
11. *Cyathopoma wynaadense* (Blanford 1868)*

Genus *Cyclophorus* Montfort 1810

12. *Cyclophorus jerdoni* (Benson 1851)*
13. *Cyclophorus nilagiricus* (Benson 1852)*

Genus *Ditropis* Blanford 1869

14. *Ditropis beddomei* Blanford 1869*
15. *Ditropis convexa* Blanford 1869*
16. *Ditropis planorbis* Blanford 1869*

Genus *Micraulax* Theobald 1876

17. *Micraulax coeloconus* (Benson 1851)
18. *Micraulax scabra* (Theobald 1876)*

Genus *Mychopoma* Blanford 1861

19. *Mychopoma hirsutum* Blanford 1869*
20. *Mychopoma limbiferum* Blanford 1869

Genus *Pearsonia* Kobelt 1902

21. *Pearsonia travancorica* Blanford 1880*

Genus *Pterocyclus* Benson 1832

22. *Pterocyclus comatus* Moellendorff 1897*
23. *Pterocyclus cumingi* (Pfeiffer 1851)
24. *Pterocyclus cyclophoroideus* (G. Nevill 1881)*
- 24a. *Pterocyclus cyclophoroideus* var. *subluteola* (G. Nevill 1881)
25. *Pterocyclus nanus* (Benson 1851)*
26. *Pterocyclus pseudocumingi* Moellendorff 1897*

Genus *Theobaldius* G. Nevill 1878

27. *Theobaldius deplanatus* (Pfeiffer 1854)*
28. *Theobaldius ravidus* (Benson 1851)*

Family DIPLOMMATINIDAE

Genus *Nicida* W. Blanford 1868

29. *Nicida anamullayana* Beddome 1875*
30. *Nicida nitidula* (Blanford 1868)*

Genus *Opisthostoma* W. and H. Blanford 1860

31. *Opisthostoma macrostoma* Blanford 1869*

Family PUPINIDAE

Genus *Tortulosa* Gray 1847

32. *Tortulosa albescens* Blanford 1880*
33. *Tortulosa calacadensis* Blanford 1869*
34. *Tortulosa recurvata* (Pfeiffer 1862)*
35. *Tortulosa tortuosa* (Chemintz 1795)*

Sub class PULMONATA

Order STYLOMMATOPHORA

Sub Order ORTHURETHRA

Super family PUPILLOIDEA

Family VALLONIIDAE

Genus *Vallonia* Risso 1826

36. *Vallonia miserrima* (Gude 1907)*

Super family BULUMINOIDEA

Family BULUMINIDAE

Genus *Ena* Leach in Turton 1831

37. *Ena nilagirica* (Pfeiffer 1846)*

Family CERASTUIDAE

Genus *Cerastua* Strand 1928

38. *Cerastua densus* (Pfeiffer 1856)

Genus *Rhachis* Albers 1850

39. *Rhachis bengalensis* (Lamarck 1822)

40. *Rhachis pulcher* (Gray 1825)

41. *Rhachis punctatus* (Anon 1834)

42. *Rhachis trutta* (Blanford 1866)*

Sub order SIGMURETHRA

Super family ACHATINOIDEA

Family SUBULINIDAE

Genus *Opeas* Albers 1850

43. *Opeas gracile* (Hutton 1834)

Genus *Glessula* Von Martens 1860

44. *Glessula anamullica* (Blanford 1866)*

45. *Glessula beddomei* (Blanford 1866)*

46. *Glessula bensoniana* (Pfeiffer 1851)*

47. *Glessula blanda* Gude 1914*

48. *Glessula deshayesi* (Pfeiffer 1852)

49. *Glessula facula* (Benson 1860)

50. *Glessula filosa* Blanford 1870*

51. *Glessula gemma* (Reeve 1850)

52. *Glessula gracilis* Beddome 1906*
53. *Glessula hebes* (Pfeiffer 1868)
54. *Glessula indica* Gude 1914*
55. *Glessula isis* (Hanley 1875)*
56. *Glessula jerdoni* (Reeve 1850)
57. *Glessula malabarica* Gude 1914*
58. *Glessula neglecta* Gude 1914*
59. *Glessula oreas* (Reeve 1850)*
60. *Glessula orophila* (Reeve 1849)
61. *Glessula paupercula* (Blanford 1861)*
62. *Glessula pusilla* Beddome 1906
63. *Glessula reynelli* var. *immitis* Gude 1914
64. *Glessula scrutillus* (Benson 1860)
65. *Glessula senator* (Hanley 1875)*
66. *Glessula subinornata* var. *minor* Beddome 1906*
67. *Glessula subjerdoni* Beddome 1906
68. *Glessula subserena* Beddome 1906*
69. *Glessula subtornensis* Gude 1914*
70. *Glessula textilis* (Blanford 1866)*
71. *Glessula tornensis* Blanford 1870*
72. *Glessula travancorica* Gude 1914*

Super family STREPTAXOIDEA

Family STREPTAXIDAE

Genus *Streptaxis* Gray 1837

73. *Streptaxis beddomii* Blanford 1899*
74. *Streptaxis peroteti* (Petit 1841)
75. *Streptaxis personatus* Blanford 1880*
76. *Streptaxis watsoni* (W and H Blanford 1860)*

Genus *Ennea* H. and A. Adams 1855

77. *Ennea bicolor* (Hutton 1834)
78. *Ennea turricula* Blanford 1899*

Super family PLECTOPYLIDOIDEA

Family PLECTOPYLIDIDAE (Corillidae)

Genus *Corilla* H. and A. Adams 1855

79. *Corilla anax* (Benson 1865)*

Super family PUNCTOIDEA

Family ENDODONTIDAE

Genus *Philalanka* Godwin-Austen 189880. *Philalanka pirrieana* (Pfeiffer 1854)*81. *Philalanka quinquelirata* Gude 1914*

Family CHAROPIDAE

Genus *Ruthvenia* Gude 191182. *Ruthvenia clathratuloides* (Gude 1897)*Genus *Thysanota* Albers 186083. *Thysanota guerini* (Pfeiffer 1842)*

Sub order ELASMOGNATHA

Super family HELIXARIONOIDEA

Family HELIXARIONIDAE

Genus *Pseudaustenia* Cockerell 189184. *Pseudaustenia atra* (Godwin-Austen 1898)*

Family ARIOPHANTIDAE

Genus *Ariophanta* Desmoulins 182985. *Ariophanta cysis* (Benson 1852)*86. *Ariophanta thyreus* (Benson 1852)*Genus *Cryptozona* Morch 187287. *Cryptozona belangeri* (Deshyes 1834)88. *Cryptozona gassi* (Blanford 1901)*89. *Cryptozona semirugata* (Beck 1837)Genus *Hemiplecta* Albers 185090. *Hemiplecta basilessa* (Benson 1865)*91. *Hemiplecta basileus* (Benson 1861)*92. *Hemiplecta beddomei* (Blanford 1874)*Genus *Indrella* Godwin-Austen 190193. *Indrella ampulla* (Benson 1850)*Genus *Euplecta* Semper 187094. *Euplecta acuducta* (Benson 1850)95. *Euplecta albizonata* (Dohrn 1853)96. *Euplecta apicata* Blanford 1870*

- 97. *Euplecta indica* (Pfeiffer 1846)
- 97a. *Euplecta indica* var. *shiplayi* (Pfeiffer 1856)
- 98. *Euplecta mucronifera* (Blanford 1901)*
- 99. *Euplecta orbiates* (Blanford 1901)*
- 100. *Euplecta pulchella* (Blanford 1904)*
- 101. *Euplecta semidecussata* (Pfeiffer 1851)
- 102. *Euplecta subcastor* (Beddome 1891)*
- 103. *Euplecta travancorica* (Pfeiffer 1865)*

Genus *Mariaella* Gray 1855

- 104. *Mariaella beddomei* (Godwin-Austen 1888)*
- 105. *Mariaella dussumeri* (Gray 1855)*

Genus *Macrochlamys* Benson 1832

- 106. *Macrochlamys peringundensis* (Beddome 1891)*
- 107. *Macrochlamys prava* (Pfeiffer 1851)
- 108. *Macrochlamys rutila* (Pfeiffer 1851)*
- 109. *Macrochlamys vallicola* (Pfeiffer 1851)
- 110. *Macrochlamys woodiana* (Pfeiffer 1851)

Genus *Sitala* H. Adams 1865

- 111. *Sitala injussa* (Blanford 1861)*
- 112. *Sitala palmaria* (Benson 1864)*

Genus *Satiella* Godwin-Austen 1908

- 113. *Satiella compressa* (Godwin-Austen 1908)*
- 114. *Satiella pertenuis* (Godwin-Austen 1908)*

Super family CAMAENOIDEA

Family CAMAENIDAE

Genus *Amphidromus* Albers 1850

- 115. *Amphidromus bontiae* (Chemnitz 1786)
- 116. *Amphidromus physalis* (Benson 1857)*

Genus *Apatetes* Gude 1914

- 117. *Apatetes bourdilloni* (Hartmann 1842)*

Genus *Trachia* Albers 1860

- 118. *Trachia proxima* (Ferrussac 1832)*
- 119. *Trachia vittata* (Muller 1774)

*Endemic to peninsular India and Sri Lanka.

DISCUSSION

This is the first comprehensive checklist of land snails for Kerala state. A total of one hundred and nineteen species excluding the varieties are present in the state. Most of the species have been recorded from the Annamalai and Wynaad regions. Subba Rao and Mitra (1986) have reported six species from the Silent Valley expedition. Since the Annamalai ranges and Agastyamalai peaks are shared with neighbouring Tamil Nadu most of the species are common with the latter. Of the twenty-two families present in the Western Ghats fourteen are present in Kerala state. It is home to some of the unique genera like *Corilla*, *Indrella* and *Cerastua*. The old system of classification has changed to a considerable extent from that followed in the Fauna series, This list tries to ease the confusion by following the latest and considered to be the most comprehensive classification of the present day Mollusca, compiled by K.C. Vaught, (1989). We hope this list will stimulate interest in gathering additional information on the distribution, ecology and the status of the species presented.

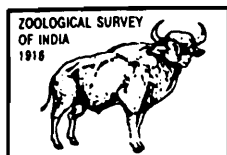
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CHECKLIST OF TERRESTRIAL GASTROPODS OF TAMIL NADU, INDIA

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INTRODUCTION

Molluscs form an important constituent of leaf litter and soil biota. They are an ideal group for monitoring site specific environmental impact assessment studies because of their limited migration patterns. Majority of them remain undiscovered or under described, partly because of insufficient exploration and partly because of their often minute sizes (Emberton, 1995). Unfortunately, for the last 75 years or so, in South India, no attention has been paid for this important group with exceptions of some localized reviews and publications [(Tonapi and Mulhekar, 1963; Tonapi 1971; Subba Rao and Mitra, 1979, 1986; Madhyastha *et al.*, 2003, 2005; Mavinkurve *et al.*, 2004a, (in press); Sandhya *et al.*, (submitted)]. The works of Ramanan (1900) and Sathyamurthi (1960) are the preliminary source for those interested in the terrestrial molluscs of Tamil Nadu. This work is in continuation of the checklist for the land snails of the southern states that is being formulated (Mavinkurve *et al.*, 2004b).

STUDY AREA

Situated on the southeastern side of the Indian peninsula, the state of Tamil Nadu has an area of 130,058 sq km. The landmass of the state can be divided into two natural divisions :

- (i) The eastern coastal plain
- (ii) The hilly region along the north and the west.

Along the whole length of the western part, at a distance from the sea varying from 80 to 160 km runs the Western Ghats range, a steep and rugged mass averaging 1220 metres above the sea level.

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The Nilgiris and the Anamalai are the hill groups with the maximum height. In the Ootacamund area of the Nilgiris District, is the highest peak Doddabetta, 2640 metres above the sea level. On the east are the Palani Hills on which is situated the hill station Kodaikanal. The slopes of the Western Ghats are covered with heavy evergreen forests and are the water source to the rivers Kaveri, Vaigai and Tamaraparni. The Eastern Ghats begin in Orissa, runs southwest through all the districts lying between Ganjam and Nilgiris plateau of Tamil Nadu.

LIST OF LAND MOLLUSCS FROM TAMIL NADU — BASED ON THE FAUNA OF BRITISH INDIA AND AVAILABLE COLLECTIONS

Class GASTROPODA

Sub Class PROSOBRANCHIA

Order MESOGASTROPODA

Super Family CYLOPHOROIDEA

Family CYCLOPHORIDAE

Genus *Japonia* Blanford, 1864

1. *Japonia (Lagochilus) malleata* Blanford 1861*

Genus *Craspedotropis* Blanford, 1864

2. *Craspedotropis cuspidata* (Benson 1851)*
3. *Craspedotropis salemensis* Beddome 1875*

Genus *Micraulax* Theobald, 1876

4. *Micraulax coeloconus* (Benson 1851)[#]

Genus *Ditropis* Blanford, 1869

5. *Ditropis beddomei* Blanford 1869**
6. *Ditropis convexa* Blanford 1869*
7. *Ditropis planorbis* Blanford 1869*

Genus *Theobaldius* G. Nevill, 1878

8. *Theobaldius annulatus* var. *nilgiricus* (Kobelt 1907)*
9. *Theobaldius deplanatus* (Pfeiffer 1854)[#]
10. *Theobaldius ravidus* (Benson 1851)[#]
11. *Theobaldius shiplayi* (Pfeiffer 1856)*
12. *Theobaldius stenostoma* (Sowerby 1843)*
- 12a. *Theobaldius stenostoma* var. *anguis* (Hanley and Theobald 1875)*
13. *Theobaldius tristis* Blanford 1869[#]

Genus *Cyclophorus* Montfort, 1810

14. *Cyclophorus aurantiacus* (Schumacher 1817)
15. *Cyclophorus jerdoni* (Benson 1851)[#]
16. *Cyclophorus nilagiricus* (Benson 1852)

Genus *Pterocyclus* Benson, 1832

17. *Pterocyclus bilabiatatus* (Sowerby 1843)*
18. *Pterocyclus comatus* Moellendorff 1897*
19. *Pterocyclus cyclophoroideus* (G. Nevill 1881)*[#]
- 19a. *Pterocyclus cyclophoroideus* var. *subluteola* (G. Nevill 1881)*
20. *Pterocyclus nanus* (Benson 1851)*
- 20a. *Pterocyclus nanus* var. *applanata* (G. Nevill 1881)*
- 20b. *Pterocyclus nanus* var. *reflexilabris* (G. Nevill 1881)*
21. *Pterocyclus pseudocumingi* Moellendorff 1897*[#]

Genus *Pearsonia* Kobelt, 1902

22. *Pearsonia fairbanki* Blanford 1869*
23. *Pearsonia travancorica* Blanford 1880*

Genus *Cyathopoma* Blanford, 1861

24. *Cyathopoma (Jerdonia) anamullayanum* Beddome 1875*
25. *Cyathopoma (Cyathopoma) atrosetosum* Beddome 1875[#]
26. *Cyathopoma (Cyathopoma) beddomeanum* (Nevill 1875)*[#]
27. *Cyathopoma (Cyathopoma) coonoorensense* Blanford 1868*[#]
28. *Cyathopoma (Cyathopoma) filocinctum* (Benson 1851)*[#]
29. *Cyathopoma (Jerdonia) imperforatum* (Nevill 1888)*
30. *Cyathopoma (Cyathopoma) kalryenense* Blanford 1861
31. *Cyathopoma (Cyathopoma) kolamulliense* Blanford 1861*
32. *Cyathopoma (Jerdonia) malabaricum* (Blanford 1860)*
33. *Cyathopoma (Jerdonia) nitidum* Beddome 1875[#]
34. *Cyathopoma (Cyathopoma) ovatum* Beddome 1875*[#]
35. *Cyathopoma (Cyathopoma) peilei* (Preston 1903)*[#]
36. *Cyathopoma (Cyathopoma) shevroyanum* Beddome 1875*[#]
37. *Cyathopoma (Cyathopoma) sivagherrianum* Beddome 1875*[#]
38. *Cyathopoma (Jerdonia) trochlea* (Benson 1851)*[#]
39. *Cyathopoma (Cyathopoma) vitreum* Beddome 1875*[#]
40. *Cyathopoma (Cyathopoma) wynaadense* Blanford 1868*[#]

Genus *Mychopoma* Blanford, 1861

- 41. *Mychopoma hirsutum* Blanford 1869**
- 42. *Mychopoma limbiferum* Blanford 1869*
- 43. *Mychopoma seticinctum* Beddome 1875*

Genus *Alycaeus* Gray, 1850

- 44. *Alycaeus expatriatus* (Blanford 1860)#
- 45. *Alycaeus footei* Blanford 1861

Family DIPLOMMATINIDAE

Genus *Nicida* W. Blanford, 1868

- 46. *Nicida anamullayana* Beddome 1875**
- 47. *Nicida fairbanki* Blanford 1868**
- 48. *Nicida kingiana* Blanford 1861**
- 49. *Nicida liricincta* Blanford 1868#
- 50. *Nicida nilgirica* (Blanford 1860)**
- 51. *Nicida pulenyana* (Blanford 1868*)

Genus *Opisthostoma* W. and H. Blanford, 1860

- 52. *Opisthostoma deccanense* Beddome 1875
- 53. *Opisthostoma nilgircum* (Blanford 1860)**

Family PUPINIDAE

Genus *Tortulosa* Gray, 1847

- 54. *Tortulosa calacadensis* Blanford 1869*
- 55. *Tortulosa costulata* Blanford 1880*
- 56. *Tortulosa recurvata* (Pfeiffer 1862)*

Super Family LITTORINOIDEA

Family POMATIASIDAE

Genus *Cyclotopsis* Blanford, 1864

- 57. *Cyclotopsis montana* (Pfeiffer 1854)*

Sub Class GYMNOMORPHA

Order SOLEOLIFERA

Family VERONICELLIDAE

Genus *Filicaulis* Simroth, 1913

- 58. *Filicaulis (Lavecaulis) alte* (Ferrussac 1821)#
- 59. *Filicaulis (Lavecaulis) frauenfeldi* (Semper 1885)*

Sub Class PULMONATA

Order STYLOMMATOPHORA

Sub Order ORTHURETHRA

Super Family PUPILLOIDEA

Family VALLONIIDAE

Genus *Vallonia* Risso, 1826

60. *Vallonia miserrima* (Gude 1907)*#

Family VERTIGINIDAE

Genus *Pupisoma* Stoliczka, 1873

61. *Pupisoma evezardi* (Blanford 1875)#

Family PYRAMIDULIDAE

Genus *Pyramidula* Fitzinger, 1833

62. *Pyramidula euomphalus* Blanford 1861*

Super Family BULUMINOIDEA

Family BULUMINIDAE

Genus *Ena* Leach in Turton, 1831

63. *Ena hanleyana* (Kobelt 1902)*#

64. *Ena nilagirica* (Pfeiffer 1846)*

Family CERASTUIDAE

Genus *Edouardia* Gude, 1914

65. *Edouardia orbus* Blanford 1861

Genus *Rhachis* Albers, 1850

66. *Rhachis bengalensis* (Lamarck 1822)#

67. *Rhachis praetermissus* Blanford 1861#

68. *Rhachis pulcher* (Gray 1825)

69. *Rhachis punctatus* (Anon 1834)#

70. *Rhachis trutta* (Blanford 1866)*

Sub Order SIGMURETHRA

Super Family ACHATINOIDEA

Family SUBULINIDAE

Genus *Subulina* Beck, 1837

71. *Subulina octona* (Bruguiere 1789)

Genus *Opeas* Albers, 1850

72. *Opeas gracile* (Hutton 1834)[#]

Genus *Prosopeas* Moersch, 1876

73. *Prosopeas hebes* Blanford 1861*

Genus *Glessula* Von Martens, 1860

74. *Glessula anamullica* (Blanford 1866)*
 75. *Glessula beddomei* (Blanford 1866)*
 76. *Glessula bensoniana* (Pfeiffer 1851)*
 77. *Glessula blanda* Gude 1914*
 78. *Glessula bollampattiana* (Hanley 1876)
 79. *Glessula botellus* (Benson 1870)*
 80. *Glessula corrosula* (Pfeiffer 1856)
 81. *Glessula courtallica* Gude 1914*[#]
 82. *Glessula facula* (Benson 1860)
 83. *Glessula filosa* Blanford 1870*
 83a. *Glessula filosa* var. *exigua* Gude 1914*
 84. *Glessula gracilis* Beddome 1906
 85. *Glessula hebes* (Pfeiffer 1868)
 86. *Glessula indica* Gude 1914*
 87. *Glessula isis* (Hanley 1875)*
 88. *Glessula jerdoni* (Reeve 1850)
 89. *Glessula mullorum* (Blanford 1861)
 90. *Glessula neglecta* Gude 1914*
 91. *Glessula nilagirica* (Reeve 1850)*[#]
 92. *Glessula oreas* (Reeve 1850)
 93. *Glessula orophila* (Reeve 1849)
 94. *Glessula paupercula* Blanford 1861[#]
 94a. *Glessula paupercula* var. *nana* Beddome 1906
 95. *Glessula perrotteti* Blanford 1861*
 96. *Glessula pseudoreas* (Nevill 1881)
 97. *Glessula pusilla* Beddome 1906*
 98. *Glessula reynelli* var. *immitis* Gude 1914
 99. *Glessula shiplayi* (Pfeiffer 1855)*

100. *Glessula sisparica* Gude 1914*#
101. *Glessula subfilosa* Beddome 1906
102. *Glessula subinornata* Beddome 1906*
103. *Glessula subjerdoni* Beddome 1906
104. *Glessula subperrotteti* Beddome 1906*
105. *Glessula subserena* Beddome 1906
106. *Glessula subtornensis* Gude 1914*
107. *Glessula tenuitesta* Gude 1914*
108. *Glessula textilis* (Blanford 1866)
109. *Glessula tinnevellica* Gude 1914*#
110. *Glessula tornensis* Blanford 1870

Genus *Zootecus* Westerlund, 1887

111. *Zootecus chion* (Pfeiffer 1856)

Super Family STREPTAXOIDEA

Family STREPTAXIDAE

Genus *Streptaxis* Gray, 1837

112. *Streptaxis beddomii* Blanford 1899*
113. *Streptaxis compressus* Blanford 1880*
114. *Streptaxis footei* (W and H Blanford 1860)*
115. *Streptaxis peroteti* (Petit 1841)*#
116. *Streptaxis personatus* Blanford 1880
117. *Streptaxis pronus* Blanford 1880*#
118. *Streptaxis scalptus* Blanford 1899#
119. *Streptaxis watsoni* (W and H Blanford 1860)

Genus *Ennea* H. and A. Adams, 1855

120. *Ennea beddomii* Blanford 1880*
121. *Ennea bicolor* (Hutton 1834)
122. *Ennea macrodon* Blanford 1880*#
123. *Ennea pirriei* (Pfeiffer 1854)*
124. *Ennea sculpta* Blanford 1869*#
125. *Ennea subcostulata* Blanford 1880*
126. *Ennea turricula* Blanford 1899#

Super Family PLECTOPYLIDOIDEA

Family PLECTOPYLIDIDAE (Corillidae)

Genus *Corilla* H. and A. Adams, 1855

127. *Corilla anax* (Benson 1865)*

Super Family PUNCTOIDEA

Family ENDODONTIDAE

Genus *Philalanka* Godwin-Austen, 1898

128. *Philalanka bidenticulata* (Benson 1852)*#
 129. *Philalanka bilirata* Blanford 1861*
 130. *Philalanka bolampattiensis* (Godwin-Austen 1898)*
 131. *Philalanka daghoba* Blanford 1861*
 132. *Philalanka febrilis* Blanford 1861*
 133. *Philalanka quinquelirata* Gude 1914*#
 134. *Philalanka tertia* Blanford 1861*#
 135. *Philalanka tricarinata* Blanford 1861*#

Family CHAROPIDAE

Genus *Ruthvenia* Gude, 1911

136. *Ruthvenia clathratuloides* (Gude 1897)*#
 137. *Ruthvenia retifera* (Pfeiffer 1845)

Genus *Thysanota* Albers, 1860

138. *Thysanota cirinigera* (Benson 1850)*#
 139. *Thysanota flavida* Gude 1914*
 140. *Thysanota guerini* (Pfeiffer 1842)*#
 141. *Thysanota tabida* (Pfeiffer 1855)*

Sub Order ELASMOGNATHA

Super Family SUCCINEOIDEA

Family SUCCINEIDAE

Genus *Succinea* Draparnaud, 1801

142. *Succinea gravelyi* (Rao 1924)

Super Family HELIXARIONOIDEA

Family HELIXARIONIDAE

Genus *Kaliella* Blanford, 1863

- 143. *Kaliella aspirans* (Blanford 1867)*
- 144. *Kaliella barrakporensis* (Pfeiffer 1852)#
- 145. *Kaliella sigurensis* (Godwin-Austen 1882)#

Genus *Pseudaustenia* Cockerell, 1891

- 146. *Pseudaustenia atra* (Godwin-Austen 1898)*
- 147. *Pseudaustenia auriformis* (Blanford 1866)*

Family ARIOPHANTIDAE

Genus *Ariophanta* Desmoulins, 1829

- 148. *Ariophanta cysis* (Benson 1852)
- 149. *Ariophanta thyreus* (Benson 1852)

Genus *Cryptozona* Morch, 1872

- 150. *Cryptozona albata* Blanford 1880*#
- 151. *Cryptozona belangeri* (Deshayes 1834)#
- 152. *Cryptozona bistrialis* (Beck 1837)#
- 153. *Cryptozona gassi* (Blanford 1901)#
- 154. *Cryptozona ligulata* (Ferussac 1819)
- 155. *Cryptozona maderaspatana* (Gray 1834)#
- 156. *Cryptozona semirugata* (Beck 1837)#
- 157. *Cryptozona sisparica* (Blanford 1866)*
- 158. *Cryptozona solata* (Benson 1848)*#

Genus *Hemiplecta* Albers, 1850

- 159. *Hemiplecta basilessa* (Benson 1865)
- 160. *Hemiplecta basileus* (Benson 1861)*
- 161. *Hemiplecta beddomei* (Blanford 1874)#

Genus *Indrella* Godwin-Austen, 1901

- 162. *Indrella ampulla* (Benson 1850)

Genus *Euplecta* Semper, 1870

- 163. *Euplecta acalles* (Pfeiffer 1856)*
- 164. *Euplecta acuducta* (Benson 1850)#
- 165. *Euplecta albizonata* (Dohrn 1853)#
- 166. *Euplecta apicata* Blanford 1870*
- 167. *Euplecta cacuminifera* (Benson 1850)*
- 168. *Euplecta granulifera* (Blanford 1901)
- 169. *Euplecta hyphasma* (Pfeiffer 1853)
- 170. *Euplecta indica* (Pfeiffer 1846)#
- 170a. *Euplecta indica* var. *shiplayi* (Pfeiffer 1856)
- 171. *Euplecta layardi* (Pfeiffer 1851)
- 172. *Euplecta mucosa* (Blanford 1882)
- 173. *Euplecta mucronifera* (Blanford 1901)*
- 174. *Euplecta orbiates* (Blanford 1901)#
- 175. *Euplecta pulchella* (Blanford 1904)*
- 176. *Euplecta semidecussata* (Pfeiffer 1851)#
- 177. *Euplecta subdecussata* (Pfeiffer 1851)#
- 178. *Euplecta turritella* (H. Adams 1869)#

Genus *Mariaella* Gray, 1855

- 179. *Mariaella beddomei* (Godwin-Austen 1888)*#
- 180. *Mariaella dussumieri* (Gray 1855)

Genus *Macrochlamys* Benson, 1832

- 181. *Macrochlamys infausta* (Blanford 1866)
- 182. *Macrochlamys lixa* (Blanford 1866)
- 183. *Macrochlamys peringundensis* (Beddome 1891)
- 184. *Macrochlamys perotetti* (Pfeiffer 1851)#
- 185. *Macrochlamys prava* (Pfeiffer 1851)
- 186. *Macrochlamys rutila* (Pfeiffer 1851)
- 187. *Macrochlamys todarum* (Pfeiffer 1851)
- 188. *Macrochlamys vallicola* (Pfeiffer 1851)
- 189. *Macrochlamys vilipensa* 1851)
- 190. *Macrochlamys woodiana* (Pfeiffer 1851)#

Genus *Sitala* H. Adams, 1865

- 191. *Sitala infula* (Benson 1848)
- 192. *Sitala injussa* Blanford 1861
- 193. *Sitala liricincta* (Stolickzka 1871)[#]
- 194. *Sitala palmaria* (Benson 1864)[#]

Genus *Satiella* Godwin-Austen, 1908

- 195. *Satiella compressa* (Godwin-Austen 1908)
- 196. *Satiella flexilis* (Godwin-Austen 1898)[#]
- 197. *Satiella levidensis* (Godwin-Austen 1898)
- 198. *Satiella pertenuis* (Godwin-Austen 1908)

Super Family CAMAENOIDEA

Family CAMAENIDAE

Genus *Amphidromus* Albers, 1850

- 199. *Amphidromus bontiae* (Chemnitz 1786)
- 200. *Amphidromus calacadensis* Blanford 1870
- 201. *Amphidromus physalis* (Benson 1857)

Genus *Chloritis* Beck, 1837

- 202. *Chloritis propinqua* (Pfeiffer 1857)

Genus *Trachia* Albers, 1860

- 203. *Trachia crassicostata* (Benson 1848)
- 204. *Trachia fallaciosa* (Ferrussac 1821)[#]
- 205. *Trachia nilgirica* (Pfeiffer 1845)
- 206. *Trachia proxima* (Ferrussac 1832)
- 207. *Trachia ruginosa* (Ferrussac 1821)
- 208. *Trachia vittata* (Muller 1774)[#]

*Endemic to Peninsular India and Sri Lanka; [#]Observed during present studies.

DISCUSSION

Of all the southern states Tamil Nadu is the richest in terms of molluscan diversity due to the presence of both the Eastern and Western Ghats. The state harbours 208 species (excluding varieties), nearly 1/3rd of the total species (257) present in the Western Ghats and 14% of the terrestrial molluscan species present in India. The region of Palani hill ranges and the Nilgiris account for

90% of the molluscan species present in this state followed by the Kalakkad-Mundunthurai Tiger Reserve with 62 species. The Palani Hill ranges and the Nilgiris may be termed as mega molluscan diversity centres. They are the type locality for most of the endemic species. One of the primary reasons for the extraordinary diversity is the favourable climate with enhanced microhabitats and secondly, they have been thoroughly explored by the British malacologists for whom these areas were favourite holiday spots. The climate hardy species like *Ariophanta belangeri*, *A. semirugata*, *Trachia vittata*, *Trachia fallaciosa* and *Rachis punctatus* are found in the arid plains, whereas the *Prosobranchiata* predominantly occupies the Ghats. The systematic position of the families, genera, and species have been thoroughly updated with the current and latest nomenclature provided in "A classification of the living Mollusca" compiled by K.C. Vaught (1989). The number will definitely increase with increased studies in others areas away from the hill stations.

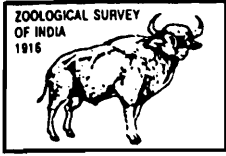
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TAXONOMIC ASSESSMENT OF INSECTS RECORDED IN KĀLIDĀSA'S WORKS

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INTRODUCTION

Kālidāsa was a famous litterateur in ancient India. Till date seven works, written by the great literature, had been discovered. They are *Abhijñāna Śakuntalā*, *Kumārsambhavaṃ*, *Mālavikāgnimitraṃ*, *Meghadūtaṃ* (Uttara Megha, Purva Megha), *Raghuvamśaṃ*, *Vikramorvśīyaṃ*, and *Ṛtusamhāra*. Period of Kālidāsa is disputable between 200 B.C. and 415 A.D., hence no period is mentioned here. For further reference Karmakar (1923) and Krishnamoorthy (1982) may be consulted.

These literature mentioned insects, birds, mammals, fishes and other animals. The descriptions of the animals have been made either citing by their general appearance or by their behaviour to make comparison with human body and behaviour.

Bhaduri *et al.*, (1972), Gupta (1962) reported descriptions of insects mentioned in Kālidāsa's works; but no attempt was made to make an assessment of probable taxonomic status of the insects. In the present article an attempt has been made to assess the taxonomic status of the insects. Sanskrit names, their references in Kālidāsa's works, description cited by Kālidāsa and a little discussion on each insect have been given. For collection of names of insects Rajendranath Vidyabhusan's *Mahākavi Kālidāser Granthāvali* (with grammatical notes, explanation of words, Bengali translation) and C. S. Gupta (1962) have been consulted.

Following names of insects were obtained in Kālidāsa's works :

1. Ali,
2. Bhramara,
3. Dvirepha,
4. Madhukara,
5. Bhṛṅga,
6. Daṃśa,
7. Khodyota,
8. Lākṣā,
9. Madhumakṣikā,
10. Madhupa,
11. Pataṅga,
12. Pipīlikā,
13. Śālabha,
14. Saṭpada,
15. Śilimukha,
16. Valmī.

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NOTES ON INSECTS

1. *Ali*

Mentioned in : Raghuvamśam (IX–44, 45; XII–102); Kumārsambhavam (IV–15), Ṛtusamhāra (VI–35, 38).

Description : It is a black insect, gregarious in nature and produces sound when fly in swarms; visits tilaka flowers and help in pollination.

Remark : According to Mukhopadhyaya and Bhattacharya (1966) 'Ali' stands for Bee, Crow, Cuckoo Scorpion etc. But the present description agrees with Bees (*Apis*). Bingham (1897) in his Fauna of British India (Vol. 1) reported body colour of *Apis* species as black. From the description available in Kālidāsa's Work, the species appears to be close to *Apis dorsata* Fabricius.

2. *Bhramara*

Mentioned in : Raghuvamśam (III–8, V–43, 68, VII–ii; X–57, XVI–47); Kumārsambhavam (XIII–27), Abhijñāna Śākuntakam (V–19); Mālavikāgnimitram (IV–2).

Description : Its body has shining black colour, like the eyes of beautiful ladies and nipple of breast of an advanced stage pregnant lady; gregarious in nature, emits sound, visits mango inflorescence, moves one flower to another flower.

Remark : Its description agrees with *Xylocopa fenestrata* (Fabricius). Bingham (1897) reported five species of *Xylocopa* from India. All of them are black. But *Xylocopa fenestrata* is shining black. This agrees with eyes as well as nipple colour of a lady. Bingham noted that *Xylocopa* are among the commonest insects in India, often coming to houses with a loud buzzing sound.

3. *Dvirepha*

Mentioned in : Kumārsambhavam (I–27, VII–36 and 56); Ṛtusamhāra (III–6, VI–1, 16 and 36). Mālavikāgnimitram (III–5), Raghuvamśam (VI–7; VI–13).

Description : It produces sound, prefers mango inflorescens and nectar of lotus.

Remark : Bees are nectar feeders. *Apis* species produce honey from lotus nectar. Therefore, it is conjectured that *Dvirepha* is probably a species of *Apis*.

4. *Madhukara*

Mentioned in : Ṛtusamhāra (VI–29), Abhijñāna Śākuntalam (VI–19 and 20).

Description : Sound producing, nectar feeding insects active during the spring season.

Remark : Madhukara means that produces honey. Insects referred here are nectar feeder and active during the spring season, which is practically the blossoming season of most of the flowers.

Honey bee's sounds are audible when they are in swarms. Madhukara also means lover; which is not applicable here. It is therefore, conjectured that Kalidasa probably tried to describe *Apis* species.

5. *Bhr̥ṅga*

Mentioned in : Ṛtusamhāra (II-14, 15; VI-23, 26).

Description : Gregarious, sound producing (insect) active during rains and spring prefers lotus for rest, attracted to the ichor of the elephant.

Remark : According to the Mukhopadhyay and Bhattacharya (1966) Bhr̥ṅga is a bee. But from the description it is not possible to decipher its taxonomic status.

6. *Daṁśā*

Mentioned in : Raghuvamśam (II-5).

Description : Daṁśā annoys cattle and bites them.

Remark : This is a horse-fly (Tabanidae : Diptera : Insecta). Horse-fly bites cattle and horses. A.D. Imms (1965) writes, "Horse-flies are active on warm sunny days. *Tabanus* species are particularly troublesome to horses and cattle, approaching their victim with a loud hum"

7. *Khadyota*

Mentioned in : Meghadūtaṁ, Uttar Megha (21).

Description : Khadyota is gregarious in nature and emits light in the field.

Remark : It is a coleoptera, belonging to the family Lampyridae. A. D. Imms (1965) has written about lampyrids, "They are nocturnal insects and most of the members are provided with photogenic organs which emit more or less bright light"

8. *Lākṣā*

Mentioned in : Raghuvamśam (XVI-15), Kumārsambhavam (V-34), Ṛtusamhāra (I-5).

Description : Lākṣā produces red colour, used by ladies in making them attractive.

Remark : The insect belongs to coccid group of Homoptera. *Dactylopius coccus* is well known cochineal insect cultivated for much prized cochineal dye. In South India, *Dactylopius indica* is very common coccid which is used for red colour (see Mani, 1968).

9. *Madhumakṣikā*

Mentioned in : Raghuvamśam (IV-63), Kumārsambhavam (VII-72), Mālavikāgnimitram (II-2).

Description : Madhumakṣikā produces honey and protects that vigorously.

Remark : Mani (1968) reported that Honeybees belong to the family Apidae of the Order Hymenoptera. Four common Honeybees occur in India — *Apis mellifica*, *A. indica*, *A. dorsata*, *A. florea*.

10. *Madhupa*

Mentioned in : Ṛtusamhāra (VI–37).

Description : It is gregarious in nature, active in spring.

Remark : Madhupa means that which drinks honey. It is, therefore, conjectured that probably it is a species of *Apis*.

11. *Pañāga*

Mentioned in : Kumārsambhavam (III–64).

Description : Insects which fall on fire while flying.

Remark : This is ant. It is not possible to sort out the genus or the species of ants, since most of them develop wings and fly near fire and sacrifice their lives. They are Formicidae.

12. *Pipīlikā*

Mentioned in : Mālavikāgnimitram (III–13 and 30).

Description : It remains on mango trees, bites when disturbed.

Remark : Tiwari (1999) reported the ant, *Oecophylla smaragdina* (Fabricius) as follows :

“This is the notorious and vicious ‘Red-Ant’ of India; it inhabits in trees and makes nest in leaves” He also wrote, “The species was collected from nests on *Mangifera indica*, *Strychnosa* sp., *Nuxvomica* sp., coconut and Ashoka trees”

Hence it is conjectured that species mentioned in Kālidāsa may be *Oecophylla smaragdina* (Fabricius).

13. *Śalabha*

Mentioned in : Abhijñāna Śakuntalam (I–30).

Description : Śalabha is red coloured, fly in swarm. The colour of the body resembles reddish colour of the environment during the descending of the sun in the horizon.

Remark : According to Mukhopadhyaya and Bhattacharya (1966) it is a locust. Mani (1968) writes, “A Locust is a migratory grass hopper that swarms at regular intervals” “*Schistocerca gregaria*, the desert locust, Gregarious phase : pale yellow in the sexually mature individuals, predominantly rose-coloured in the young adults”

14. *Satpada*

Mentioned in : Raghuvamśam (VI-69), Kumārsambhavam (VIII-33 and 39).

Description : It is gregarious in nature, fly and move in rows, prefer to remain on mango trees during blossoming. Satpada in Sanskrit which has got six legs.

Remark : Although colour is not mentioned but the behaviour agrees with red ant, *Oecophylla smaragdina* (Fabricius).

15. *Silimukha*

Mentioned in : Raghuvamśam (VIII-57).

Description : It occurs in South India, near Malayahill. Attracted to ichor flowing from the temples of elephant.

Remark : Mukhopadhyaya and Bhattacharya (1966) considered it as a Bhramara. Here it is conjectured that the insect may either be of *Apis* or of *Xylocopa* of the family Apidae (Hymenoptera). It is also to be noted that Mallinātha regards it as Ali, Nandargikar (1897) translated it as sting-mouthed black bee.

16. *Valmī*

Mentioned in : Abhijñāna Samuntalam (VII-11), Meghadūtam (Purba Megha 15).

Description : Well built termite hill, lizards, snakes, scorpions inhabit, birds built nest inside.

Remark : According to Mukhopadhyaya and Bhattacharya (1966) it is termite. Survey parties from Zoological Survey of India have several times collected snake, Lizards, scorpion, collembala (Wingless insect). In all cases the termites identified as *Odontotermes obessus* (Rmb.). Sen-Sarma (1974) reported some insect species from termite mounds. Imms also reported occurrence of birds nest, lizard, snakes and scorpions in the termite mounds.

DISCUSSION

Kālidāsa used common vernacular names of insects, but the morphology and behaviour he described help us to decipher the probable taxonomic statuses of the insects. Followings have been conjectured :

1. *Apis* species (Order Hymenoptera : Family Apidae) is the probable scientific name of Ali, Dvirepha, Madhukara, Madhumakṣikā and Madhupa. Gupta isolated Ali from the Dvirepha, Madhukara, but meaning of the Words and description in Kalidasa's Works contradict Gupta's (1961) contention.

2. *Xylocopa* species (Fabricius) has been considered as the name for Bhramara; but Gupta (1961) clubbed it with Dvirepha and Madhukara. As per description cited by Kālidāsa Bhramara does not produce honey, on the other hand Dvirepha and Madhukara do produce honey. In Sanskrit Bhramara is the common name for Honeybee as well as other bees.
3. *Tabanus* species (Order Diptera : Family Tabanidae) has been assigned to Damsā, because its nature agrees with the modern researches on Tabanids.
4. Species of Lampyridae (Order : Coleoptera) has been considered the proper taxonomic status of Khadyota. Gupta (1961) considered it as glow Worm or firefly. Glow Worm is wingless insect remain in soil; but firefly (Lampyrids) is easily visible in the night.
5. Species of Coccidae (Order : Homoptera) has been assigned to Lākṣā since it produces red colour.
6. Species of Formicidae have been considered as the name of Pataṅga, Pipīlikā and Saṭapada. Of which habit/behaviour of pipilika and saṭapada agree with behaviour of *Oecophylla smaragdina* (Fabricius).
7. Śilimūkha's taxonomic status can be considered as a species of the family Apidae, since nothing of morphology and behaviour clearly say about it, but the meaning of the word indicates Ali and Bhramara.
8. Śalabha has been considered as *Schistocerca gregaria* (Order : Orthoptera; Family : Locustidae) since the nature and body colour agree with the modern studies.
9. Valmī is being considered as *Odontotermes obesus* (Order : Isoptera; Family : Termitidae). Therefore, it can be said that Kālidāsa indicated genera viz. *Apis*, *Xylocopa*, *Tabanus*, *Oecophylla*, *Schistocerca*, *Odontotermes* and unidentifiable species of the family Lampyridae and Coccidae of Coleoptera and Homoptera respectively.

SUMMARY

Kalidasa probably meant following insects of modern taxonomy (*Apis*, *Xylocopa*, *Tabanus*, *Oecophylla*, *Schistocerca*, *Odontotermes* species of *Lampyridae* and Coccidae have been discussed.

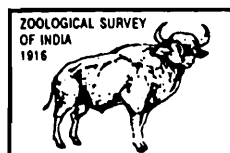
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*Not consulted in original.



Rec. zool. Surv. India : 105 (Part 1–2) : 105-109, 2005

A NEW SPECIES OF *DIPARA* WALKER (HYMENOPTERA : PTEROMALIDAE) FROM SRI LANKA AND KEY TO THE SPECIES OF INDIAN SUBCONTINENT

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INTRODUCTION

Dipara Walker belongs to the subfamily Diparinae of Pteromalidae, which is represented by 15 species all over the world with distribution in North America, Europe, Africa, Australia and South Asia (Noyes, 2001). Biological data is not available for any of these species, which were often collected from litter under tree or from pitfall traps. They are probably parasitic on some Coleoptera dwelling in the soil or on roots of plants (Boucek, 1988). Though Boucek *et al.*, (1979) reported an undescribed species of *Dipara* from Sri Lanka and Boucek (1988) mentioned the occurrence of three species elsewhere from South Asia, it was Narendran & Sureshan (2001) who described three Indian species. Here one new species of *Dipara* is described from the central province of Sri Lanka. The specimen belongs to the collections of Bohart Museum of Entomology, University of California which was made available for our study by the kind courtesy of Dr. Steven L. Heydon. A key to the *Dipara* species of the Indian subcontinent is also provided here to accommodate the new species.

Following abbreviations are used in the text : F1-F7–Funicular segments 1 to 7, OOL–Ocellocular distance; POL–Postocellar distance; SMV–Submarginal vein; MV–Marginal vein; PMV–Postmarginal vein; STV–Stigmal vein; T1-T5–Gastral tergites 1 to 5.

Dipara intermedia sp. nov.

(Figs. 1-3)

Holotype : *Female* : Length 2.5 mm. Yellowish brown, darker on mesoscutum and scutellum dorsally and lower part of mesopleuron and metapleuron laterally; eyes silvery white; antenna

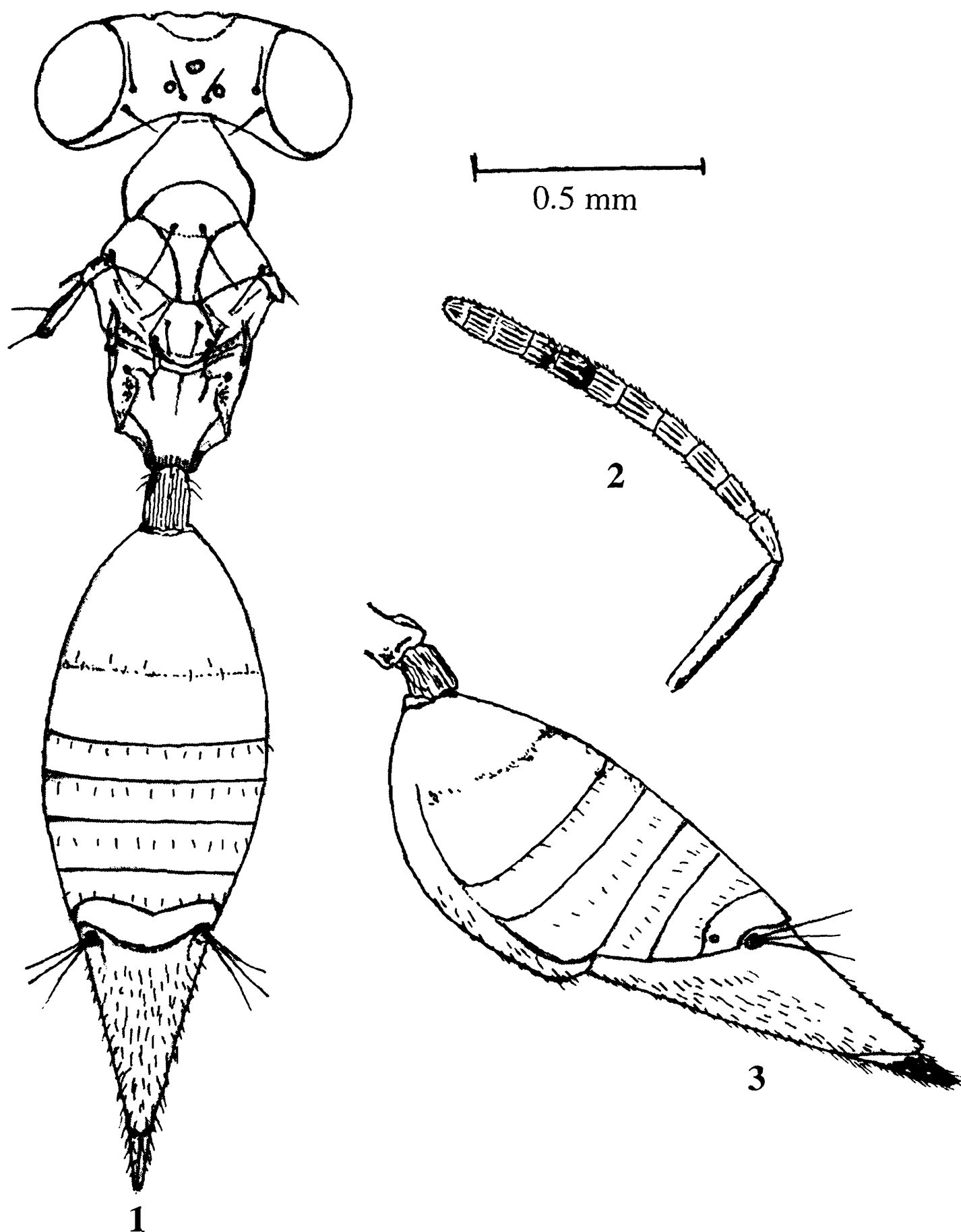
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brownish yellow, scape slightly brownish, F5 completely brown; tip of F4 and base of F6 slightly brown, club whitish yellow. Fore and hind coxae yellowish white, mid coxae pale brown, remainder of legs pale brownish yellow; gaster brown except basal 2/3 of T1 and epipygium brownish yellow, petiole yellowish white with base and apex brownish; tegulae yellowish white, wing stump brown, bristles dark brown.

Head : (Fig. 1) Face moderately reticulate on lower part up to middle including scrobal cavity, upper face and vertex almost shiny; reticulation finer on gena; malar grooves distinct; clypeus a little wider than long, a little raised, anterior margin straight, paraclypeal area and area just above clypeus a little raised; tips of mandibles dark brown. Head, in front view, 1.2x as wide as long; scrobe deep, not reaching median ocellus; parascrobal area transversely striate reticulate; toruli wide apart, separated by 2x their individual diameter; malar space 0.33x eye height (in profile); eye length 1.4x width. In dorsal view head width 2.1x height; OOL almost as long as POL; vertex with 3 pairs of setae, abruptly ending posteriorly, temple very narrow. Antennae (Fig. 2) inserted almost level with lower margins of eyes, formula 11173; scape as long as eye; pedicel plus flagellum length 1.62 x head width in dorsal view; pedicel slightly longer than F1, F2-F5 almost equal in length and each a little shorter than F1; F6 a little shorter than F5 which is equal to F7; club three segmented, as long as 3 preceding segments combined.

Thorax : (Fig. 1) Pronotum very finely reticulate, almost shiny, 2x as wide as long (in dorsal view), collar anteriorly with fine but distinct carina. Mesoscutum 1.54x as broad as long, anterior part with a semicircular smooth yellow area, upper part of side lobes transversely reticulate, rest of the parts almost shiny, notauli complete, converging posteriorly, mesoscutum with 2 pairs of long setae, one on median lobe above middle in the yellow area, the other on lower outer corner of scapulae. Scutellum raised, medially half as long as mesoscutum with 2 pairs of short setae, finely reticulate, except on frenal area finely and longitudinally striate. Propodeum almost completely shiny, with very faint longitudinal striations, plicae incomplete, reaching only up to one third length, median carina weakly indicated up to $\frac{3}{4}$ length (visible in certain reflection of light); lateral margins of nucha represented in the form of a fine brown carinae on either side, which connect with another short carinae running from below laterally; propodeum medially slightly shorter than mesoscutum. Mesopleuron almost shiny, pleural line represented in the form of a shallow groove with several short transverse carinulae. Metapleuron shiny. Prepectus shiny. Forewing stump very short, only a little longer than tegula with 2 long setae. Tegulae with one short seta. Hind coxa transversely striate, fore and mid coxae also with slight indication of transverse striae. Relative lengths of hind coxa 17, femur 25, tibia 30, tarsi 21.

Gaster : (Figs. 1, 3) Elongated, smooth, 3x as long as wide in dorsal view, length (including petiole) 2x as long as thorax; petiole 1.2x as long as wide in dorsal view, longitudinally striate and minutely reticulate, basally with two fine backwardly directed hairs on each side; circus with 3



Figs. 1-3. : *Dipara intermedia* sp. nov. (female).
1. Body in dorsal view; 2. Antenna; 3. Gaster in profile.

long setae; T1 as long as T2-T5 combined (in dorsal view); epipygium 2x as long as wide dorsally; ovipositor sheath 0.3x as long as epipygium dorsally; hypopygium reaching almost half length of gaster, upto hind margin of T3.

Material examined : Holotype : Female : SRI LANKA : Central province, Kandy district, Hantana Mt. N 7°15' E 80°37', 10-14.vii.1999 (in pan trap), coll. M. & J. Wasbauer (in Bohart Museum of Entomology, University of California).

Etymology : The species is named after its morphology, which is intermediate between the two closely related Indian species.

Remarks : The new species shows an intermediate set of characters in between the species *Dipara mohanae* Narendran & Sureshan and *Dipara keralensis* Narendran & Sureshan. From both the above species it can be readily separated by the characters given in the key.

Key to the species of *Dipara* Walker from the Indian subcontinent (modified from Narendran & Sureshan (2001))

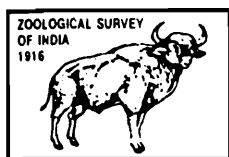
1. Macropterous; mesoscutal bristles nearer to the middle of scutum in the upper half; scutellum with frenal area broad, almost half of the length of scutellum; frenal line almost in the center; propodeum without median carina *Dipara miniae* Narendran & Sureshan
- Subapterous; mesoscutal bristles above middle of scutum in the upper half; scutellum with frenal area narrow, frenal line far behind, close to hind margin; propodeum with distinct or weak median carina 2
2. Propodeum with basomedial area between the plicae conically elevated up to middle; surface of propodeum with longitudinal striations, not shiny; wing stump long, extending well beyond the hind margin of scutellum, touching base of petiole and with 5 or 6 bristles 3
- Propodeum with basomedial area between the plicae not elevated, surface almost shiny with very weak striations; wing stumps short, not reaching much beyond hind margin of scutellum and with only 2 setae *Dipara intermedia* sp. nov.
3. Upper face and vertex distinctly reticulate, size 2.6 mm; POL equal to OOL; antenna with F6 and F7 whitish yellow as club; F2-F5 dark brown, wing stump with 5 bristles; hind coxae reticulate *Dipara keralensis* Narendran & Sureshan
- Upper face and vertex almost shiny, only weakly reticulate, size 1.5 mm; POL little shorter than OOL (0.83x); only F7 whitish yellow as club; F3-F6 brown; wing stump with 6 bristles; hind coxae striate reticulate *Dipara mohanae* Narendran & Sureshan

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Rec. zool. Surv. India : **105** (Part 1–2) : 111-116, 2005

**NEW HOST AND DISTRIBUTIONAL RECORDS FOR
SOLENUM ANIA (WALKER) FROM INDIA AND
REDESCRIPTION OF *SOLENUM FERETRIUS* (WALKER)
(HYMENOPTERA : CHALCIDOIDEA : PTEROMALIDAE)**

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INTRODUCTION

Solenura Westwood is an old world pteromalid genus belonging to the tribe Lyciscini, of subfamily Cleonyminae. It is represented by five species distributed in the Afrotropical, Oriental and Palearctic regions of the world (Fig. 3). Among the other Lyciscini *Solenura* and *Grooca* Sureshan and Narendran form a monophyletic group (see Gibson, 2003, for the phylogeny of these genera). Host records are available only for the species *S. ania* (Walker), which was reared from *Chrysobothris succedanea* Sanders (Buprestidae) and *Trichoferus campestris* (Faldermann) (Cerambycidae) in China, though the other species of *Solenura* may also prove to be parasitoids of wood boring beetle larvae.

During the faunal exploration surveys conducted in the Lonar Crater Wild Life Sanctuary of Buldhana district, Maharashtra (19°59'N 76°34'E), the author could rear one specimen of *Solenura ania* (Walker) from a piece of dead wood of *Ficus* sp. heavily infested with wood boring beetles. Two specimens of the Cerambycid beetle *Olenocamptus bilobus* Fabricius were also reared from the same wood. Mani and Kaul (1973) reported *S. telescopica* Westwood (later synonymised with *S. ania* by Boucek *et al.*, 1979) from Dehradun (now in Uttaranchal) and Assam without mentioning the host, and it was the only record of this species from India. The present record of *S. ania* represents further extension of the distribution of the species to the deccan peninsula. Though the present specimen of *S. ania* is not having any direct host data, it is assumed that the species parasitise the larvae of the beetle *Olenocamptus bilobus*, which attacked the wood.

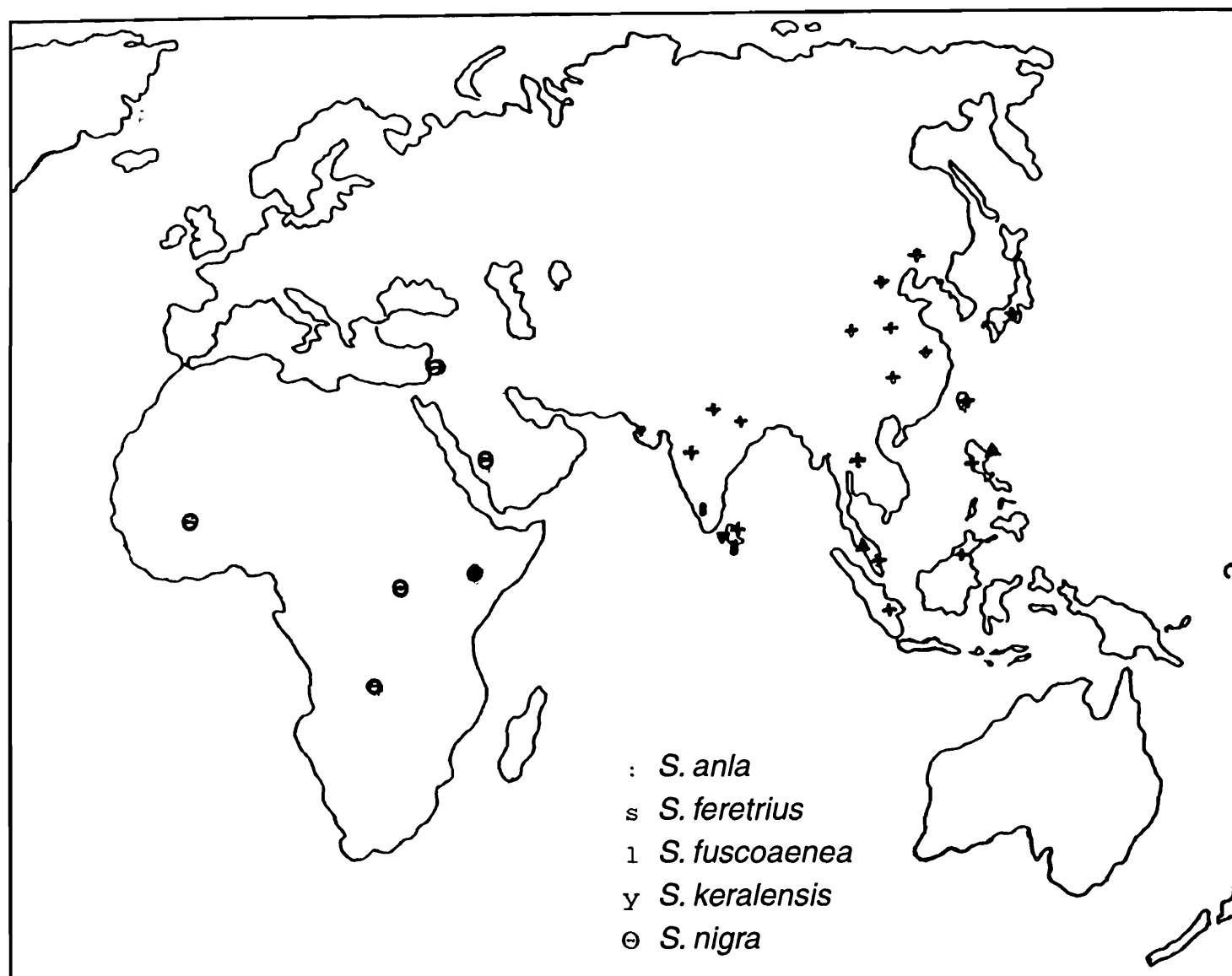


Fig. 3. : Map showing the world distribution of *Solenura* species.

The grubs of *Olenocamptus bilobus* normally infest decaying wood of *Ficus* sp. but also attack living branches of other trees and are known pest of cultivated fig. The beetles are found in Dehra Dun and southwards throughout the Gangetic plains (Stebbing, 1914). Thus collection of *S. ania* by Mani and Kaul (1973) also might have been from *Olenocamptus bilobus* as its host fig. is common there.

In connection with the studies on the *Solenura* species from India I borrowed and examined the lectotype of *S. feretrius* (Walker) from the BMNH. *S. feretrius* is a rare species occurring only in the Philippines, Malaysia and Sri Lanka. Since the description given by Walker (1846) is inadequate, a redescription of *S. feretrius* is provided here based on the lectotype specimen.

Following abbreviations are used in the text : BMNH – The Natural History Museum, London, U.K.; F1-F2 – Funicular segments 1 to 2, T1-T6 – Gastral tergites 1-6; OD-Ocellar diameter; OOL-Ocellocular distance; POL-Postocellar distance; SMV-Submarginal vein; MV-Marginal vein; PMV-Post marginal vein; STV-Stigmal vein.

Solenura ania (Walker)

(Fig. 1)

1846. *Epistenia ania* Walker, : 93-94, Female, Philippines (Lectotype Female, designated by Boucek in Boucek *et al.*, 1979; BMNH)
1961. *Solenura ania* (Walker), *Hedqvist.* : 98. (For further synonymy, see Boucek *et al.*, 1979 and Gibson, 2003).

Diagnosis : (based on the Indian specimen) Length 8.7 mm. Body (including antennae) black with greenish blue luster, punctate reticulate; scape of antenna reddish brown; tip of ovipositor sheath brownish yellow; interantennal ridge with distinct notch at base of dorsal process; antenna with pedicel 1.5x as long as F1 and a little shorter than club, which is as long as 2.5 preceding segments combined. Dorsomedian carina on pronotum distinct; dorsellum finely reticulate, setose. Propodeum (Fig. 1) with posterior margin almost straight; median carina distinct. Wings subhyaline, length 2.9x width; relative lengths of SMV 35, MV 18, PMV 10.5, STV 3.5. Gaster length 1.8x as long as head plus thorax (length up to tip of syntergum); petiole in the form of a fine thin strip with very short carinulae anteriorly; exposed part of T2 half as long as posterior smooth strip of T1; dorsomedian carina of T4 reaching 4/5 length from the posterior end; cerci small; length of gastral tail 6.42x width of syntergum at level of circus; exposed part of ovipositor sheath 0.4x postcercal length; precercal length 2.1x postcercal length; ovipositor not exerted.

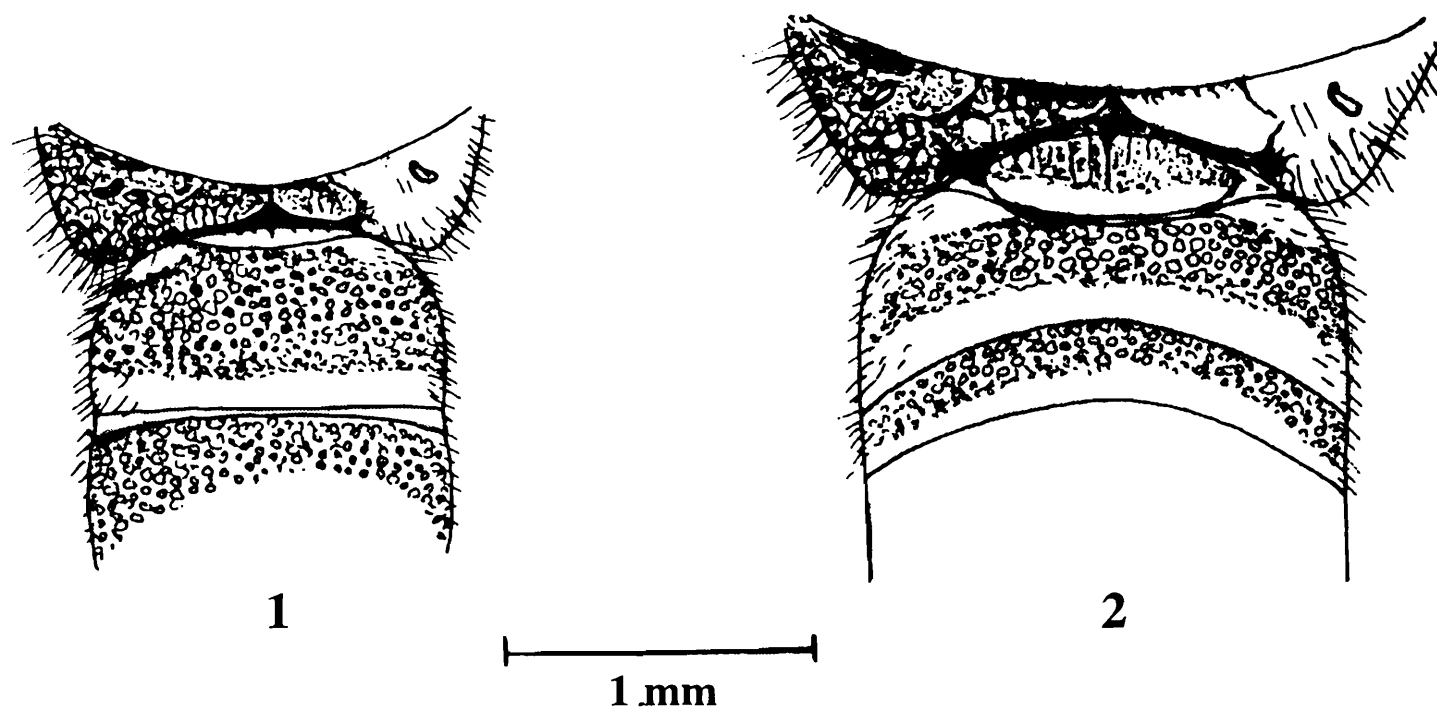
Material examined : 1 Female, INDIA : Maharashtra : Buldhana district, Lonar Crater Wildlife Sanctuary (southern part of crater basin) (19°59"N 76°34"E), coll. P. M. Sureshan, 20.xi.2003, ex. Dead wood of *Ficus* sp. infested with wood boring beetles (In ZSI, WRS, Pune).

Solenura feretrius (Walker)

(Fig. 2)

1846. *Epistenia feretrius* Walker, : 92-93, Female, Philippines (Lectotype Female, designated by Boucek in Boucek *et al.*, 1979; BMNH)
1961. *Solenura feretrius* (Walker), *Hedqvist.* : 98.

Lectotype : Female : Length 9.8 mm (up to tip of syntergum). Colour black with slight metallic luster, gastral tail brownish; antennae with scape yellowish brown on basal half, upper half and pedicel dark brown, F1 and F2 brownish black (right antenna except scape and pedicel and left antenna except scape, pedicel anelli F1 and F2 missing); eyes chocolate brown; mandibles brown with distal half black; tegulae dark brown, wings with slight brownish tinge, veins brown; coxae black, rest of legs reddish brown with tarsi paler, (one mid leg (right) except coxae and trochanter, hind leg (right) except coxae, trochanter, femur and tibia and hind leg (left) except coxae, trochanter missing).



Figs. 1-2. : Propodeum and basal part of gaster, dorsal view;
1. *Solenura ania* (Walker), 2. *Solenura feretrius* (Walker).

Head : Distinctly punctate reticulate, meshes smaller on vertex and gena with dense white pubescence; clypeal area finely reticulate striate with few deep punctures in the lower half, anterior margin almost straight; both mandibles with three teeth; inter antennal area with median ridge, dorsally with acutely angled process; scrobal depression extending to less than 1 OD of anterior ocellus; POL 1.75x OOL; occiput without carina; malar space 0.4x eye length (in profile), malar grooves distinct; eyes densely microsetose, length 1.44x width; inner orbits distinctly divergent ventrally and not strongly divergent dorsally, in dorsal view orbits strongly divergent behind level of posterior ocelli. Head in dorsal view 2.3x as broad as long; in front view 1.4x as broad as height. Antennae inserted slightly below level of lower orbits, dorsal margin of toruli at level of margin of eyes, scape 0.7x as long as eye, expanded towards tip, with a triangular depression ventrally on the upper part reaching up to 1/3 length; pedicel little longer than F1; F1 and F2 with numerous small sensillae arranged in four rows; F1 as long as F2, anelli 1.8x longer than wide.

Thorax : 1.8x as long as broad, punctate reticulate with moderately dense pubescence. Pronotum more finely sculptured than mesoscutum and scutellum with neck abruptly inclined, median line on neck not very distinct, collar not carinate. Mesoscutum 2.3x as broad as long; notauli in the form of shallow furrows of aligned reticulations, reaching upto trans scutal articulation. Scutellum a little longer than wide; axillula finely sculptured. Dorsellum very finely reticulate, bare, with a very narrow crenulate margin dorsally. Prepectus triangular with posteroventral margin slightly incurved, moderately reticulate. Mesepimeron punctate except for the smooth and shiny

transepimeral line with upper mesepimeron extensively setose and lower mesepimeron setose posteriorly; mesepisternum distinctly punctate reticulate. Metapleuron largely punctate reticulate and setose. Propodeum (Fig. 2) with median area very narrow due to the highly inwardly projecting posterior margin; plical region crenulate punctate; callus coarsely punctate reticulate and densely setose, no distinct median carina but median area with an irregular median ridge; spiracles reniform. Forewing uniformly setose, 2.7x as long as broad. Relative lengths of SMV 40, MV 18, PMV 11.5, STV 4. Coxae reticulate with meshes small; hind coxae carinate dorsally with outer concave surface bare and densely setose ventrolaterally, 2x as long as broad; hind femora slightly enlarged, hind tibia with two unequal spurs; length of long hind tibial spur a little shorter than apical width of tibia.

Gaster : Broadly attached to thorax, petiole broad and transverse with anterior half finely granulate with a strong median carina reaching upto middle and with a few short carinulae on either side in the anterior half, posterior half smooth and shiny; T4 posteriorly and T5 and T6 entirely carinate mediolongitudinally; T1 reticulate punctate except on posterior half; exposed part of T2 a little shorter than median length of T1, punctate basally and smooth apically, T3 a little longer than T1 medially, extensively punctate except for a posterior narrow smooth band; T4 completely punctate except for a smooth line posteriorly, medially slightly longer than 2x T3; T5 medially a little shorter than T4, finely punctate reticulate; in lateral view length of gastral tail 5.33x height of syntergum at level of circus (measured from spiracle to posterior margin of syntergum) syntergum with precercal length 0.7 lx post cercal length (measured from hind margin of T6 to middle of circus) exposed part of ovipositor sheath half as long as postocercal length; ovipositor distinctly exerted out; hypopygium reaching up to half length of T4; T6 and syntergum finely reticulate and extensively setose; T5 extensively setose; T1-T4 extensively setose laterally; length of gaster (measured from base of petiole to tip of syntergum) 1.51x as long as head plus thorax.

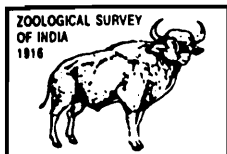
Material examined : Lectotype Female (designated by Boucek), Philippine islands, B. M. type Hym. 5.901. (in BMNH).

ACKNOWLEDGEMENTS

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DESCRIPTIONS OF FEW LAND MOLLUSCS FROM KODAGU DISTRICT OF KARNATAKA, INDIA

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INTRODUCTION

Tropical rainforest floor forms the workshop of diverse interactions between various organisms. The interactions in majority of the cases result in cycling of energy and nutrients. The land snails form the epigeic species *i.e.*, those which live and feed on the soil surface. They form an important link in the recycling chain decomposing the macro litter into microforms facilitating for the action by microorganisms. In India, especially from the Western Ghats in Karnataka, land snails have been least worked out (Madhyastha *et al.*, 2002; Mavinkurve *et al.*, 2003, 2004 a, b; in press). The present report is from our collection from Kodagu district. The collection includes sixty-five examples forty of them have been identified to the species level with the remaining assigned their generic name. The system of Classification followed is that given in 'A Classification of Living Mollusca' (Vaught, 1989). The study assumes significance because about 9 out of the 23 families of land snails found in the Western Ghats (Madhyastha, 2002) are present in this district.

Descriptions of twelve of those identified at species level have been given below :

Key to the Families

- 1. Shells with operculum 2
- Shells without operculum 3
- 2. Shells depressed, widely umbilicate *Cyclophoridae*
- Shells elongate/cylindrical, narrowly umbilicate *Diplommatinidae*

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3. Shells without dentition in the aperture (*Mariaella* with internal flattened shell)
 *Ariophantidae*
- Shells with dentition in the aperture 4
4. Shells with excentric aperture, dentitions at the periphery *Streptaxidae*
- Shells with normal aperture and deep seated dentitions *Charopidae*

SYSTEMATIC ACCOUNT

Sub Class PROSOBRANCHIA

Order MESOGASTROPODA

Family CYCLOPHORIDAE

Genus *Cyclophorus* Montfort, 1810

Cyclophorus nilagiricus (Benson, 1852)

1852. *Cyclophorus nilagiricum* Benson, *Ann. Mag. nat. Hist.*, (2)10 : 268.

1914. *Cyclophorus nilagiricus* : Gude, *Fauna Brit. India*, Mollusca III : 51.

Shell globose, sturdy, opaque, widely umbilicate, spire short, dark brownish, with distinct chestnut flame like streaks near the sutures, and with distinct spiral lirations criss crossed by transverse striations. Body whorl with an indistinct keel, with 3–5 lirations above the keel prominent, near the suture flattened. Whorls 5, shouldered, rapidly increasing, with visible growth lines, sutures distinct. Apex acute, prominent, chestnut coloured with the periostracum generally corroded. Aperture oblique and rounded, orange coloured, lips thickened and reflected, continuous forming a thick callus on the columellar margin. Operculum thin, concave and concentric.

Measurements : Height = 35 mm, Diameter = 42 mm.

Material observed : Five examples. Kadamakal hills and Sullia, 3/12/2000 (Coll. Madhyastha N.A. and Sandhya P.S.).

Distribution : Tamil Nadu : Nilgiris, Travancore, Walaghat, Koondah hills; Karnataka : South Canara, Balarangam, Kadamakal hills, Sullia.

Remarks : This is much similar to *Cyclophorus jerdoni* varying from it with a comparatively elevated spire.

Genus *Pterocyclus* Gray, 1850

1881. *Pterocyclus cyclophoroideus* G. Nevill, *J. Asiat. Soc. Bengal*, 1 : 145.

1921. *Pterocyclus cyclophoroideus* : Gude, *Fauna Brit. India*, Mollusca III : 103.

Shell globose discoid, widely umbilicate, dark brown, apex darkened. Shell thick with microscopic vertical striations. Whorls 5, increasing regularly, shouldered and sutures impressed.

A peripheral inconspicuous brown band present on the body whorl. Aperture not descending rounded with a wing like projection at the point of attachment to the penultimate whorl. Lips double, outer expanded discontinuous, inner lip continuous with a sinus near the wing. Operculum convex, with much raised concentric lamellae, retracts completely to the aperture. Umbilicus deep and broad, revealing up to the apex.

Measurements : Height = 19 mm, Diameter = 9 mm.

Material observed : Six examples, Thadiyandamoola and Kadamakal hills. 26/10/2003 (Coll. Sandhya P.S. and Rajendra G.M.).

Distribution : Tamil Nadu : Annamalai hills; Karnataka : Kadamakal hills, Thadiyandamoola (new report).

Remarks : The wing is not fully distinct but the sinus present in the inner lip is the distinguishing feature of this species.

Family DIPLOMMATINIDAE

Genus *Nicida* Blanford, 1868

Nicida liricincta (Blanford, 1868)

1868. *Diplommatina* (*Nicida*) *liricincta* Blanford, *Journ. Conchyl.*, **16** : 336, pl. 14, fig. 5.

1921. *Nicida liricincta* : Gude, *Fauna Brit. India*, Mollusca III : 293.

Shell ovate, imperforate, glossy, thin and translucent. Spire elevated, apex obtuse, sutures impressed. Whorls 5½, distinctly sculptured with 2 spiral lirations on third, fourth and 3 on the penultimate whorls, body whorl with 4–5 lirations. The penultimate whorl is the largest, body whorl slightly constricted. Aperture rounded slightly ascending touches nearly half of the penultimate whorl. Lips double, outer lip slightly reflected, Operculum thin, fully retractable much beyond the aperture.

Measurements : Height = 3 mm, Diameter = 1.5 mm.

Material observed : Seven examples, Sampaje Ghat. 9/9/2002 (Coll. Sandhya P.S. and N.A. Madhyastha)

Distribution : Maharashtra : Khandalla; Karnataka : Sharavathi Valley, Kodagu (Sampaje Ghat).

Remarks : This is a widely distributed species endemic to South India.

Nicida nitidula (Blanford, 1868)

1868. *Diplommatina nitidula* Blanford, *Journ. Conchyl.*, **16** : 334, pl. 14, fig. 3.

1921. *Nicida nitidula* : Gude, *Fauna Brit. India*, Mollusca III : 294.

Shell ovate, imperforate, glossy, thin and translucent. Spire elevated, apex obtuse, sutures impressed. Whorls 6, distinctly sculptured with 4 spiral lirations on fourth and penultimate whorls,

body whorl with a fifth indistinct keel. The penultimate whorl is the largest, body whorl slightly constricted. Aperture rounded, ascending. Lips double, inner lip continuous much produced and reflected, outer lip also reflected, discontinuous at the point of attachment to the penultimate whorl. Operculum thin, fully retractable much beyond the aperture.

Measurements : Height = 2 mm, Diameter = 1.5 mm.

Material observed : Three examples, Thalakaveri. 7/12/2002 (Coll. Sandhya. P.S).

Distribution : Kerala : Kulputty hills, Wynaad; Karnataka : Kodagu (Thalakaveri).

Remarks : Distinguished from the former by the presence of a distinct double lip and smaller size.

Sub Class PULMONATA

Order STYLOMMATOPHORA

Family ARIOPHANTIDAE

Genus *Ariophanta* Desmoulins, 1829

Ariophanta cysis (Benson, 1852)

1852. *Helix cysis* Benson, *Ann. Mag. nat. Hist.*, (2)9 : 404.

1908. *Ariophanta cysis* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : 33.

Shell sinistral, moderately umbilicate, sturdy, with hay yellow periostracum, underneath paler. Spire moderate, apex obtuse, whorls rapidly increasing, and sutures prominent. Whorls 5, swollen, surface with coarse transverse striations, converging with lines of growth, body whorl slightly angled near the aperture, which is rounded, a pale indistinct band runs around the angulation. Aperture scarcely descending, oblique, lunately rounded, lips slightly thickened. White and nacreous inside. Umbilicus moderate and deep partly covered by the thick triangularly reflected columellar lip.

Measurements : Height = 32 mm, Diameter = 48 mm.

Material observed : An example each from Bhagmandala and Thadiyandamoola. 13/9/2003 (Coll. Sandhya P.S. and N.A. Madhyastha).

Distribution : Tamil Nadu : Nilgiris, Annamalai; Karnataka : Mysore, Bhagmandala, Thadiyandamoola.

Remarks : This is one of the large shells of the genus *Ariophanta* found in thick litter, under the forest canopy. The periostracum is fragile and present in only fresh shells; hence old shells seem to be white in colour.

***Ariophanta thyreus* (Benson, 1852)**

1852. *Helix thyreus* Benson, *Ann. Mag. nat. Hist.*, (2)9 : 405.

1908. *Ariophanta thyreus* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : fig. 20, p. 34.

Shell sinistral, moderately umbilicate, thick, sturdy and opaque. Spire flattened, apex obtuse, golden yellow, above with a chestnut band below the periphery after which the colour fades into white nearing the umbilicus, whorls rapidly increasing, and sutures not impressed. Whorls 5, surface with coarse transverse striations, body whorl distinctly keeled, rounded nearing the aperture in mature forms. Aperture oblique, negligibly descending, with nacre just behind the slight darker aperture, lips thickened. Columellar lip triangularly reflected, but does not cover the moderate and deep umbilicus.

Measurements : Height = 18 mm, Diameter = 36 mm.

Material observed : Three examples, from Kadamakal hills. 16/9/2000. (Coll. Sandhya P.S. and Rajendra G.M.).

Distribution : Karnataka : B. R. Hills, Brahmagiri, Kadamakal Hills; Tamil Nadu : Nilgiris and Annamalai.

Remarks : This is clearly distinguished from the other members of the genus by the flat whorls, thickened lips and the distinct sharp keel. The peripheral band may be absent in some specimen.

Genus *Cryptozona* Morch, 1872

This genus was earlier grouped with the sinistral *Ariophanta*.

***Cryptozona solata* (Benson, 1848)**

1848. *Helix solata*, Benson, *Ann. Mag. nat. Hist.*, (2)2 : 159.

1908. *Ariophanta solata* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : 31.

Shell dextral, moderately umbilicate and translucent. Spire moderate, apex obtuse, pinkish, turning white as the shell grows. Shell with small specks all over the body whorl; with a chestnut coloured band at the periphery, coinciding with the sutures and another just below it visible only on the body whorl, both the bands end abruptly just behind the aperture. Whorls 5½, rapidly increasing, sutures impressed, surface with smooth transverse striations, body whorl rounded. Aperture negligibly descending, lips thin, white but just behind it is hay coloured, inside it has nacre. Upper lip flattened, basal lip inflated and rounded, columellar lip triangularly reflected, partly covering the umbilicus.

Measurements : Height = 16 mm, Diameter = 26 mm.

Material observed : Ten examples, from Thadiyandamoola. 26/10/2003. (Coll. N.A. Madhyastha)

Distribution : Tamil Nadu : Nilgiris; Karnataka : Sharavathi valley, Kodagu (Thadiyandamoola).:

Remarks : It can be easily distinguished by other members of the genus by its whitish shell and the translucent spots unique to it.

Genus *Mariaella* Gray, 1855

1855. *Mariaella dussumieri* Gray, *Cat. Pulm. B. M.* : 63.

1908. *Mariaella dussumieri* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : 205, fig. 71.

Shell internal, flat, solid in mature forms, with beak like apex, sides sharp, hay yellow in colour, spire indistinct. Animal is a slug; yellowish with dark brown spots present in the hind region in older forms, the spots are not distinct in the younger. Shell is internal, partly visible externally through the pore present on the top of the mantle. Mantle lobes united to form a shield enclosing the various systems, surface with two ridges running almost parallel to each other, the right one from the respiratory orifice to the shell aperture the other round the left margin. Posterior portion sharply keeled behind the mantle, ending in the mucus pore. Foot tripartite, edges with short vertical black parallel lines.

Measurements : Animal at full stretch 55 mm.

Material observed : Three examples at Napkolu, two at Kadamakal hills, 26/10/2003 (Coll. N.A. Madhyastha).

Distribution : India : Maharashtra : Mahabaleshwar, Poona; Karnataka : Kodagu, Sharavathi valley, Karwar, Kudremukh; Kerala; Wynad. Found in Sri Lanka also.

Remarks : This endemic slug of Western Ghat/Sri Lanka hill ranges is an agricultural pest. In areca nut and coffee plantations it is very common.

Genus *Indrella* Godwin-Austen, 1901

Indrella ampulla (Benson, 1850)

1850. *Helix ampulla* Benson, *Ann. Mag. nat. Hist.*, (2)5 : 213.

1908. *Indrella ampulla* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : fig. 28, p. 49.

Shell dextral, imperforate and translucent. Spire small, apex obtuse, generally whitish due to the loss of the periostracum. Shell glossy, golden brown, irregularly dark at some places, near the columellar lip darker. Whorls 3, rapidly increasing, sutures impressed, surface wavy with smooth decussating transverse and spiral striations, body whorl very large, rounded. Aperture disproportionately large, negligibly descending, inside it has nacre. Upper lip sharply slanted, basal lip inflated and rounded, columellar lip slightly thickened.

Measurements : Height = 16 mm, Diameter = 26 mm.

Material observed : Ten examples, from Thadiyandamoola, Kadamakal hills. 16/9/2000. (Coll. Rajendra G.M. and N.A. Madhyastha).

Distribution : Tamil Nadu : Nilgiris, Annamalai hills; Kerala : Wynaad; Karnataka : Thadiyandamoola, Kadamakal Hills (new report).

Remarks : Sir Walter Elliot has described the animal to be Greenish yellow, and Col. Beddome has reported it to be black. But the specimens we have are cream coloured with a fluorescent orange, leaf like pattern on the back. It would be of interest to know which one of them is a variety or a new species. Another point of note is the animal is not fully retractable when disturbed in the active state. When it aestivates the animal covers itself with the white mantle and secretes a thin film of epiphragm.

Family STREPTAXIDAE

Genus *Streptaxis* Gray, 1837

Streptaxis peroteti (Petit, 1841)

1841. *Helix peroteti* Petit, *Rev. zool.* p. 100;

1908. *Streptaxis peroteti* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : 10, fig. 8.

Shell dextral, moderately umbilicate, yellowish, glossy, thick and sturdy. Spire short, apex obtuse. Whorls 5½ nearly flat, rapidly increasing, sutures impressed, surface with coarse transverse striations above the angulation, smooth below. Penultimate whorl slightly angled projecting more than the body whorl, which is slightly excentric and flattened below. Aperture axe shaped, with indentations present behind the peristome, which is reflected, lips thin. Aperture with a deeply re entering parietal lamella, scarcely bifid and 4 palatal teeth, a single basal parallel to the lamella, a columellar and of the two on the right margin the upper one is very small. Umbilicus shallow.

Measurements : H = 7 mm; Diameter = 11 mm.

Material observed : A single example at Abbey falls and another at Sampaje Ghat, 14/8/2000 (Coll. N.A. Madhyastha and Sandhya P.S.).

Distribution : Tamil Nadu : Annamalai, Nilgiris, Tirunelveli; Karnataka : Kodagu, Abbey Falls, Sampaje Ghat (new report). Also found in Sri Lanka.

Remarks : This is the first report of this species from Karnataka. As is the norm in this family they are found very rarely.

Streptaxis scalptus Blanford, 1899

1899. *Streptaxis scalptus* Blanford, *Proc. zool. Soc. Lond.*, p. 766, pl. 50, figs. 8, 9, 10.

1908. *Streptaxis scalptus* : Blanford and Godwin-Austen, *Fauna Brit. India*, Mollusca I : 12.

Shell dextral, moderately umbilicate, and white in colour, thick and sturdy. Spire flattened, apex obtuse. Whorls $5\frac{1}{2}$ nearly flat, rapidly increasing, sutures impressed, surface with transverse striations. Penultimate whorl rounded projecting scarcely beyond the ultimate whorl, which is excentric and flattened below. Aperture axe shaped, with indentations present behind the peristome, which is reflected, lips thin. Aperture with bifid re entering parietal lamella and 6 palatal teeth, two basal, two columellar and two on the right margin. Umbilicus shallow.

Measurements : H = 6 mm; Diameter = 11 mm.

Material observed : A single example Bhagmandala and another at Thalakaveri, 23/12/2000 (Coll. Sandhya P.S. and Rajendra G.M.).

Distribution : Karnataka : B. R. Hills, Bhagmandala, Thalakaveri.

Remarks : This species is endemic to Karnataka. It is distinguished from the preceding species by the presence of an extra columellar tooth, basal tooth being slightly left to the lamella and a deeper umbilicus. Also the columellar margin being slightly indented and not as straight in the former.

Family CHAROPIDAE

Genus *Ruthvenia* Draparnaud, 1801

Ruthvenia retifera Pfeiffer, 1845

1845. *Helix retifera* Pfeiffer, *Proc. zool. Soc. Lond.*, p. 73.

1914. *Ruthvenia retifera* : Gude, *Fauna Brit. India*, Mollusca II : fig. 5, 26.

Shell dextral, broadly conic, moderately umbilicate, hay coloured, thin glossy and translucent. Spire short, apex obtuse. Whorls $6\frac{1}{2}$, gradually increasing, sutures impressed, surface with vertical lirations that continues to form hair like appendages from the single prominent spiral liration present just above the sutures. The body whorl keeled, flattened below, and contains dentitions visible at a short distance from the aperture. Dentitions five, of which three are horizontal and parallel to each other; the remaining two are vertical and continuous. Aperture more than double the spire, lips thin, columella chestnut coloured. Umbilicus moderately wide and deep.

Measurements : H = 4 mm, Diameter = 7 mm.

Materials observed : Nine examples from FMKMC campus Madikeri. 13/9/2003 (Coll. Sandhya P.S., N.A. Madhyastha and Rajendra G.M.).

Distribution : Tamil Nadu : Nilgiris, Coonoor, Thirunelveli, Shevroy Hills; Karnataka : Mysore, Madikeri.

Remarks : This interesting species has teeth situated deep and far away from the aperture. The teeth are present in sets of five, at regular intervals.

SUMMARY

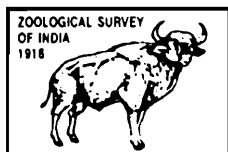
This study is the first report on land snails of Kodagu district. The land snails of Western Ghats in particular are important due to their high endemism; 94% including those common with Sri Lanka (Ramakrishna and Mitra 2002, Mavinkurve *et al.*, 2003). A sum of 439 individuals belonging to 9 families, 28 genera and 50 species were collected. Kodagu district land snails fauna shows considerable resemblance with that of Wynaad. Many of them are quite interesting. The monotypic genus *Indrella ampulla* in this area marks the extension of the distributional limits and another point to be noted is that of the colour of the animal, which varies considerably from the description given in the Fauna. The presence of two species of the carnivorous snail *Streptaxis* is also interesting as a pointer to high molluscan diversity. *Mariaella dussumieri* is a serious pest causing damage to the economically important plantation crops. It is common in Home Gardens, near water pipes, and wherever there is even slight amount of moisture. All the species described are endemic to Western Ghats and Sri Lanka hill ranges.

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The authors acknowledge the grant of funds for this study through Ministry of Environment and Forests under the AICOPTAX scheme. The authors are thankful to all those who helped during collections and also the Principal Poornaprajna College, Udupi for extending institutional facilities. The authors are also grateful to Mr. S.C. Mitra, Officer-in-Charge, Mollusca Section, ZSI, Kolkatta, for his help during identification of the species.

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Rec. zool. Surv. India : **105** (Part 1–2) : 127-132, 2005

DEPLETION OF ORGANIC COMPOUNDS IN THE LEAVES OF BANI (*AVICENNIA ABLA* BLUME), GUAVA (*PSIDIUM GUAJAVA* LINN.), JUTE (*CORCHORUS CAPSULARIS* LINN.) AND PUMPKIN (*BENINCASA CERIFERA* SAVI) DUE TO FEEDING OF MITE

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INTRODUCTION

Infestation of various pests including mites is known to cause depletion of organic compounds in plants leading to their physiological and morphological changes (Hervert & Butler, 1973; Golek, 1975; Shree and Nataraja, 1993). Since nothing is known as to what extent the feeding of different species of mites influence changes in the biochemical components of leaves of bani, guava, jute and pumpkin, it was thought desirable to undertake a preliminary study on this aspect and the results thereof are presented in this paper.

MATERIALS AND METHODS

Heavily infested leaves as well as uninfested healthy leaves of bani (*Avicennia alba* Blume), guava (*Psidium guajava* Linn.), jute (*Corchorus capsularis* Linn.) and pumpkin (*Benincasa cerifera* Savi) were collected from field at Bamankhali, Sagar Island, South 24-Paraganas (S) district of West Bengal and tested separately for estimating depletion or increase of organic components like chlorophyll, total protein, total carbohydrate and total phenol.

The estimation of chlorophyll was done following Arnon (1949). Total carbohydrate was estimated using Anthrone reagent. Phenol was estimated following Spies (1955) while the estimation of total protein was done by the method suggested by Lowry and Folin (1951). The entire study was made during August, 2000 to July, 2003. All experiments were repeated five times. The results thus obtained were subjected to statistical calculation and given in Table 1.

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RESULTS AND DISCUSSION

As per Table 1, a marked depletion in percentage content of organic compounds was recorded excepting in case of total phenol, where percentage increase was recorded. The percentage of depletion in case of chlorophyll, total protein and total carbohydrate contents were 3.25 ± 0.33 , 16.28 ± 0.41 and 9.44 ± 0.84 respectively in case of Bani, 20.25 ± 0.22 , 30.25 ± 0.59 and 26.00 ± 0.28 , in case of guava, 13.45 ± 0.17 , 42.0 ± 0.25 and 56.22 ± 0.93 , in case of jute and 52.55 ± 1.03 , 28.36 ± 0.98 and 40.54 ± 0.84 respectively in case of pumpkin. But in case of phenol, the percentage increase was 1.12 ± 0.26 in case of bani, 0.75 ± 0.06 in case of guava, 8.20 ± 0.27 in case of jute and 4.36 ± 0.67 in case of pumpkin.

Table 1. : Increase or decrease of organic compounds in the leaves of different plants due to mite feeding.

Name of organic components	Control (Average amount $\pm$ SD) [n = 5]	Infested (Average amount $\pm$ SD) [n = 5]	Percentage of decrease or increase (Average amount $\pm$ SD) [n = 5]
In case of Bani (<i>Avicennia alba</i>) infested with <i>Schizotetranychus hindustanicus</i>			
Chlorophyll	9.00 ± 0.47 mg/gm	8.70 ± 0.59 mg/gm	3.25 ± 0.33 (d)
Total Protein	78.00 ± 1.25 μ g/gm	65.30 ± 0.98 μ g/gm	16.28 ± 0.41 (d)
Phenol	0.436 ± 0.35 μ g/gm	0.445 ± 0.49 μ g/gm	1.12 ± 0.26 (i)
Total Carbohydrate	1.8 ± 0.68 mg/100 mg sample	1.63 ± 0.39 mg/100 mg sample	9.44 ± 0.84 (d)
In case of Guava (<i>Psidium guajava</i>) infested with <i>Eotetranychus hicoriae</i>			
Chlorophyll	3.20 ± 0.33 mg/gm	2.25 ± 0.02 mg/gm	20.25 ± 0.22 (d)
Total Protein	120.00 ± 2.36 μ g/gm	83.70 ± 1.86 μ g/gm	30.25 ± 0.59 (d)
Phenol	0.262 ± 0.21 μ g/gm	0.290 ± 0.25 μ g/gm	0.75 ± 0.06 (i)
Total Carbohydrate	2.50 ± 0.81 mg/100 mg sample	1.60 ± 0.67 mg/100 mg sample	26.00 ± 0.28 (d)
In case of Jute (<i>Corchorus capsularis</i>) infested with <i>Polyphagotarsonemus latus</i>			
Chlorophyll	5.6 ± 0.33 mg/gm	4.84 ± 0.89 mg/gm	13.45 ± 0.17 (d)
Total Protein	55.00 ± 0.08 μ g/gm	31.90 ± 0.53 μ g/gm	42.0 ± 0.25 (d)
Phenol	1.31 ± 0.61 μ g/gm	1.40 ± 0.74 μ g/gm	8.20 ± 0.27 (i)
Total Carbohydrate	4.50 ± 0.56 mg/100 mg sample	1.97 ± 0.37 mg/100 mg sample	56.22 ± 0.93 (d)
In case of Pumpkin (<i>Benincasa cerifera</i>) infested with <i>Tetranychus urticae</i>			
Chlorophyll	2.10 ± 0.16 mg/gm	0.99 ± 0.14 mg/gm	52.55 ± 1.03 (d)
Total Protein	85.00 ± 0.63 μ g/gm	60.89 ± 0.89 μ g/gm	28.36 ± 0.98 (d)
Phenol	0.124 ± 0.08 μ g/gm	0.129 ± 0.02 μ g/gm	4.36 ± 0.67 (i)
Total Carbohydrate	3.70 ± 0.68 mg/100 mg sample	2.20 ± 0.77 mg/100 mg sample	40.54 ± 0.84 (d)
(i) = Percentage increase, (d) = Percentage decrease, n = number of experiments.			

The decrease in chlorophyll level is due to mechanical damage of chloroplasts of leaves caused by mite feeding or it may be due to decolouration of chloroplasts. According to Tomezyk and Kropczynska (1985) the water stress induced by mite feeding may have an influence on chlorophyll metabolism of injured cells or may be due to cell disturbances and removal of chloroplasts. Kolodoziej *et. al.*, (1979) indicated positive correlation between increases in mite density with decrease of chlorophyll. Contrary to this, Poskuta *et. al.*, (1975) and Sances *et. al.*, (1979, 1982) indicated that damage to chlorophyll due to mite feeding was quite low even in high mite density. Chatterjee and Gupta (1997) reported chlorophyll damage to the extent of 33.62% on *Luffa acutangula* due to infestation of *Tetranychus ludeni* while Nangia *et. al.*, (1999) reported chlorophyll loss on different varieties of mulberry due to feeding of *Eotetranychus suginamensis* as 153.75% on MS variety, 185.00% in S-54 variety, 74.50% in Mysore local variety and 12.60% in RFS 175 variety. Goyal and Sadana (1983) reported chlorophyll loss as 63.12% mg/m² on *Coleus* sp. infested by *Brevipalpus obovatus* and Sumangala and Haq (1995) reported it as 47% over uninfested leaves in case of *Eichhornia crassipes* due to feeding of *Eutetranychus orientalis*. Therefore, in view of the above reports, the chlorophyll loss as was seen in the present case was low. Chlorophyll loss due to mite feeding was also reported by Van de Vrie *et. al.*, (1972) and Atanosov (1973).

In the present study, the increase in phenolic compounds was observed as $1.12 \pm 0.26\%$ in case of bani, $0.75 \pm 0.06\%$ in case of guava $8.20 \pm 0.27\%$ in case of jute and $4.36 \pm 0.67\%$ in case of pumpkin. Similar observation towards increase of phenolic compounds was also reported by Kielkiewiez (1981) and according to this author the increase was noticed in upper and lower epidermis after mite feeding though its reduction was observed in palisade parenchyma.

As regards total protein, the reduction was seem to be $16.28 \pm 0.41\%$ in case of bani, $30.25 \pm 0.59\%$ in case of guava, $42.0 \pm 0.25\%$ in case of jute and $28.36 \pm 0.98\%$ in case of pumpkin which were indeed very high. Similar observation was recorded by Nangia *et. al.*, (1999) where depletion varied from 57.50% in Mysore local variety of mulberry leaves to 38.80% in RFS-175 variety, due to feeding of *Eotetranychus suginamensis*. They attributed this depletion due to their breakdown by proteolytic enzymes secreted by mites and subsequent utilization of that by the concerned mite. Agarwal *et. al.* (1982), Zukova (1963), Goyal and Sadana (1983) also made similar observations *i.e.* reduction of protein due to feeding by different species of mites.

Regarding total carbohydrate, the percentage decrease was alarmingly high *i.e.*, 9.44 ± 0.84 in case of bani, 26.00 ± 0.28 in case of guava, 56.22 ± 0.93 in case of jute and 40.54 ± 0.84 in case of pumpkin. Similar observation was made by Nangia *et. al.* (1999) where the decrease was reported to be 12.30% in MS variety, 17.55% in S-54 variety, 19.10% in Mysore local variety and 12.70% in RFS-175 variety of mulberry due to feeding on *Eotetranychus suginamensis*. Usha *et. al.* (1999) reported changes in the level of total sugar, reducing sugar and non-reducing sugar due to mite infestation. Non-reducing sugar reduced significantly in plants infested by mites but reducing sugar content did not differ significantly between infested and uninfested leaves.

The changes of organic compounds of leaves because of mite feeding brought about changes in physiological functioning of leaves producing the characteristic damage symptoms on leaves in the form of yellowing and browning of leaves, curling and crinkling specially on young leaves, *etc.* All such leaves dried up, plants suffered defoliation and all these contributed towards reducing the yield.

SUMMARY

Due to feeding of *Schizotetranychus hindustanicus* (Hirst) on bani leaves (*Avicennia alba* Blume), *Eotetranychus hicoriae* Megregor on guava leaves (*Psidium guajava* Linn.), *Polyphagotarsonemus latus* (Banks) on jute leaves (*Corchorus capsularis* Linn.) and *Tetranychus urticae* Koch on pumpkin leaves (*Benincasa cerifera* Savi), biochemical changes with regard to organic compounds were observed which in case of chlorophyll, total protein and total carbohydrate contents among organic compounds were reduced by 3.25 ± 0.33 , 16.28 ± 0.41 and 9.44 ± 0.84 respectively in case of Bani, 20.25 ± 0.22 , 30.25 ± 0.59 and 26.00 ± 0.28 , in case of guava, 13.45 ± 0.17 , 42.0 ± 0.25 and 56.22 ± 0.93 , in case of jute and 52.55 ± 1.03 , 28.36 ± 0.98 and 40.54 ± 0.84 respectively in case of pumpkin. But in case of phenol, the mite feeding induced their increase by 1.12 ± 0.26 in case of bani, 0.75 ± 0.06 in case of guava, 8.20 ± 0.27 in case of jute and 4.36 ± 0.67 in case of pumpkin respectively.

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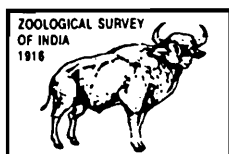
The authors are thankful to the Ministry of Environment and Forests, Government of India for funding the research project and to Prof. Amalesh Choudhury, Secretary, S.D. Marine biological Research Institute for providing the laboratory facilities. The authors are also thankful to the authorities of Jadavpur University for extending help in analysis of organic components of leaves.

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Rec. zool. Surv. India : 105 (Part 1–2) : 133-138, 2005

NEW RECORD OF *PORITES ANNAE* CROSSLAND AND *PORITES CYLINDRICA* DANA FROM GULF OF MANNAR AND ANDAMAN WATERS

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INTRODUCTION

Most of the species of the genus *Porites* are commonly known as boulder corals because of their massive structure and size. They are the real barriers in the seas protecting the islands from erosion. *Porites* has wide range of growth forms such as massive, sub massive, laminar and encrusting. World wide, 52 species have been recorded so far (Veron, 2000). Pillai (1983) recorded 10 species of *Porites* from India. Venkataraman *et. al.*, (2003) reported 11 species from the four major reef areas *viz.* Gulf of Mannar, 7; Andaman and Nicobar Islands, 6; Gulf of Kachchh, 3 and Lakshadweep Islands, 6 species. Complexity in structure and very small corallite size require thorough microscopic examination for identifying species.

Family Poritidae is the third largest family in the world and includes the genera *Porites*, *Goniopora*, *Alveopora*, *Sylaraea* and *Poritopora* comprising 89 known species. Genus *Porites* having 52 species is the third largest genus in the world after *Acropora* (170 species) and *Montipora* (72 species). The present paper reports two new record such as *Porites annae* Crossland, 1952 and *Porites cylindrica* Dana, 1846 from and Gulf of Mannar Biosphere Reserve and Andaman Island respectively.

SYSTEMATIC ACCOUNT

Phylum CNIDARIA

Class ANTHOZOA

Subclass ZOANTHARIA DeBlainville, 1830

Order SCLERACTINIA Bourne, 1905

Family PORITIDAE Gray, 1842

Genus *Porites* Link, 1807

The family Poritidae is colonial and hermatypic. They are mostly extant. Colony formation is primarily by extra-tentacular budding. Corallites have porous walls of clearly differentiated synapticalae and trabeculae and corallites are closely compacted with little coenosteum (Veron and Pichon, 1982; Veron 2000). Except *Poritopora*, all the other genera are reported in India (Venkataraman *et. al.*, 2003; Raghuram and Venkataraman, 2003).

Colonies of the genus *Porites* are massive or columnar. Massive colonies are spherical or hemispherical, small, helmet or dome shaped. Corallites are small, immersed with calices less than 2 mm in diameter and filled with septa. *Porites* resembles *Montipora* (Veron, 2000).

Porites annae Crossland, 1952

(Figs. 1-4)

1952. *Porites annae* Crossland. Madreporaria, Hydrocoralline, *Heliopora* and *Tubipora*. *Sci. Rep. Great Barrier Reef Exped.* 1928-29. *Br. Mus. (Nat. Hist.)*, 6(3), 85-257.

1982. *Porites* (*Porites*) *annae* (Crossland) Veron and Pichon, *Australian Inst. of Mar. Sci.*, Australia. Vol. 5, 48-51.

2000. *Porites annae* (Crossland) Veron, *Australian Inst. of Mar. Sci.*, Australia, 3 : 310-311.

Material Examined : During the coral reef status survey of GoMBR (January and March 2003), colonies of *Porites annae* were collected in the intertidal reef flat from the Poomarichan (Lat. 9° 14'38"N; Long. 79° 10' 51" E) and Talairi Islands (Lat. 9° 10' 58" N; Long. 78° 56' 03" E) of GoMBR (Reg. No. ZSI/MBS-C/0009 dt. 18.08.03) by K. P. Raghuram, Marine Biological Station, ZSI, Chennai.

Characters : Colonies are columnar to sub massive. Nodular branches usually anastomose or are columnar. Corallites have 5 larger palli and 3 smaller palli. Corallites are 1.28 mm in diameter; Calices are 0.91 mm in diameter. Corallites, coenosteum are porous. Columella is small or absent, triplet has free margins (Figs. 2 and 3).

Distribution : It is a new record to India. World wide it is distributed in Great Barrier Reef, Papua New Guinea, Phillipines, Indonesia and coral sea (Veron, 2000).

Remarks : *Porites annae* is uncommon in GoMBR. In Poomarichan Island it was found in the southern side. It was seen in the vicinity of breaker zone where the depth is about four feet. *Porites annae* colonies were seen associated with *Montipora digitata* and *M. hispida*. Colony greenish brown in colour. In Talairi Island it was found in the eastern side 10 m off the shore. Lagoon constituted only sand with a few *Acropora* sp. and sea grasses, and the present species was found on the sand substratum, no other fauna or flora was observed near the specimen. The colonies

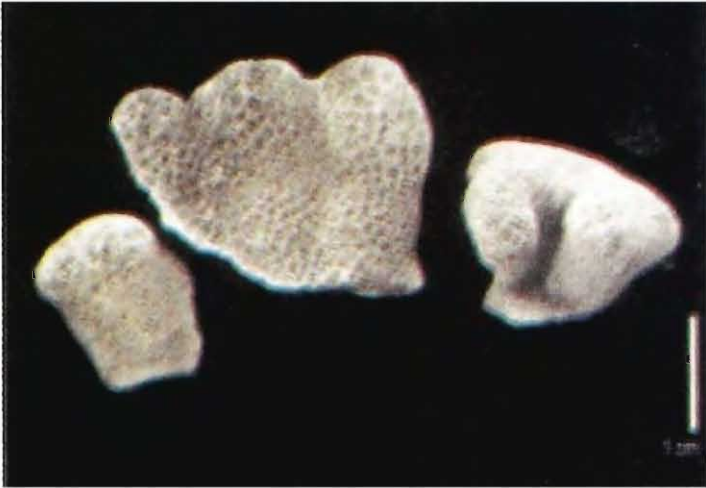


Fig. 1 : *Porites annae* (A small portion of colony).



Fig. 2 : Plan view of a corallite (enlarged).



Fig. 3 : Plan view of a corallite (enlarged).

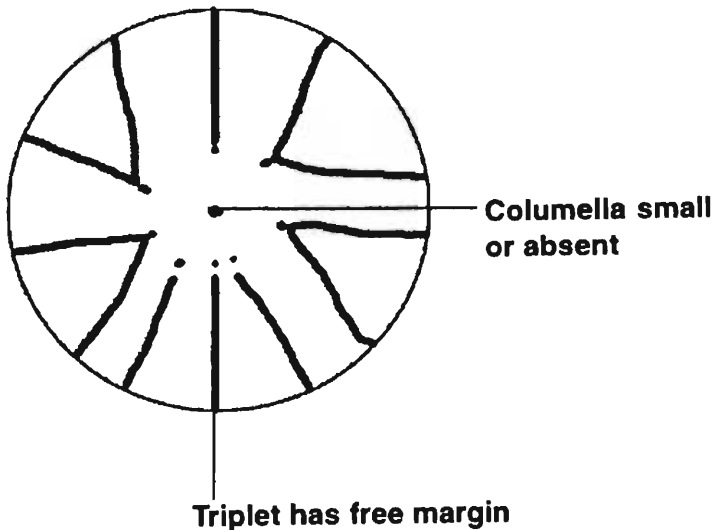


Fig. 4 : Schematic representation of a plan view of *P. annae* corallite.

were of 3 ft length, 3 ft width, 1.5 ft height and 8.5 ft circumference. Upper portion of the colony was bleached probably due to intensive exposure to sunlight. Colonies from both the islands were found in turbid free environment.

***Pontes cylindrica* Dana, 1846**

(Figs. 5-7)

1846. *Porites cylindrica* Dana. *U.S. Explor. Exped.*, 7, 1-740, pl. 1-61.

1918. *Porites andrewsi* Vaughan, *Pap. Dep. Mar. Biol. Carnegie Inst. Wash.*, 9, p. 203, pl. 91.

1973. *Porites andrewsi* (Vaughan) Pillai and Scheer. *Zool. Jahrb. Abt. Syst. Oekol. Geogr. Tiere.*, 100, p. 471.

1982. *Porites cylindrica* (Dana) Veron and Pichon. Veron and Pichon. *Australian, Inst. of Mar. Sci.*, Australia. Vol. 5, 35-38.

Material examined : During the 'India Australia Training and Capacity Building on Coral Reefs' at Andaman (March, 2003), colonies were photographed in the reef slope of the North Reef, Andaman.

Characters : Colonies are branched and closely packed. Secondary branches are small. Colonies are found to grow on other corals as an encrusting form and later become branching or columnar. Colonies measure more than one meter across in the reef slope.

Distribution : In India *P. cylindrica* has been recorded only in Minicoy Island, Lakshadweep by Pillai 1971 as *P. andrewsi* Vaughan, however Veron and Pichon (1982) synonymised *P. andrewsi* with *P. cylindrica* Dana. In Andaman and Nicobar Islands Pillai (1971) recorded *P. eridani* Umbgrove as *P. cylindrica*, Veron (2000) described *P. eridani* as a separate species. Hence the present species is a new record to Andaman waters.

Remarks : Colonies are light green in colour and are found in the reef slope, where the depth is about 12 ft. The height of the colony is not more than one foot. Colonies of *P. cylindrica* have nodular anastomosing branches or columns with encrusting bases (Fig. 5). Whereas in *P. eridani* Umbgrove, 1940, colonies have large basal laminae, often with contorted branches. Corallites are found both in laminae and branches (Fig. 6).

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Fig. 5 : *Porites cylindrica* along side by *Fungia* sp. from North Bay, Andaman.



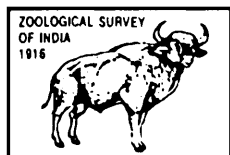
Fig. 6 : *P. eridani* (brown colour) at North Bay, Andaman.



Fig. 7 : *Porites cylindrica* from North Bay.

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STUDIES ON SOUTH POLAR SKUA (*CATHARACTA MACCORMICKI*) IN AND AROUND MAITRI, SCHIRMACHEAR OASIS, ANTARTICA

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INTRODUCTION

The harsh combination of rapidly changing temperatures, strong drying winds, irregular water and nutrient supply, frequent snow falls and frosts and continental soil movement due to freezing and thawing means that only a few plants and invertebrates can survive on the ice-free land such as Schirmacher oasis of Antarctica. These areas are capable of supporting life, mostly microinvertebrates in the soil and in moss-water or in the bodies as well as many avian and a few mammalian forms.

Skuas are dark coloured predatory sea birds with conspicuous white flashes in the primary feathers that show only in flight. The dark bill is strongly hooked and is covered at the clawed. Females are on the average large than males. The south polar skuas *Catharacta maccormicki* are well known for their aggressive rapacious habits. They have a rapid, sustained and powerful flight, which enable them to rob many birds. Skuas prey on chicks and eggs, particularly those of penguins and take a heavy toll of small petrels. Skuas characteristically proclaim jurisdiction over a territory by boldly challenging intruders with open wings raised over their back. The challenger is accompanied by a harsh screaming charr' charr charr' They are particularly aggressive in defence of young chicks and engage in a series of swooping dives, striking trespassers with their wings and feet. A perusal of the literature shows that studies on *Catharacta maccormicki* from continental Antarctica is scanty. Hull *et. al.*, (1994) studied the breeding technology of *C. maccormicki* from Magnetic Island. Also other skuas such as arctic skua, great skua and brown skua were studied from different Antarctic islands (Sears *et. al.*, 1995; Young, 1994).

In the present study, habitat, reproduction, population density and the behavioral pattern to the recorded and simulated voices of other skua present in the Schirmacher Oasis were conducted.

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MATERIAL AND METHODS

The present study was conducted between Jan 14th to Feb 14th, 1995. All the nesting sites were visited frequently to assess the breeding success. Mist nets were used to catch the skua for ringing studies. The mist net was spread in a conical shape above the ground with one side open. A piece of meat was kept inside the net as a bait to attract the birds. When the birds were busy eating the meat they were chased inside the conical mist net drop and were caught. Since skua has territorial behaviour this mist net trap was laid at different places around Maitri station. Voices of skua were recorded using the tape recorder (SONY, WALKMAN) and played back to the same bird and different pairs and the behaviour was recorded. On a few occasions the voice was mimicked by the author and the behaviour was noted. The recorded voice and the mimicked voice were played to Adelie penguin and the behaviour was noted.

Metal rings (also called 'bands') bearing a return address (Bombay Natural History Society, Bombay) and serial number were used to mark birds to study long distance movements in Antarctica. Individual birds may thus be recognized and their movements, survival and behaviour studied. The markers used in the present study are tarsus rings made of Aluminium. These tarsal rings have numbers large enough to be read with binoculars eliminating the necessity for capturing a bird in order to read its band. Adults were banded on the right tarsus and chicks on the left tarsus.

RESULTS AND DISCUSSION

A total of six adult skuas and one chick were ringed (Table 1). A ring (No. 13100) was recovered from an adult skua near Russian station (Novalazarevskaya) at Schirmacher Oasis, which was ringed earlier (1991-1992) by Zoological Survey of India Calcutta. The measurements on the morphometry of various body parts of the skua were made (Table 2) while ringing was done. An adelie penguin standard at Maitri during January 1995 was also ringed using 'K' ring (K, 581) and measurements such as beak (7 cm), height (43 cm), flapper length (920 cm) and toe length (10 cm) were made.

Table 1. : Data on the ringing of the *Catharacta maccormicki* and *Phygoscelis adeliae*.

S. No.	Name of the species	Status	Sex	Ring No	Date
1.	<i>Phygoscelis adeliae</i>	Adult	?	K581	03.02.95
2.	<i>Catharacta maccormicki</i>	Chick	?	F13150	24.01.95
3.	<i>Catharacta maccormicki</i>	Adult	Female	F13149	13.02.95
4.	<i>Catharacta maccormicki</i>	Adult	Female	F13148	13.02.95
5.	<i>Catharacta maccormicki</i>	Adult	Male	F13147	13.02.95
6.	<i>Catharacta maccormicki</i>	Adult	Male	F13146	15.02.95
7.	<i>Catharacta maccormicki</i>	Adult	Female	F13145	15.02.95

Table 2. : Data on the morphometry of the *Catharacta maccormicki* ringed in and around Maitri, Schirmacher oasis during 1994-95 summer (length in cm).

Sl. No.	Ring No.	Beak	Wing	Long feather	Wing width	Leg	Toe			Web	Total
							Middle	Left	Right		
1.	F13150	5.5	30.0	40.0	—	7.5	5.2	4.5	4	—	80.0
2.	F13149	5.0	31.4	31.0	—	17.5	8.0	7.4	4	9	—
3.	F13148	5.0	34.0	29.0	17.5	18.0	7.8	6.5	5	8	—
4.	F13147*	5.5	33.0	40.0	19.0	—	7.0	6.0	6	8	133.0
5.	F13146	5.5	32.0	33.0	19.0	19.0	7.0	6.0	5	—	137.0
6.	F13145	5.6	31.0	38.0	19.0	20.0	7.0	6.0	5	—	—
7.	F13100**	5.2	35.0	40.0	18.0	21.0	7.0	6.0	5	—	—

(*Bird with torn web on the right leg; **ring recovered from a bird ranged during 1991-92 summer by ZSI, Calcutta)

The ringing programme on the skuas of Schirmacher Oasis was done earlier on two occasions by German scientists in 1984-85 and 1988-89 (Richter *et. al.*, 1990) and on one occasion by Zoological Survey of India, Calcutta in 1991-92 (Table 3). Both the two birds which were ringed in 1991-92 by ZSI using BNHS, Bombay rings were observed in 1994-95 out of which one was recovered. This clearly reveals that, the skuas were returning to the Schirmacher Oasis for breeding,

Table 3. : Data on the ringing programme conducted from 1984-1995 at Schirmacher Oasis.

Sl. No.	Name of the station	Number		Year and ring number	Remarks
		Adult	Chick		
1.	George Forster**	4	6	1984-85*	No morphometry measurements
2.	George Forster	—	9	1988-89*	No morphometry measurements
3.	Maitri Station	—	—	1991-92*	No morphometry measurements
4.	Maitri Station	6	—	1994-95 (F13145-F13150)	Measurements taken and ringing in and around Maitri

(*Ring numbers not available;

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however they were coming to the same nesting site or not is yet to be confirmed due to non-availability of data on the ringing site. During the present study only once the skua was ringed (chick at the nest). All other birds were ringed in and around Maitri station when they come for feeding. A continuous programme on ringing and more studies on both adult and chickens, will help to confirm how many pairs of skuas return to Schirmacher Oasis, or are they the same pairs of skua or a new pair, or are they returning to the same site or not and whether the young visit immediately the next year or how many years later.

Population

Studies on skua had been conducted in 1979-80, 1984-85, 1988-89, 1991-92 and 1994-95 (present study). Earlier three studies were made by George Forster, GDR (Richter *et. al.*, 1990) and the latter two by Maitri, India (Zoological Survey of India, Calcutta). A total of well-confirmed 10 nets have been found by earlier studies and also by the present (Fig. 1). The number of skua

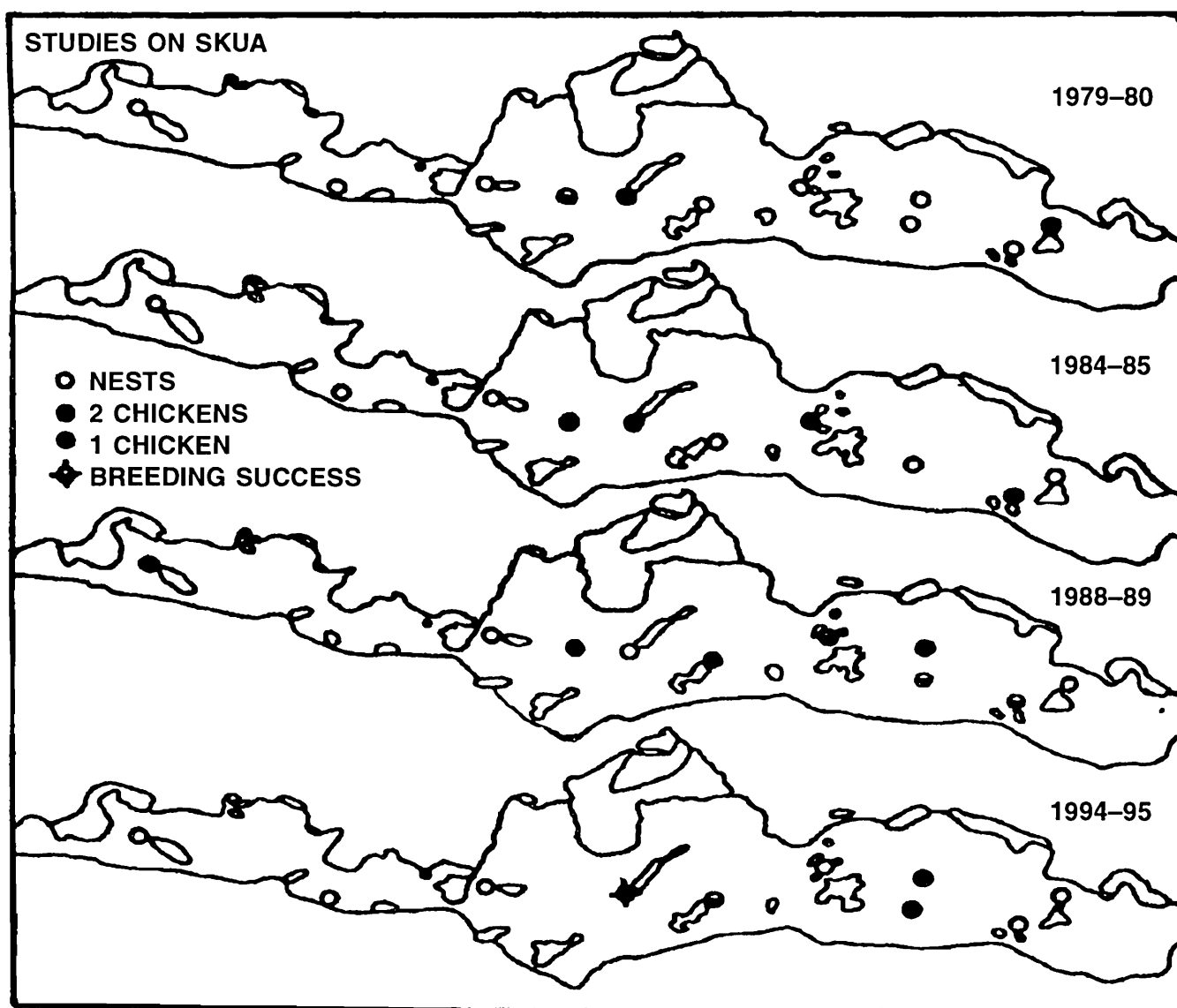


Fig. 1. : Breeding success of South polar skua in the Schirmacher Oasis studied by George Forester and Maitri Station (1979-1995).

nests have not increased during the years and also the population. A total of 15 skuas were seen at Maitri during one time flight and the data on the nests shows that all 10 nesting sites can accommodate 10 pairs (20 birds). It is clear from the present studies that skua nests only near the water body and it warrants a good view of the vicinity. The number of water bodies remains same during the years as the number of nests, and the territorial behaviour of these birds also restricts the increase of nests. The fate of successful chickens are not known clearly, after they leave Schinnacher Oasis. More ringing programmes may give us the data on the migratory pattern and nesting activities of the chickens during the adult phase.

Breeding

The number of nests, seen, the number of breeding pairs and the breeding success during the present study are shown in Fig. 2. In Schinnacher Oasis the South polar skua arrived/appeared between 25 to 31st October (records from winters observers) and the present observation was made

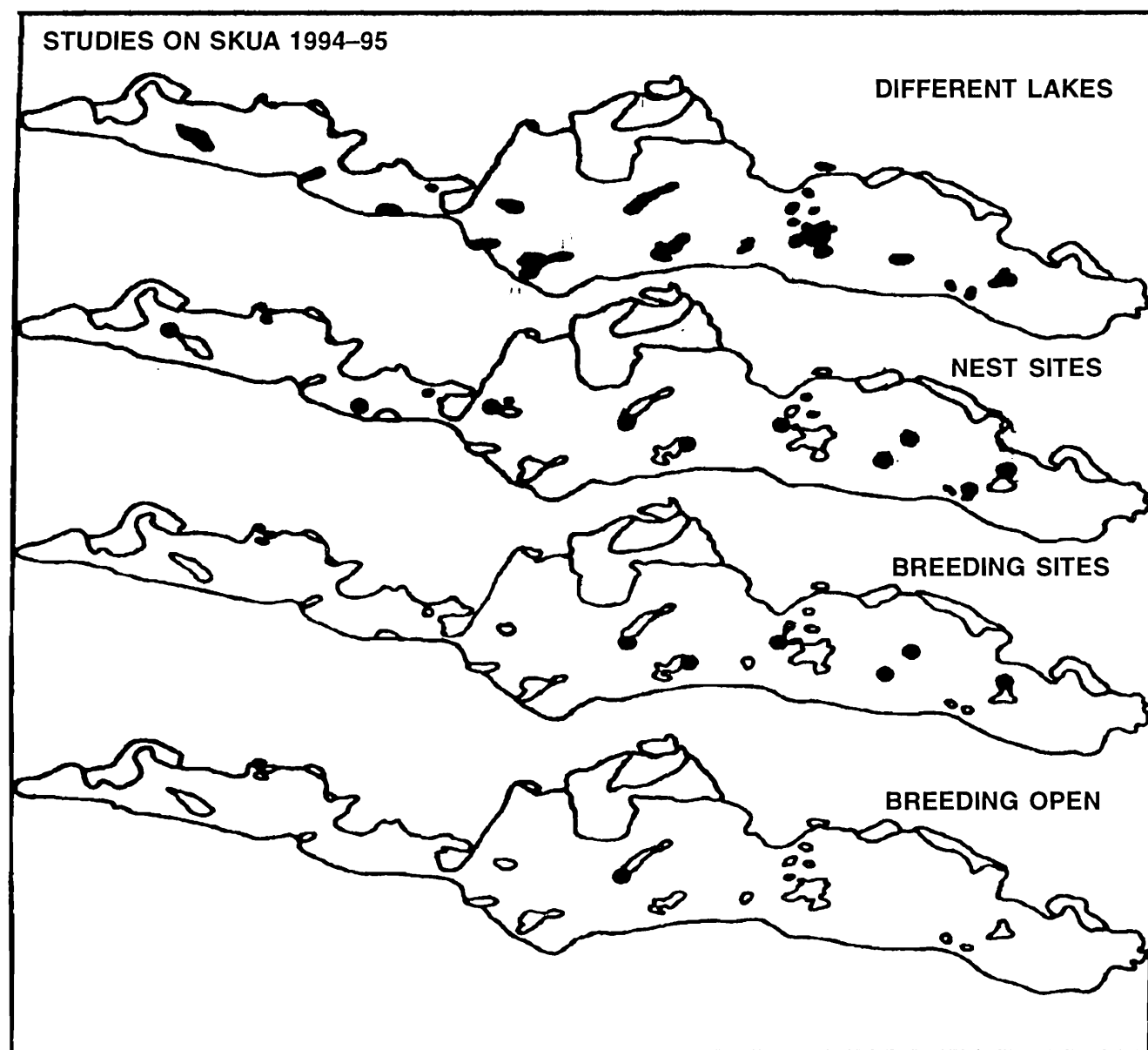


Fig. 2. : Nest sites and the breeding sites of South polar skua in the Schirmacher Oasis in 1994-95 summer.

from January 15 onwards. By the time the expedition team reached the Oasis, already the egg laying, hatching and feeding was started by the skua pairs. All the nesting sites contained with very old remnants of bones of petrels. It is well observed from their behavioural pattern that they never allow other pairs to enter into their nesting sites. The territorial behaviour mainly explains that they will not share their food as well as defend their clutches and chickens from the other skuas. This shows that there is always a chance for the predation of egg and chickens by other skuas whenever it is warranted due to any forced conditions such as nonavailability of food for a number of days due to high wind velocity and blizzard. Therefore, the breeding success of skuas in Schirmacher Oasis highly depends on the feeding conditions. The reduction in number of prey such as snow petrels and Wilson's storm petrels in the Schirmacher Oasis may also affect the breeding success of skua. During the present study, only on two occasions Wilson's storm petrels were seen flying in the Schirmacher Oasis but no snow petrel were observed. It appears that the skuas in Schirmacher Oasis have to fly a long distance for hunting. On one occasion a pair of skua with a chick was seen with the kill of a snow petrel near Indian Bay *i.e.*, about 100 km away from the Oasis. On two occasions fresh kills were observed in the nests visited. However, the rubbish from the stations Novolazarevskaya (Soviet Union), George Forster (GDR) and Maitri (India) are eaten by most of the skuas, which live nearer to these places. It is evident from the present study (Fig. 2) that most of the nests were observed with one or two eggs. Mostly the breeding success takes place only around Maitri or other stations in the Schinnacher Oasis. During 1994-95 (present study) the present author had noticed many skuas visiting regularly in pairs to collect their food such as meat, chicken and fish waste thrown near the garbage dump of Maitri Station. During night (2100-0200 h during Jan-Feb) many birds were observed to roost near Maitri station (near garbage dump and near Annapurna hut) till the morning to collect the rubbish.

Behavioural studies

A variety of studies were conducted on skua that visited Maitri station using recorded voices of adult skuas. When the recorded voices of the skuas were played to the same skua pair, the behaviour was aggression. This was noticed in the case of other skuas too. When the recorded voice was played near the nest with chickens, the adult skua started striking the tape recorder. When the voices of Adelie penguin was played, they started challenging with open wings raised over the back. On an occasion a meat piece was shown to a pair of skua and then hidden under a stone. The skua pair recovered the meat after a search for two hours and forty-five minutes from the place where it was hidden. Immediately after the recovery of the meat piece it was taken to the lake nearby and was placed under water near a well-marked stone. The bird was seen visiting the place where the meat was kept under water, time and again to feed. The same behaviour was observed on many other occasions. A few skua pairs receiving meat pieces from the expedition members directly from hand was observed on some occasions. This mean that the skuas are habituated to the food availability near the expedition stations in the Schirmacher Oasis. After every blizzard

which lasts for about four to five days these birds were seen following every expedition member passing by, to receive food.

SUMMARY

The Indian Antarctic Station Maitri is situated in the Schirmacher oasis, at Princes Astrid Coast at a distance of about 80–100 km from the open sea. The area of the Schirmacher oasis is about 34 km² (70°44'33"S to 70°46'30"S and 11°22'00"E). The low lying hills in the oasis interspersed by many glacial lakes are used by South polar skua *Catharacta maccormicki* as their nesting and breeding sites.

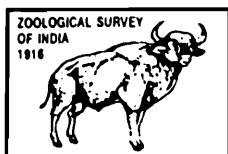
Studies on south polar skua were conducted in and around Schirmacher oasis. Nesting sites, breeding success and population studies of south polar skua were compared with other observations over several years. Out of six breeding pairs, only one could succeed in breeding. One Adelie penguin and six south polar skuas (one chick and five adult) were ringed to study the population density and the migratory pattern. A total of 10 nests were sighted during the present study.

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SCARABAEID BEETLES (COLEOPTERA) OF KANHA TIGER RESERVE, MADHYA PRADESH

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INTRODUCTION

Kanha Tiger Reserve is one of the oldest and best managed wildlife reserves in Central India. This tiger reserve was included in Project Tiger in first phase *i.e.*, in the year 1973-74. The reserve is extended into the two districts *e.g.*, Mandla and Balalghat district in Madhya Pradesh. The total area of the tiger reserve is 1945 sq. km., the core zone includes the park area of 945 sq. km. and the buffer zone is 1000 sq. km. This is located in the Central Indian Highlands of the Satpura and the Maikal Range. Geographically, it lies between 22°1'5" and 22°27'48" North Latitudes and 80°26'10" and 81°4'40" East Longitudes and at 1299 m above sea level. It is well diversified area famous for its abundance of varieties of animals, including insects, birds and mammals.

The first comprehensive account of Scarabaeid beetles of the Indian region was published by Arrow (1910, 1917 and 1931) in three volumes of *Fauna of British India*, wherein 58 species were reported from Madhya Pradesh, which was the earlier part of Central India. Frey (1971) reported 3 species of genus *Holotrichia* from Central India. Kuitjen (1978, 1981 and 1984) revised the species of subfamily Hybosorinae of genus *Phaeochrous*, *Hybosorus* and reported 3 species from Central India. Chandra (2000) published an Inventory of Scarabaeid beetles of which revealed the presence of 94 species belonging to 30 genera under 9 subfamilies. While working on the faunal diversity of Pachmarhi Biosphere Reserve, Chandra and Singh (2004) recorded 18 species of Scarabaeid beetles belonging to 11 genera under 6 subfamilies. Newton and Malcolm (1985) is the only publication on dung beetles of Kanha Tiger Reserve, where in 15 species were recorded. Since then, no study on the group was undertaken. During the year 2003-04, four extensive surveys were undertaken and more than 700 specimens of the Scarabaeid beetles (applying the light trap and ground searching method) from various localities *i.e.*, Kisli rest house campus, Gubdudi nala, Kanha, Sonph, Sondhar, Shravan Tall, Baisanghat, Mukki, Supkhar *etc.* were collected from the

various kind of habitats (Table 2) and 61 species of Scarabaeid beetles belonging to 27 genera and eight subfamilies are identified (Table 1). Of these, 14 species are new to the fauna of Madhya Pradesh and 48 species are recorded for the first time from Kanha Tiger Reserve.

HABIT AND HABITAT

The Scarabaeid beetles occur in various habitats. The species of subfamily Scarabaeinae are dominant in the different kinds of dungs and manure. The species like *Onthophagus dama*, *O. catta*, *O. cervus*, *O. bonasus* and *Caccobius* sp. were found in the dung of elephant, where as on Gaur and cow dung more than 15 species collected and the species viz., *Onthophagus catta*, *O. bonassus*, *O. sagittarius*, *O. cervus*, *O. ramosus*, *O. tarandus* were common. Two species i.e., *Gymnopleurus* and *Sisyphus* sp. were commonly present in the Tiger (*Panthera tigris*) dung. The single specimen of *Onthophagus pactolus*, which occurred in the dung of Chital (*Axis axis*) and other species viz., *Onthophagus bonasus* and *O. catta* were collected in the dung of Barasingha. *Aphodius* and *Caccobius* species were present in the dung of Hanuman Langur. The genera *Onitis*, *Oniticellus* and *Drepanocerus* are mostly collected from the dry dung of Chital and Gaur in open grounds. *Copris* species have nesting behaviour, collect their food in the underground chamber inside the burrows and utilize it during the breeding period. The species of *Gymnopleurus gemmatus* and *G. cyaneus* and *Phalops divisus* and *P. olivaceus* are generally attracted to the wet dung of Wild boar during the rains and dung balls are made, which are rolled to their nest.

The Cetoniinae beetles are diurnal and collected from the long grasses of *Themeda*, *Granida* and *Sacchharum* in the meadows areas. Where as the species of Melolonthinae, Rutelinae and Dynastinae commonly known as grub beetle feed on leaf, stem and roots of the trees, are collected during the night by the light trap.

LIST OF SCARABAEID BEETLES OF KANHA TIGER RESERVE

(w.s.r. to their status in tiger reserve)

Species Name (Scientific)	Status	KNKTR/NRKTR/NRMP
Family SCARABAEIDAE		
I. Subfamily APHODIINAE		
1. <i>Aphodius moestus</i> Fabricius	VC	NRKTR
II. Subfamily BOLBOCERINAE		
2. <i>Bolboceras quadridens</i> (Fabricius)	R	NRKTR/NRMP
III. Subfamily HYBOSORINAE		
3. <i>Hybosorus orientalis</i> Westwood	C	NRKTR
4. <i>Phaeochrous</i> sp.	C	NRKTR

Species Name (Scientific)	Status	KNKTR/NRKTR/NRMP
IV. Subfamily SCARABAEINAE		
5. <i>Copris andrewesi</i> Waterhouse	VC	NRKTR
6. <i>Copris imitans</i> Felsche	C	NRKTR
7. <i>Copris carinicus</i> Gillet	C	Newton & Malcolm, 1985
8. <i>Copris davisoni</i> Waterhouse	C	Newton & Malcolm, 1985
9. <i>Copris repertus</i> Walker	C	Newton & Malcolm, 1985
10. <i>Catharsius pithecius</i> (Fabricius)	VC	NRKTR
11. <i>Catharsius molossus</i> (Linnaeus)	VC	NRKTR
12. <i>Catharsius sagax</i> (Queensland)	VC	NRKTR
13. <i>Drepanocerus setosus</i> (Wied.)	VC	NRKTR
14. <i>Gymnopleurus cyaneus</i> (Fabricius)	C	Newton & Malcolm, 1985
15. <i>Gymnopleurus gemmatus</i> Harold	C	NRKTR
16. <i>Gymnopleurus sinuatus</i> (Olivier)	VC	Newton & Malcolm, 1985
17. <i>Heliocopris bucephalus</i> (Fabricius)	VC	NRKTR
18. <i>Onthophagus bonasus</i> (Fabricius)	VC	NRKTR
19. <i>Onthophagus catta</i> (Fabricius)	VC	NRKTR
20. <i>Onthophagus cervus</i> (Fabricius)	VC	NRKTR/NRMP
21. <i>Onthophagus dama</i> (Fabricius)	VC	NRKTR
22. <i>Onthophagus griseosetosus</i> Arrow	VC	Newton & Malcolm, 1985
23. <i>Onthophagus pactolus</i> (Fabricius)	R	NRKTR
24. <i>Onthophagus ramosus</i> (Wied.)	C	NRKTR
25. <i>Onthophagus sagittarius</i> (Fabricius)	C	NRKTR
26. <i>Onthophagus tarandus</i> (Fabricius)	C	NRKTR/NRMP
27. <i>Onthophagus tragus</i> (Fabricius)	C	NRKTR/NRMP
28. <i>Onitis philemon</i> (Fabricius)	VC	NRKTR
29. <i>Onitis brahma</i> Lansberg	VC	NRKTR
30. <i>Onitis subopacus</i> Arrow	C	Newton & Malcolm, 1985
31. <i>Onitis virens</i> Lansberg	VC	NRKTR
32. <i>Oniticellus cinctus</i> (Fabricius)	VC	NRKTR
33. <i>Oniticellus pallens</i> (Olivier)	C	NRKTR/NRMP
34. <i>Oniticellus spinipes</i> Roth	C	NRKTR/NRMP
35. <i>Phalops divisus</i> (Wied.)	C	NRKTR
36. <i>Phalops olivaceus</i> Lansberg	C	Newton & Malcolm, 1985

Species Name (Scientific)	Status	KNKTR/NRKTR/NRMP
37. <i>Sisyphus crispatus</i> Gory	C	Newton & Malcolm, 1985
38. <i>Scarabaeus sanctus</i> (Fabricius)	C	NRKTR
V. Subfamily RUTELINAE		
39. <i>Anomala bengalensis</i> Blanchard	C	NRKTR
40. <i>Anomala biharensis</i> Arrow	VC	NRKTR
41. <i>Anomala cantori</i> (Hope)	VC	NRKTR/NRMP
42. <i>Anomala dorsalis</i> (Fabricius)	VC	NRKTR
43. <i>Anomala fraterna</i> (Burmeister)	VC	NRKTR
44. <i>Anomala varicolor</i> (Gyll.)	C	NRKTR
45. <i>Anomala rugosa</i> Arrow	C	NRKTR
46. <i>Anomala ruficapilla</i> (Burmeister)	C	NRKTR
47. <i>Adoretus bicolor</i> Brenske	C	NRKTR
48. <i>Adoretus bimarginatus</i> Ohaus	C	NRKTR/NRMP
49. <i>Adoretus lasiopygus</i> (Burmeister)	C	NRKTR
50. <i>Adoretus duvauceli</i> Blanchard	C	NRKTR
51. <i>Mimela inscripta</i> (Nonfried)	C	NRKTR/NRMP
52. <i>Mimela macleayana</i> (Vigors)	VC	NRKTR/NRMP
53. <i>Singhala robusta</i> (Ohaus)	VC	NRKTR/NRMP
VI. Subfamily MELOLONTHINAE		
54. <i>Apogonia</i> sp.	VC	NRKTR/NRMP
55. <i>Schizonycha ruficollis</i> (Fabricius)	C	NRKTR
56. <i>Holotrichia sculpticollis</i> Blanchard	C	NRKTR/NRMP
VII. Subfamily DYNASTINAE		
57. <i>Eophileurus perforatus</i> Arrow	C	NRKTR
58. <i>Heteronychus lioderes</i> (Burmeister)	C	NRKTR
59. <i>Xylotrupes gideon</i> (Linnaeus)	C	NRKTR
VIII. Subfamily CETONIIDAE		
60. <i>Clinteria klugi</i> (Hope)	VC	NRKTR
61. <i>Coenochilus trabecula</i> Schaum	C	NRKTR/NRMP

Abbreviation used :

K.T.R.–Kanha Tiger Reserve; KNKTR–Known from Tiger Reserve; NRKTR–New Record from Kanha Tiger Reserve; NRMP–New Record from Madhya Pradesh; C–Common; VC–Very Common; R–Rare; Coll.–Collection; exs.,–Number of examples.

Table 2 : Date wise collection of Scarabaeid beetles from Kanha Tiger Reserve

Date of coll.	Locality	Species	No. of exs.	Source
09.IX.2003	Kisli R. H.	<i>Catharsius molossus</i> (Linnaeus)	2	Light
"	"	<i>Anomala biharensis</i> Arrow	1	"
"	"	<i>Xylotrupes gideon</i> (Linnaeus)	2	"
10.IX.2003	"	<i>Singhala robusta</i> Ohaus	6	"
11.IX.2003	Kisli R. H.	<i>Phaeochrous</i> sp.	2	"
"	"	<i>Aphodius moestus</i> Fabricius	2	Dung
"	"	<i>Onthophagus dama</i> (Fabricius)	4	"
"	"	<i>Onthophagus ramosus</i> (Wiedmann)	5	"
"	"	<i>Onthophagus tarandus</i> (Fabricius)	1	"
"	"	<i>Onitis philemon</i> (Fabricius)	1	Light
"	"	<i>Oniticellus cinctus</i> (Fabricius)	1	Dung
"	"	<i>Anomala cantori</i> Hope	2	Light
"	"	<i>Singhala robusta</i> Ohaus	2	"
"	"	<i>Coenochilus trabecula</i> Schaum	1	"
12.IX.2003	"	<i>Oniticellus cinctus</i> (Fabricius)	5	Dung
13.IX.2004	Kisli R. H.	<i>Aphodius moestus</i> (Fabricius)	2	Light
"	"	<i>Bolboceras quadrigens</i> (Fabricius)	1	"
"	"	<i>Hybosorus orientalis</i> Westwood	2	"
"	"	<i>Phaeochrous</i> sp.	2	"
"	"	<i>Mimela inscripta</i> (Nonfried)	1	"
"	"	<i>Mimela macleayana</i> (Vigors)	7	"
"	"	<i>Singhala robusta</i> Ohaus	2	"
"	Digdola	<i>Clinteria klugi</i> (Hope)	5	On Plants
"	Kisli R. H.	<i>Coenochilus trabecula</i> Schaum	1	Light
14.IX.2003	Gudbudi nala	<i>Copris andrewesi</i> Waterhouse	2	Dung
"	"	<i>Copris imitans</i> Felsche	2	"
"	"	<i>Gymnopleurus sinuatus</i> (Olivier)	2	"
"	"	<i>Helicopris bucephalus</i> (Fabricius)	2	Light
"	"	<i>Onthophagus cervus</i> (Fabricius)	2	Dung
"	"	<i>Oniticellus cinctus</i> (Fabricius)	2	"
"	"	<i>Clinteria klugi</i> (Hope)	10	On Plants

Date of coll.	Locality	Species	No. of exs.	Source
15.IX.2003	Gudbudi nala	<i>Heliocopris bucephalus</i> (Fabricius)	1	Light
"	"	<i>Copris repertus</i> Walker	1	Dung
"	"	<i>Apogonia</i> sp.	3	Light
"	"	<i>Xylotrupes gideon</i> (Linnaeus)	1	"
16.IX.2003	Kanha R. H.	<i>Anomala cantori</i> Hope	1	"
"	"	<i>Adoretus duvauceli</i> Blanchard	1	"
17.IX.2003	"	<i>Anomala cantori</i> Hope	1	"
"	"	<i>Xylotrupes gideon</i> (Linnaeus)	1	"
"	"	<i>Eophileurus perforatus</i> Arrow	1	"
"	Sonph	<i>Onthophagus pactolus</i> (Fabricius)	1	Dung
18.IX.2003	"	<i>Mimela macleayana</i> (Vigors)	1	Light
"	"	<i>Xylotrupes gideon</i> (Linnaeus)	1	"
19.IX.2003	"	<i>Heteronychus lioderes</i> (Redtenbacher)	1	"
20.IX.2003	"	<i>Clinteria klugi</i> Hope	3	On Plants
21.IX.2003	Mukki R. H.	<i>Onthophagus dama</i> (Fabricius)	5	Dung
22.IX.2003	Sondhar	<i>Onthophagus dama</i> (Fabricius)	4	"
23.IX.2003	Mukki R. H.	<i>Xylotrupes gideon</i> (Linnaeus)	1	Light
"	"	<i>Anomala cantori</i> Hope	1	"
22.V.2004	Kisli R. H.	<i>Onthophagus bonasus</i> (Fabricius)	3	Dung
23.V.2004	"	<i>Gymnopleurus sinuatus</i> (Olivier)	1	"
24.V.2004	"	<i>Bolboceras quadridens</i> (Fabricius)	1	Light
"	"	<i>Hybosorus orientalis</i> Westwood	2	Light
"	"	<i>Catharsius pithecius</i> (Fabricius)	2	"
25.V.2004	"	<i>Gymnopleurus cyaneus</i> (Fabricius)	2	Dung
"	"	<i>Onthophagus catta</i> (Fabricius)	3	"
"	"	<i>Oniticellus spinipes</i> Roth.	5	"
"	"	<i>Oniticellus pallens</i> (Olivier)	1	"
"	"	<i>Onitis brahma</i> Lansberg	1	"
26.V.2004	"	<i>Onthophagus catta</i> (Fabricius)	5	"
"	"	<i>Onthophagus bonasus</i> (Fabricius)	3	"
"	"	<i>Oniticellus cinctus</i> (Fabricius)	3	"
"	"	<i>Phalops divisus</i> (Wiedman)	1	"

Date of coll.	Locality	Species	No. of exs.	Source
27.V.2004	Kisli R. H.	<i>Scarabaeus sanctus</i> (Fabricius)	1	Dung
"	"	<i>Anomala bengalensis</i> Blanchard	2	Light
"	"	<i>Anomala biharensis</i> Arrow	2	"
"	"	<i>Anomala varicolor</i> Gyll.	1	"
"	"	<i>Anomala rugosa</i> Arrow	1	"
"	"	<i>Anomala ruficapilla</i> Burmeister	1	"
"	"	<i>Adoretus bicolor</i> Brenske	2	"
"	"	<i>Phaeochrous</i> sp.	2	"
29.V.2004	"	<i>Drepanocerus setosus</i> (Wied.)	2	Dung
30.V.2004	"	<i>Drepanocerus setosus</i> (Wied.)	5	"
11.VI.2004	Mukki R. H.	<i>Onthophagus catta</i> (Fabricius)	5	"
21.VI.2004	"	<i>Phaeochrous</i> sp.	5	Light
24.VI.2004	"	<i>Apogonia</i> sp.	1	"
25.VI.2004	"	<i>Apogonia</i> sp.	5	Light
26.VI.2004	Kisli R. H.	<i>Schizonycha ruficollis</i> (Fabricius)	5	"
"	"	<i>Apogonia</i> sp.	3	"
28.VI.2004	Mukki R. H.	<i>Holotrichia sculpticollis</i> Blanchard	5	"
"	"	<i>Heliocopris bucephalus</i> (Fabricius)	2	"
"	"	<i>Catharsius molossus</i> (Linnaeus)	1	"
"	"	<i>Anomala dorsalis</i> (Fabricius)	1	"
"	"	<i>Anomala fraterna</i> Burmeister	1	"
"	"	<i>Adoretus bimarginatus</i> Ohaus	1	"
"	"	<i>Adoretus lasiopygus</i> Burm.	1	"
"	"	<i>Onitis virens</i> Lansberg	1	Dung
24.VII.2004	Kisli R. H.	<i>Copris andrewesi</i> Waterhouse	2	"
25.VII.2004	"	<i>Onthophagus sagittarius</i> (Fabricius)	2	"
26.VII.2004	"	<i>Onthophagus ramosus</i> (Wied.)	2	"
11.VIII.2004	"	<i>Onthophagus dama</i> (Fabricius)	10	"
"	"	<i>Onthophagus ramosus</i> (Wied.)	10	"
16.VIII.2004	"	<i>Onthophagus tragus</i> (Fabricius)	5	"
18.VIII.2004	"	<i>Heliocopris bucephalus</i> (Fabricius)	1	Light

Date of coll.	Locality	Species	No. of exs.	Source
18.VIII.2004	Kisli R. H.	<i>Onthophagus tragus</i> (Fabricius)	3	Dung
"	"	<i>Onthophagus ramosus</i> (Wied.)	5	"
"	"	<i>Catharsius molossus</i> (Linnaeus)	1	Light
"	"	<i>Catharsius pithecius</i> (Fabricius)	2	"
19.VIII.2004	"	<i>Heliocopris bucephalus</i> (Fabricius)	1	"
21.VIII.2004	"	<i>Mimela macleayana</i> (Vigors)	1	"
23.VIII.2004	"	<i>Catharsius sagax</i> Queensland	1	"
24.VIII.2004	"	<i>Copris imitans</i> Felsche	2	Dung
26.VIII.2004	"	<i>Onthophagus tragus</i> (Fabricius)	2	"
27.VIII.2004	"	<i>Onthophagus cervus</i> (Fabricius)	1	"

SUMMARY

The paper presents a comprehensive list of Scarabaeid beetles of Kanha Tiger Reserve collected from the various localities. The list also incorporates the status and their habitats in the Tiger Reserve. Total 61 species pertaining to 27 genera under eight subfamilies are known from the Kanha Tiger Reserve. Of which, 48 species are recorded for the first time from the Kanha Tiger Reserve and 14 are new to the fauna of Madhya Pradesh.

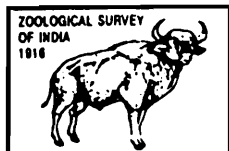
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Rec. zool. Surv. India : **105** (Part 1–2) : 157-159, 2005

FIRST RECORD OF IXODID TICK (ACARINA : METASTIGMATA) FROM MAHESHKHALI ISLAND, CHITTANGONG, BANGLADESH

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INTRODUCTION

In the month of December, 2003 the author went to Maheshkhali, an island off the coast of Cox's Bazar, Chittagong, Bangladesh, surrounded by low hills in the center of the island and along the coast lines and fringed by mangrove jungle. During the visit he collected eight specimens of ixodid ticks from cattle and goat. The present contribution records four species of tick for the first time from Maheshkhali Island.

1. *Boophilus microplus* (Canestrini)

1887. *Haemaphysalis micropla* Canestrini, *Atti. Soc. veneto-Trent. Sci. nat.*, **11** : 104.

1890. *Rhipicephalus micropa* Canestrini, *Padova*, **4** : 493.

1943. *Boopophilus microplus*, Fairchild, *Am. J. Trop. Med.*, **23**(6) : 586.

Diagnosis : Male : Scutum quite hirsute; short caudal appendage and tapering; inner margin of basal palpal segment ventrally concave; dentition 4/4.

Female : Coxa I with deep, inverted 'V'-shaped cleft, inner margin of basal palpal segment ventrally short, deeply concave; dentition 4/4.

Material examined : Bangladesh : Chittagong, Maheshkhali island, beside Adinath temple, 2 ♀ ♀, from cow, 24.xii.2003, coll. A. K. Sanyal.

Distribution : Bangladesh : All districts.

Elsewhere : Africa, Australia, central America, Formosa, India, Indonesia, Japan, Myanmar, New Guinea, Philippines, South America, Sri Lanka.

Remarks : The species is a common cattle infesting tick.

2. *Haemaphysalis bispinosa* Neumann

1897. *Haemaphysalis bispinosa* Neumann, *Mem. Soc. Zool. Fr.*, **10** : 341.

Diagnosis : Male : Elongate-oval shaped scutum; cervical grooves with convergent depressions; long, well-marked lateral grooves ending behind spiracles; festoons twice as long as broad; slightly salient palps, segment 2 and 3 subequal, segment 3 bluntly conical and bears a prominent dorsal retrograde spur in the mid-dorsal line and a similar but larger ventral spur; dentition 4/4; a moderate sharp spur on coxa I; a very slight protubérance on coxae II and IV.

Female : Sub-cordiform scutum, punctations little larger than male; basis capituli broader; short cornua; oval porose areas; palpi similar to male.

Material examined : Bangladesh : Chittagong, Maheshkhali Island, beside Adinath temple, 2 ♀ ♀, from cow, 1 ♀ ♀, from goat, 24.xii.2003, coll. A. K. Sanyal.

Hosts in Bangladesh : Cow, Indian Bison, goat, dog, barking deer, vegetation.

Distribution in Bangladesh : Almost all over the country.

Elsewhere : All Asian countries, Australia and Newzealand.

Remarks : The species is responsible for transmitting the KFD viruses in mammals. The species was first recorded from Rangamati Hill district, Bangladesh from barking deer and dog (Sharif, 1928).

The species is recorded here for the first time from goat.

3. *Hyalomma anatolicum anatolicum* Koch

1844. *Hyalomma anatolicum anatolicum* Koch, *Arch. Naturgesch.*, **10**(1) : 220.

Diagnosis : Male : Lightly punctated scutum; lateral grooves short but distinct; posteromedian groove not reaching the parma; subanal shields small, situated directly posterior of adanals; basis capituli dorsally with slightly concave posterior margin, never angular; legs without ring.

Female : Scutum longer than wide with narrowly rounded posterior margin; punctuations large in scapular areas; operculum short, small.

Material examined : Bangladesh : Chittagong, Maheshkhali, near salt field, 1 ♀, from cow, 24.xii.2003, coll. A. K. Sanyal.

Distribution : Bangladesh : Allmost all districts.

Elsewhere : Afganistan, Border of Mediterranean sea, Canary Islands, East Africa, India, Pakistan, Portugal, U.S.S.R., West Asia, Southeast Europe.

Remarks : This is a most common tick infesting cattle.

4. *Rhipicephalus haemaphysaloides* Supino

1897. *Rhipicephalus haemaphysaloides* Supino, Atti. Soc. veneto-Trent. Sci. Nat., 2s. 3(1) : 234.

Diagnosis : Male : Lateral grooves narrow, deep; cervical grooves short converging pits; few punctations of larger and smaller types; basis capituli twice as broad as long; palpi longer than broad; adanal shields sickle-shaped; spiracle comma-shaped; dentition 3/3.

Female : Cervical grooves deep; punctations few, large, finer one hardly visible; spiracle sub-triangular with a large mecula; cornua short; blunt palpi twice as long as broad.

Material examined : Bangladesh : Chittagong, Maheshkhali, near salt field, 2 ♀ ♀, from goat, 24.xii.2003, coll. A. K. Sanyal.

Distribution : Bangladesh : All over the country.

Elswhere : China, India, Indonesia, Myanmar, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks : It is suspected that the species plays some role in transmission of tick typhus fever.

SUMMARY

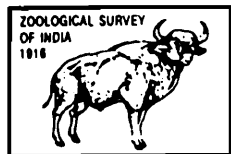
The paper records four species of ixodid ticks viz., *Boophilus microplus*, *Haemaphysalis bispinosa*, *Hyalomma anatolicum anatolicum* and *Rhipicephalus haemaphysaloides*; for the first time from Maheshkhali Island, Chittagong, Bangladesh. Brief descriptions of the species are also incorporated in the paper.

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Rec. zool. Surv. India : 105 (Part 1–2) : 161-164, 2005

ADDITIONS TO THE GRASSHOPPER (ORTHOPTERA : INSECTA) FAUNA OF KERALA, SOUTH INDIA

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INTRODUCTION

Orthoptera is one of the largest orders of insects that also include the destructive locusts. Over 17,250 species are known to science globally. More than 1,750 species, (about 10% of the total world species) are recorded from India and nearly an equal number is expected to be awaiting discovery (Tandon and Hazra, 1998). Annandale, 1906; Bolivar, 1900, 1902 & 1918; Hebard, 1929; Henry, 1937 & 1940; Kesavaram, 1986; Prabakar and Radhakrishnan, 2004; Shishodia and Hazra, 1986; Shishodia and Kulkarni, 2001, 2002; Shishodia and Vasanth, 2001; Singh and Kevan, 1965; Uvarov, 1929 and Vasanth, 1991 have dealt with the taxonomy of the South Indian Orthoptera. While studying the Orthopteran specimens deposited in the faunal holdings of the Zoological Survey of India, Calicut, the authors came across 4 species of grasshoppers (Orthoptera : Insecta) in the collection that are apparently hitherto unreported from Kerala, the details of which are presented below.

SYSTEMATIC LIST

Order ORTHOPTERA

Superfamily ACRIDOIDEA

Family ACRIDIDAE

Subfamily ACRIDINAE

1. *Phlaeoba angustidorsis* Bolivar

Subfamily PYRGOMORPHINAE

2. *Aularches miliaris* (Fabricius)
3. *Pseudomorphacris* (*Tagasta*) *notata* (Brunner, 1893)

Subfamily EYPREPOCNEMIDINAE

4. *Choreodocus illustris* (Walker)

SYSTEMATIC ACCOUNT

1. *Phlaeoba angustidorsis* Bolivar

1902. *Phlaeoba angustidorsis* Bolivar, *Ann. Soc. Ent. France*. LXX, p. 590.

Diagnostic characters : Body brown in colour, male with a yellow band extending from head to the tip of tegmina; pronotum very narrow; tegmina barely reaching the tip of the abdomen or shorter; hind femora pale brown with brown knees.

Material examined : 4 exs., 22.vii.1993, Adivaram (Wynad), Coll. C. Radhakrishnan.

Distribution : INDIA : Tamil Nadu : Kodaikanal and Kerala (present record).

2. *Aularches miliaris* (Fabricius)

1793. *Gryllus scabiosae* Fabricius, *Ent. Syst.*, ii, p. 51.

1914. *Aularches scabiosae* Kirby, *Fauna Brit. India*, I, p. 170.

1963. *Aularches miliaris* : Kevan, *Ark. Zool.*, 16 : 75.

Diagnostic characters : Body shining black in colour with a broad yellow band across the head and sides of the pronotum; the pronotum with the front including the large rounded tubercles, yellow; upper and lower sides of abdomen with a red band; tegmina, brown or greenish coloured with numerous yellow callous spots.

Material examined : 2 exs., Silent Valley, 5.ii.1988, Coll. G. U. Kurup; 3 exs., Wynad, 9.xii.1994, Coll. P. M. Sureshan.

Distribution : INDIA : Karnataka and Kerala (present record).

3. *Pseudomorphacris (Tagasta) notata* (Brunner)

1893. *Mestra notata* Brunner, *Ann. Mus. Geneva*, xxxiii, p. 130, pl. v, fig. 50.

Diagnostic characters : Fastigium of the vertex rather pointed; pronotum uniformly impress-punctate; tegmina green in colour with a black spot marked with an orange one near the base; tegmina longer than the abdomen, obtusely rounded at the tip; wings narrow, hyaline, suffused with rosy violet at the base, the costal area being sub hyaline.

Material examined : 2 exs., Idukki district : Eravikulam National Park : Rajamalaj, 4.iv.1994, Coll. K. C. Gopi; 1 ex., Kozhikode district : Thusharagiri, 26.viii.2003, Coll. K. G. Emiliyamma.

Distribution : INDIA : West Bengal, Meghalaya and Kerala (present record : from hilly areas); MYANMAR.

4. *Choreodocus illustris* (Walker)

1870. *Heteracris illustris* Walker, *Cat. Derm. Salt. B.M.*, iv, pp. 663-664.

1914. *Heteracris illustris*, Kriby, *Fauna Brit. India*, I, p. 263.

1921. *Choreodocus illustris* : Uvarov, *Trans. ent. Soc. Lond.*, London : 109.

Diagnostic characters : Face with a moderately narrow blue-black stripe beneath each eye; pronotum punctured, with whitish depressions above; tegmina with small-scattered black spots on the disc; hind tibiae and tarsi puplish blue.

Material examined : 1 ex., 22.vii.1993, Adivaram (Wynad), Coll. C. Radhakrishnan.

Distribution : South India; however, reported from Kerala by the present record.

SUMMARY

The present account deals with 4 new records of grasshoppers (Orthoptera : Insecta) from the Kerala state.

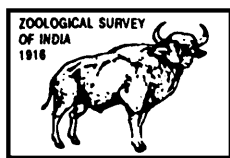
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Rec. zool. Surv. India : 105 (Part 1–2) : 165-167, 2005

Short Communication

DESCRIPTION OF A NEW SPECIES OF SPIDER GENUS CAMARICUS (THOMISIDAE : ARANEAE) FROM INDIA

INTRODUCTION

Spiders of the family Thomisidae in India have received attention by Tikader (1960–1980). The Fauna of India (Thomisidae) has been published by Tikader (1980) after the Fauna of British India, Arachnida by Pocock (1900) where the family Thomisidae was not included, though the Thomisid spiders are abundant in our country. While examining the spider collections from Silent Valley Expedition, we came across a new species of *Camaricus* Thorell which is described in this paper. This, in fact, is the third species of this genus known from the Indian Sub-continent.

The type is deposited in the National Collection of the Zoological Survey of India, Kolkata-53.

***Camaricus rinkae* sp. nov.**

(Figs. 1-3)

General : Cephalothorax brown, first and second pair of legs blackish brown; third and fourth pair of legs and pedipalp pale yellow in colour. Abdomen black with yellowish ornamentation. Total length 7.00 mm. Carapace 2.50 mm long, 2.50 mm wide; abdomen 4.50 mm long, 3.00 mm wide.

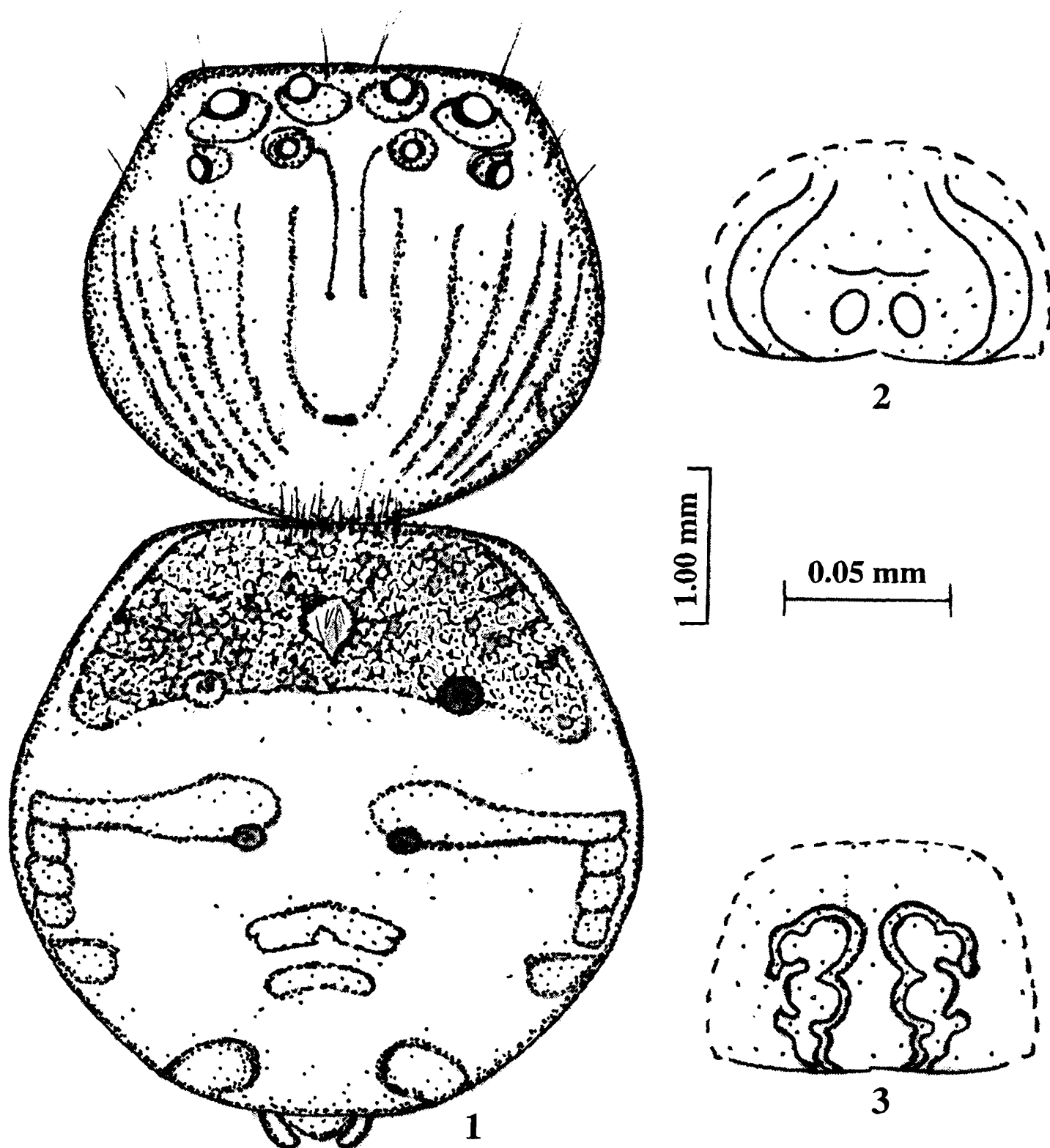
Cephalothorax : High at the middle and sloping posteriorly, few spine like, hair projected anteriorly. Two rows of eyes, both rows slightly procurved and heterogenous. Bases of the antero lateral eyes with prominent white tubercles (Fig. 1). Ocular quad wider than long. Sternum heart shaped, pointed behind, deep brown in colour. Labium is brown. Maxillae is brown. Chelicerae are strong. First and second pair of legs are robust with spine like hair. Tibiae and metatarsi of first and second pair of legs provided with four pairs of spines ventrally. Leg formulae are $\frac{1}{2} / \frac{3}{4}$.

Abdomen : Longer than wide, broadest at the middle, clothed with hair, decorated anteriorly and laterally also. Dorsum of the abdomen with chalk white ornamentation and middle onwards upto posterior with scattered chalk white patches. Ventral side with two lateral white bands extended from epigastric furrow to the base of spinnerets. Lateral and median are dark black in colour.

Male : Unknown.

Type specimen : Holotype female preserved in rectified spirit (70%). Registration number is 5570/18.

Type-locality : Road to Valliapara Thodar, Silent Valley, Kerala, India, 05.xii.1980, coll. R.S. Pillai.



Figs. 1-3. : *Camaricus rinkae*; 1. Dorsal view of female, Holotype (legs are omitted); 2. Epigyne; 3. Internal genitalia.

Remarks : *Camaricus rinkae* sp. nov. is similar to the *Camaricus formosus* but differs in the following characters. (1) Colour, ornamentation of *C. rinkae* is different from the *C. formosus*. (2) First and second pair of legs provided with four pair of spines ventrally on tarsus and metatarsus respectively but three pairs in *C. formosus*. (3) One single and two pairs (i.e. five in number) of sigilla present in *Camaricus rinkae* but in *Camaricus formosus* no such sigilla. (4) Epigyne and internal genitalia are also structurally different.

Distribution : INDIA : Kerala (new record).

SUMMARY

A new species under the genus *Camaricus* Thorell (Family : Thomisidae) described and illustrated. This, in fact, the third species described from the Indian Sub-continent.

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