STUDIES ON THE FRESH WATER MITES OF KERALA

THESIS SUBMITTED TO THE

UNIVERSITY OF CALICUT

FOR THE PARTIAL FULFILMENT FOR
THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY
IN THE FACULTY OF SCIENCE

BY

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December 2001

CERTIFICATE

This is to certify that the thesis entitled "Studies on the fresh water mites of Kerala" submitted to the University of Calicut, for the degree of Doctor of Philosophy in Zoology is a *bonafide* record of the research work carried out by John.C.C. at the Department of Zoology, Christ College, Irinjalakuda under my supervision and guidance and that it has not been previously submitted for the award of any degree or diploma.

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DECLARATION

I do here by declare that the thesis entitled " Studies on the fresh water mites of Kerala" is based on the research work originally carried out by me under the supervision and guidance of Dr. N.D.Inasu, Head of the Deptartment of Zoology, Christ College, Irinjalakuda. This work has not been submitted either in whole or in part for the award of any degree or diploma.

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ABSTRACT

Water mites, also known as the Hydracarina, Hydrachnidia or Hydrachnellae are obviously separated from other taxa in the Cohort parasitengona by having nymphal and adult stages that live beneath the surface of the water. Fresh water mites were collected from different localities of Kerala State. At the time of collection the P^H and temperature of the water body were noted. The specimens were preserved in Koenike's solution. Slides were prepared in glycerine jelly after clearing in Lundblad's soloution and identification was done. Drawings were made with the help of camera lucida. Measurements were taken with a calibrated ocular micrometer. A total of 35 species of water mites were collected during the period of study. Nineteen new reports are there from Kerala. There are four Indian records and three new species. More water mites were collected from the water bodies in plain lands. Aquatic vegetation was found to be the ideal habitat. Five species of water mites were collected from the mantle cavity of fresh water mussel *Lamellidens marginalis*. Bimonthly collections of fresh water mussel were done to study the polpulation studies of these mites. *U.brandti* was found to be the dominant species in the study area. Nearly 90 percent of the mussels were found infected with water mites. Number of water mites per host was found to be limited.

ACKNOWLEDGEMENTS

I pay my tributes to my late guide Dr.A.G. Govindankutty, Head of the Department of Zoology, Christ College, Irinjalakuda who left the world before this great day.

I wish to thank my supervisor, Dr. N.D. Inasu, Head of the Department of Zoology, for his guidance, help and encouragement, in the writing of this thesis.

I am deeply indebted to Prof. M. Mohanasundaram, Tamil Nadu Agricultural University, for the immense help and support extended to me during this work.

I am grateful to the support given to me by Dr. Malcom F. Vidrine, Louisiana State University, U.S.A; Dr. P.R. Wiles, University of Buckingham, U.K and Dr. Heather Proctor, Griffth University, Australia.

I wish to thank the Management and Principal of St. Thomas College, Trichur for selecting me for the U.G.C, TFS grant and permitting me to avail leave to complete the thesis. I also thank the Management and Principal of Christ College, Irinjalakuda for providing the facilities for carrying out my research.

I acknowledge with gratitude the immense help and encouragement given to me by Prof. K.T. George, Head of the Department and my colleagues in the Department of Zoology, St. Thomas College, Trichur. I also thank the staff of the Department of Zoology Christ College, Irinjalakuda for their kind help.

I am indebted to Department of Entomology, Tamil Nadu Agricultural University and thankful to the Librarians of Tamil Nadu Agricultural University and Kerala Forest Institue, Peechi, Trichur.

I also thank U.G.C. for giving me the fellowship.

I acknowledge the help and encouragements given by Dr. Thobias; Dr.C.K.G Nair; Dr. Subash; Dr. Sunny; Dr. Babu, Dr. Unnikrishnan ; Dr. John.T. Kocheril; Dr. Ranjit, Mr.Xavier, Smt.Mythili, Mr.Binu Antony and Mr.Liaju

I acknowledge my wife Anila, son Jerry and daughter Mary Ann for giving me their help and support in this grand endeavour.

Last but not the least, I express my heartfelt gratitude to the good will of countless people, who in various ways helped and blessed me for the successful completion of this work.

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INTRODUCTION

INTRODUCTION

Our knowledge of mites inhabiting the fresh water bodies of Kerala is scanty. They can be found in all aquatic habitats. They are often associated with vegetation or with top few millimeter substrates, but they can also lead a planktonic existence. They are common in ponds, lakes and depositional zones of rivers and at the margins of various water bodies. Some species are adapted to live in such extreme environment such as thermal springs, glacial melt-water rivers, temporary pools and in the interstitial habitats. Water-mites in lentic water are often free-swimming and conspicuously coloured, while more interesting species are cryptic, clinging to vegetation or buried in the substrate.

Apart from the works of Viets (1926), Walter (1928) and Cook (1967), we have practically no information regarding this group of organisms of this locality. No account has hitherto been published on the ecology and distribution of water-mites of Kerala waters. It is the paucity of even general information on this fascinating group of animals that prompted this study. The present study is an investigation into the systematics, ecology and distribution of these animals. A detailed study of the systematics of mites of this locality is the main part of the work. Ecological studies include observations on relative abundance and

seasonal fluctuations of population. An attempt is also made to study the parasitic mites associated with the fresh water mussel *Lamellidens marginalis* Lamark.

The basic life history pattern of water mites involves a parasitic larval stage in insects. The larval stages as well as the adult stages of water mites have direct influence on the size of insect populations. Almost majority of the water mites larvae are parasitic on insects or insect larvae associated with water bodies. Larval water mites regularly parasitize 20-50% of adults in natural populations of aquatic insects in different families of Corixidae (Homoptera), Dytiscidae(Coleoptera) Libellulidae(Odonata), Culicidae, and Chironomidae(Diptera). Experimental studies have shown that parasitism by larval water mites impairs the vitality, growth, mobility and fecundity of host insects. In general, host loading by parasitic larvae must be limited to levels that permit some host to reproduce, though there is evidence of an occasional mite-induced crashes of host populations. Maintenance of viable populations of mites and their host must then depend upon a dynamic equilibrium involving all interacting species of the community.

Deutonymphal and adult water mites are voracious predators on small aquatic organisms like Ostracods, Cladocerans, Copepodes including eggs of

insects and fish and larvae of nematocerous diptera and other insects. Predation by water mites on immature stages of mosquitoes can be used in the biological control of mosquitoes. Water mites play an important influence on the size and structure of the organisms in the aquatic environment.

Water mite populations can also be used as potential indicators of environmental pollution. Water mite diversity is dramatically reduced in habitats that have been degraded by pollution. Preliminary studies of physiochemical and pollution ecology of the relatively well-known fauna of Europe have demonstrated that water mites are excellent indicators of habitat quality. Application of potentially useful information on water mites in assessing and monitoring the well-being of fresh-water habitats and communities demands clearer understanding of the individual niche requirements and trophic relationships of species. This can be achieved by improving systematic knowledge of the group and by developing more appropriate collecting, and rearing techniques.

Water mites represent a series of extensive adaptive radiation and occur in most fresh water habitat. Some members are known for their unusual behaviour. They are parasites of fresh water mussel. The benefits obtained by these mites living inside a mussel are obvious. They live in a protected, relatively stable

environment, competition with other species is avoided, the active stages are provided with an unlimited supply of food (Baker, 1976). The fresh water mussel *Lamellidens marginalis* is commonly found in the fresh water bodies of Kerala. No work has been reported from Kerala on water mites associated with *Lamellidens marginalis*. The present study also attempts to find out the different species of mites associated with fresh water mussel *Lamellidens marginalis* and to study the incidence and abundance of the dominant species.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

There are published works that describes water mites from scattered localities from India. Although politically distinct, Ceylon is zoogeographically related to India and any discussion of the hydrachnid fauna of this region begin with the work of Daday (1898) on the water mites of Ceylon. The following species were reported by Daday.

Hydrachna dilatata Daday

Hydryphantes silvestrii Daday = *Diplodontus silvestrii* (Daday)

Frontipoda picta Daday = *Oxus pictus* (Daday)

Frontipoda ceylonica Daday = *Oxus pictus* (Daday)

Atax singalensis Daday = *Unionicola singalensis* (Daday)

Atax nodosus Daday = *Neumania nodosa* (Daday)

Curvipes horvathi Daday = *Encentidophorus horvathi* (Daday)

Piona dadayi (Piersig)

Curvipes conglobatus (Koch) = *Piona conglobata* (Koch)

Arrenurus singalensis Daday

Arrenurus madaraszi Daday = *Arrenurus madaraszi* (Daday)

Arrenurus ceylonicus Daday

Arrenurus rostratus Daday

Arrenurus orientalis Daday

Arrenurus liberatus Walter

Arrenurus congener Daday

Arrenurus gottlandica (Neuman) = *Arrenurus gotlandicus* (Neuman)

Piersig (1900) recognised that the male and female of what Daday had called *Curvipes horvathi* belonged to separate species and this name was given to the female and *Curvipes dadayi,* to the male. Cook (1967) has tentatively assigned a female specimen from south India to this latter species.

Many drawings in Daday's(1898) publication were diagramatic and often the descriptions were inadequate. Walter (1929a) published a 'Revision der von E. von Daday beschriebenen Hydracarinen von Ceylon', based on Daday's specimens. The specimens Daday named *Curvipes horvathi, Frontipodo ceylonica, Arrenurus singalensis,* and *Hydrachna dilatata* were not seen by Walter and could not be included in the redescriptions. Walter discovered that male and female of what Daday had called *Arrenurus orientalis* were actually separate species, and renamed the male as *Arrenurus liberatus.* This latter species was collected by Cook (1967) from Mysore and Kerala states.

Cook's study revealed that the female specimen which Daday called *Curvipes horvathi* is actually a member of the genus *Encentridophorus.* Also , *Frontipoda ceylonica* (= *Oxus ceylonicus*) was placed in synonymy with *Frontipoda pica* (=*Oxus pictus*). Daday's records of *Cruvipes conglobatus* (=*Piona conglobata*) and *Anurania gottlandica*(=*Arrenurus gotlandicus)* are extremely doubtful. The latter two indentifications were based on nymphal specimens and, except in the more primitive water mites, it is rarely possible to make accurate species identifications from nymph. Adults of *Conglobata* have a known Holarctic distribution; *Arrenurus gotlandicus* has otherwise been found only in Sweden.

Apstein (1910) reported *Piona longicornis imminuta* (Piersig) from Ceylon. This subspecies, now known as *Piona coccinea imminuta,* otherwise has been reported only from Europe. Athough *Piona coccinea imminuta* apparently occurs in the Oriental realm, it is doubtful that the subspecies, *imminuta,* extends this far.

Viets (1926), in his " Indische Wassermilben", published a study of collections from scattered localities in India and Burma. Below is the list of these species and the states in which they were taken. The records from Burma have been omitted.

Hydrachna trilobata Viets –Bihar

Hydrachna sp., nymph –Bengal

Eylais degenerata asiatica Viets = *Eylais degenerata* Koenike –Bihar, Uttar Pradesh

Eylais rimosoides Viets –Uttar Pradesh

Diplodontus despiciens (Muller) = *Hydrodroma despiciens* (Muller) –Bihar

Limnesia gentilis indica Viets = *Limnesia lembangensis* Piersig –Uttar Pradesh

Hygrobates falcipalpis Koenike –Bihar

Encentridophorus chelatus Walter –Uttar Pradesh

Unionicola diversipes Viets –Bengal

Unionicola scutigera Viets –Bengal

Neumania volzi indica Viets = *Neumania indica* Viets –Uttar Pradesh

Arrenurus pseudoaffinis Piersig –Bihar, Andaman Islands

Arrenurus congener Daday –Uttar Pradesh

Viet's indentifications of *Hygrobates falcipalpis* and *Encentridophorus chelatus* are based on female specimens. In the genus *Encentridophorus,* and in the group to which *H. falcipalpis* belongs, females are difficult to identify to species level. These latter two records from India should be regarded as tentative.

The largest previous study of Indian water mites is that of Walter (1928), "Zur Kenntnis der Mikrofauna von Britisch Indien. II. Hydracarina." Walter's work is based on collections made in the vicinity of Calicut (Kerala), the Darjeeling District and the Punjab. Below is a list of species and the areas in which they were taken.

Hydrovolzia infringata Walter –Darjeeling

Eylais rimosoides Viets –Calicut

Diplodontus despiciens monticolus Piersig = *Hydrodroma monticola* (Piersig) – Calicut

Nilotonia indica Walter –Calicut

Libertia orientalis Walter –Punjab

Oxus orientalis Walter –Calicut

Attractides angulatus Walter = *Torrenticola angulata* (Walter) –Darjeeling, Punjab

Testudacarus tripeltatus Walter –Punjab

Magapus minutus Walter= *Atractides minutes* Walter –Punjab

Unionicola crssipes (Muller) –Calicut

Neumania ambigua Piersig –Calicut

Neumania volzi Piersig = *Neumania nodosa* (Daday) –Calicut

Neumania longipes Walter –Calicut

Neumania pilosa Koenike –Calicut

Piona pseudouncata Piersig –Calicut

Axonopsis latifrons Walter –Calicut

Aturus scutelliferus Walter –Punjab

Arrenurus aculeatifrons Piersig = Arrenurus rostratus Daday –Calicut

Arrenurus belaniensis Piersig = *Arrenurus ceylonicus* Daday –Calicut

Arrenurus bicornicodulus Piersig –Calicut

Arrenurus micropetiolatus Walter –Calicut

Arrenurus palembangensis Piersig = *Arrenurus madaraszi* Daday –Calicut

Arrenurus pseudobruzelii Walter = *Arrenurus pseudoaffinis* Piersig –Calicut

Lundblad (1934) described the hydrachnids taken in Kashmir by the

Yale North India Expedition of 1932. Although endemic genera and species are present, the relationship of the water mite fauna is closer to that of the Palearctic region than of that of South India.

Hydrachna conjecta Koenike

Elyais hamata Koenike

Eylais degenerata Koenike

Protziella hutchinsoni Lundblad

Calonyx montanus Lundblad = *Protzia (Calonyx) montana* (Lundblad)

Calonyx flagellum Lundblad = *Protzia (Calonyx) flagella* (Lundblad)

Parathyas primitiva Lundblad

Kashmirothyas hutchinsoni Lundblad = *Trichothyas(Kashmirothyas) hutchinsoni* (Lundblad)

Megapus proximalis Lundblad = *Atractides proximalis* (Lundblad)

Acerus ornatus (Koch) = *Tiphys ornatus* Koch

Vitzthum (1942) described *Octolundbladia ladakiana* and *Thermacarus thermobius* from specimens collected by the Yale North India Expetition to the Kashmir. Viets (1957) placed the former species in synonymy with *Trichothyas hutchinsoni* (Lundblad).

Lundblad (1941) published preliminary descriptions of a large number of water mites from the Oriental region. There was one Indian species, *Arrenurus(s.s.)hamipetiolatus*, collected in the Bombay area of Maharashtra.

Cook made extensive collections during his collection trip to India during 1962-1963. This field work lead to the publication of the book "Water mites from India". During the trip large areas, especially in the Himalayan region and all of eastern India were not sampled. In his book he presents an adequate beginning to our knowledge of the water mite fauna of Maharashtra, Mysore, Madras and Kerala States. In this book he described 173 species that he collected from India. Out of this nearly 148 were new species. They belonged to the following 21 families and 48genera.

Prasad(1974) catalogued 202 species of water mites from India and it was mainly based on "Water mites from India" by Cook (1967).

In Kerala, Cook made collections from seven localities in six districts.They were from Kottayam, Ernakulam, Trichur, Calicut, Vyanad, and Palghat. Excecpt five families, Hydrovolziidae, Eylaidae, Protziidae, Sperchonidae and Mideopsidae all other sixteen families are represented in

seventeen genera. He collected sixty one species from Kerala. Out of the sixty one species, thirty three species which belongs to ten genera under seven families are from Vayitiri, Vyanad. Eight species from Trichur, two from Kottayam, two from Ernakulam, eight from Calicut and two from Palakkad.

Following is the list of species reported from Kerala by Cook (1967)

1. *Hydrachna(s.s.) similis* (New)
2. *Limnochares (cyclothrix) crinita* Koenike
3. *Javathyas cornipes* (New)
4. *Diplodontus silvestrii* Daday
5. *Hydrodroma monticloa* Piersig
6. *Hydrodroma topanii* (New)
7. *Nilotonis (Tadagatonia) indica* Walter
8. *Mamersella(s.s.) maryellenae* (New)
9. *Navamamersides karekari* (New)
10. *Navamamersides similis* (New)
11. *Nilgiriopsis imamurai* (New)
12. *Platymamersopsis mysorensis*(New)
13. *Oxus pictus* Daday
14. *Torrenticola* (s.s.) *vicista* (New)

15 *Torrenticola* (s.s.) *microdentifera* (New)

16 *Torrenticola* (s.s.) *indica* (New)

17 *Torrenticola* (s.s.) *mulherkarae* (New)

18 *Torrenticola(Monatractides)pinapalpis*(New)

19 *Torrenticola (Monatractides) setivalvata* (New)

20 *Torrenticola* (*Monatractides*) *nondescripta* (New)

21 *Torrenticola (Monatractides) yosana* (New)

22 *Torrenticola (Monatractides) devatta* (New)

23 *Torrenticola (Monatractides*) *parvatiya* (New)

24 *Torrenticola (Monatractides) sakina* (New)

25 *Torrenticola (Monatractides) sucria* (New)

26 *Torrenticola (Monatractides) apratima* (New)

27 *Torrenticola (Allotorrenticola) suvarna* (New)

28 *Nicalimesia andha* (New)

29 *Limnesia* (s.s.) *lembangensis*

30 *Hygrobates* (s.s.) *grimshawi* (New)

31 *Hygrobates* (s.s.) *hamatus bharatensis* (New sub species)

32 *Hygrobates* (*Monobates) keralensis* (New)

33 *Hygrobates (Monobates) karekari* (New)

34 *Atractides*(s.s.) *vayitriensis* (New)

35 *Atractides* (s.s.) *keralensis* (New)

36 *Atractides* (s.s.) *orthoporus* (New)

37 *Atractides* (s.s.) *biscutatus* (New)

38 *Atractides* (s.s.) *dorsoscutatus* (New)

39 *Unionicola(Pentatax) affinis* Piersig

40 *Unionicola(Pentatax) kantaka* (New)

41 *Neumania nodosa* Daday

42 *Neumania (Soarella) flagellata* Walter

43 *Neumania (Sorella) ulbana* (New)

44 *Piona catatama* (New)

45 *Axonopsalbia indica* (New)

46 *Axonopsis* (s.s.) *vayitriensis* (New)

47 *Axonopsis* (s.s.) *keralensis* (New)

48 *Axonopsis (Paraxonopsis) vivarna* (New)

49 *Axonopsis (Paraxonopsis) projecta* (New)

50 *Axonopsis (Paraxonopsis) angulata* (New)

51 *Albia suvarna* (New)

52 *Bharatalbia* (s.s.) *sucirapalpis* (New)

53 *Kongsbergia* (s.s.) *parvtiya* (New)

54 *Bharatohydracarus longatus* (New)

55 *Bharatohydracarus schwoerbeli* (New)

56 *Harpagopalpus* (s.s.) *indicus* (New)

57 *Africasia rucira* (New)

58 *Africasia navina* (New)

59 *Africasia ruksa* (New)

60 *Africasia pinguipalpis* (New)

61 *Arrenurus liberatus* Walter

Apart from this Walter (1928) made collections from the vicinity of Calicut, and reported the following species.

1. *Eylais rimosoides* Viets –Calicut
2. *Diplodontus despiciens monticolus* Piersig = *Hydrodroma monticola* (Piersig) –Calicut
3. *Nilotonia indica* Walter –Calicut
4. *Oxus orientalis* Walter –Calicut
5. *Unionicola crassipes* (Muller) –Calicut
6. *Neumania ambigua* Piersig –Calicut
7. *Neumania volzi* Piersig = *Neumania nodosa* (Daday) –Calicut

8. *Neumania longipes* Walter –Calicut

9. *Neumania pilosa* Koenike –Calicut

10. *Piona pseudouncata* Piersig –Calicut

11. *Axonopsis latifrons* Walter –Calicut

12. *Arrenurus aculeatifrons* Piersig = *Arrenurus rostratus* Daday –Calicut

13. *Arrenurus belaniensis* Piersig = *Arrenurus ceylonicus* Daday –Calicut

14. *Arrenurus bicornicodulus* Piersig –Calicut

15. *Arrenurus micropetiolatus* Walter –Calicut

16. *Arrenurus palembangensis* Piersig = *Arrenurus madaraszi* Daday – Calicut

17. *Arrenurus pseudobruzelii* Walter = *Arrenurus pseudoaffinis* Piersig – Calicut

The only outstanding work on fresh water mites from Kerala was that of Amma (1967). She did extensive work on the anatomy and embryology of *Elyias extendens* (Muller) (Family: Eylidae: Hydracarina). The group of Hydracarina to which the mite belongs is especially interesting because of its aquatic mode of life and its morphological adaptation for sucking juice of water plants. There were only two earlier reports on the anatomy of *Elyais* sp, namely that of Croneberg (1879) and Stout (1953). Owing to the small size of these mites and

their opaque, chitinous exoskeleton, the study of their anatomy was difficult. Even though it is possible to recognize most of the internal organs through the skin during ecdysis when the skin is almost transparent, inner detail could not be observed owing to the overlapping nature of the internal organs. Hence gross anatomy was studied by dissecting fresh specimens in glycerine. The general facts thus obtained were later confirmed by detailed study of serial sections. In her report she had given a detailed account of the body wall of *E.extendens* with detailed sketches. The digestive system consists of fore gut, midgut and two pairs of buccal glands. The midgut ends blindly, rectum and anus are absent. According to her report the vascular system in *E.extendens* is feebly developed as in other Acarina where most of them do not posses a heart or blood vessel. In *E. extendens* there is no blood vessels but there is an elongated pocket like heart in the dorsal side immediately behind the anterior half of the body. The nervous system was described consisting of a median ganglionic mass and twelve pairs of lateral nerves and one median nerve. The nervous system agrees more or less with the general pattern present in the other Acarina. There is description of the excretory system and that of the reproductive system of the female only. During her study even though a very large number of specimens of *E. extendens* were collected they were all females and so only the female reproductive system was described.

Though there are a number of reports on the taxonomy of water mites its embryology does not seem to have attracted much attention. The earliest work on Acarina development is that of Claparede (1868) who described the post-embryonic stages of five species of mites. Viets (1925) described the spawning habits of fifteen species of water mites. Mitchell (1958) studied the sperm stransfer in the water mite *Hydryphantes rubber* Geer. The larvae of *Piona alpicola* parasitize upon imagines of *Chironomus plumosus* and *C.tentans* Albertine et al (1970). Davids (1973 a) observed that the larvae of *Hydrachna conjecta* and *H.skorikowi* were parasitic on corxidae. Marja and Davids (1985) studied the larvae of three species of the genus *Hygrobates*. The three species he studied were *H.longipalpis*, *H.nigromaculatus* and *H.trigonicus* and observed that the life cycle of *Hygrobates nigromaculatus* differes from that which was typical for water mites. The larvae of this species developed directly into nymphs without undergoing a parasitic phase. Margret and Carolyn (1989)observed *P.exigua* is not parasitic upon aquatic insects during its larval stage.

Amma(1967) did extensive work on the embryology of *E.extendens*. For the purpose of her study a large number of adults and nymphs were collected with a small plankton net and were reared in glass troughs. The mating behavior

was not reported. Eggs are laid on the inner surface of the glass container and also around the stems of Hydrilla. Single female had layed upto 500 eggs at a time. Few of these eggs are preserved in Smiths fluid and alcoholic Bouin's and slides prepared. She found that early embryonic development takes place inside the anastamosing ovarian tubules. The just hatched out larva rises up and floats passively on the surface of water. She described the structure of the larva in detail. On reaching the surface they float passively for three or four days aided by the numerous hairs on the legs and sides of the body. If within this period they come across a *Ranatra* they attach themselves to its body and continue their development. If no host is available they all perish by the end of the fourth day. The attachment to the host is effected by the pedipalpi and by this process it enters into the second stage of its life history namely, nymphohan stage. The part of the body behind the legs now begins to enlarge and finally assumes the form of a short necked oval flask with a rounded bottom. Duration of the nymphohan stage varied from 17-20 days. From the rapid growth in size of the nymphophan it is evident that large quantities of food is being absorbed from the host's tissue. Such a large scale absorption is possible only with a very efficient type of sucking arrangement.

When the nymph is fully developed and is ready to liberate itself from the main stem, the nymphoderma, breaks. The just emerged nymph is bright red in colour. Skin is covered with numerous small chitinous patches. Arragement of the coxal plates is also like that of the adult but the genital cleft between the anterior pairs of coxae is quite indistinct and the legs are devoid of swimming hairs. This free living nymphal stage lasts at the most for nine days. By the eighth day it attaches itself permanantly to any submerged object with the help of all the four pairs of appendages and the mouth parts. This stage is called the teleiophan stage. The full grown adult emerges after seven or eight days when the teleioderma ruptures along the mid-dorsal line. This is a rather hazardous phase during which a large number of the nymphs perish.

Nayar (1969) reported several new species of water mites from Kerala. The following water mites were reported and identified from the tanks in and around Trivandrum, Nagercoil, Poovar and Aruvikkarai.

1 *Pseudoprotzia papillata*, gen.et sp. nov

2 *Armothyas indicus,* gen et sp. nov.

3 *Pseudatractides pyriformis,* gen. et sp. nov

4 *Neumania* (Neumania) *armata,* sp, nov.

5 *Arrenurus* (Arrenurus) *mammifera*, sp. nov.

6 *Arrenurus* (Arrenurus) *incisifrons* sp. nov.

7 *Arrenurus* (Arrenurus) *quadrilobatus* sp.nov

8 *Arrenureus* (Arrenurus) *incisicauda*, sp. nov.

MATERIALS AND METHODS

MATERIALS AND METHODS

The survey and study of the native water mite fauna of Kerala region was undertaken during different periods in different aquatic situations. The following equipments were used for the collection of water mites.

1) Stainless steel sieves of 30 cm. diameter with 3mm and o.3 mm mesh size.
2) Scoop net of 20 cm. mouth diameter and 0.3 mm mesh size.
3) Buckets of 20 liter capacity.
4) A light weight collapsible table

COLLECTION: The scoop net was used to make collections from the littoral area of the lakes and ponds by scooping it through the weed flora found in the margins of the water spread area to collect the epiphytic forms of mites. The dip net tied to a long rope was used for collection of mites from limnetic region. The dip net was dragged through the subsurface water column from the bank or from a moving boat to collect the swimming limnetic species of water mites. To collect the bottom dwelling forms, the thin superficial layer at the bottom of the pond was stirred up and collected in the dip net. To extract the water mites from these collections made either by scoop net or dip net they were sieved through a 3mm mesh sieve on to a o.3 mm mesh sieve using the buckets and washing through the sieves. The contents caught in the fine mesh sieve was placed in

white enamal tray, to spot and pick the water mites using a medicine dropper (Cook and Mitchell, 1952a).

PRESERVATION: The collected water mites were preserved in Koenike's solution which was prepared by mixing glacial acetic acid, glycerol and water in the ratio of 1:5:4 respectively (Krantz,1978).

SLIDE PREPARATION AND STUDY: The specimens collected and preserved in Koenike's solution were transferred to Lundblad's solution (Wiles, 1990) for clearing. A small hole was made in the specimen using a minuten needle, to enable the clearing agent to penetrate inside the body easily. After the completion of corrosion in a few hours, the liquified content of the body was pressed out using the blunt head end of a pin. Following the clearing process the specimens were placed in a mixture of 70% ethyl alcohol containing 5% glycerine (Cook and Mitchell, 1952 b). The alcohol was allowed to evaporate by keeping the specimens in this mixture in a hot air oven kept at 60°C , so that the specimens are left in pure glycerine.

To prepare the slide for study, the specimen was lifted from glycerine by a minuten needle and transferred on to an one inch cover slip. Any dissection needed was done at this stage. Then a small drop of liquified glycerine jelly was placed on the specimen and covered with 7/8 inch cover slip. Necessary glass

needle support was given to keep the specimens in natural form without much crushing.

The glycerine jelly medium was prepared by mixing gelatine 40gms, saturated aqueous solution of Arsenic trioxide 200 c.c and glycerine 120c.c (Cook and Mitchell, 1952 b).The double cover slip mounted preparation was left to harden at least for 2 hours and then the edge of the cover slip sealed with plastic non aquatic nail polish.

Drawings were made using a camera lucida and all measurements taken using a calibrated ocular micrometer.

During collection the temperature of the water in the pond was taken using an ordinary mercury thermometer and the pH of the water measured using pH paper strips.

AREA OF COLLECTION AND STUDY:

Kerala State is one of the smallest states in India, lying between 8°18' and 12°48'N latitude and 74°52' and 77°22' east longitude. This State is unique for

its water spread areas, ponds, lakes and backwaters and hence rich in water mite fauna. In the present study samples were collected from 144 locations, the details of which are enumerated below.

Collection sites:

1) Aarampetta pachayathkulam.(Thiruvillamala, Trichur)

An artificial pond covered with thick layers of grass. This pond is near a paddy field and it is about 25 years old.

Date of collection: 07-08-93, pH 6.5, temperature 31°C

2) Aluva puzha. (Aluva, Ernakulam)

Periyar near Aluva town. Water is slow flowing. Here and there sandy regions exposed. On the margins of this there is rooted vegetation. Collections made from the sandy shore, water and from the vegetation.

Date of collection: 13-04-93, pH 6, temperature 30°C.

3) Anavayal.(Parabikulam,Palakkad)

A marshy area, in the Parambikulam forest. This place is about 2000feet above sea level. Shallow waters. Weeds present. On the margins bamboo trees are abundant. Collections taken from a small ditch, where bamboo leaves were decaying.

Date of collection: 28-10-00, temperature 30°C.

4)Appalam pond.(Appalam,Palakkad)

The pond is very big and without any vegetation. Trees are on the banks. Collections made from the marginal waters where there is decaying vegetation. Date of collection: 04-11-00, pH 6.5, temperature 32°C.

5) Athirappilly lower stream. (Chalakudy,Trichur)

The Athirappilly river, is in the Vazhachal forest near Chalakudy. Since it was summer time there was not much flow of water. Collections made from the lower stream, from small rocky pools with gravel in the bottom.

Date of collection: 08-04-95, pH 6, temperature 27C.

6) Ayamana Pond (Muvatupuzha, Ernakulam)

It is a big pond on the sides of the highway four kilometers before reaching the Muvatupuzha town from Kothamanghalam. The pond is full of aquatic vegetation.

Date of collection: 16-09-00, pH 6.5

7) Ayankulam.(Madakkathara, Trichur)

A pond near Madakkathara Substation. Vegetation sparse.

Date of collection: 14-08-93, pH 6, temperature 28°C

8) Ayappan kulam.(Kollenkode, Palakkad)

A pond without any aquatic vegetation. Clear water is present in the pond.

Date of collection: 10-04-93, pH 6.5, temperature 32°C.

9) Kabani River .(Manathavady, Vyanad)

Kabani river on the way to Manathavady from Kalpetta. There is flow of water in the river. Collections are taken from the vegetation along the edge of the stream.

Date of collection: 07-04-93. pH 6, temperature 28°C.

10) Irrigation- canal (Karuvannore.Trichur)

The canal is on the way from Trichur to Irinjalakuda. Water is slow flowing. Aquatic vegetation is abundant, consisting of *Salvenia*.sp. and other rooted aquatic weeds.

Date of collection: 20-01-00, pH. 6.5, temperature 29°C.

11) Canal -Childrens park.(Ernakulam)

It is the canal near the Subash Chandrabose children's park in Ernakulam town. Water is stagnant and it is dirty without any vegetation.

Date of collection: 13-04-93, pH 6.5, temperature 30°C

12) Irrigation-canal, Nappanchira.(Vaikkom, Ernakulam)

It is a small canal on the way to Ernakulam from Vaikkom. The canal is full of aquatic vegetation.

Date of collection: 27-12-00, pH 6.5, temperature 28°C.

13) Irrigation- canal,Chelad (Kothamangalam. Ernakulam)

It is small branch of an irrigation canal from the Boothathankettu. Water appears almost stagnant. On the margins there is sparse rooted vegetation and some algae growth.

Date of collection: 15-09-00, pH 6, temperature 28°C.

14) Irrigation- canal, Mulloore Kayal.(Trichur)

Canal with full of aquatic vegetation, mainly *Salvenia* sp. and some rooted weeds. Water stagnant. On either side of the canal are paddy fields.

Date of collection: 12-04-95, pH 6.5, temperature 30°C.

15) Canal,Vallakkadavu(Trivandrum)

This is a part of Parvathy puthanar canal. Water is flowing slowly. Aquatic weeds present mainly *Eichornia* sp.

Date of collection: 25-02-00, pH7, temperature 29°C

16) Canal,Venpalavattom. (Trivandrum)

This is a part of the Parvathy puthanar canal. Here water is slowly flowing. Aquatic vegetation is not so thick but consists of *Salvenia* sp and rooted weeds.

Date of collection: 25-02-00, pH 5, temperature 29°C

17) Chaghamkulaghara pond. (Koratty,Trichur)

A big pond on the left side of NH47, on the way to Ernakulam from Trichur, near Koratty. Full of aquatic weeds mainly *Salvenia* sp. and *Hydrilla* sp.

Date of collection: 29-06-93, pH 6.5, temperature 27°C.

18) Chaaka,Parvathy puthanar canal.(Trivandrum)

A part of Parvathy puthanar canal . Water very dirty and almost stagnant. The whole surface is almost covered with vegetation especially *Eichornia* sp.

Date of collection: 25-2-00, pH 6.5, temperature 27°C

19) Chanthamarakulam.(NH47 way to Palakkad)

This pond is on the right side of the NH47 on the way to Palakkad from Trichur, 13 Kms before Palakkad. Full of aquatic vegetation, mainly *Salvenia* sp and good number of lotus plants.

Date of collection: 10-04-93, pH 6.5, temperature 32°C.

20) Chathankulam. (Chirakkankode, Trichur)

This pond is near Chirakkankode. Full of aquatic vegetation mainly *Salvenia* sp. and *Hydrilla* sp. plants. There are roots of weeds in the margin of the water body. Two collections made, one from the roots and the other from aquatic weeds.

Date of collection: 14-08-93, pH 6.5, temperature 27°C.

21) Chattukulam. (Kunnamkulam,Trichur)

A very big pond 3 kilometer from Kunnamkulam town on the way to Guruvayur. Vegetation sparse.

Date of collection: 27-07-93, pH 6, Temperature 27°C.

22) Chovoor Pond.(Chovoor,Trichur)

On the way to Irinjalakuda from Trichur. Full of aquatic vegetation consisting of *Hydrilla* sp. and rooted weeds.

Date of collection: 24-09-92, pH 6.5, temperature 28°C.

23) Check dam Padagiri estate.(Nelliyampathy, Palakkad)

It is a small check dam within the Padagiri estate, in the Nelliyampathy hills, which is a part of the western ghats. This is a cardamom estate about 2200 feet above sea level. Aquatic vegetation present.

Date of collection: 02-02-97, pH 6.5, temperature 16°C.

24) Chellamkulam.(Pavarty, Trichur)

A small pond near Pavarty town. Sandy soil. Aquatic vegetation present, mainly *Eichornia* sp.

Date of collection: 04-07-93, pH 6.5, temperature 27°C.

25) Chirakkankode canal. (Chirakkankode, Trichur)

Near Chirakkankode temple. Shallow slow running waters. This canal is a part of the Peechi water irrigation system. Aquatic weeds, *Utricularia* sp and other rooted weeds present. Rocky bottom.

Date of collection: 14-08-93,pH 6.5, temperature 28°C.

26) Chirakkankode Temple pond (Chirakkankode,Trichur)

Full of aquatic vegetation consisting of *Hydrilla* sp and other rooted weeds.

Date of collection: 14-08-93, pH 6.5, temperature 28°C.

27) Chittattukara pond.(Chittatukara,Trichur)

This is near Chittattukara Roman Catholic Church on the way to Pavarty. Sandy soil. Aquatic vegetation mainly consists of *Salvinia* sp.

Date of collection: 04-07-93, pH 6.5, temperature 27°C.

28) Chittoor pond (Near Chittoor Govt. college,Chittoor, Palakkad)

On left side of the road, 30meters interior on the way to Chittoor Government college from Palakkad. Three kilometers before the college. Presence of vegetation is found only in the margins of the water body.

Date of collection: 05-11-00,pH 6.5, temperature 28°C.

29) Devikulum upperlake.(Devikulum, Munnar)

A small lake of about 4.6 hectares situated in Western ghat region. At an altitude of 2025 meters. Collections were made through aquatic weeds mostly of *Cypus* sp and *Utricularia* sp

Date of collection: 19-04-95, pH 7, temperature 14°C.

30) Dhoni Dam.(Dhoni,Palakkad)

This is situated in the Dhoni forest area, which form part of western ghats, 15 kilometers from Palakkad town after Dhoni farm. We have to walk ½ kilometer into the interior of the forest to reach the collection site, from where the motorable road ends. Since it was dry summer there was very little water. One collection was taken from where there was detrifying leaves.

Date of collection: 13-02-00, pH 6.5, temperature 29°C.

31) Eenjakulam.(Kunnamkulam,Trichur)

Two kilometers west of Kunnamkulun town. One kilometer right side on the way to Guruvayur. Very little used pond, with full of vegetation mainly *Salvenia* sp and creepers.

Date of collection: 27-07-93, pH 5.5, temperature 27°C.

32) Elanjikulam pond.(Nadathara, Trichur)

One kilometer from Nadathara town. A big pond covered with *Salvenia*.sp. which was in the processes of being cleared.

Date of collection: 28-08-92, pH 6, temperature 28°C.

33) Feroke pond.(Feroke,Kozhikode)

A large pond in the Feroke town. The pond was more or less covered with weeds like *Salvenia* sp And *Eichornia* sp.

Date of collection: 6-3-92

34) Fresh water mussel.(Alappad, Trichur)

Fresh water mussel was collected from canal in the Koal land, near Alappad,Trichur.

Date of collection: 16-01-96, pH 6.5

35) Fresh water mussel (Manalipuzha, Trichur)

Fresh water mussel was collected from Manalipuzha, Trichur.

Date of collection : 26-01-96, pH 6.5

36) Fresh water mussel.(Chavakkad,,Trichur)

Brought from Sree Krishna College,Guruvayur.The collection was taken from nearby paddy fields.

Date of collection: 13-02-01

37) Fresh water mussel.(Pullazhy,Trichur)

Fresh water mussel was collected from a canal in the Pullazhy kole field.

Date of collection: 12-04-00, pH 6.5, temperature 27°C.

38) Govindapuram pond. (Govindapuram,Palakkad)

On the way to Govindapuram from Palakkad on right side of the road. Full of aquatic vegetation consists of *Hydrilla* sp.

Date of collection: 5-11-00, pH 6.5 temperature 29°C.

39) Janakinayar kulam. (Thiruvillamala,Trichur)

It is a small pond in a private compound. Beyond this is the paddy field. The pond is full of vegetation mainly *Utricularia* sp and other weeds.

Date of collection: 07-08-93, pH 6, temperature 27°C.

40) Kayal,Thevara.(Thevara,Ernakulam)

This is part of backwaters near Thevara College. No vegetation is present.

Date of collection: 13-04-93, pH 6.5, temperature 30°C.

41) Kinnassery pond.(Kinnassery,Palakkad)

This pond is near Kinnassery Vayanasala.This is a big Pond with newly constructed side walls. Vegetation sparse.

Date of collection: 05-11-00, pH 6.5, temperature 29°C.

42) Kole Muriad. (Trichur)

Five kilometers from Irinjalakuda on the way to Chalakudy. Collection made from a small canal with full of aquatic vegetation. Water is almost stagnant.

Date of collection: 25-01-01,pH 6.5, temperature 28°C.

43) Kole Palakkal.(Trichur)

Water turbid. Floating *Salvenia* sp probably drifted from some other parts of the field because of flood.

Date of collection: 14-07-93, pH 6, Temperature 27°C.

44) Kokkalai pond.(Trichur)

It is a very old pond near the Railway station. Thick aquatic vegetation is present on the surface. Water very dirty.

Date of collection: 17-04-93, pH 6.5, Temperature 27°C.

45) Kottakulam pond.(Urakam,Trichur)

On the way to Irinjalakuda from Trichur, on the right side of the road. Aquatic vegetation consists of *Eichornia* sp, abundant.

Date of collection: 17-09-92, pH 6.5, Temperature 27°C.

46) Kurukamparakulam.(Kunnamkulam,Trichur)

This is a pond formed by the excavation of quarry. It is a very big pond. Aquatic vegetation is absent.

Date of collection: 27-07-93, pH 7, temperature 27°C.

47) Kuthirakulam.(Perivaramb,Palakkad)

It is a big pond at Perivaramb, Palakkad. The pond is surrounded by paddy fields on three sides and on the one side a private compound. Aquatic vegetation is abundant at the time of first collection. It consists of *Eichornia* sp and rooted weeds. But at the time of second collection most of the weeds disappeared.

1)Date of collection: 05-11-00, pH 6.5, temperature 28°C.

2)Date of collection: 10-03-01, pH 6.5, temperature 29°C.

48) Kuttikkave Temple pond.(Minaloore,Trichur)

This is a small pond near the railway track, two kilometers from Minaloore Junction. Aquatic vegetation is abundant, consisting mainly of *Hydrilla* sp.

Date of collection: 07-08-93, pH 6.5, temperature 27°C.

49) Kuyalmananam Pond. (Kuyalmannam, Palakkad)

It is a temporary pond near Kuyalmannam. Aquatic vegetation is absent.

Date of collection: 10-04-93, pH 6.5, temperature 32°C.

50) Lower Check Dam(Nelliyampathy,Palakkad)

This is near Kaikatti in the Pothundi river, Nelliyampathy forest. This place is about 2100 feet above sea level. Vegetation in the check dam

from where collection was made was sparse. Decaying logs and leaves are there. Water flow is slow.

Date of collection: 02-02-97, pH 7, temperature 15°C.

51) Malampuzha dam.(Malampuzha,Palakad)

Collection was taken from a small canal. Aquatic vegetation is abundant, mainly *Vallisneria* sp. There is no flow of water.

Date of collection: 10-04-93, pH.6, temperature 30 °C.

52) Malasvamangalam pond. (Thiruvillamala,Trichur)

It is a small pond with aquatic vegetation. On two sides of the pond there are mountains. On the other sides presence of paddy field.

Date of collection: 07-08-93, pH 7, temperature 28°C.

53) Manakulam.(Chiralayam,Trichur)

A big pond in Chiralayam, Kunnamkulam. The pond is connected with paddy field. Aquatic vegetation sparse consisting of *Utricularia* sp.

Date of collection: 27-07-93, pH 5.5, temperature 27°C.

54) Mananthavady Town Pond. (Mananthavady,Vyanad)

It is a small pond full of aquatic vegetation in a private compound.

Date of collection: 7-04-93, pH 6.5, temperature 26°C

55) Mankudam kadavu (Chavakkad, Trichur)

It a small stream on the way to the seashore from the Chavakkad town. On the edges of this stream there is submerged vegetation.

Date of collection: 04-07-93, pH 6.5, temperature 27°C

56) Mathurakulam.(Kunnamkulam,Trichur)

This pond is near the telephone exchange Kunnamkulam. Pond is connected with paddy field. Water turbid after the rain. Vegetation sparse.

Date of collection: 27-07-93, pH, 6.5, temperature 27°C.

57) Mattom pond.(Mattom,Trichur)

The pond is near the paddy field. Aquatic vegetation abundant, consisting of mainly *Salvenia* sp and *Urticularia* sp.

Date of collection: 21-07-93,pH 6.5, temperature 27°C.

58) Mavoor paddy field. (Mavoor, Kozhikode)

A paddy field near Mavoor Rayons factory, not used for agriculture. A ditch inside the field, bottom full of mud. The weeds and algal growth were observed.

Date of collection: 9-3-92, pH 6.5

59) Meenachil river near Kottayam.(Kottayam)

There is good flow of water. Collection taken from the aquatic vegetation present on the margins of the river, near the bridge.

Date of collection: 15-01-93, pH 6.5, temperature 28C.

60) Metropolitan Pond.(Thankamani.Trichur)

A small pond near the Metropolitan hospital Trichur. Aquatic vegetation is abundant.

Date of collection: 04-11-92, pH 6.5, temperature 27°C.

61) Modappalam Pond(Nemmara,Palakkad)

This is a clear pond with out any aquatic vegetation.

Date of collection: 10-04-93, pH 6.5, temperature 28°C.

62) Monastery pond .(Irinjalakuda, Trichur)

This is a small pond, near Christ College. Aquatic vegetation is abundant, mainly *Hydrilla* sp.

Date of collection : 18-08-93, pH 6.5, temperature. 27°C.

63) Muriyamkulam. (Kunnamkulam,Trichur)

The pond is connected with paddy field by a small canal. aquatic vegetation is abundant.

Date of collection: 27-07-93, pH 5.5, temperature 27°C.

64) Muslim pallikulam.(Thathamangalam,Palakkad)

This is a big pond adjacent to the Muslim mosque in Thathmangalakm, on the way to Chittoor. Abundant aquatic vegetation mainly *Hydrilla*.sp.

Date of collection: 05-11-00, pH 6.5, temperature 27°C.

65) Muthukunnam canal.(Muthukunam.Ernakulam)

On the way to Kodungalur from Paravur. Water is slow flowing. Water looks dirty.

Date of collection: 13-04-93, pH 6, temperature 27°C.

66) Muthuvattur pond.(Chavakkad,Trichur)

It a small pond near Muthuvattur Jn. Sandy soil. Aquatic vegetation consisting of *Salvenia* sp. present. Water little turbid.

Date of collection: 04-07-93, pH 6.5, temperature 27°C.

67) Natyanchirakulam. (Near Thiruvillamala, Trichur)

Almost a clear pond. Grass fringing into the pond from the banks.

Date of collection: 07-08-93, pH 6.5, temperature 27°C

68) Nellikullangara pond.(Nemmara,Palakkad)

A pond without any aquatic vegetation.

Date of collection: 10-04-93, pH 6.5, temperature 28°C

69) Olarasserikulam. (Thiruvillama,Trichur)

A pond is situated in the middle of a private estate. Vegetation moderate. Water turbid after the rain. Rocky area.

Date of collection: 07-08-93, pH 5.5, temperature 28°C

70) Oochithrakulam.(Thiruvillamala,Trichur)

This pond is in the middle of a paddy field, 3 kilometers before Thiruvillamala, at Cherakuzhy, on the right side of the road. Aquatic vegetation is abundant, mainly *Hydrilla* sp.

Date of collection: 07-08-93, pH 6.5, Temperature 27°C

71) Paddy field Kaloor. (Muvatupuzha,Ernakulam)

This is a small paddy field which is surrounded by rubber estate. This paddy field is partially converted for the cultivation of pineapple and arecanut. The area maintains a shallow water body with abundant aquatic vegetation.

Date of collection: 16-09-00, pH 6.5, temperature 27°C.

72) Paddy field near Cheroor(Cheroor,Trichur)

On the way to Trichur town. In the rainy season it maintains a shallow water body. No paddy cultivation is made in this area. Aquatic vegetation is present.

Datre of collection : 12-07-93, pH 6.5, temperature 27°C

73) Paddy field Puchunnypadam.(Trichur)

This is also an uncultivated paddy field. Collection made from a small ditch where there were abundant aquatic weeds. Water seems dirty.

Date of collection: 25-01-00, pH 6.5, temperature 27°C

74) Paddy field, Pananghode.(Trivandrum)

Paddy field converted for coconut cultivation. In between the small bunds, there are waterlogged areas with plenty of weeds. On one side this area is connected to the Vellayani lake.

Date of collection: 26-02-00, pH 6.5, Temperature 26°C

75) Paddy field.(Changanassery ,Kottayam)

Water logged area. Paddy field converted for coconut cultivation. Aquatic vegetation was abundant.

Date of collection: 26-12-00, pH 6.5, temperature 28°C

76) Paddy field, Amrithapuri. (Oochira,Kollam)

Water logged area. Paddy field converted for coconut cultivation. Aquatic vegetation was abundant.

Date of collection: 26-12-00, pH 6.5, temperature 28°C

77) Paddy field, Gourishpattam.(Trivandrum)

Water logged area. Paddy field nearby partially filled for construction of houses. Collection made from a ditch. Aquatic vegetation was abundant.

Date of collection: 25-02-00, pH 6.5, temperature 28°C

78) Paddy field, Kolazhy. (Kolazhy,Trichur)

Half an kilometer from Trichur to Shornur main road. Not used for paddy cultivation for the last few years. shallow waters. Algae and aquatic weeds present.

Date of collection: 06-02-00, pH 6.5, temperature 27°C.

79)Paddy field,Mulamthuruthy.(Ernakulam)

This is near Mulamthuruthy railway gate on the right side of the road to Ernakulam. The paddy field maintains shallow water with weeds.

Date of collection : 27-12-00, pH 6.5, temperature 28°C.

80) Palakkal kulam.(Palakkal,Trichur)

This pond is on the way to Irinjalakuda from Trichur 50 meters left of the road near Palakkal. Aquatic weeds were abundant, mainly *Salvenia* sp and other rooted weeds. Water turbid.

Date of collection: 14-07-93 , Ph 6.5,

81) Pallikulam, Trichur town (Trichur)

A big pond located in the town. Aquatic vegetation mainly of *Salvenia* sp.

Date of collection: 08-09-92, pH 6.5, temperature 29°C.

82) Panchayath pond,way to Mannuthy.(Trichur)

This is a panchayath pond on the way to Mannuthy, 3 kilometers from Trichur town. Aquatic vegetation is abundant, mainly *Hydrilla* sp .

Date of collection: 15-09-92, pH 6.5, temperature 29°C.

83) Papanassini.(Vyanad)

Papanassini river. Shallow waters, which extends over a wide area. The bottom of the river covered with gravel. Not much aquatic vegetation.

Date of collection: 07-04-93, pH 6.5, temperature 27°C.

84) Peringhamkulam.(Perambra,Trichur)

This pond is on the right side of the highway to Ernakulam from Trichur, near Perambra. The pond is abundant with aquatic vegetation.

Date of collection: 29-07-93, pH 6.5

85) Perinkulam.(Pongham, Trichur)

This is a small pond on the side of the highway to Ernakulam from Trichur, at Pongham, near Koratty. On the other sides of the pond it is surrounded by paddy fields. Aquatic vegetation is abundant, Mainly *Hydrilla* sp.

1)Date of collection: 29-07-93, pH 6.5, temperature 27°C.

2)Date of collection: 17-07-93, pH 6.5, tempetature 28°C.

86) Pokodekulum.(Vithanassery,Palakkad)

Seven kilometers from Kollengode, aquatic vegetation present.

Date of collection : 10-04-93, pH 6.5

87) Pond Ayamana(Muvattupuzha,Eranakulam).

Ayamana pond is a big pond, 4 kilometeres before reaching Muvattupuzha town from Thodupuzha. Abundant aquatic vegetation mainly *Salvenia* sp.

Date of collection: 15-09-00, pH 6.5, temperature 29°C.

88) Pond (Chimmini forest.Trichur)

This is in the Chimmini forest, and the pond is called Nellikulam. Chimmini forest is a part of the western ghats. This small artificial pond is for the water requirements of the wild animals. This part of the forest is semideciduous. *Utricularia* sp abundant.

Date of collection: 20-01-00, pH 6.5, temperature 27°C.

89) Pond Near St.Mary's college (Vyanad)

This pond is in a paddy field near the college. The pond is small, lot of lotus grows in the pond along with other weeds.

Date of collection: 24-03-97, pH 6.5

90) Pond, Ashtamichira.(Trichur)

This is big pond on the way to Mala from Trichur. Aquatic vegetation is present on the margins consisting of *Salvenia* sp and other rooted weeds.

Date of collection: 02-10-00, pH 6, temperature 29°C.

91) Pond, Mala Town (Trichur)

Half a kilometer before Mala town. Water Turbid. Aquatic vegetation sparse.

Date of collection: 02-10-00, pH 6, temperature 29°C.

92) Pond, Valiyaparambu.(Trichur)

This pond is one kilometer after Valiyaparmbu on the way toVennore, in a paddy field. Aquatic vegetation is abundant on the margins.

Date of collection: 02-10-00, pH 6.5, temperature 29°C

93) Pond, Kalore. (Muvatupuzha,Ernakulam)

This is a pond formed by excavation of quarry in the middle of a rubber estate. Aquatic vegetation sparse except few rooted weeds in the margins.

Date of collection: 16-09-00, pH. 7, temperature 29 °C.

94) Pond.estate,Edanad.(Ernakulam)

This pond is in a private compound where arecanut is grown. Aquatic vegetation is present.

Date of collection: 13-04-93, pH 6.5, temperature 28°C.

95) Pottakulam (Trichur town)

On the way to Mannuthy from Trichur, near Shastri road. Aquatic weedsabundant. The weed consists mainly of *Hydrilla* sp. Weeds clearing work was taking place at the time of the collection..

Date of collection: 15-09-92, pH 6.5, temperature 28°C.

96) Pookodue lake.(Vyanad)

Pookodue lake is a water body of about 7.5 hectares surrounded by a chain of mountains, situated in Vythiri taluk of Vynad district. At the time of collection the lake was completely cleared of weeds.

Date of collection: 07-04-93, pH 6.5, temperature 28°C.

97) Pullukulam. (Chirakkanthode.Trichur)

Clear pond. Very old side walls. Fringing from the walls roots emerges into the water. Collection is taken from these roots.

Date of collection: 14-08-93, pH 6.5, temperature 27°C.

98) Reservoir Thattaekad (Idukki)

The reservoir situated in Idukki. The reservoir is the part of Thattaekad bird sanctuary. Collection made from the fringes where there is some vegetation.

Date of collection: 19-04-95, pH 6.5, temperature 28°C.

99) Rock pool, Thattaekad. (Idukki)

This is a small rocky pool on a rocky mountain, in the Thattaekad forest, where there is a small brook. Due to summer there is very little quantity of water. At the bottom of the pool there was decaying leaves and logs.

Date of collection: 19-04-95, pH 7, temperature 30°C.

100) S.N.Pond.(Irinjalakuda,Trichur)

It is a big pond situated in Irinjalakuda municipality area two kilometers before reaching Irinjalakuda from Trichur on the right side of road. Pond is connected with the paddy field. Vegetation consists of *Salvenia* sp.

Date of collection: 29 - 02 – 92, pH 7, temperature 31°C.

101) Sasthakulam. (Pattikad,Trichur)

Pond is near the Pattikad centre. Aquatic vegetation was sparse.

Date of collection: 14-08-93, pH 6.5

102) Sasthamkotta lake.(Kollam)

A big lake vegetation only in the fringes.

Date of collection: 20-04-99, temperature 30°C.

103) Sidhik pallikulum,Kadapuram(Chavakkad Trichur)

This pond is in the coastal belt, adjacent to a mosque. Vegetation sparse.

Date of collection: 04-07-93, pH 6.5, temperature 27°C.

104) Sree Kanddasura temple pond. (Trivamdrum)

Five kilometers from the city. No vegetation.

Date of collection: 25-02-00, pH 6, temperature 30°C.

105) Sree Varaha temple pond.(Trivandrum)

A temple pond in the city, aquatic vegetation present.

Date of collection. 25-02-00, pH 7.5

106) Sreemurthy temple pond.(Trivandrum)

Temple pond in the city. No Aquatic vegetation present

Date of collection: 25-02-00, pH 6.5, temperature 30°C.

107) Stream, AVT estate. (Nelliyampathy,Palakkad)

It is a small stream in the AVT Tea estate Nelliyampathy hills. Because of summer not much water flow. Aquatic weeds are present. Water looks very dirty.

Date of collection: 02-02-97, pH 7, temperature 15°C.

108) Stream, Changanassery. (Kottayam)

A small stream near Changanassery on the way to Kollam. Water flow was slow. Abundant aquatic vegetation present, mainly *Salvenia* sp.

Date of collection: 26-12-00, pH 6.5

109) Stream near Dhoni.(Palakkad)

This is a stream on the way to Palakkad from Dohni. Full of aquatic weeds. Water moves slowly.

Date of collection: 13-02-00, pH 6.5, temperature 30°C.

110) Stream, Kanjani (Trichur)

It a small stream in the kole field. Aquatic vegetation abundant.

Date of collection: 10-09-95, pH 6

111) Stream, Karayamparambe (Ernakulam)

On the way to Trichur from Aluva. Collection taken from below the bridge. Good flow of water. On the margins there is rooted aquatic weeds.

Date of collection: 27-06-93, pH 6.5, temperature 28°C.

112) Stream, Karumaloore.(Paravoore, Ernakulam)

A small stream on the way to Paravur, near Neerukode. No vegetation. Water is slow flowing. Decaying leaves at the bottom of the stream. Collection was taken from this region.

Date of collection: 13-04-93, pH 6.5, temperature 27°C.

113) Stream, Kariyanchola. (Parabikulam,Palakkad)

A small stream which form the boarder between Tamil Nadu and Kerala. It is in the thick forest area. Water level is much low. On the fringes grasses are there.

Date of collection: 28-10-00, pH 6.5, temperature 27°C.

114) Stream, Munnar. (Munnar,Idukki)

Water fast running. Few aquatic plants on the margins.

Date of collection: 19-04-95, pH 6.5, temperature 23°C.

115) Stream near check post. (Parambikulam,Palakkad)

Water flow is slow and restricted to some regions. Rocky bottom. Small stagnant pits here and there where there is some aquatic vegetation.

Date of collection: 28-10-00, pH 6.5 , temperature 27°C.

116) tream near paddy field Kolazhy. (Trichur)

A small stream adjacent to the paddy field in Kolazhy half a kilometer left to Trichur – Shornur highway. Water stagnant. Aquatic weeds were present.

Date of collection: 06-02-00, pH 6.5, temperature 29°C.

117) Stream Parambikulam.(Parambikulam,Palakkad)

This stream is near the watch-tower close to the guest house. Rocky bottom. There was no water in the stream except in small ditches, where leaves and logs decay.

Date of collection: 28-10-00, pH 6.5, temperature 27°C.

118) Stream, Puzhakal.(Trichur)

This is a small stream in the Puzhakal paddy field one kilometer after Pukkunnam on the way to Guruvayur. Aquatic vegetation, *Eichornia* sp. is abundant. Water stagnant.

Date of collection: 21-09-92, pH 7, temperature 28°C.

119) Stream, Kodakkallu. (Chimmini forest,Trichur)

This stream is in the interior of the forest. Rocky bottom. Flow of water very slow. Stagnant water present in small ditches where detritus leaves and logs was present.

Date of collection: 20-01-00, pH 6.5, temperature 27°C.

120) Stream, Muthangha.(Vyand)

This stream is near Muthangha. No vegetation. Bottom is sandy.

Date of collection: 24-03-97, pH 6.5, temperature 28°C.

121) Stream, Perunipalli.(Ernakulam)

A small stream on the way to Ernakulam from Viakkam. There is some flow of water. Aquatic vegetation is present, mainly *Utricularia* sp and

other rooted vegetation. Collection was taken from below the bridge on the high way.

Date of collection: 27-12-00, pH 6.5

122) Stream (Chimmini forest,Trichur)

This is a small stream two kilometers interior in the forest. Flow of water very low. Water is present in small ditches. They carry detritus leaves.

Date of collection: 20-01-00, pH 6.5, temperature 27°C.

123) Stream (Chimmini forest,Trichur)

A small stream three kilometers farther away from the above collection site in the Chimmini forest. Water present in small ditches. They carry decaying leaves.

Date of collection: 21-01-00, pH 6.5, temperature 27°C.

124) Stream,Palakkal (Trichur)

This is within the palakkal kole field. Aquatic vegetation is present.

Date of collection: 14-07-93, pH 6

125) Temple pond. Mannuthy (Trichur)

This Temple pond is two kilometers away from the collection site:82 on the way to Mannuthy. Aquatic vegetation was abundant.

Date of collection: 15-09-92, pH 6.5, temperature 28°C.

126) Thamarakulum. Mullekara(Tirchur)

This pond is 100feet interior left side of NH47 near Mullekara. On the side of pond there is a Siva temple. Lot of lotus plants was there in the pond along with other aquatic weeds.

Date of collection: 14-08-93, pH 6.5, temperature 28°C.

127) Thenkulangara temple pond, Cheroor (Trichur)

On one side of the pond is the paddy field and on all other sides temple land. Abundant aquatic vegetation present.

Date of collection: 26-01-00, pH 6.5, temperature 29°C.

128) Thanneerpanthal pond. (Palakkad)

Shallow pond surrounded by paddy field converted into coconut plantation. The whole area is water logged. Aquatic vegetation abundant.

Date of collection: 05-11-00, pH 6.5, temperature 28°C.

129) Thekkankulum,Edanad (Ernakulam)

This pond is near Edanad temple.Aquatic vegetation consists of *Salvenia* sp.

Date of collection: 13-04-93,pH 6.5

130) Thiruvanikave Temple pond, Ayanthole(Trichur)

This pond is on the back side of Trichur Collectorate. Aquatic vegetation abundant.

Date of collection: 26-07-93, pH 6.5, temperature 27°C.

131) Thiruvanikulam.(Thiruvanikulam,Ernakulam)

This is small pond on the right side of the highway from Vaikkom to Ernakulam, 10 kilometers before Mulanthurithy railway gate. Aquatic vegetation abundant consisting of *Hydrilla* sp.

Date of collection: 27-12-00, pH 6.5, temperature 28°C.

132) Thrikkarikulanghara pond, Ayanthole(Trichur)

Two kilometer from Ayanthole, Chungam bus stop. The pond is connected to a paddy field by a small canal. Aquatic weeds cleared, but some weeds were there near the margins.

Date of collection: 26-07-93, pH 6.5, temperature 27°C.

133) Upper Check dam (Nelliyampathy.Palakkad)

This is near Kaikatti, in the Pothundi river, Nelliyampathy hills. Aquatic vegetation was sparse except in the margins of the reservoir.

Date of collection: 02-02-97, pH 6.5, temperature 15°C.

134) Vadakkumchery Pond.(Palakkad)

On the way to Palakkad from Trichur after the Kuthiran. A big pond. Aquatic vegetation abundant mainly *Salvenia* sp.

Date of collection: 18-07-93, pH 6.5, temperature 27°C

135) Vallarakulum. near Thiruvilamala(Trichur)

10 kilometers away from collection No. 67 on the way to Thiruvillamala. It is a very big pond without any aquatic vegetation.

Date of collection: 07-08-93, pH 6.5, temperature 28°C

136) Vazachal, upper river.(Trichur)

It is part of the chalakudy river. Collections are made from 8 kilometers upper to the first collection site. Collections taken from matted roots of trees in a shallow river side where the river forms a small pocket marshy area.

Date of collection: 08-04-95, pH 6.5, temperature 27°C.

137) Vadakanchary temple pond.(Trichur)

A big pond near Vadakanchary Govt. School. Aquatic vegetation abundant mainly *Hydrilla* sp.

Date of collection: 07-08-93, pH 6.5

138) Vadakken kulum.Edanad.(Ernakulam)

This is near Edanad Temple. Clear Pond without any aquatic vegetation.

Date of collection: 13-04-93, pH 6.5.

139) Vembanad kayal(Kumarakam,Kottayam)

This collection was taken from Vembanad lake near Kumarakam bird sanctuary.

Date of collection: 15-01-93, pH 6.5, temperature 27°C.

140) Vyttila, Marshy land(Ernakulam)

This is part of backwaters near Thevara college. No aquatic vegetation. Decaying logs are present. Water seems dirty.

Date of collection: 13-04-93, pH 6.5

141) Vallakkadavue, Parvathy puthanar canal. (Trivandrum)

Aquatic vegetation is abundant mainly *Eichornia* sp. Water very dirty and contains many larvae. Water almost stagnant. This is a portion of the Parvathy puthanar canal.

Date of collection: 25-02-00, pH 7, temperature 30°C

142) Well, Kumarakam Sanctuary(Kottayam)

It is a small well in the Kumarakam bird sanctuary. Aquatic vegetation abundant mainly *Salvenia* sp Water in the well over flows and mixes with the water in the near by kayal (Vembanad) .

Date of collection: 15-01-93, pH 6.5, temperature 28°C.

143) Well, Rubber estate, Kalore.(Muvatupuzha.Ernakulam)

It is a well in the rubber estate. Aquatic vegetation present in the well.

Date of collection: 26-09-00, pH 6.5.

144) Yakara Puzha.(Palakkad)

Water is slowly flowing. Rocky bottom. Here and there are pockets of stagnant water with aquatic vegetation.

Date of collection: 10-04-93, pH 6.5, temperature 30°C.

The types and paratype slides will be deposited in the Acarina collections of The Zoological Survey of India, Calcutta.

EXPERIMENTAL RESULTS

EXPERIMENTAL RESULTS

A. SYSTEMATIC ACCOUNT:

Fresh water mites belongs to Superchort Hydrachnella, suborder Prostigamata , order Acariformes, Subclass Acari under Class Arachnid. Over 5000 species of water mites are currently recognised worldwide. They represent more than 300 genera and subgenera in over 100 families and sub-families(Viets,1987). The families are conservatively grouped into eight superfamilies (Smith and Cook,1991). They are Stygothrombidioidea; Hydrovolzioidea; Hydrachnoidea; Eylaoidea; Hydryphantoidea; Lebertioidea; Hygrobatoidea and Arrenuroidea.

TAXONOMIC KEY TO DIFFERENT SPECIES STUDIED

1a Tibia of pedipalp much shorter than genu and bearing a dorsodistal projection extending well beyond insertion of tarsus.....2

1b Tibia of pedipalp not much shorter than genu and bearing a dorsodistal projection extending well beyond insertion of tarsus.....3

2a Genital field with a deep median cleft. Posteromedial margins of fourth coxae with well developed apodemes.....*Hydrachna multipora* Cook

2b Genital field without a deep median cleft. Posteromedial margins of fourth coxae without well developed apodemes.....*Hydrachna similes* Cook

3a Lateral eye capsule usually fused medially into a common eye plate. Genital acetabula borne scattered in more or less uniform way in the posterior and lateral aspects to the gonopore.....*Limnochares crinita* Koenike

3b Lateral eye capsule usually not fused medially into a common eye plate, genital acetabula not like scattered as above.....4

4a Tebia with a dorsodistal extension well beyond the insertion of tarsus.....5

4b Tebia without a dorsodistal extension well beyond the insertion of tarsus.....7

5a Dorsal extension of pedipalp tibia relatively short. Dorsum with a series of closely fitting platelets forming the dorsal shield..*Mamersa gennada* Cook

5b Dorsal extension of pedipalp tibia relatively long with out a series of closely fitting platelets forming the dorsal shield.....6

6a First coxae with well developed median apodemes. Fourth and fifth segments of fourth leg with numerous swimming hairs.....*Hydrodroma monticola* Piersig

6b First coxae with a short median apodemes. Fourth segment of fourth leg with five and fifth segment of fourth leg with two swimming hairs.....*Hydrodroma tonapii* Cook

7a Movable genital flalps. Genital acetabula lying free in gonophore. Tarsi of fourth pair of legs lacking claws. .....*Oxus pictus* Daday

7b Movable genital flaps usually not present. Genital acetabula lying not in gonophore.....8

8a Dorsal and ventral shields some times present but usually soft. Complete sclerotization of the body not common. Shape not variable in form. Pedipalp tibia not broad.....9

8b Usually dorsal and ventral shields present. Complete sclerotization of the body common, body variable in form. Tibia very broad.....30

9a Dorsum soft. Femur of pedipalp bearing a single ventral setae.....10

9b Dorsum soft. Femur of pedipalp not bearing a single ventral seta.....13

10a Genital field triangular in shape with a deep median notch, second pair of genital acetabula lying lateral to third pair, IV-leg-6 ending in a very short terminal seta.....*Limnesia lucifera uniseta* Cook

10b Genital field not like above. Second pair of genital acetabula not lying lateral to third pair. IV-leg-6 not ending in short terminal seta.....11

11a P-II with a very long tubercle bearing a short spine like seta. Capitular bay 'V' shaped and deep.....*Limnesia lembangensis* Piersig

11b P-II with a short tubercle. Capitular bay 'V' shaped and not deep.....12

12a Genital field very slender. Two genital acetabula near the posterior end and one at the anterior end of the genital plates....*Limnesia thobiasi* n. sp.

12b Genital field very broad. Two genital acetabula not near the posterior end and one at the anterior end of the genital plates as above..... *Limnesia buruensis* Imamura

13a First coxae fused medially 15

13b First coxae not fused medially.....19

14a Fourth palpal segment hairy. Genital plate having four pairs of genital acetabula.....*Atractides biscutatus* Cook

14b Fourth palpal segment not hairy. Genital plate having three pairs of genital acetabula.....16

15a Dorsoventral portion of P-II drawn out into a bluntly-pointed tubercle.....17

15b Dorsoventral portion of P-II not drawn out into a bluntly-pointed tubercle.....18

16a Dorsoventral portion of P-III with several small papillae P-V comparatively shorter.....*Hygobates keralensis* Cook

16b Dorsoventral portion of P-III without several small papilla. P-V comparatively longer in size.....*Hygrobates karekari* Cook

17a Posterior margins of fourth coxae without small apodeme. Distoventral portion of P-II and P-III expanded and bearing numerous small papillae.....*Hygobates dadyi* Cook

17b Posterior margins of fourth coxae with a small apodeme. Distoventral portion of P-II and P-III not expanded, but bearing numerous small papillae.....*Hygobates hamates bharatensis* Cook

18a Apodemes of the first and second coxal group extending to the anterior portion of the third coxal plate 19

18b Apodemes of the first and second coxal group extends to approximately the middle of the fourth coxal plates.....28

19a Genital acetabula lying free in the integument .....*Encentridophorus similes* Cook

19b Genital acetabula not lying free in the integument.....20

20a Genital acetabula five pairs; lateral flaps of second and third coxal plates extend into long finger like projections laterally..*Unionicola armata* Walter

20b Genital acetabula five or more than five pairs; no lateral flaps of second and third coxal plates extend into long finger like projections laterally.....22

22a Female genital field with a single pair of acetabular plate.....23

22b Female genital field with two pairs of acetabular plate.....24

23a Genital field with less than 20 pairs of genital acetabula.....*Unionicola brandti* Vidrine

23b Genital field with more than 20 pairs of genital acetabula.....*Unionicola diversipes* Viets

24a Body heavily sclerotized; genital plate bearing more than six pairs of genital acetabula.....25

24b Body not sclerotized; genital plate with six or less than six pairs of genital acetabula.....26

25a Posterior end of fourth coxae completely fused with ventral side without any marks; genital acetabula 20 pairs on each side.....*Unionicola trichurensis* n.sp

25b Posterior end of fourth coxae appear 'V' shaped; number of acetabula 14 pairs on each side.....*Unionicola scutigera* Viets

26a Pedipalp tarsus nearly quadrate in lateral view with two large clawletes.....*Unionicola kantaka* Cook

26b Pedipalp tarsus not nearly quarate in lateral view with two large clawletes.....27

27a The spines on the first leg small and feable; projections on the tibia of pedipalp feable and small.....*Unionicola mohanasundarami* n.sp

27b The spines on the first leg strong and long; projections on the tibia very prominent.....*Unionicola affinis* Piersig

28a Dorsum with enlarged muscle attachment platelets. Coxal groups fused to form a ventral shield.....*Neumania multiscutata bharatensis* Cook

28b Dorsum not with muscle attachment plateletes. coxal groups not fused to form a ventral shield.....29

29a Genital acetabula 15-20 numbers on each side...*Neumania nodosa* Daday

29b Genital acetabula 6-10 numbers on each side...*Neumania ambigua* Piersig

30a Anterior end of the body produced into a pointed projection in the case of male and female. Male with a long cauda.....*Arrenurous rostratus* Daday

30b Anterior end of the body not produced into a pointed projection.....31

31a P-II bear tuft of seta both in male and female.....*Arrenurous ceylonicus* Daday

31b P-II without a tuft of setae.....32

32a Posterior end of the body produced into a long, broad cauda. Dorsal furrow complete. .....*Arrenurous caviger* Viets

32b Posterior end of the body not produced into a long cauda.....33

33a Posterior end of the body produced into short, very broad cauda with a broad, shallow concavity.....*Arrenurous bicornicodulus* Piersig

33b Posterior end of the body not like above.....34

34a Posterior end of the body with short cauda with a long petiole. The distal end of the petiole bears recurved hyaline area. Dorsal shield not complete.....*Arrenurus liberatus* Walter

34b Posterior end of the body with short cauda, with a well developed pit bearing a small petiole. Dorsal shield complete.....*Arrenurus madaraszi* Daday

Superfamily :HYDRACHNOIDEA
Family :HYDRACHNIDAE
Subfamily : HYDRACHNINAE
Genus : HYDRACHNA

1) ***Hydrachna* (s.s) *similis* Cook 1967**

(Figure-1 Figs: A – I. Plate –1 Photographs 1a and 1b)

Female: Length of the body 665μ; length between anterior end of first coxae and posterior end of last coxae, 292μ; genital field 119μ in length and 146μ in width; genital acetabula numerous; dorsal length of palpal segments: P-I, 93μ; P-II, 79μ; P-III, 106μ; P-IV, 53μ; P-V, 26μ; proximal end of the ventral side of P-IV more concave; chelicera 465μ in length; dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 79μ; I-leg-3, 79μ; I-leg-4, 66μ; I-leg-5, 106μ; I-leg-6, 119μ; dorsal length of the segments of the fourth leg: IV-leg-1, 53μ; IV-leg-106, 93μ; IV-leg-3, 93μ; IV-leg-4, 172μ; IV-leg-5, 198μ; IV-leg-6, 133μ.

Male: Length of the body 465μ; length between anterior end of first coxae and posterior end of last coxae, 295μ; genital field 133μ in length and 119μ in width; genital acetabula numerous; dorsal length of palpal segments: P-I, 80μ; P-II, 75μ; P-III, 79μ; P-IV, 39μ; P-V, 26μ in length; chelicera 345μ in length;

Figure 1

Figures: A-I *Hydrachna* (s.s) *similis* Cook

A. Fourth leg female
B. First leg female
C. Coxal region female
D. Female genital field
E. Palpal segments female
F. Coxal region male
G. Fourth leg male
H. Palpal segments male
I. First leg male

Figure-1

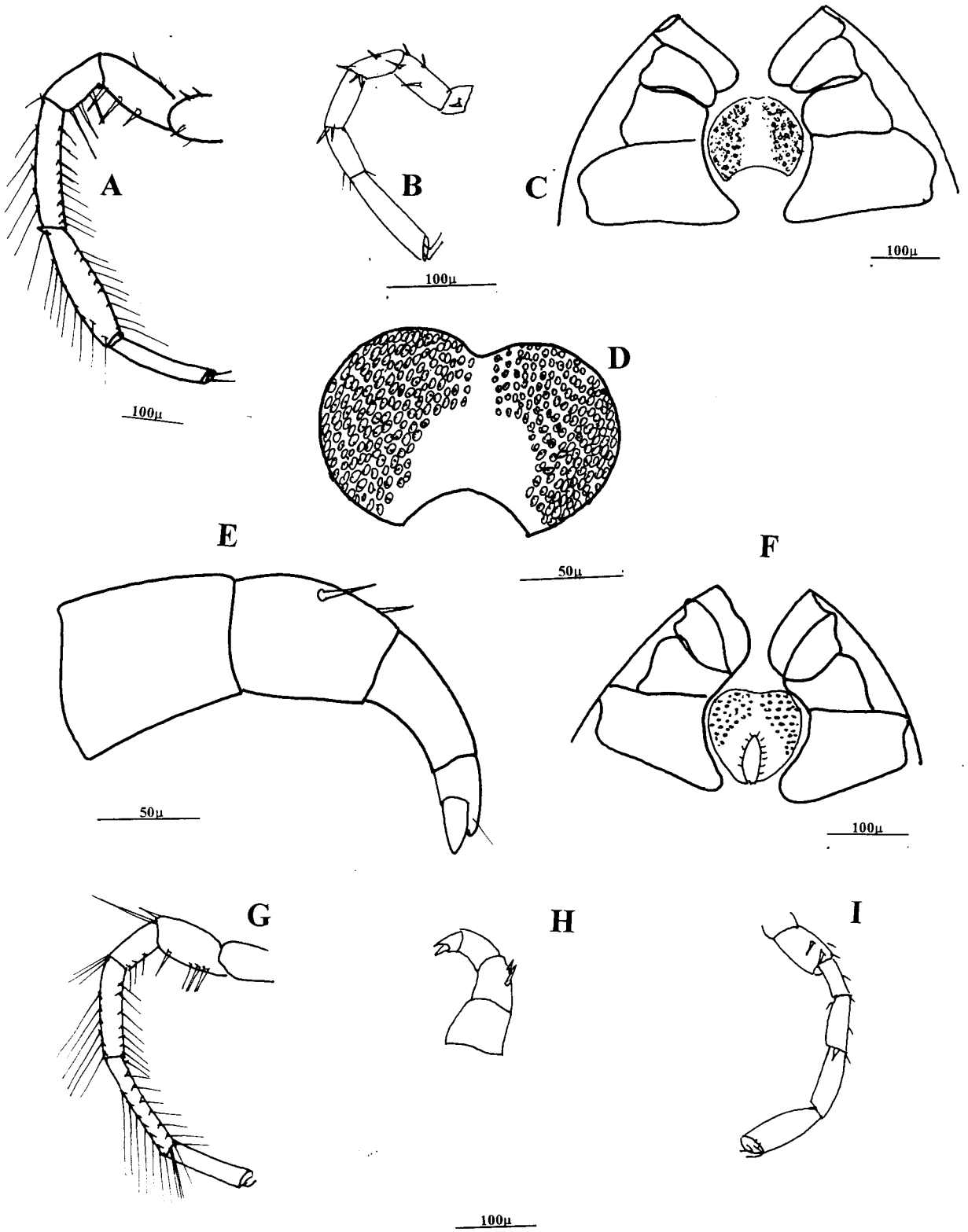


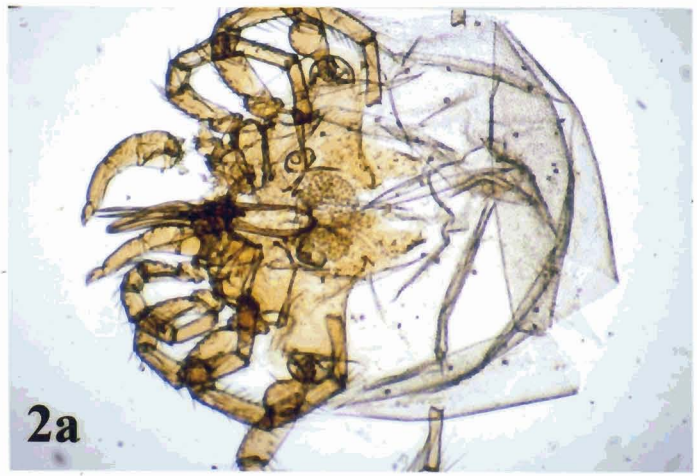
PLATE-I
(photos 1a- 4b)

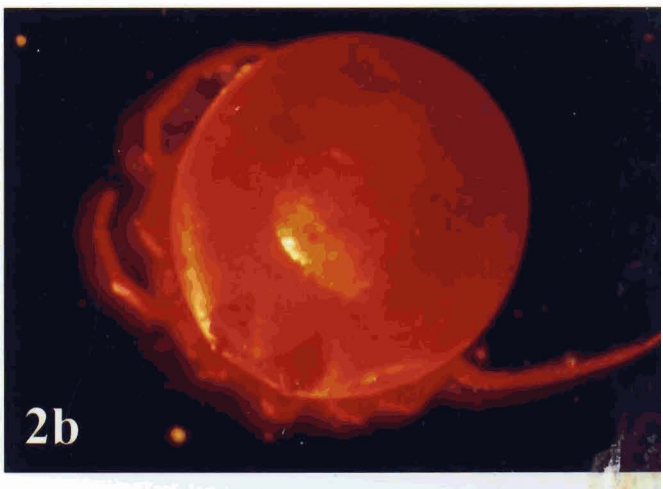
1a- *Hydrachna similis* female
1b- *Hydrachna similis* male
2a- *Hydrachna multipora* female
2b- *Hydrachna multipora* before clearing
3a- *Limnochares crinita* female
3b- *Limnochares crinita* male
4a- *Mamersa gennad* female
4b- *Nilotonia indica* male

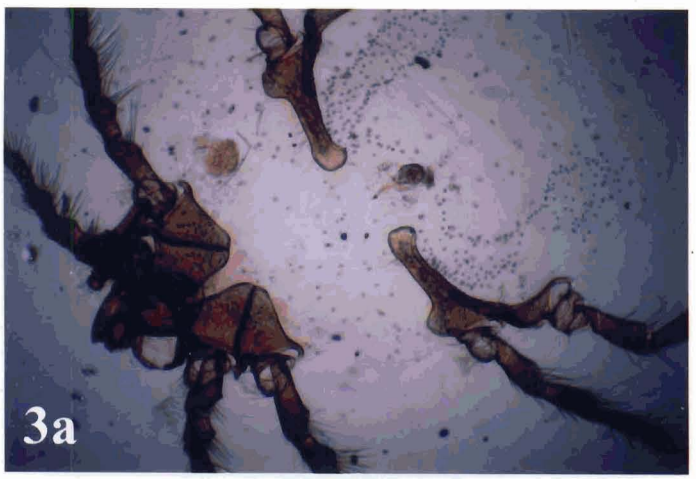
Plate : I


1a


1b


2a


2b


3a


3b


4a


4b

dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 39μ; I-leg-4, 85μ; I-leg-5, 93μ; I-leg-6, 106μ; dorsal length of the segments of the fourth leg: IV-leg-1, 79; IV-leg-2, 93μ; IV-leg-3, 79μ; IV-leg-4, 133μ; IV-leg-5, 146μ; IV-leg-6, 119μ.

Occurrence: Stream Perunipalli. Collection No: 121

Habitat: Stream.

Distribution: Kerala; Ceylon

Remarks: *Hydrachna similis* male was first reported by Cook in 1967, from Trichur, Kerala. *Hydrachna similis* female is a new report.

2) ***Hydrachna* (Rhabdohydrachna) *multipora* Cook 1967**

(Figure- 2. Figs: A – D. Plate-1 Photographs 2a and2b)

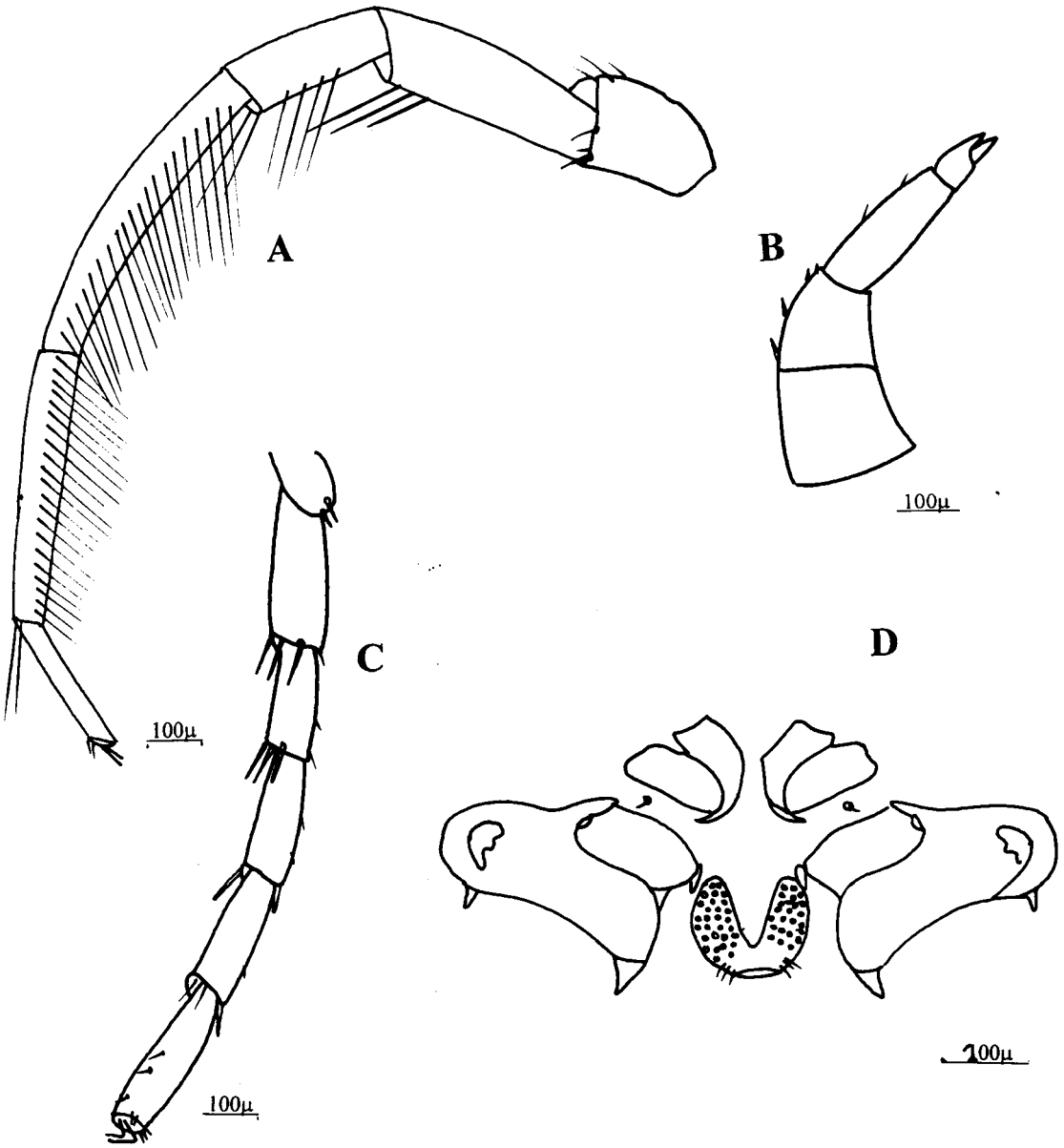
Female: Length of the body 1998μ; length between anterior end of the first coxae and posterior end of fourth coxae 864μ; dorsum with two pairs of platelets, anterior one 399μ in length and posterior one 119μ in length; posteriomedial end of third and fourth coxae with long apodemes; genital field 279μ in length and 385μ in width, anterior end of genital field with a very deep median cleft; genital acetabula numerous; dorsal lengths of the palpal segments: P-I, 196μ; P-II, 145μ;

Figure-2

Figures: A- D, *Hydrachna* (Rhabdohydrachna) *multipora* Cook

A. Fourth leg female
B. Palpal segments female
C. First leg female
D. Coxal region female

Figure-2



P-III, 215μ; P-IV, 99μ; P-V, 48μ; chelicera 1253μ.; dorsal length of the segments of the first leg: I-leg-1,66μ, I-leg-2, 239μ; I-leg-3, 146; I-leg-4,212μ; I-leg-5,199μ; I-leg-6, 226μ; dorsal length of the segments of the fourth leg: IV-leg-1, 226μ; IV-leg-2, 291μ; IV-leg-3, 226μ; IV-leg-4, 532μ; IV-leg-5, 438μ; IV-leg-6, 239μ;

Male: Not observed.

Occurrence: Kuthirakulum. Collection No: 47

Habitat: Ponds

Distribution: Karnataka and Kerala States in India.

Remarks: The structure of the female genital field of *Hydrachna multipora* is very characteristic. Larva (Plate-VIII, Photo-4b) parasitic on *Ranatra sordidula* (Plate-VIII, Photo-4a); New record from Kerala

Superfamily : EYLAOIDEA
Family : LIMNOCHARIDAE
Subfamily : LIMNOCHARINAE
Genus : LIMNOCHARES

3) ***Limnochares* (Cyclothrix) *crinita* Koenike,**

(Figure- 3. Figs: A – H. Plate-1. Photographs 3a and 3b)

Female: Length of the 2660μ; integument soft; occular plate 385μ in length, 159μ in width; longest measurement of first coxal group 550μ; first coxae bears few long setae; second coxae also with few long setae; longest measurement of posterior coxal group638μ; genital acetabula more than 100 on each side; length of palpal segments P-I,13μ, P-II, 60μ, P-III, 45μ, P-IV, 55μ, P-V, 33μ. Dorsal length of segments of the first leg: I-leg-1, 50μ; I-leg-2, 85μ; I-leg-3, 133μ; I-leg-4, 133μ; I-leg-5, 172μ; I-leg-6, 186μ. Dorsal length of distal segments of the fourth leg: IV-leg-1, 66μ, IV-leg-2, 172μ; IV-leg-3, 292μ; IV-leg-4, 345μ; IV-leg-5, 372μ; IV-leg-6, 359μ,fourth legs with many swimming hairs.

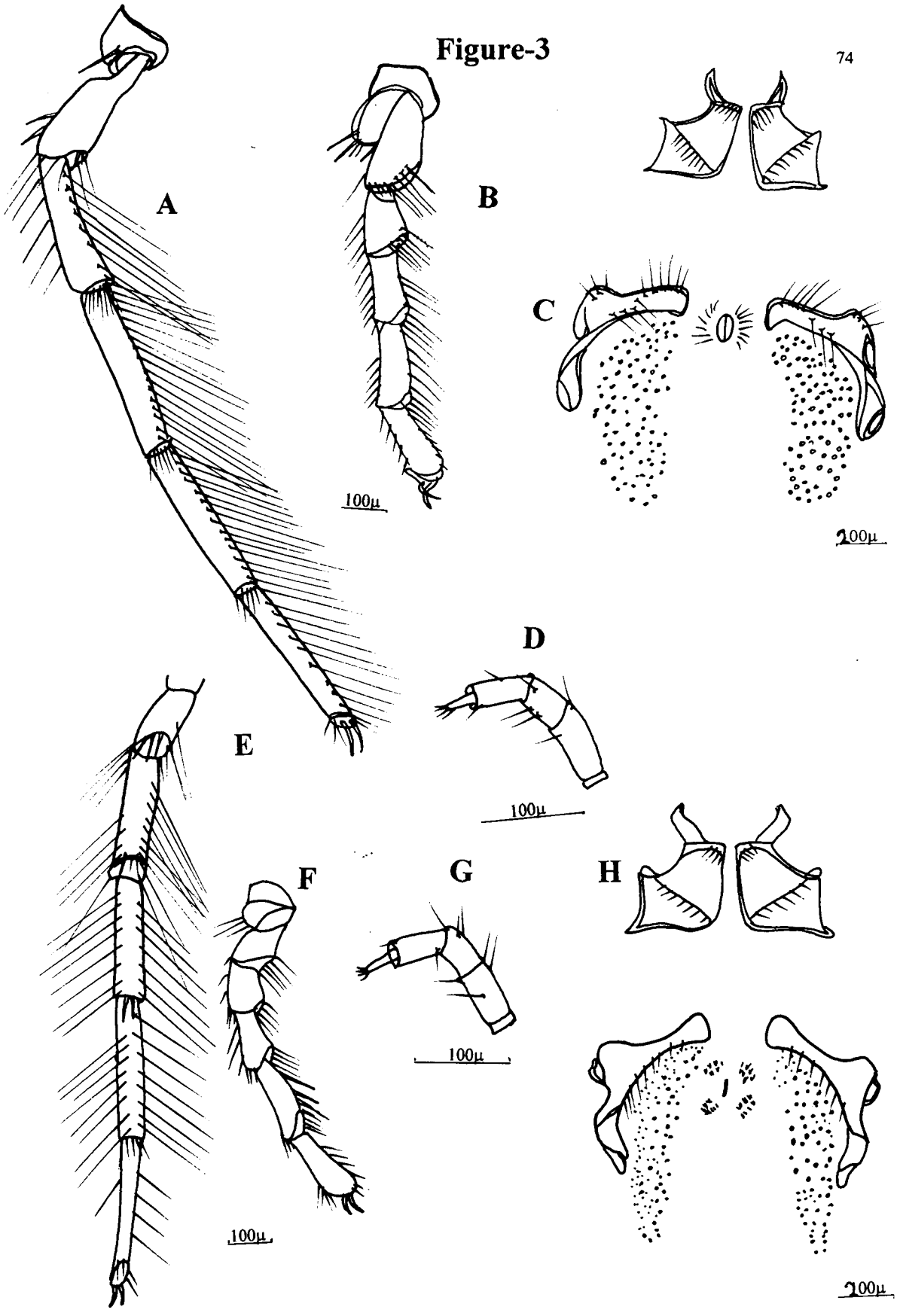
Male: Length 1990μ; integument soft; occular plate 390μ in length,170μ in width; longest measurement of first coxal group 332μ; first coxae bears few long setae; second coxae also with few long setae; longest measurement of posterior coxal group 638μ; genital acetabula small and around 100 on each side; length of

Figure-3

Figures: A- H, *Limnochares* (Cyclothrix) *crinita* Koenike

A. Fourth leg female
B. First leg female
C. Coxal region female
D. Palpal segments female
E. Fourth leg male
F. First leg male
G. Palpal segments male
H. Coxal region male

Figure-3



palpal segments P-I,10μ, P-II, 60μ, P-III, 40μ, P-IV, 60μ, P-V, 25μ. Dorsal length of segments of the first leg: I-leg-1, 50μ; I-leg-2, 79μ; I-leg-3, 133μ; I-leg-4, 133μ; I-leg-5,159μ; I-leg-6,180μ. Dorsal length of distal segments of the fourth leg: IV-leg-1, 40μ; IV-leg-2, 186μ; IV-leg-3, 266μ; IV-leg-4, 305μ; IV-leg-5, 359μ; IV-leg-6, 359μ; fourth legs with many swimming hairs.

Occurrence: Irrigation canal Mulloore Kayal (Trichur) Collection No: 14

Habitat: Canal

Distrubution: Kerala State in India.

Superfamily : HYDRYPHANTOIDEA
Family : HYDRYPHANTIDAE
Subfamily : MAMERSINAE
Genus : MAMERSA

4) ***Mamersa gennada* Cook 1967**

(Figure- 4. Figs: A – H. Plate-1. Photograph 4a)

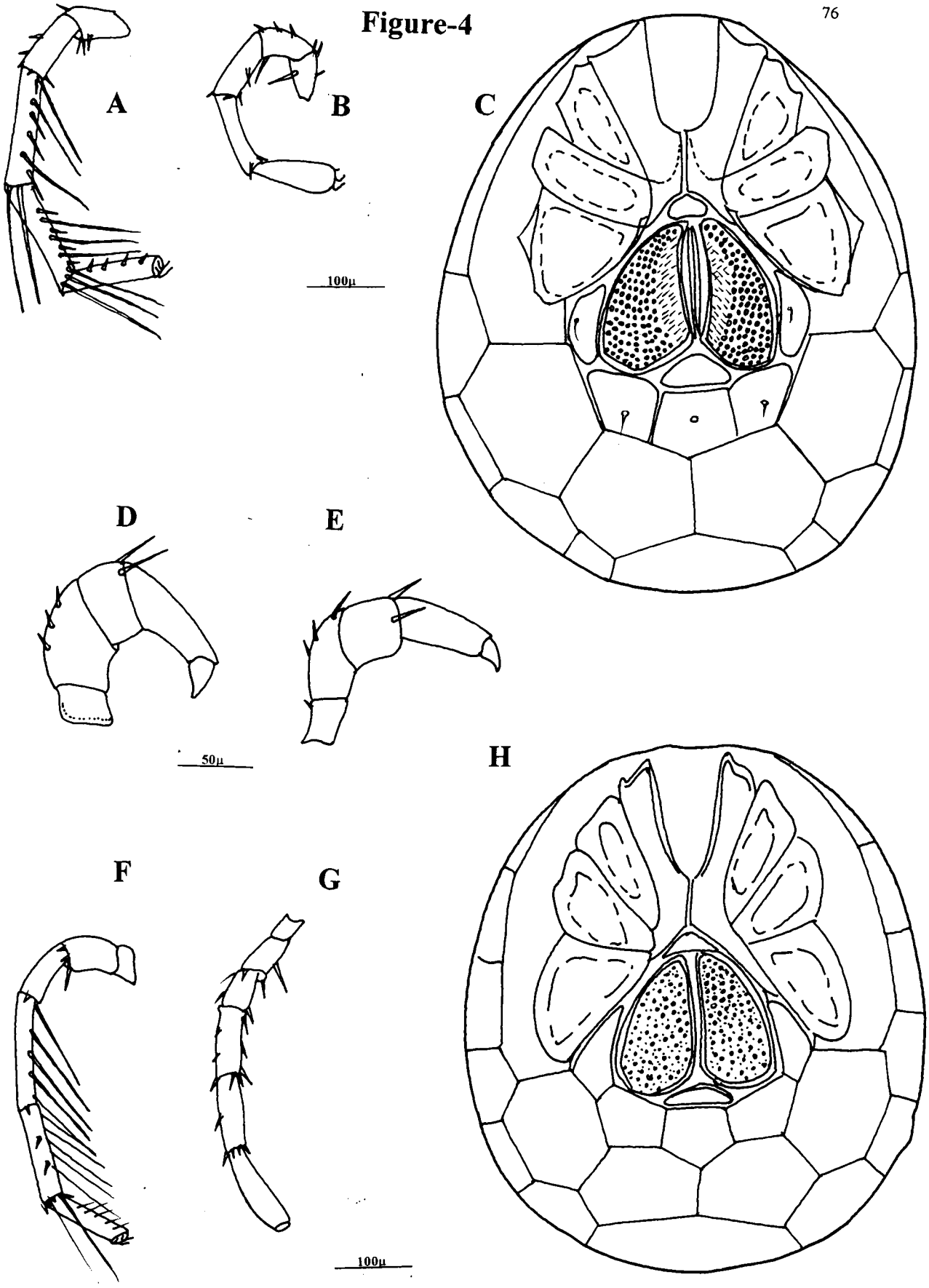
Female: Length of the animal 744μ; dorsum with a series of closely fitted plateletes forming a dorsal shield as shown in the figure; ventral shield also shows platelets;. genital field 226μ in length and 266μ in width; dorsal length of the palpal segments : P-1, 30μ; P-II, 75μ; P-III, 37μ; P-IV, 100μ; P-IV, 25μ;dorsal length of segments of the first leg:I-leg-1, 26μ; I-leg-2, 46μ;

Figure-4

Figures: A- H, *Mamersa gennada* Cook

A. Fourth leg female
B. First leg female
C. Coxal region female
D. Palpal segments female
E. Palpal segments male
F. Fourth leg male
G. First leg male
H. Coxal region male

Figure-4



I-leg-3, 66μ; I-leg-4, 93μ; I-leg-5,113μ; I-leg-6,106μ; dorsal length of segments of fourth leg: IV-leg-1, 53μ; IV-leg-2, 79μ; IV-leg-3, 93μ; IV-leg-4, 159μ; IV-leg-5,130μ; IV-leg-6, 119μ; third and fourth legs with swimming hairs.

Male: Length of the body 704μ; width of the body 691μ;dorsum with a series of closely fitted platelets; genital field 226μ in length and 239μ in width; dorsal length of the palpal segments: P-I, 30μ; P-II, 70μ; P-III. 35μ; P-IV, 75μ; P-V, 25μ; dorsal length of the segments of the first leg: I-leg-1, 25μ; I-leg-2, 39μ; I-leg-3, 53μ, I-leg-4, 85μ; I-leg-5, 85μ; I-leg-6, 100μ; dorsal length of the segments of the fourth leg: IV-leg-1, 26μ; IV-leg-2, 39μ; IV-leg-3, 79μ; IV-leg-4, 146μ; IV-leg-5, 125μ; IV-leg-6, 110μ; third and fourth leg with swimming hairs.

Occurrence: Chovoor pond, Stream Kanjani, Stream Puzhakal. Collection No: 22; 110 and 118

Habitat: Ponds and streams.

Distribution: Karnataka State and Kerala State.

Remarks: Male reported for the first time. This is first report from Kerala.

Family :HYDRODROMIDAE
Subfamily :HYDRODROMINAE
Genus :HYDRODROMA

5) ***Hydrodroma monticola* Piersig 1906**

(Figure- 5. Figs: A – H. Plate-II. Photograph 1a and 1b)

Female: Length of the body 850μ; length between anterior end of first coxae and posterior end of fourth coxae 465μ; length between median edge of first coxae and lateral edge of second coxae 266μ; length between median edge of third coxae and lateral edge of fourth coxae 332μ; coxae bearing numerous long setae; first coxae with well developed median apodemes; genital field 226μ in length, 213μ in width; genital acetabula numerous; dorsal length of palpal segments: P-I, 66μ; P-II, 66μ; P-III, 46μ; P-IV, 185μ; P-V, 60μ; dorsal lengths of the segments of the first leg: I-leg-1, 53μ; I-leg-2; 66μ; I-leg-3, 106μ; I-leg-4,199μ; I-leg-5, 252μ; I-leg-6, 213μ; dorsal length of the segments of the fourth leg: IV-leg-1, 75μ; IV-leg-2, 199μ; IV-leg, 3 199μ; IV-leg-4, 319μ; IV-leg-5, 326μ; IV-leg-6, 266μ. Swimming hairs present.

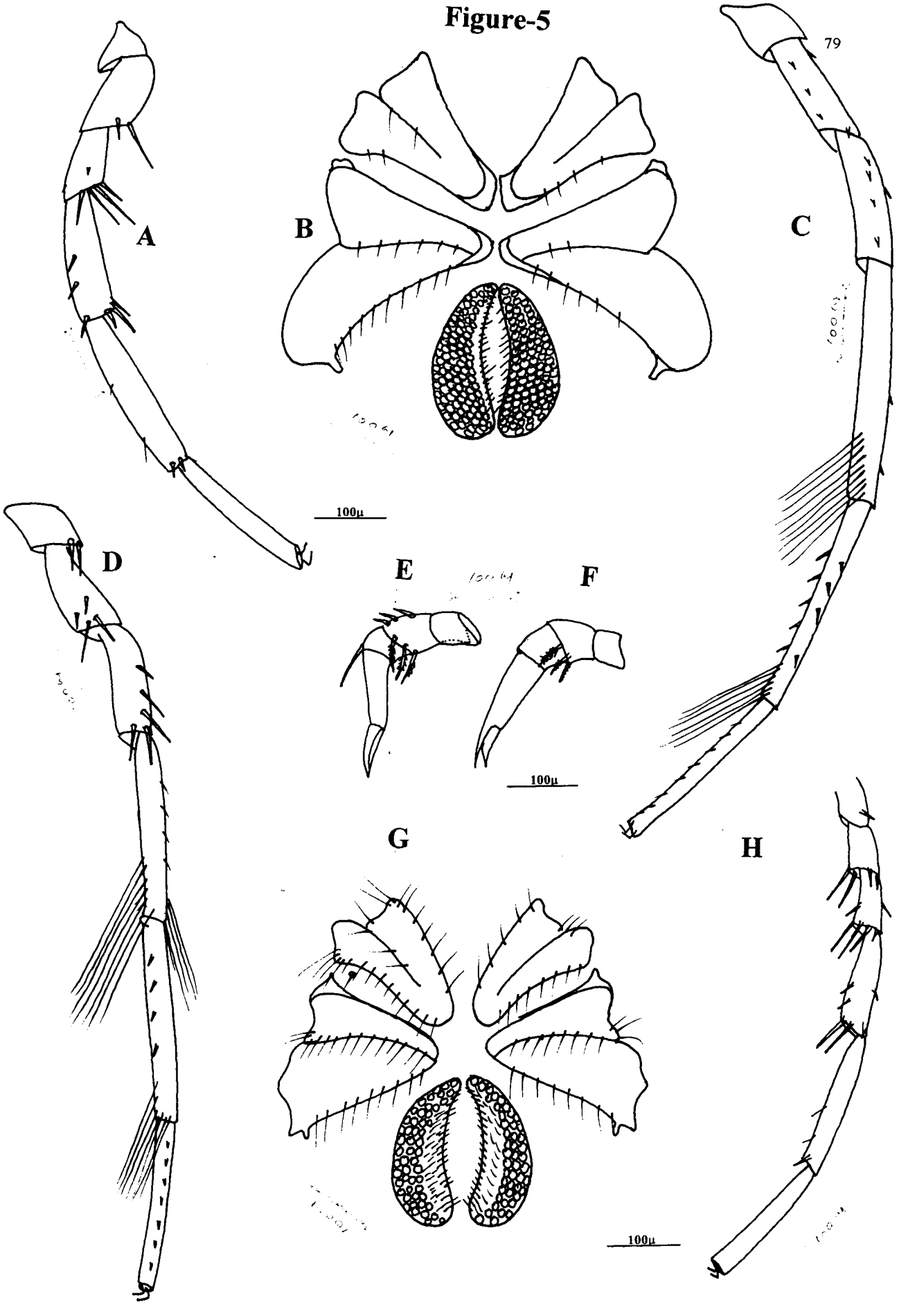
Male: Length of the body 731μ; length between anterior end of first coxae and posterior end of fourth coxae 452μ; length between median edge of first coxae and lateral edge of second coxae 200μ; length between median edge of third

Figure-5

Figures: A- H, *Hydrodroma monticola* Piersig

A. First leg female
B. Coxal region female
C. Fourth leg female
D. Fourth leg male
E. Palpal segments female
F. Palpal segments male
G. Coxal region male
H. First leg male

Figure-5



coxae and lateral edge of fourth coxae 288μ ; coxae bearing numerous long setae; first coxae with well developed median apodemes; genital field 240μ in length, 227μ in width; genital acetabula numerous; dorsal length of palpal segments: P-I, 39μ; P-II,66μ; P-III, 53μ; P-IV, 159μ; P-V, 66μ; dorsal lengths of the segments of the first leg: I-leg-1, 39μ; I-leg-2; 66μ; I-leg-3, 79μ; I-leg-4, 159μ; I-leg-5, 212μ; I-leg-6, 193μ; dorsal length of the segments of the fourth leg: IV-leg-1, 66μ; IV-leg-2, 119μ; IV-leg, 3 159μ; IV-leg-4, 266μ; IV-leg-5, 292μ; IV-leg-6, 252μ. Swimming hairs present.

Occurrence: Pond Astamichira , Kuthirakulum . Monastry pond. Collection No: 90 , 47 and 62

Habitat: Ponds

Distribution: Karnataka, Kerala, Tamil Nadu and Maharasta States in India, Sumatra, Java and Australia.

6) ***Hydrodroma tonapii* Cook 1967**

(Figure- 6. Figs: A – E. Plate-II. Photograph 2a)

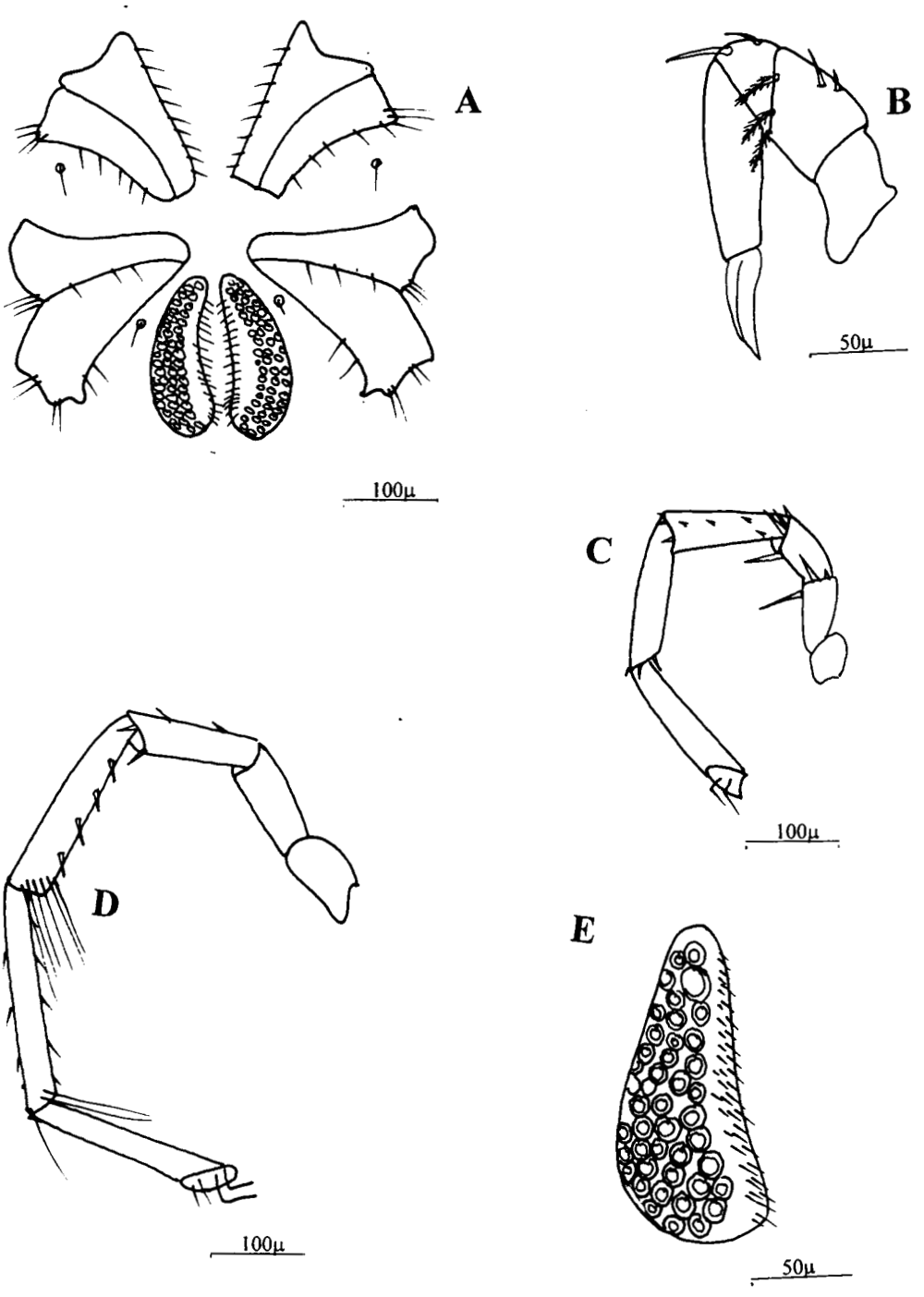
Male: Length of the body 665μ; length between anterior end of first coxae and posterior end of fourth coxae 425μ; length between median edge of first coxae and lateral edge of second coxae 206μ; length between median edge of third

Figure-6

Figures: A- E, *Hydrodroma tonapii* Cook

A. Coxal region male
B. Palpal segments male
C. First leg male
D. Fourth leg male
E. Half portion of the male genital field enlarged

Figure-6



coxae and lateral edge of fourth coxae 266μ; coxae bearing numerous long setae; first coxae with short median apodemes; genital field 172μ in length, 159μ in width; genital acetabula numerous; dorsal length of palpal segments: P-I, 39μ; P-II, 62μ; P-III, 40μ; P-IV, 150μ; P-V, 50μ; dorsal lengths of the segments of the first leg: I-leg-1, 39μ; I-leg-2; 66μ; I-leg-3, 79μ; I-leg-4,133μ; I-leg-5, 172μ; I-leg-6, 186μ; dorsal length of the segments of the fourth leg: IV-leg-1, 46μ; IV-leg-2, 106μ; IV-leg,3 133μ; IV-leg-4, 212μ; IV-leg-5, 239μ; IV-leg-6, 226μ. Swimming hairs present.

Female: Not observed

Occurrence: Nellikulum (Chimmini forest) Collection No: 88

Distribution: Kerala State in India.

Remarks: *Hydrodroma tonapii* male is reported from India for the first time. Relatively few setae on the coxal surfaces and relatively few swimming hairs on IV-leg-4 and 5 are characteristic.

Superfamily : LIBERTIOIDEA
Family : ANISITSIELLIDAE
Subfamily : NILOTONIINAE
Genus : NILOTONIA

7) ***Nilotonia* (Tadagatonia) *indica* Walter 1928**

(Figure- 7.Figs: A – D. Plate-1. Photograph 4b)

Male: Length of the body 864μ; dorsum soft; venter almost completely sclerotised, forming a ventral shield that extends to the sides of the body; length between anterior end of first coxae and posterior end of the fourth coxae 532μ; genital field in a bay formed by the fourth coxae genital field 172μ in length and 119μ in width; three pairs of genital acetabula; dorsal length of the segments of the palp: P-I, 33μ; P-II, 119μ; P-III, 66μ; P-IV, 146μ; P-V, 26μ; P-IV without setal tuburcles; dorsal length of the segments of first leg: I-leg-1, 53μ; I-leg-2, 79μ; I-leg-3, 79μ; I-leg-4, 106μ; I-leg-5, 146μ; I-leg-6,146μ ; dorsal length of the segments of the fourth leg: IV-leg-1, 106μ; IV-leg-2, 106μ; IV-leg-3, 133μ; IV-leg-4, 173μ; IV-leg-5, 186μ; IV-leg-6, 186μ;

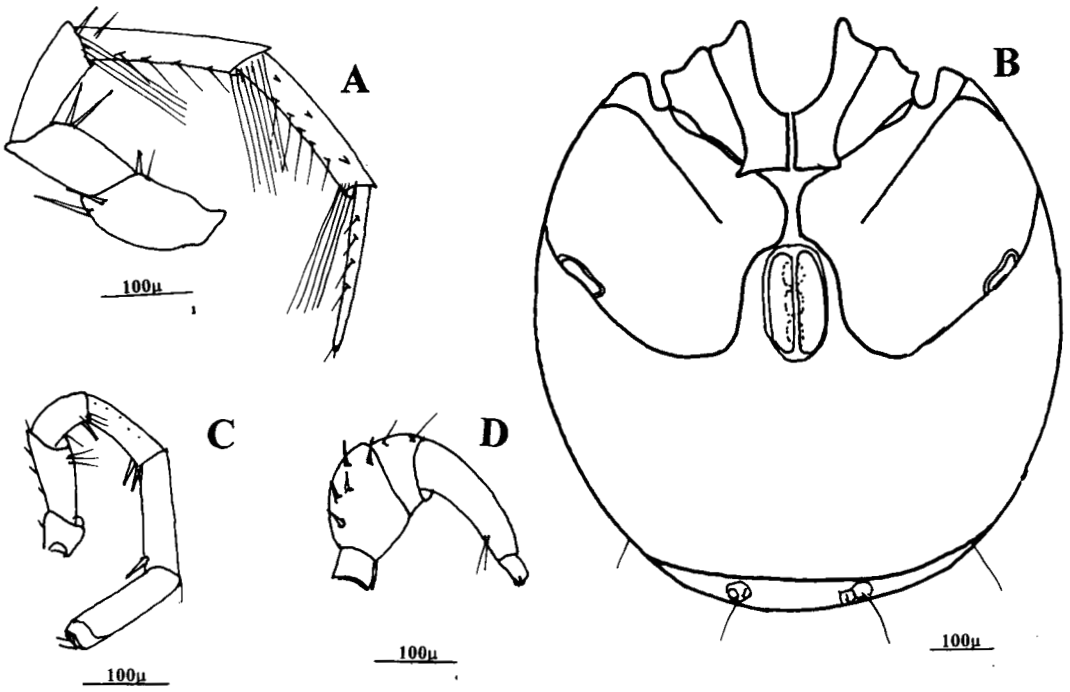
IV-leg-6 without claws or heavy setae; IV-leg – 3, IV-leg-4, IV-leg-5 each with three, nine and six swimming hairs respectively.

Figure-7

Figures: A- D, *Nilotonia* (Tadagatonia) *indica* Walter

A. Fourth leg female
B. Coxal region female
C. First leg female
D. Palpal segments female

Figure-7



Occurrence: Pullukulum, Chirakanthode pond, Kottakulum, and Stream puzhakal . Collection No: 97, 26, 45 and 118.

Habitat: Ponds and streams.

Distribution: Karnataka, Kerala.

Remarks: *Nilotonia indica* Walter was first reported by Walter from Calicut, Kerala (1928). This is the second report from Kerala.

Family : LEBERTIIDAE
Subfamily : OXINAE
Genus : OXUS

8) *Oxus pictus* **Daday 1898**

(Figure- 8. Figs: A – H. Plate-II. Photograph 2b)

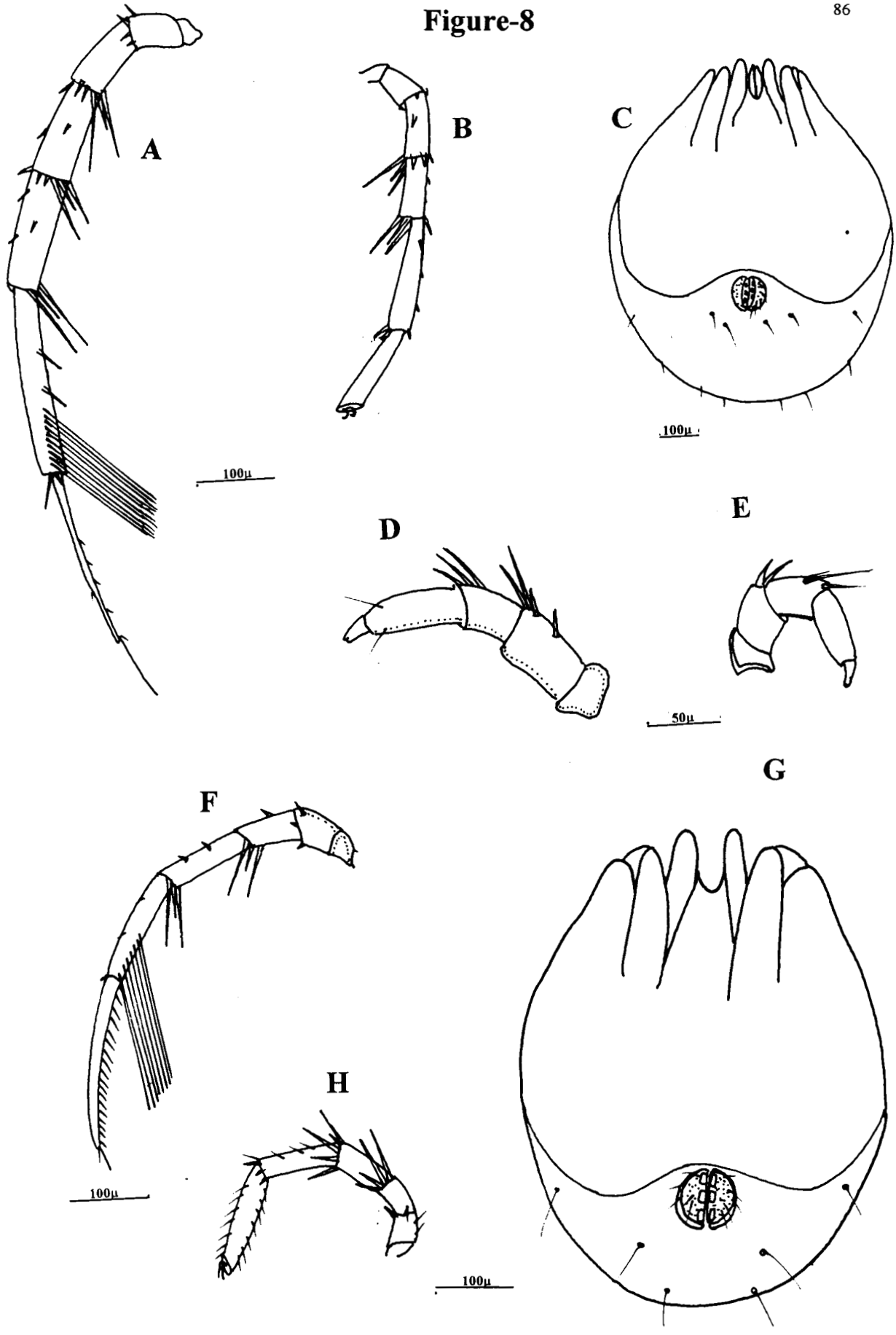
Female: Length of the body 997μ; length between anterior end of first coxae and posterior end of fourth coxae 731μ; genital field 159μ in length and 146μ in width; three pairs of genital acetabula; dorsal lengths of palpal segments: P-I, 35μ; P-II, 57μ; P-III, 55μ; P-IV, 75μ; P-V, 30μ ; dorsal length of segments of the first leg: I-leg-1, 26μ; I-leg-2, 53μ; I-leg-3, 73μ; I-leg-4, 73μ; I-leg-5, 159μ; I-leg-6, 146μ; dorsal length of the segments of the fourth

Figure-8

Figures: A- H, *Oxus pictus* Daday

A. Fourth leg female
B. First leg female
C. Coxal region female
D. Palpal segments female
E. Palpal segments male
F. Fourth leg male
G. Coxal region male
H. Frist leg male

Figure-8



leg: IV-leg-1, 53μ; IV-leg-2, 106μ; IV-leg-3, 136μ; IV-leg-4, 172μ; IV-leg-5, 252μ; IV-leg-6, 252μ; IV-leg-6 clawless and ending in two heavy setae; numerous swimming hairs present on II-leg-5, III-leg-5 and IV-leg-5.

Male: Length of the body731μ; length between anterior end of first coxae and posterior end of fourth coxae 598μ; genital field 87μ in length and 100μ in width; genital field at the posterior end of the fourth coxae; three pairs of genital acetabula; dorsal lengths of palpal segments: P-I, 30μ; P-II, 42μ; P-III, 45μ; P-IV, 62μ; P-V, 17μ ; dorsal length of segments of the first leg: I-leg-1, 26μ; I-leg-2, 39μ; I-leg-3, 59μ; I-leg-4, 93μ; I-leg-5, 119μ; I-leg-6, 150μ; dorsal length of the segments of the fourth leg: IV-leg-1, 30μ; IV-leg-2, 57μ; IV-leg-3, 96μ; IV-leg-4, 133μ; IV-leg-5, 146μ; IV-leg-6, 239μ; IV-leg-6 clawless and ending in two heavy setae; numerous swimming hairs present on II-leg-5, III-leg-5and IV-leg-5.

Occurrence: Paddy field Cheroor, paddy field Kolazhy and Kottakulam. Collection No: 72, 78 and45.

Habitat: Ponds and streams.

Distribution: Maharashtra , Kerala and Karnataka States in India. Ceylon.

Superfamily:HYGROBTOIDEA

Family :LIMNESIIDAE

Subfamily :LIMNESIINAE

Genus :LIMNESIA

9) ***Limnesia* (s.s) *lambengensis* Piersig 1906**

(Figure- 9. Figs: A – J. Plate-II. Photograph 3a-3b)

Female: Length of the body 1064μ; length between the anterior end of first coxae to the posterior end of fourth coxae 465μ; median boarders of first coxae very close together but not fused; capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 186μ in length , 133μ in width; three pairs of genital acetabula, dorsal length of the palpal segments: P-I, 26μ; P-II, 206μ; P-III, 106μ; P-IV, 266μ; P-V, 79μ; on the ventral side of P-II with a short proximally directed , heavy seta; seta on ventral side of P-II on a tubercle; ventral side of P-IV with small tubercles bearing two hair like setae; dorsal length of the segments of first leg: I-leg-1, 53μ; I-leg-2, 93μ; I-leg-3, 119μ; I-leg-4, 133μ; 1–leg-5, 159μ; I-leg-6, 146μ; dorsal length of segments of fourth leg: IV-leg-1, 133μ; IV-leg-2, 133μ; IV-leg-3, 172μ; IV-leg-4, 226μ; IV-leg-5, 266μ; IV-leg-6, 279μ; IV-leg without claws, but ending in a subterminal seta. Swimming hairs present on third and fourth legs.

Figure-9

Figures: A- J, *Limnesia* (S.S) *lembangensis* Piersig

A. First leg female
B. Coxal region female
C. Fourth leg female
D. Palpal segments male
E. Fourth leg male
F. Coxal region male
G. First leg male
H. Palpal segments female
I. Male genital field
J. Female genital field

Figure-9

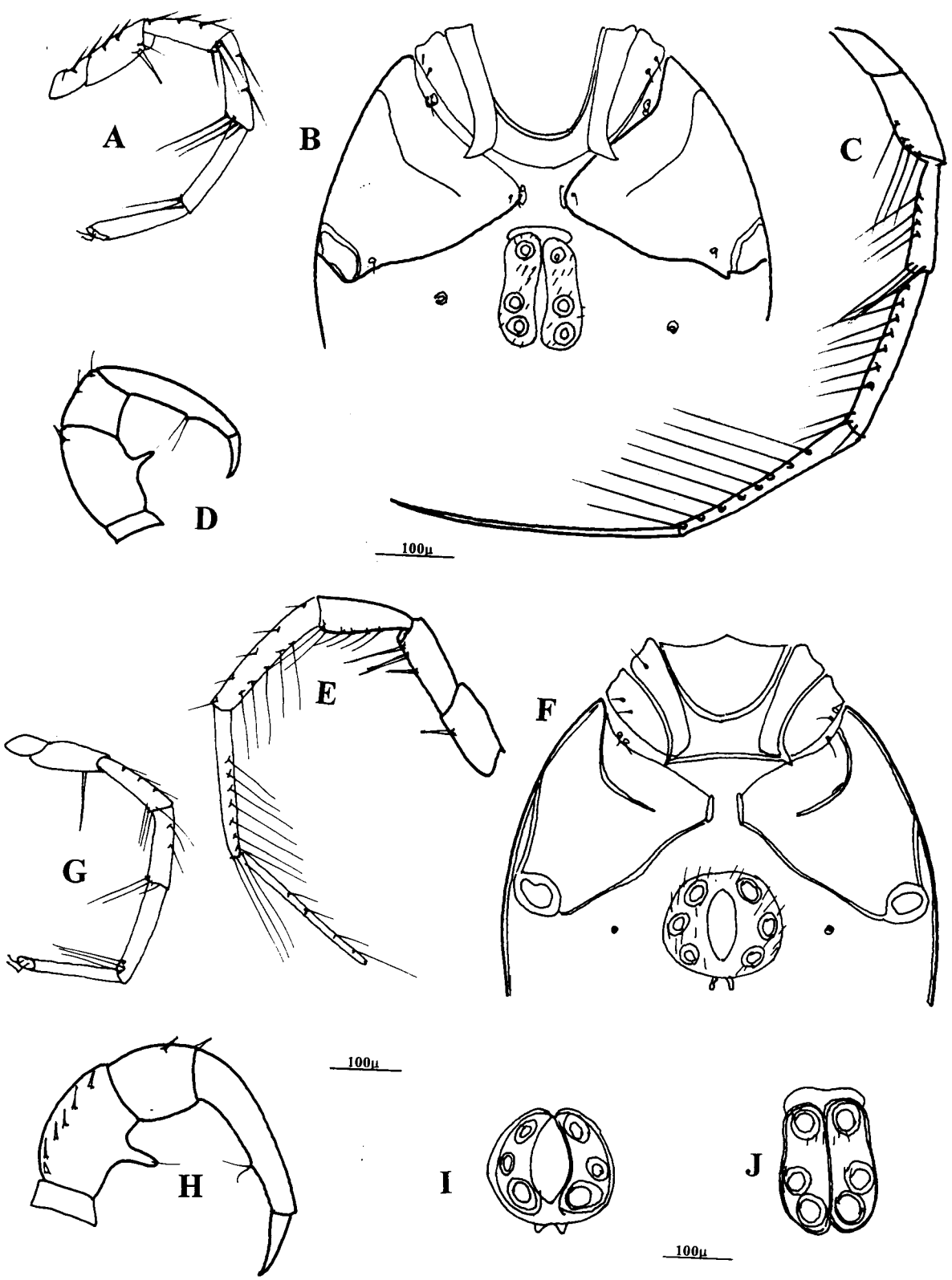


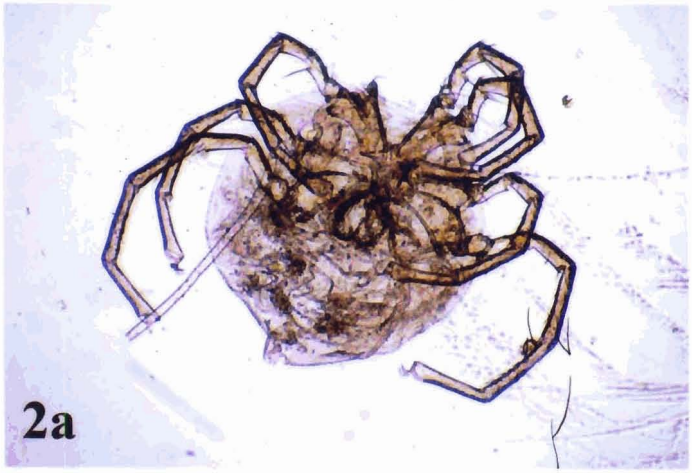
PLATE-II
(photos 1a-4b)

1a- *Hydrodroma monticola* female
1b- *Hydrodroma monticola* male
2a- *Hydrodroma tonapii* male
2b- *Oxus pictus* female
3a- *Limnesia lembangensis* female
3b- *Limnesia lembangensis* male
4a- *Limnesia lucifera uniseta* female
4b- *Limnesia lucifera uniseta* male

Plate : II

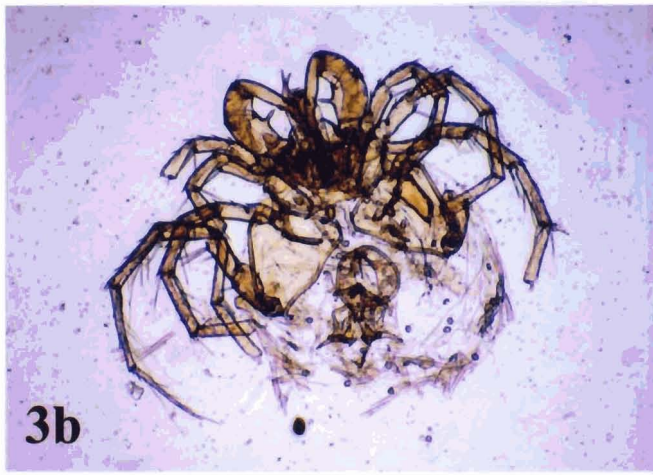

1a

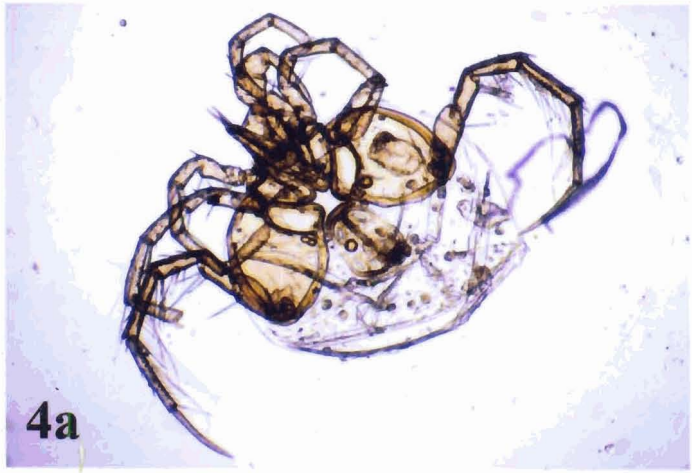

1b


2a


2b


3a


3b


4a


4b

Male: Length of the body 731μ;Length between the anterior end of first coxae to the posterior end of fourth coxae 400μ; Median boarders of first coxae connected by a bridge of secondary sclerotizatiom, capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 142μ in length, 159μ in width; three pairs of genital acetabula, these are somewhat triangular in shape; dorsal length of the palpal segments: P-I, 26μ; P-II, 146μ; P-III, 125μ; P-IV, 221μ; P-V, 71μ; on the ventral side of P-II with a short proximally directed, heavy seta; seta on ventral side of P-II on a tubercle; dorsal length of the segments of first leg: I-leg-1, 53μ; I-leg-2, 85μ; I-leg-3, 112μ; I-leg-4, 126μ; 1 –leg-5, 150μ; I-leg-6, 150μ; dorsal length of segments of fourth leg: IV-leg-1, 113μ; IV-leg-2, 113μ; IV-leg-3, 159μ; IV-leg-4, 210μ; IV-leg-5, 235μ; IV-leg-6, 220μ; IV-leg without claws, but ending in a subterminal seta. Swimming hairs present on third and fourth legs.

Occurrence: Anavayal, irrigation canal Chelad, Canal Venpalavattom, Chanthamarakulam, Chittoor pond, Elanjikulam pond, Feroke pond, Kottakulam pond, Mattom pond, Monatry pond, Muslim Pallikulam, paddy field Kaloor, paddy field Pananghode, paddy field Mulamthuruthy, Puzhakal stream, Oochithrakulum, Chovoore pond, Perinkulam, Mulloore kayal, Chirakathode, Edanad, Kuttikavue, Pullukulum, Vadakkanchery, Aluva puzha, Muriyankulum, Ayamana pond, pond Astamichira, paddy field Gourispattom, paddy field

Changanassery, pond near St.Mary's College, Vyanad. Peringhamkulum Parabra, Changhamkulaghara pond, Koratty. Collection No: 3, 13, 16, 19, 32, 33, 45, 57, 62, 64, 71, 74, 79, 28, 118, 70, 22, 85, 14, 26, 129, 48, 97, 137, 2, 63, 6, 90, 77, 75, 89, 84 and 17.

Habitat: Ponds, streams and paddy fields

Distribution: Maharastra, Rajasthan, Uttar Pradesh, Karnataka, Tamil Nadu and Kerala States in India. Thailand, Singapore, Frormosa, Indonesia and Australia.

10) ***Limnesia* (s.s) *lucifera uniseta* Cook 1967**

(Figure-10. Figs: A – H. Plate-II. Photograph 4a-4b)

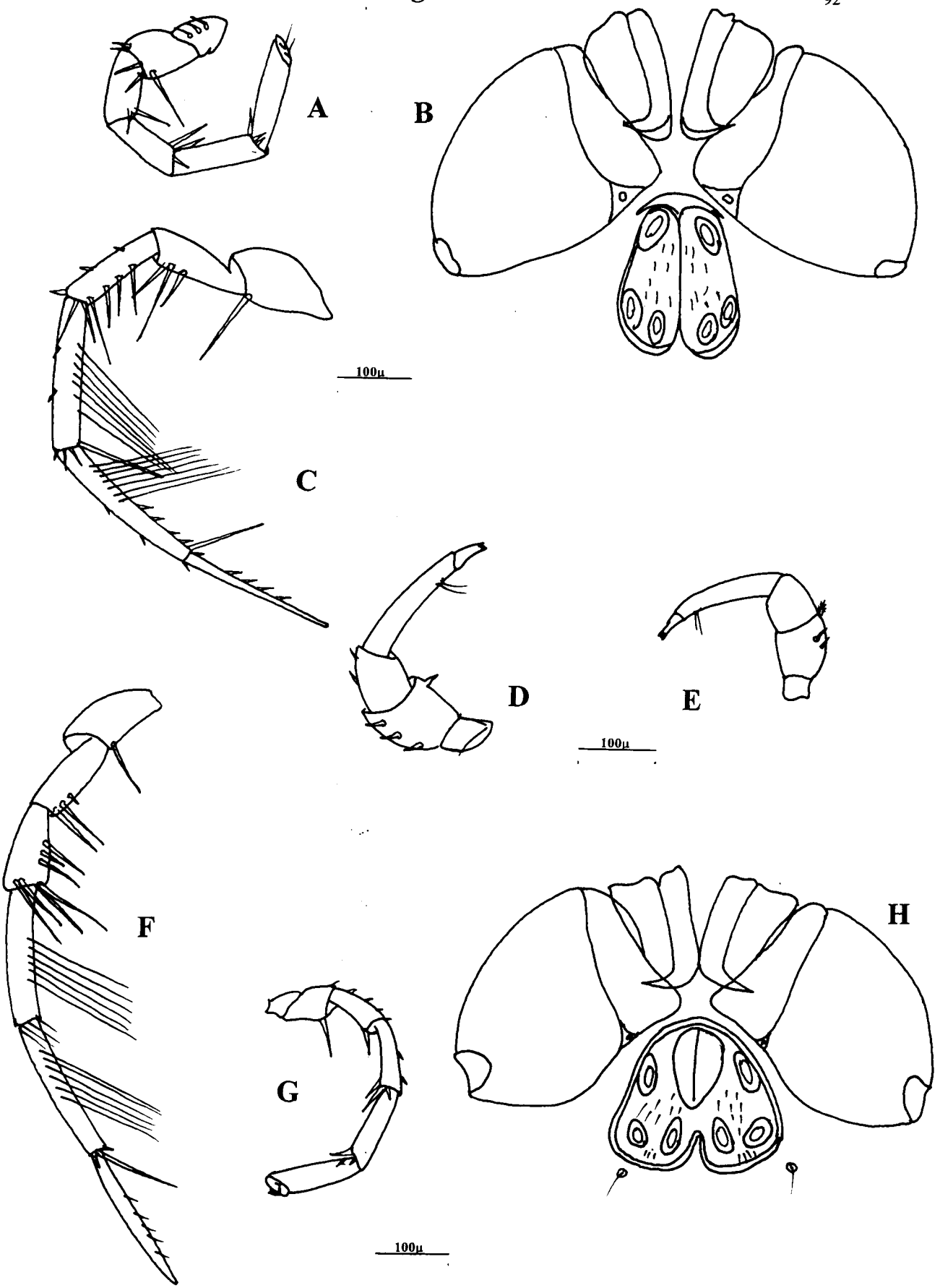
Female: Length of the body 997μ; length between the anterior end of first coxae to the posterior end of fourth coxae 452μ; median boarders of first coxae very close together but not fused; capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 239μ in length, 172μ in width; three pairs of genital acetabula, one anterior and the other two posterior lying side by side; dorsal length of the palpal segments: P-I, 26μ; P-II, 106μ; P-III, 86μ; P-IV, 159μ; P-V, 39μ; on the ventral side of P-II with a short proximally directed , heavy seta; seta on ventral side of P-II not on a tubercle;

Figure-10

Figures: A- H, *Limnesia* (S.S) *lucifera uniseta* Cook

A. First leg female
B. Coxal region female
C. Fourth leg female
D. Palpal segments female
E. Palpal segments male
F. Fourth leg male
G. First leg male
H. Coxal region male

Figure-10



ventral side of P-IV without tubercles but setae present; dorsal length of the segments of first leg: I-leg-1, 66μ; I-leg-2, 66μ; I-leg-3, 99μ; I-leg-4, 119μ; I-leg-5, 133μ; I-leg-6, 146μ; dorsal length of segments of fourth leg: IV-leg-1, 119μ; IV-leg-2, 119μ; IV-leg-3, 159μ; IV-leg-4, 212μ; IV-leg-5, 239μ; IV-leg-6, 226μ; IV-leg without claws, but ending in a subterminal seta. Swimming hairs present on third and fourth legs.

Male: Length of the body 798μ; length between the anterior end of first coxae to the posterior end of fourth coxae 425μ; median boarders of first coxae very close together but not fused; capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 212μ in length, 226μ in width; these are somewhat triangular in shape; three pairs of genital acetabula; posterior margin of the genital field with a deep median notch; dorsal length of the palpal segments: P-I, 26μ; P-II, 73μ; P-III, 79μ; P-IV, 133μ; P-V, 39μ; on the ventral side of P-II with a short proximally directed , heavy seta; seta on ventral side of P-II not on a tubercle; ventral side of P-IV without tubercles but setae present; dorsal length of the segments of first leg: I-leg-1, 33μ; I-leg-2, 53μ; I-leg-3, 66μ; I-leg-4, 93μ; 1 –leg-5, 106μ; I-leg-6, 119μ; dorsal length of segments of fourth leg: IV-leg-1, 119μ; IV-leg-2, 106μ; IV-leg-3, 133μ; IV-leg-4, 172μ;

IV-leg-5, 199μ; IV-leg-6, 199μ; IV-leg without claws, but ending in a subterminal seta. Swimming hairs present on third and fourth legs.

Occurrence: Pond, Chimmini forest. Collection No: 88

Habitat: Ponds

Distribution: Maharastra and Kerala States in India.

Remarks: *Limnesia lucifera uniseta* can be easily distinguished from other species by the triangular shaped field and the structure of the coxal region. Female *of Limnesia lucifera uniseta* is reported for the first time. Male *Limnesia lucifera uniseta* is also reporting for the first time from Kerala State.

11) ***Limnesia buruensis* Imamura**

(Figure-11.Figs: A – J. Plate-III. Photograph 1a-1b)

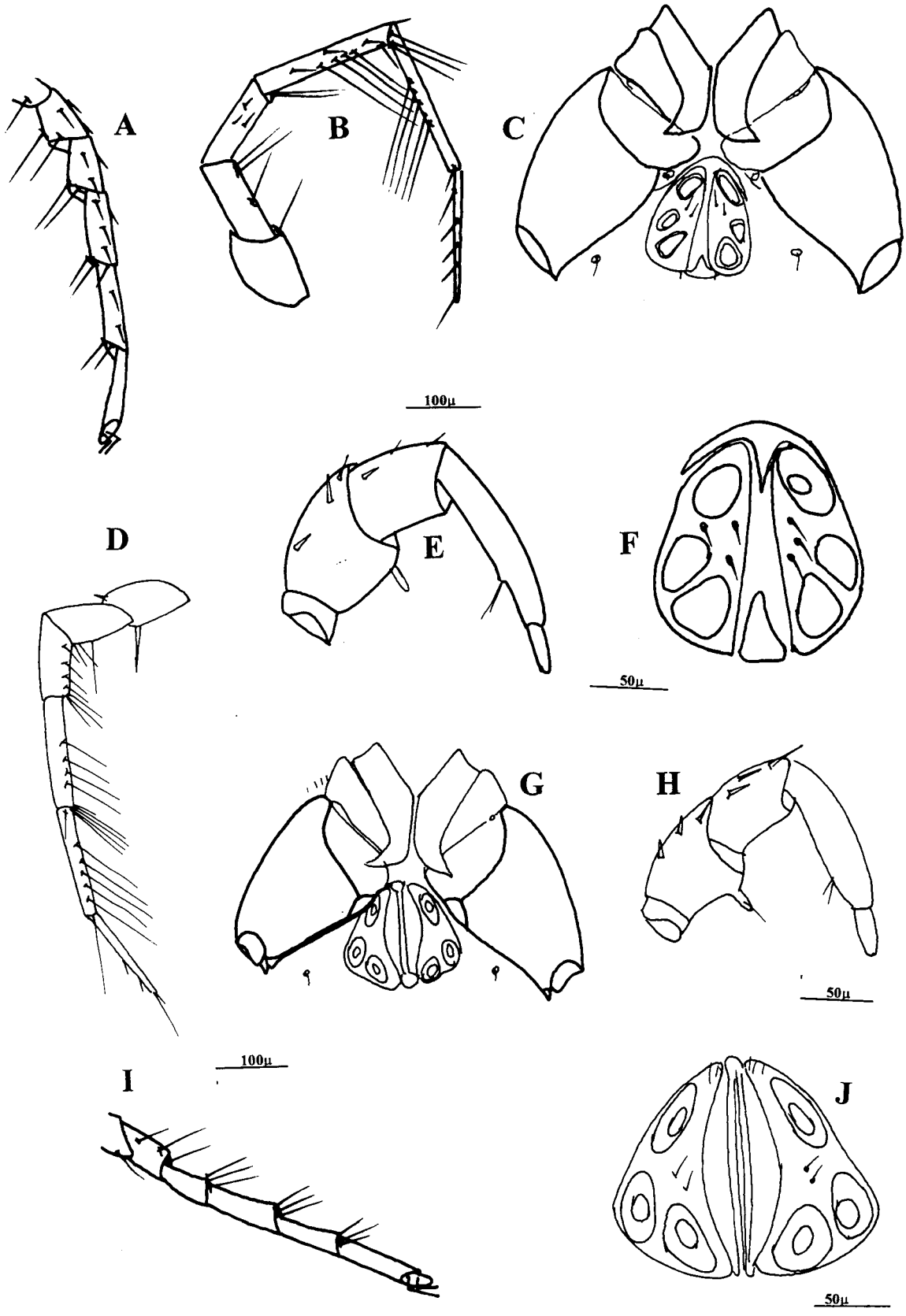
Female: Length of the body 665μ; length between the anterior end of first coxae to the posterior end of fourth coxae 425μ; median boarders of first coxae very close together but not fused; capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 159μ in length, 133μ in width; three pairs of genital acetabula, these are somewhat triangular in shape; dorsal length of the palpal segments: P-I, 17μ; P-II, 86μ; P-III, 80μ; P-IV, 132μ; P-V, 37; dorsal length of the segments of first leg: I-leg-1, 39μ; I-leg-2, 53μ;

Figure-11

Figures: A- J, *Limnesia buruensis* Imamura

A First leg female
B Fourth leg female
C Coxal region female
D Fourth leg male
E Palpal segments female
F Female genital field G Coxal region male
H Palpal segments male
I First leg male
J Male genital field

Figure- 11



I-leg-3, 79μ; I-leg-4, 93μ; 1–leg-5, 106μ; I-leg-6, 119μ; dorsal length of segments of fourth leg: IV-leg-1, 79μ; IV-leg-2, 93μ; IV-leg-3, 133μ; IV-leg-4, 178μ; IV-leg-5, 199μ; IV-leg-6, 186μ; IV-leg without claws, but ending in a subterminal seta 79μ in length.

Male: Length of the body 638μ; length between the anterior end of first coxae to the posterior end of fourth coxae 385μ; median boarders of first coxae very close together but not fused; capitular bay V-shaped, apodemes of the first coxal group extending slightly posterior; genital field 146μ in length, 172μ in width; three pairs of genital acetabula, these are somewhat triangular in shape; dorsal length of the palpal segments: P-I, 20μ; P-II, 75μ; P-III, 75μ; P-IV, 117μ; P-V, 30; dorsal length of the segments of first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 66μ; I-leg-4, 84μ; 1–leg-5, 93μ; I-leg-6, 112μ; dorsal length of segments of fourth leg: IV-leg-1, 79μ; IV-leg-2, 79μ; IV-leg-3, 106μ; IV-leg-4, 146μ; IV-leg-5, 159μ; IV-leg-6, 159μ.

Occurrence: Check dam, Padagiri Estate, Nallyampathy. Collection No: 23

Distribution: Kerala State in India, Japan, South China and Indonesia.

Remarks: *Limnesia buruensis* is a new report from India. The specimens collected from Nellyiampathy hills.

12) ***Limnesia thobiasi*** **n.sp.**

(Figure-12.Figs: A – H. Plate-III. Photograph 2a-2b)

Female: Length of the body 598μ; length between the anterior end of first coxae to the posterior end of fourth coxae 266μ; median boarders of first coxae very close together but not fused; apodemes of the first coxal group extending slightly posterior; genital field 172μ in length, 106μ in width; three pairs of genital acetabula, dorsal length of the palpal segments: P-I, 25μ; P-II, 87μ; P-III, 62μ; P-IV, 110μ; P-V, 25; dorsal length of the segments of first leg: I-leg-1, 25μ; I-leg-2, 39μ; I-leg-3, 66μ; I-leg-4, 66μ; 1–leg-5, 73μ; I-leg-6, 93μ; dorsal length of segments of fourth leg: IV-leg-1, 60μ; IV-leg-2, 79μ; IV-leg-3, 93μ; IV-leg-4, 119μ; IV-leg-5, 146μ; IV-leg-6, 119μ; IV-leg without claws, but ending in a subterminal seta of 66μ in length.

Male: Length of the body 478μ; length between the anterior end of first coxae to the posterior end of fourth coxae 232μ; apodemes of the first coxal group extending slightly posterior; genital field 106μ in length, 119μ in width; three pairs of genital acetabula, these are somewhat triangular in shape; dorsal length of the palpal segments: P-I, 20μ; P-II, 70μ; P-III, 50μ; P-IV, 87μ; P-V, 25; dorsal length of the segments of first leg: I-leg-1, 26μ; I-leg-2, 32μ; I-leg-3, 53μ; I-leg-4, 59μ; 1–leg-5, 66μ; I-leg-6, 79μ; dorsal length of segments of fourth leg:

Figure-12

Figures: A- H, *Limnesia thobiasi* n.sp

A. Coxal region male
B. Coxal region female
C. Palpal segments male
D. Palpal segments female
E. Fourth leg male
F. First leg male
G. First leg female
H. Fourth leg female

Figure-12

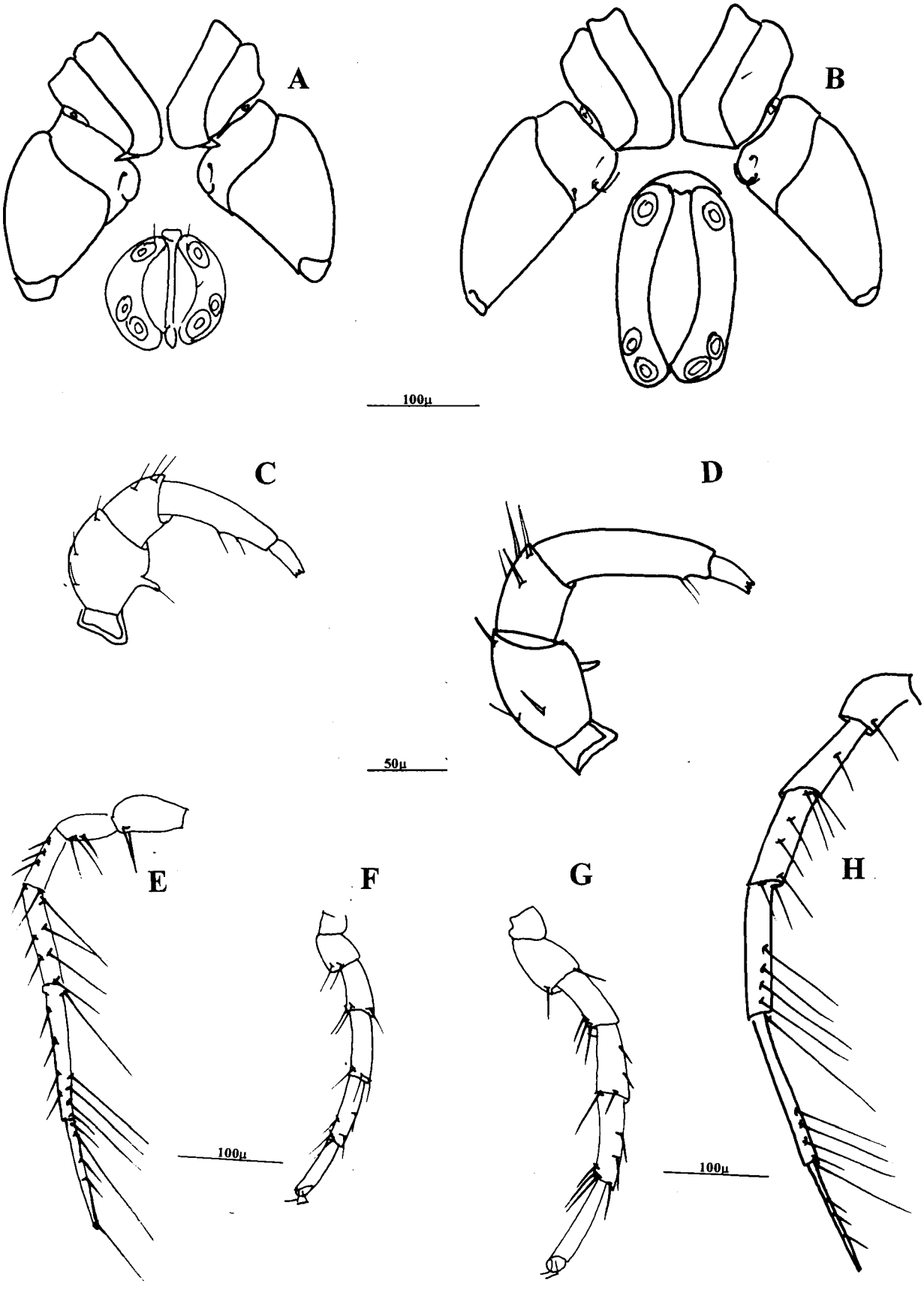


PLATE- III
(Photos 1a-4b)

1a- *Limnesia buruensis* female
1b- *Limnesia buruensis* male
2a- *Limnesia thobiasi* female
2b- *Limnesia thobiasi* male
3a- *Hygrobates dadayi* female
3b- *Hygrobates dadayi* male
4a- *Hygrobates hamatus bharatensis* female
4b- *Hygrobates hamatus bharatensis* male

Plate : III


1a


1b


2a


2b


3a


3b


4a


4b

IV-leg-1, 39μ; IV-leg-2, 53μ; IV-leg-3, 66μ; IV-leg-4, 99μ; IV-leg-5, 106μ; IV-leg-6, 100μ.; IV-leg without claws, but ending in a subterminal seta of 53μ in length.

Occurrence: Well, Kumarakam. Collection No: 142

Habitat: Well

Distribution: Kerala

Remarks: This new species shows similarities to *L.patens* Viets and *L.lembangensis* in the case of number of genital acetabula. All of them have three genital acetabula. But the genital acetabula of *L.thobiasi* female is conspicuously slender and elongated compared to its body size. The P-II in the case of *L. lembangensis* bears long narrow setal tubercle bearing a short spine like setae whereas in *L. thobiasi* P-II is with a short setal tubercle.

Type: A holotype female : INDIA: Kerala; Kumarakam, 15-01-93 in a well, Coll: John. C.C; several paratype slides with collection data same as type.

Family: HYGROBATIDAE
Subfamily: HYGROBATINAE
Genus: HYGROBATES

13) ***Hygrobates* (s.s) *dadayi* Cook 1967**

(Figure-13. Figs: A – H. Plate-III. Photograph 3a-3b)

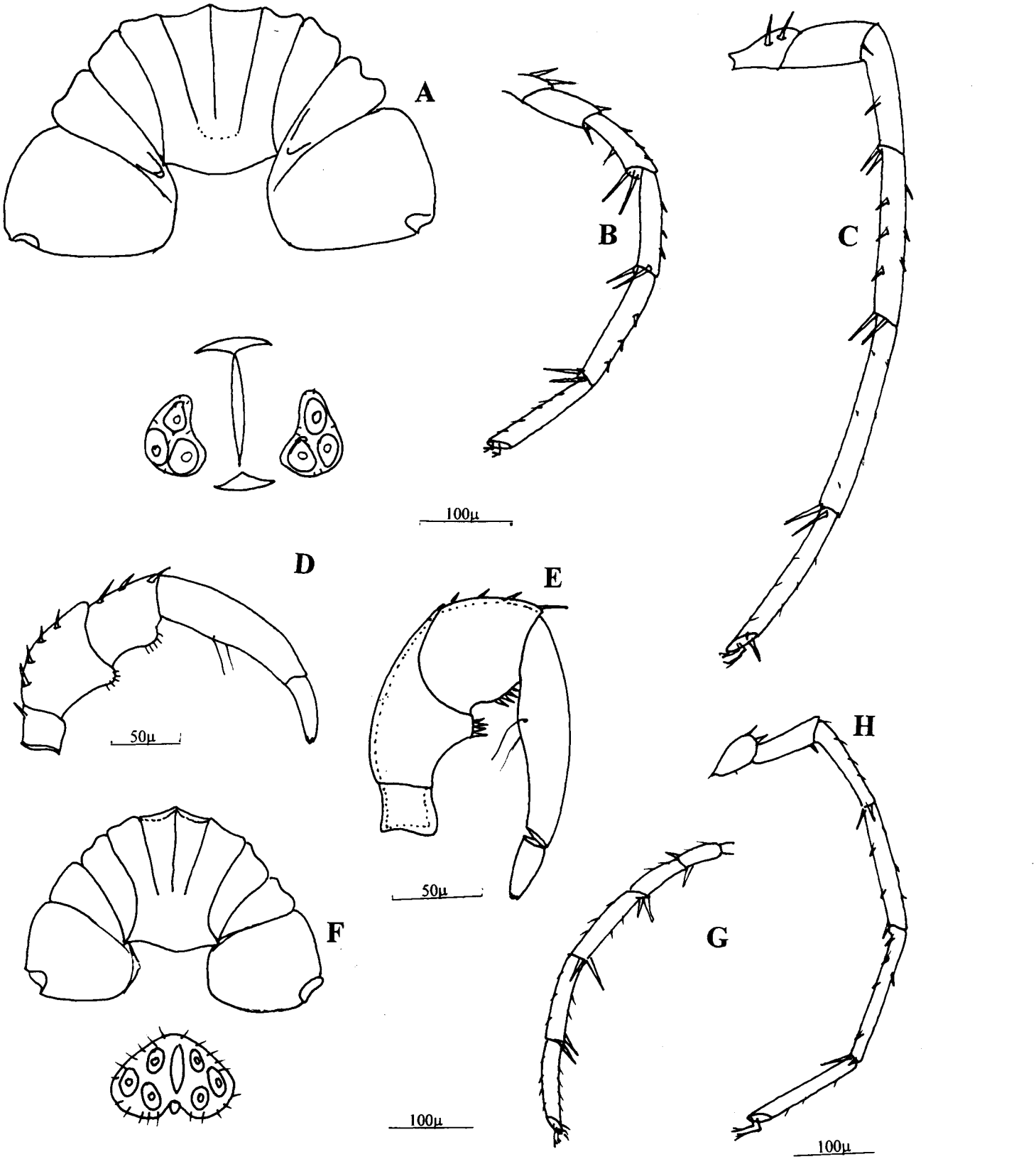
Female: Length of the body 598μ; length between anterior end of capitulum and posterior end of fourth coxae 279μ; dorsum soft, epimeroglandularia one fused with the second coxae; apodemes between third and fourth coxae extending to the median margin; posterior margins of the fourth coxae without well developed apodemes; acetabular plates relatively small; three pairs of genital acetabula, acetabula occupying most of the area of the acetabular plates. Dorsal length of palpal segments P-1, 29μ; P-II, 79μ; P-III, 60μ; P-IV, 106μ; P-V, 46μ; distoventral portion of P-II bearing numerous, small papellae; distoventral portion of P-III also bearing numerous papillae; dorsal length of segments of the first leg: I-leg-1, 46μ; I-leg-2, 53μ; I-leg-3, 79μ; I-leg-4, 106μ; I-leg-5, 119; I-leg-6, 119μ; dorsal length of segments of fourth leg: IV-leg-1,66μ; IV-leg-2, 79μ; IV-leg-3, 133μ; IV-leg-4, 186; IV-leg-5, 199μ; IV-leg-6, 166μ; swimming hairs absent .

Figure-13

Figures: A- H, *Hygrobates* (S.S) *dadayi* Cook

A. Coxal region female
B. First leg female
C. Fourth leg female
D. Palpal segments female
E. Palpal segments male
F. Coxal region male
G. First leg male
H. Fourth leg male

Figure-13



Male: Length of the body 465μ; length between anterior end of capitulum and posterior end of fourth coxae 246μ; dorsum soft, coxal region similar to female; genital field 104μ in length and 133μ in width; three pairs of acetabula. Dorsal length of palpal segments P-1, 25μ; P-II, 80μ; P-III, 47μ; P-IV, 106μ; P-V, 40μ; distoventral portion of P-II bearing numerous, small papellae; distoventral portion of P-III also bearing numerous papillae; dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 79μ; I-leg-4, 106μ; I-leg-5, 119; I-leg-6, 119μ; dorsal length of segments of fourth leg: IV-leg-1, 66μ; IV-leg-2, 79μ; IV-leg-3, 93μ; IV-leg-4, 146; IV-leg-5, 159μ; IV-leg-6, 146μ; swimming hairs absent.

Occurrence: Edanad, Peringhakulum Parambra. Devikulam lake and Anavayal. Collection No: 138, 85, 29 and 3.

Habitat: Ponds and lakes

Distribution: Maharastra, Karnataka and Kerala States in India.

Remarks: *Hygobates dadayi* is reported from Kerala for the first time

14) ***Hygrobates* (s.s) *hamatus bharatensis* Cook 1967**

(Figure-14. Figs: A – J. Plate-III. Photograph 4a-4b)

Female: Length of the body 864μ; length between anterior end of capitulum and posterior end of fourth coxae 372μ; dorsum soft, epimerogladularia one fused with the second coxae; suture line between third and fourth coxae complete; posterior margin of fourth coxae with small projections; acetabular plates relatively long; three pairs of acetabula. Dorsal length of palpal segments P-1, 26μ; P-II, 106μ; P-III, 93μ; P-IV, 159μ; P-V, 33μ; distoventral portion of P-II and P-III bearing numerous, small papellae; dorsal length of segments of the first leg: I-leg-1, 53μ; I-leg-2, 93μ; I-leg-3, 146μ; I-leg-4, 186μ; I-leg-5, 199; I-leg-6, 159μ; dorsal length of segments of fourth leg: IV-leg-1,133μ; IV-leg-2, 146μ; IV-leg-3, 212μ; IV-leg-4, 266; IV-leg-5, 319μ; IV-leg-6, 266μ; swimming hairs absent .

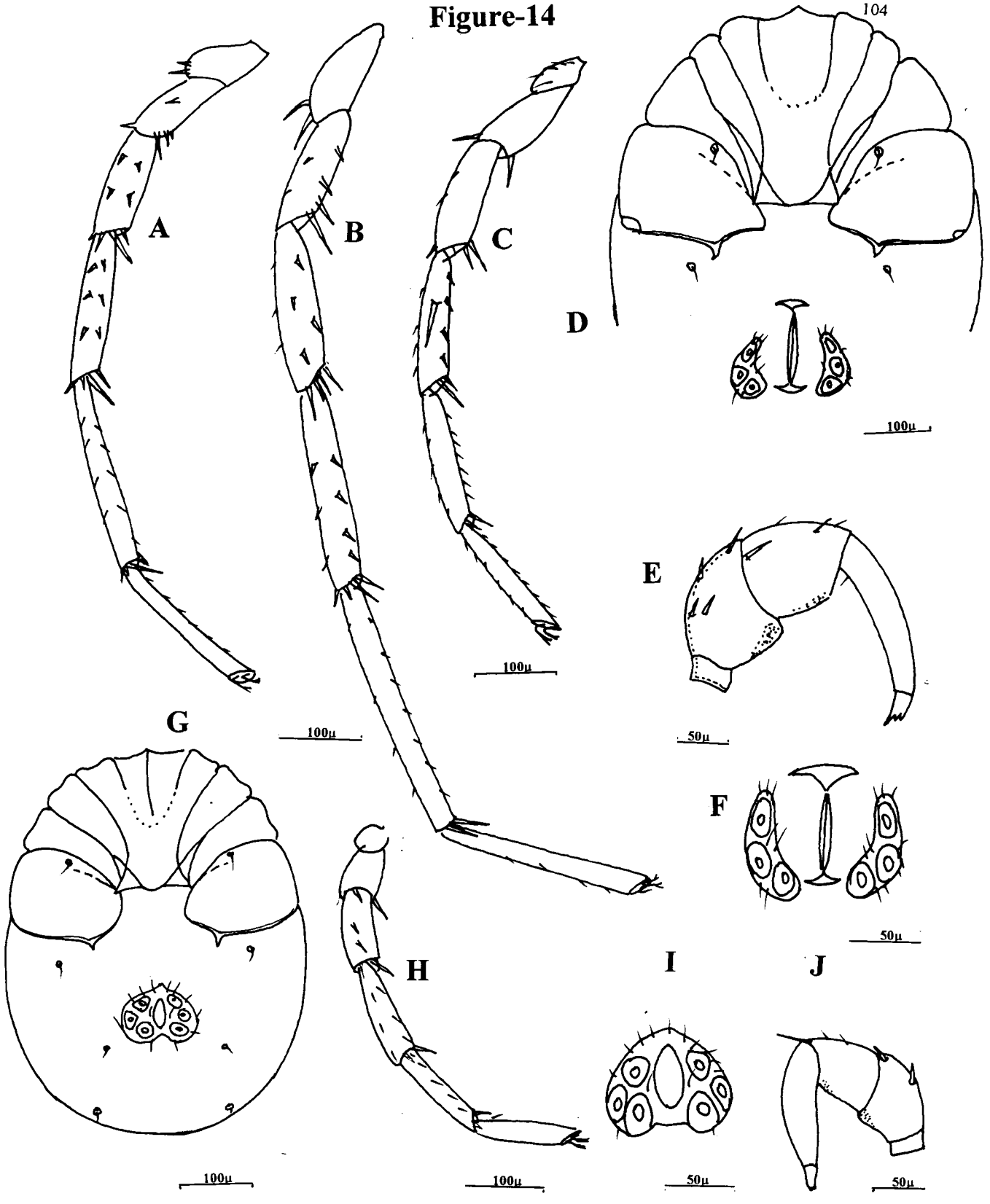
Male: Length of the body 492μ; length between anterior end of capitulum and posterior end of fourth coxae 266μ; dorsum soft, capitulum relatively large and broadly fused at the base; genital field 78μ in length and 93μ in width; three pairs of genital aectabula; anterior end of genital field slightly projecting; epimeroglandularia fused with the second coxae; coxal area similar to that of female; Dorsal length of palpal segments P-1, 17μ; P-II , 87μ; P-III, 75μ;

Figure-14

Figures: A- J, *Hygrobates* (S.S) *hamatus bharatensis* Cook

A. Fourth leg male
B. Fourth leg female
C. First leg female
D. Coxal region female
E. Palpal segments female
F. Female genital field
G. Coxal region male
H. First leg male
I. Male genital field
J. Palpal segments male

Figure-14



P-IV, 112μ; P-V, 25μ; distoventral portion of P-II bearing numerous, small papellae; distoventral portion of P-III also bearing numerous papillae; dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 79μ; I-leg-4, 133μ; I-leg-5, 133; I-leg-6, 133μ; dorsal length of segments of fourth leg: IV-leg-1,53μ; IV-leg-2, 93μ; IV-leg-3, 133μ; IV-leg-4, 172; IV-leg-5, 226μ; IV-leg-6, 186μ; swimming hairs absent .

Occurrence: Lower check dam, Nellyampathy, Check dam Padagiri Estate Nellyampathy, Stream Kodakkallu, Perighamkulam, Edanad pond. Collection No: 50, 23, 119, 84 and 94.

Habitat: Streams and Ponds

Distribution: Maharatra, Madhya Pradesh Karnataka, Tamil Nadu and Kerala States in India.

15) ***Hygrobates*** **(Monobates)** ***keralensis*** **Cook 1967**

(Figure-15.Figs: A – H. Plate-IV. Photograph 1a-1b)

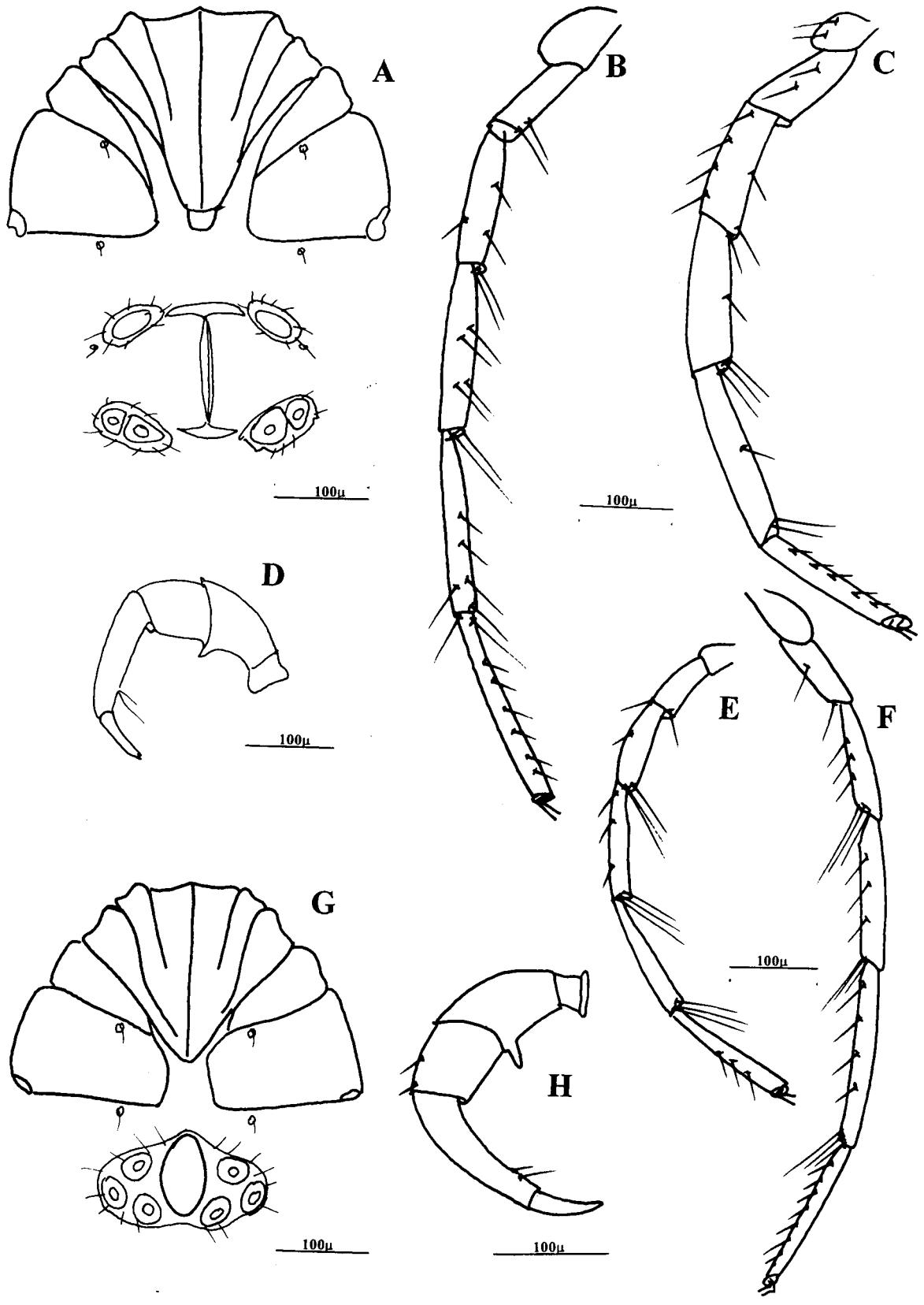
Female: Length of the body 864μ; length between anterior end of capitulum and posterior end of fourth coxae 332μ; dorsum soft, epimerogladularia one fused with the second coxae; suture line between third and fourth coxae complete; posterior margin of fourth coxae without projections;

Figure-15

Figures: A- H, *Hygrobates keralensis* Cook

A. Coxal region female
B. Fourth leg female
C. First leg female
D. Palpal segments female
E. First leg male
F. Fourth leg male
G. Coxal region male
H. Palpal segments male

Figure-15



genital field 172μ in length and 226μ in width; three pairs of acetabula; first acetabula separate but with associated seate; posterior two acetabula on each side located on a common plate; Dorsal length of palpal segments, P-1, 26μ; P-II, 133μ; P-III, 93μ; P-IV, 166μ; P-V, 66μ; distoventral portion of P-II drawn out into a tubercle; P-III bearing numerous, small papellae; dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 79μ; I-leg-3, 106μ; I-leg-4, 159μ; I-leg-5, 159; I-leg-6, 159μ; dorsal length of segments of fourth leg: IV-leg-1,106μ; IV-leg-2, 119μ; IV-leg-3, 172μ; IV-leg-4, 199; IV-leg-5, 212μ; IV-leg-6, 212μ; swimming hairs absent .

Male: Length of the body 598μ; length between anterior end of capitulum and posterior end of fourth coxae 279μ; dorsum soft, first coxae fused medially; epimeroglandularia one fused with the second coxae; posterior margins of the fourth coxae without projections; genital field much wider then long; genital field 133μ in length and 226μ in width; three pairs of genital aectabua; Dorsal length of palpal segments P-1, 28μ; P-II, 113μ; P-III, 79μ; P-IV, 146μ; P-V, 53μ; distoventral portion of P-II drawn out into a tubercle; ventral side of P-III with several small papellae; dorsal length of segments of the first leg: I-leg-1, 39μ; I-leg-2, 67μ; I-leg-3, 106μ; I-leg-4, 146μ; I-leg-5, 152; I-leg-6, 159μ; dorsal length of segments of fourth leg: IV-leg-1,79μ; IV-leg-2, 106μ; IV-leg-3, 146μ; IV-leg-4, 186; IV-leg-5, 199μ; IV-leg-6, 186μ; swimming hairs absent.

Occurrence: Peringhamkulum, Stream AVT Estate, Nellyampathy. Collection No: 84 and 107

Habitat: Ponds and Streams.

Distribution: Kerala State India. Sumatra.

Remarks: *Hygrobates keralensis* female, is reported for the first time from India. The specimens collected from a pond near Parambra and also from Nelliyampathy

16) ***Hygrobates* (Monobates) *karekari* Cook 1967**

(Figure-16. Figs: A – H. Plate-IV. Photograph 1a-1b)

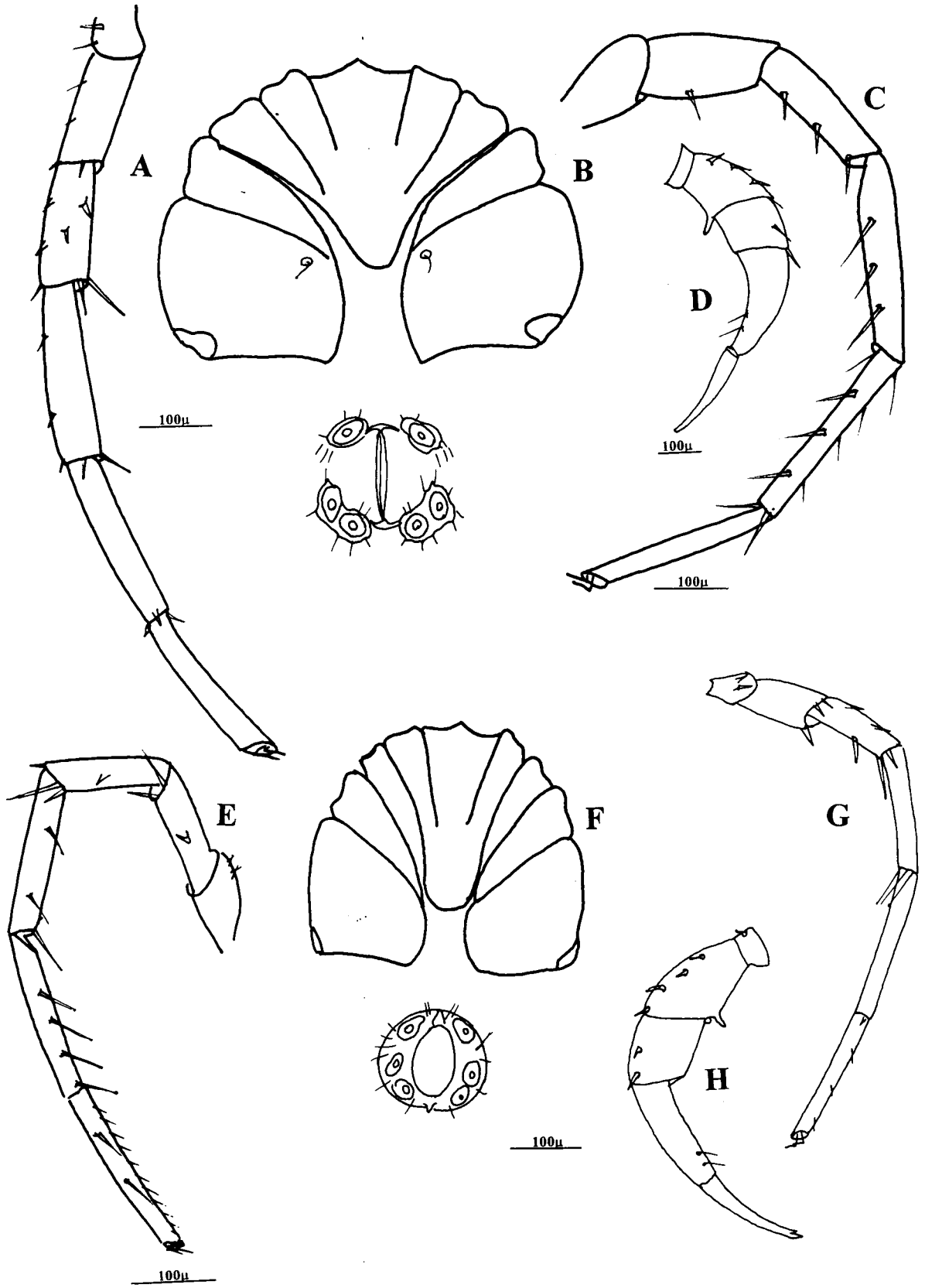
Female: Length of the body 824μ; length between anterior end of capitulum and posterior end of fourth coxae 385μ; dorsum soft, epimerogladularia one fused with the second coxae; suture line between third and fourth coxae complete; genital field 172μ; in length and 186μ in width; acetabular plates incomplete; three pairs of acetabula; first acetabula separate but with associated seate; posterior two acetabula on each side located on a common plate; dorsal length of palpal segments, P-1, 33μ; P-II, 186μ; P-III, 119μ; P-IV, 226μ; P-V, 186μ; distoventral portion of P-II drawn out into a tubercle; P-V comparatively long and slender; dorsal length of segments of the first leg: I-leg-1, 33μ;

Figure-16

Figures: A- H, *Hygrobates karekari* Cook

A. First leg female
B. Coxal region female
C. Fourth leg female
D. Palpal segments female
E. Fourth leg male
F. Coxal region male
G. First leg male
H. Palpal segments male

Figure-16



I-leg-2, 146μ; I-leg-3, 146μ; I-leg-4, 212μ; I-leg-5, 212; I-leg-6, 212μ; dorsal length of segments of fourth leg: IV-leg-1, 93μ; IV-leg-2,159μ; IV-leg-3, 192μ; IV-leg-4, 279; IV-leg-5, 266μ; IV-leg-6, 266μ; swimming hairs absent .

Male: Length of the body 585μ; length between anterior end of capitulum and posterior end of fourth coxae 325μ; dorsum soft, first coxae fused medially;epimeroglandularia one fused with the second coxae; suture line between third and fourth coxae complete; genital field 133μ in length and 146μ in width; three pairs of genital aectabula; gonopore relatively large, 93μ in length and67μ in width; Dorsal length of palpal segments, P-1, 26μ; P-II, 133μ; P-III, 93μ; P-IV, 159μ; P-V, 119μ; distoventral portion of P-II drawn out into a tubercle; P-V, comparatively long and slender; dorsal length of segments of the first leg: I-leg-1, 53μ; I-leg-2, 93μ; I-leg-3, 119μ; I-leg-4, 186μ; I-leg-5, 199μ; I-leg-6, 186μ; dorsal length of segments of fourth leg: IV-leg-1, 93μ; IV-leg-2, 119μ; IV-leg-3, 159μ; IV-leg-4, 220; IV-leg-5, 226μ; IV-leg-6, 226μ; swimming hairs absent.

Occurrence: Stream AVT Estate, Nelliyampathy, Paddy field Cheroor, Oochithrakulam. Collection No: 107, 72 and 70

Habitat: Ponds, Streams and Paddy fields.

Distribution: Maharastra, Rajasthan, Karnataka, Andhra Pradesh and Kerala States in India.

Subfamily : ATRACTIDINAE

Genus : ATRACTIDES

17) ***Atractides* (Octomegapus) *biscutatus* Cook 1967**

(Figure-17. Figs: A – E. Plate-IV. Photograph 4a)

Female: Length of the body 731μ; length between anterior end of first coxae and posterior end of fourth coxae 305μ; dorsum soft, first coxae fused medially, epimerogladularia one fused with the second coxe; genital field 159μ in length and 172μ in width; four pairs of genital acetabula; dorsal length of palpal segments : P-I, 37μ; P-II, 75μ; P-III, 70μ; P-IV, 112μ; P-V, 37μ; dorsal length of the segments of the first leg: I-leg-1, 39μ; I-leg-2, 66μ; I-leg-3,106μ; I-leg-4, 140μ; I-leg-5, 146μ; I-leg-6, 99μ; I-leg-6 bowed; dorsal length of segments of the fourth leg: IV-leg-1, 79μ; IV-leg-2, 93μ; IV-leg-3, 146μ; IV-leg-4, 186μ; IV-leg-5, 212μ; IV-leg-6, 186μ; swimming hairs absent.

Male: Not observed.

Occurrence: Stream Dhoni, Plalakkad. Collection No: 109

Habitat: Streams

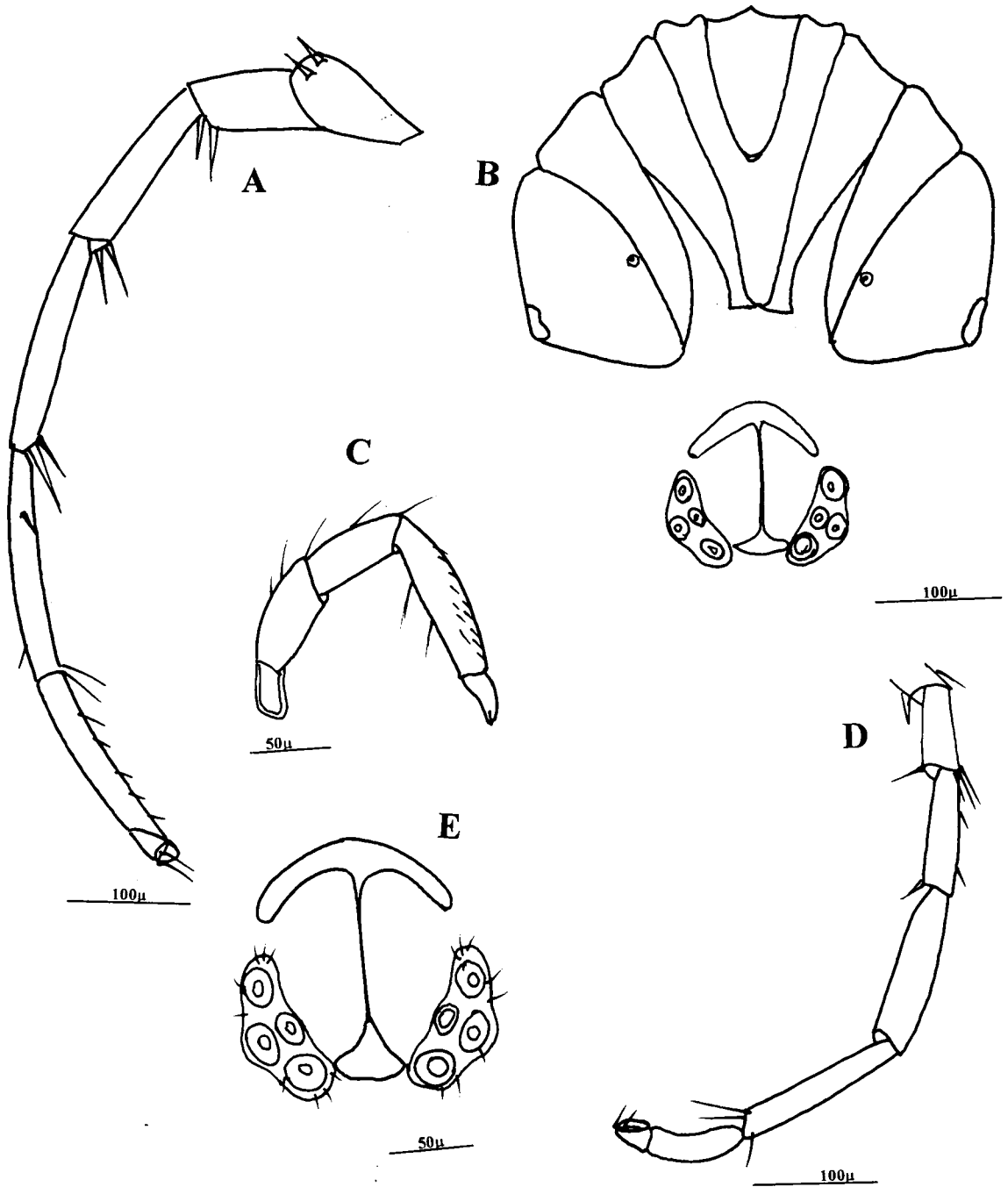
Distribution: Maharastra and Kerala.

Figure-17

Figures: A- E, *Atractides* (Octomegapus) *biscutatus* Cook

A. Fourth leg female
B. Coxal region female
C. Palpal segments female
D. Female genital field
E. First leg female

Figure-17



Family :UNIONICOLIDAE
Subfamily :ENCENTRIDOPHORINAE
Genus :ENCENTRIDOPHORUS

18) ***Encentridophorus* (s.s) *similis* Cook 1967**

(Figure-18. Figs: A – H. Plate-IV. Photograph 3a-3b)

Female: Length of the body 864μ; length between anterior end of first coxae and posterior end of fourth coxae 438μ; apodemes of the first coxal group extending to the anterior margin of the third coxae; suture line between third and fourth coxae complete; genital field 199μ in length and 492μ in width; 13 genital acetabula present on each side; dorsal length to the palpal segments: P-I, 26μ; P-II, 142μ; P-III, 66μ; P-IV, 172μ; P-V, 59μ; dorsal lengths of the segments of first leg: I-leg-1, 53μ, I-leg-2, 133μ; I-leg-3, 159μ; I-leg-4, 200μ; I-leg-5, 200μ; I-leg-6, 186μ; dorsal length of the segments of the fourth leg: IV-leg-1, 93μ; IV-leg-2,133μ; IV-leg-3, 186μ; IV-leg-4, 200μ; IV-leg-5, 239μ; IV-leg-6, 212μ; swimming hairs present.

Male: Length of the body 616μ; length between anterior end of first coxae and posterior end of fourth coxae 431μ; apodemes of the first coxal group extending to the anterior margin of the third coxae; suture line between third and

Figure-18

Figures: A- H, *Encentridophorus* (S.S) *similis* Cook

A. First leg female
B. Coxal region female
C. Fourth leg female
D. Palpal segments female
E. Palpal segments male
F. Fourth leg male
G. First leg male
H. Coxal region male

Figure-18

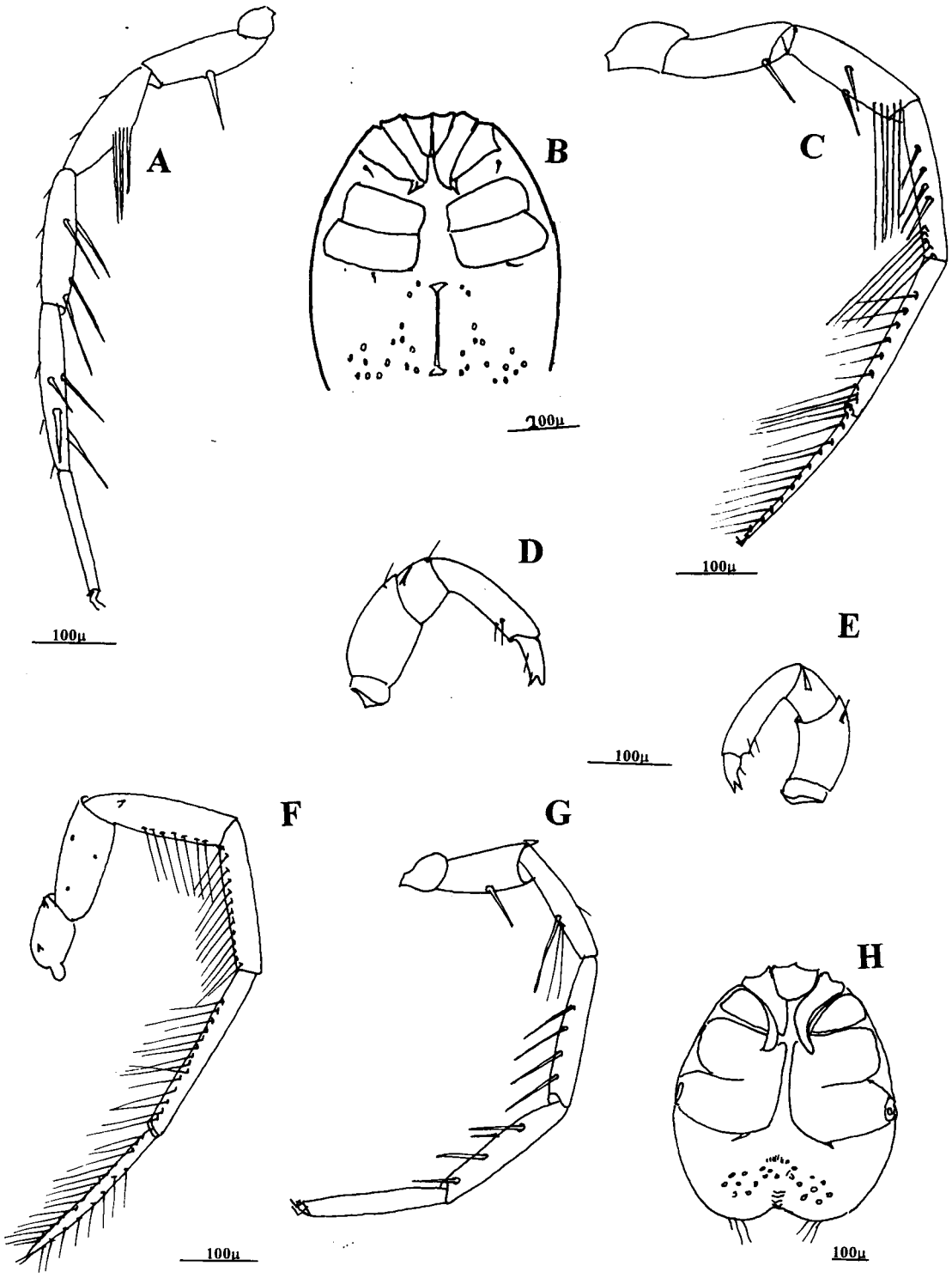


PLATE- IV
(photos 1a- 4b)

1a- *Hygrobates karekari* female
1b- *Hygrobates karekari* male
2a- *Hygrobates keralensis* female
2b- *Hygrobates keralensis* male
3a- *Encentridophorus similis* female
3b- *Encentridophorus similés* male
4a- *Atractides biscutatus* male
4b- *Neumania multiscutata* female

Plate : IV

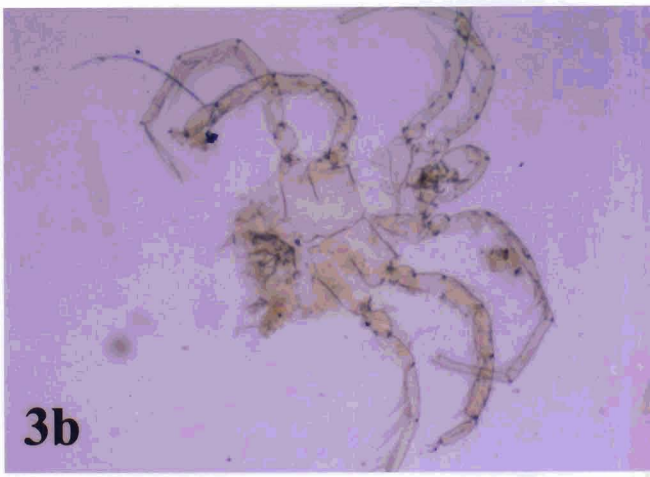

1a

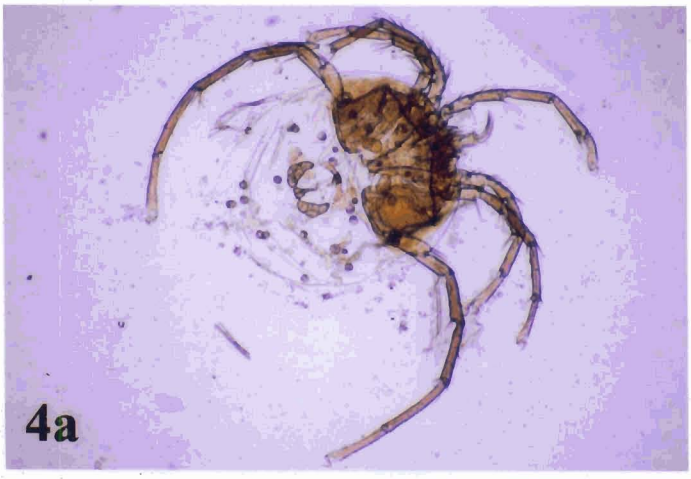

1b


2a


2b


3a


3b


4a


4b

fourth coxae incomplete; genital field 154μ in length and 385μ in width; 11 genital acetabula present on each side; posterior end of the body some what truncate, indented medially in the region of the small setae; four usually thickened setae present on each side at posterior end of the body ; dorsal length to the palpal segments: P-I, 26μ; P-II, 119μ; P-III, 66μ; P-IV, 146μ; P-V, 53μ; dorsal lengths of the segments of first leg: I-leg-1, 53μ, I-leg-2, 106μ; I-leg-3, 146μ; I-leg-4, 186μ; I-leg-5, 200μ; I-leg-6, 200μ; dorsal length of the segments of the fourth leg: IV-leg-1, 79μ; IV-leg-2,133μ; IV-leg-3, 159μ; IV-leg-4, 200μ; IV-leg-5, 226μ; IV-leg-6, 212μ; swimming hairs present.

Occurrence: Thiruvanikulum, Rock pool, Thettaekad and Devikulam lake. Collection No: 131, 99 and 29

Habitate: Ponds and pools.

Distribution: Rajasthan, Maharastra,Karnataka, Tamil Nadu and Kerala.

Remarks: *Encentridophorus similis* female and male is reported from Kerala for the first time.

Sub family :UNIONICOLINAE

Genus :UNIONICOLA

19) ***Unionicola* (Pentatax) *affinis* Piersig 1906**

(Figure-19.Figs: A – J. Plate-V. Photograph 2a-2b)

Female: Length of the body 598μ; length between anterior end of first coxae and the posterior end of fourth coxae 372μ. Dorsum soft, and a pair of enlarged glandularia near posterior end; apodemes of first coxal group extending slightly posterior to the anterior margin of the third coxae; medial pair of glandularia located between the fourth coxae and the genital field fused with the fourth coxae; genital field terminal, 119μ length, 133μ width. There are four acetabular plates in the genital field. Each dorsal and ventral acetabular plate with three acetabulae. Dorsal length of the palpal segments: P-I, 26μ; P-II, 106μ; P-III, 53μ; P-IV, 119μ; P-V, 79μ. P-IV bears three projections out of these the middle one is much longer. Dorsal length of the segments of the first leg: I-leg-1, 39μ; I-leg-2, 133μ; I-leg-3, 212μ; I-leg-4, 332μ; I-leg-5, 226μ; I-leg-6, 199μ. The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 66μ; IV-leg-2, 146μ; IV-leg-3, 226μ; IV-leg-4, 319μ; IV-leg-5, 399μ; IV-leg-6, 359μ.

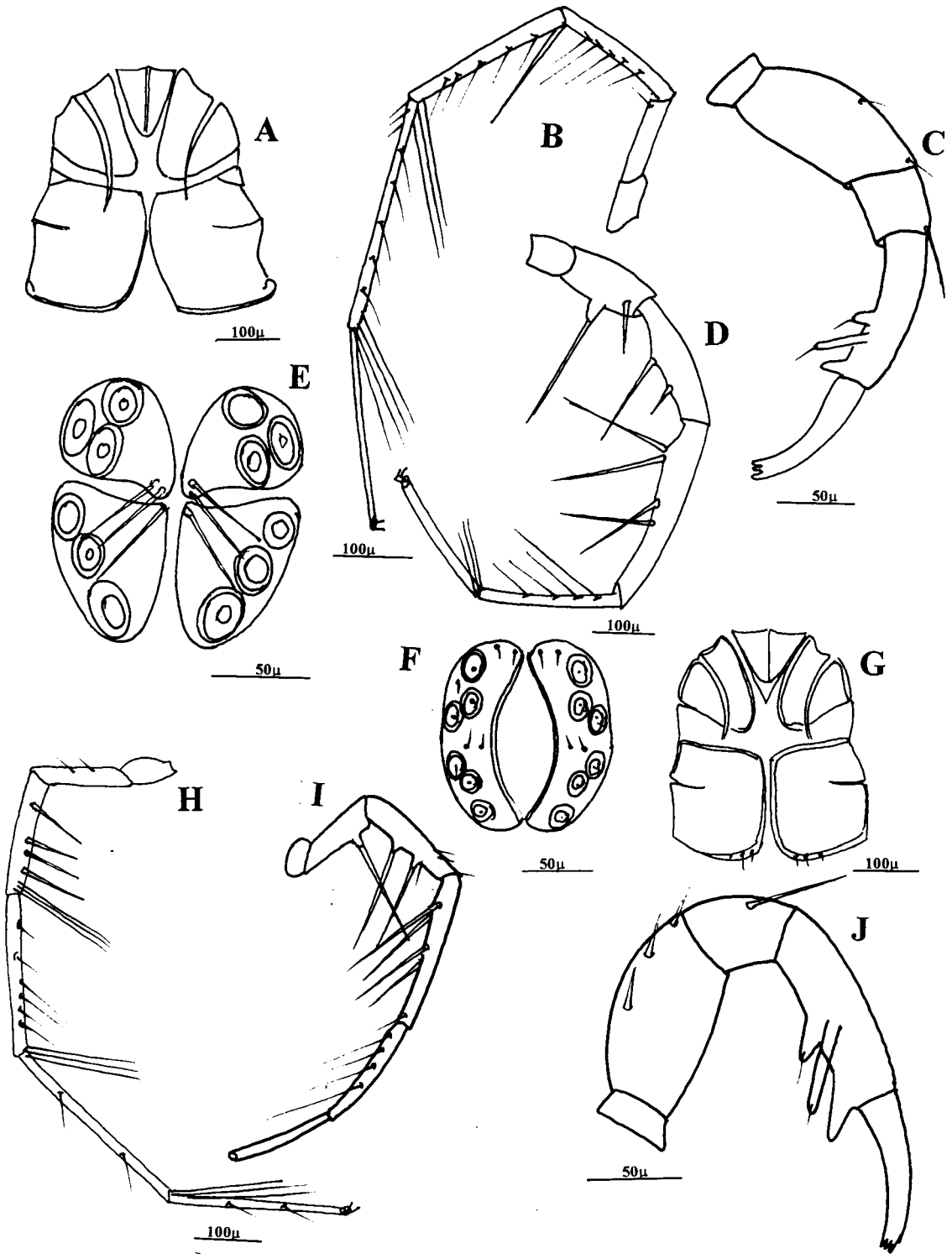
Male: Length of the body 539μ; length between anterior end of first coxae and the posterior end of fourth coxae 369μ. Dorsum soft, and a pair of enlarged glandularia near posterior end; apodemes of first coxal group extending

Figure-19

Figures: A- J, *Unionicola*(Pentatax) *affinis* Piersig

A. Coxal region female
B. Fourth leg female
C. Palpal segments female
D. First leg female
E. Female genital field
F. Male genital field
G. Coxal region male
H. Fourth leg male
I. First leg male
J. Palpal segments male

Figure-19



slightly posterior to the anterior margin of the third coxae; medial pair of glandularia located between the fourth coxae and the genital field fused with the fourth coxae; genital field terminal, 138μ.in length, 123μ in width. There are five pairs of acetabula. Dorsal length of the palpal segments: P-I, 15μ; P-II, 92μ; P-III, 46μ; P-IV, 92μ; P-V, 77μ; P-IV bears three projections out of these the middle one is much longer. Dorsal length of the segments of the first leg: I-leg-1, 61μ; I-leg-2, 138μ; I-leg-3, 184μ; I-leg-4, 277μ; I-leg-5, 200μ; I-leg-6, 184μ . The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 61μ; IV-leg-2, 138μ; IV-leg-3, 200μ; IV-leg-4, 277μ; IV-leg-5, 354μ; IV-leg-6, 292μ.

Occurrence: Chovoore, Pogham, Arempetta, Janikinayar pond, Vadakkanchery pond, Kuttikave and Chanthamarakulam. Panchayath pond Mannuthy. Collection No: 22, 85, 1,39, 137, 48, 19 and 89

Habitat: Ponds

Distribution: Maharastra, Karnataka, Tamil Nadu and Kerala states in India.and Sumatra, Java, Thailand and central China.

20) ***Unionicola mohanasundarami*** n. sp.

(Figure-20. Figs: A – J. Plate-V. Photograph 1a-1b)

Female: Length of the body 462μ; Length between the anterior end of first coxae to the posterior end of fourth coxae 305μ apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Dorsum soft. Genital field terminal; genital field 96μ in length and 119μ in width; four genital plates; each posterior plates carries a spinnous process. The anterior plates carries two spinnous process each; there are two genital acetabula on each dorsal genital plate and three on each ventral genital plates. Dorsal length of the palpal segments: P-1, 26μ; P-II, 106μ; P-III, 53μ; P-IV, 106μ; P-V, 66μ. Ventral side of the P-IV segment bears small tubercles with seata. Dorsal length of the segments of the first leg: I-leg-1, 46μ; I-leg-2, 78; I-leg-3, 138μ; I-leg-4, 184μ; I-leg-5, 184μ; I-leg-6, 154μ . The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 77μ; IV-leg-2, 123μ; IV-leg-3, 169μ; IV-leg-4, 200μ; IV-leg-5, 266μ; IV-leg-6, 246μ.

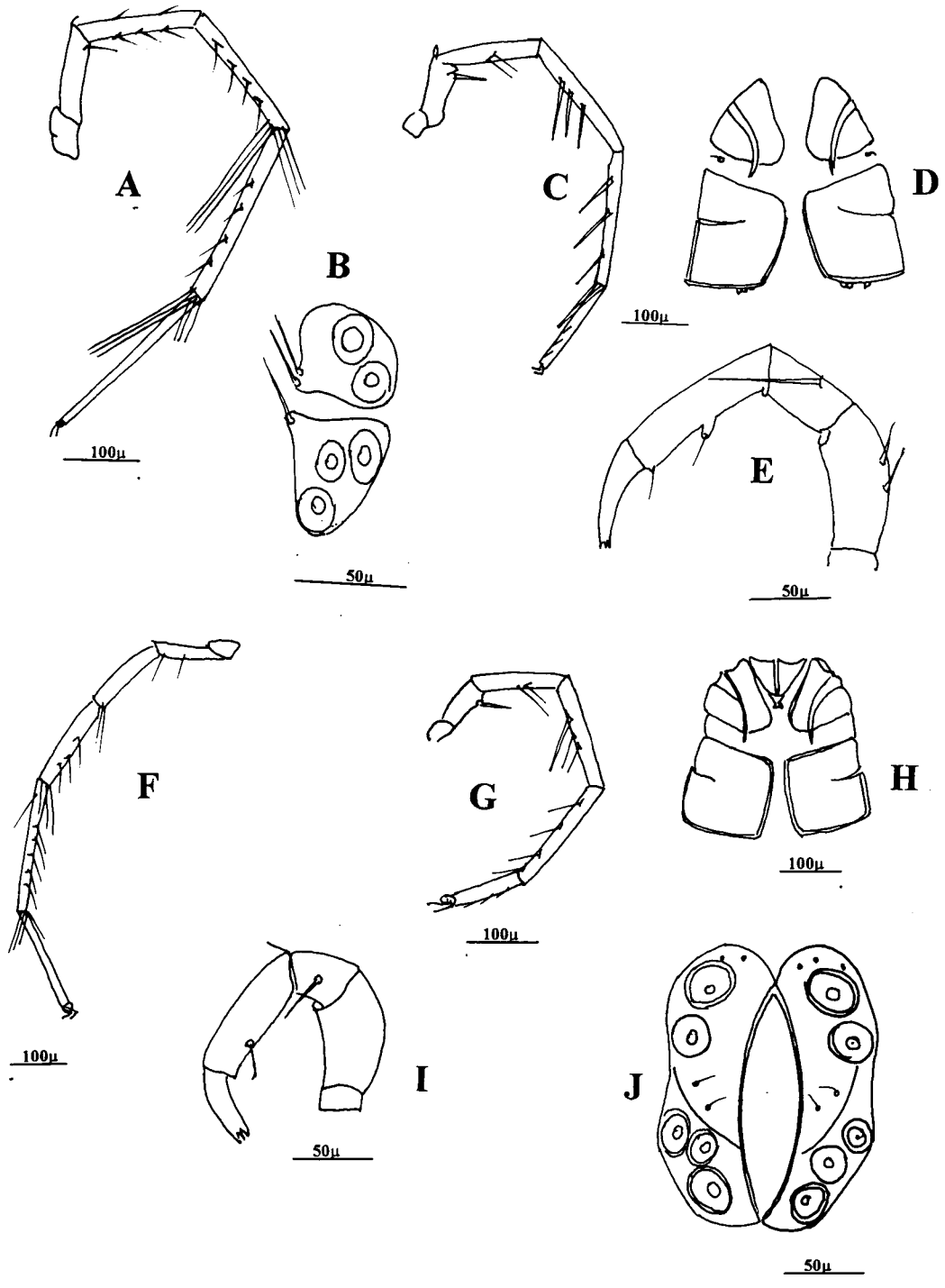
Male: Length of the body 460μ;Length between the anterior end of first coxae to the posterior end of fourth coxae 261μ; apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Dorsum soft. Genital field terminal and it is 138μ in length and 92μ in width;

Figure-20

Figures: A- J, *Unionicola* (Pentatax) *mohanasundarami* n.sp

A. Fourth leg female
B. One half of female genital field
C. First leg female
D. Coxal region female
E. Palpal segments female
F. Fourth leg male
G. First leg male
H. Coxal region male
I. Palpal segments male
J. Male genital field

Figure-20



two genital plates, each carries five accetabulae. There is a characteristic marking at the centre of each genital plates. Dorsal length of the palpal segments: P-1, 13μ; P-II, 79μ; P-III, 39μ; P-IV, 93μ; P-V, 53μ. Ventral side of the P-IV segment bears tubercles with seatae. Dorsal length of the segments of the first leg: I-leg-1, 46μ; I-leg-2, 77μ; I-leg-3, 123μ; I-leg-4, 162μ; I-leg-5, 154μ; I-leg-6, 126μ. The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 53μ; IV-leg-2, 93μ; IV-leg-3, 119μ; IV-leg-4, 159μ; IV-leg-5, 212μ; IV-leg-6, 199μ.

Occurrence: Chattukulum, Thekkankulum. Collection No: 21

Habitat: Ponds

Distribution: Kerala

Remarks: This species shows similarities with *U.setifera*, but differentiated from it in the following characters. The genital field in the case of *U.stifera* male bears numerous setae, whereas in the case *of U. mohanasundarami* there is no numerous setate present. Length of the body as well as the length between the anterior end of first coxae to the posterior end of fourth coxae for females are 462μ, 305μ for *U.mohanaundarami* and 800μ and 464μ for *U.setifera* respectively and these measurements for the males are 460μ, 261μ for *U.mohanasundarami* and 653μ, 440μ for *U.setifera*.

Types: A holotype slide with female, INDIA: KERALA: Chattukulam, 27-07-1993 in a Pond, Collected: John.C.C. Several paratype slides, with collection data same as type.

21) ***Unionicola* (Pentatax) *kantaka* Cook 1967**

(Figure-21. Figs: A – J. Plate-V. Photograph 3a)

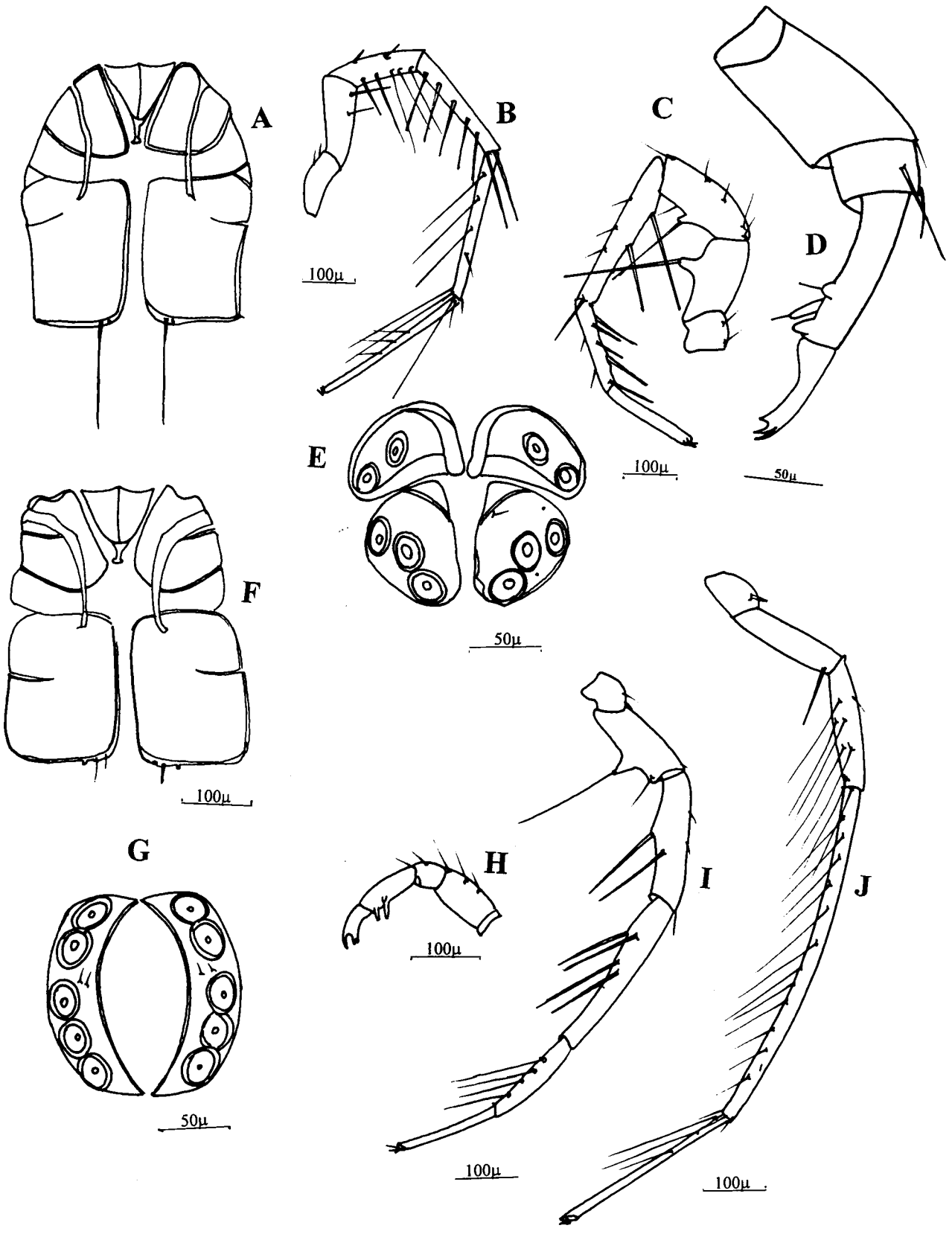
Female: Length of the body 731μ; length between the anterior end of first coxae to the posterior end of fourth coxae 425μ; dorsum soft, apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Median pair of gladularia located between fourth coxae and genital field fused with the fourth coxae. Genital field terminal; surface of the coxae reticulate, on either side of the genital field there are enlarged gladularia; genital field 133μ in length and 159μ in width; four genital plates. The anterior plates carry two pairs of genital acetabula posterior genital plates carry three pairs of accetabula. Dorsal length of the palpal segments: P-1, 26μ; P-II, 106μ; P-III, 46μ; P-IV, 99μ; P-V, 66μ. Pedipalp tarsus is nearly quadrate in lateral view with two large clawlets. Dorsal length of the segments of the first leg: I-leg-1, 53μ; I-leg-2, 146; I-leg-3, 172μ; I-leg-4, 239μ; I-leg-5, 146μ; I-leg-6, 159μ. The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the

Figure-21

Figures: A- J, *Unionicola*(Pentatax) *Kantaka* Cook

A. Coxal region female
B. Fourth leg female
C. First leg female
D. Palpal segments female
E. Female genital field
F. Coxal region male
G. Male genital genital field
H. Palpal segments male
I. First leg male
J. Fourth leg male

Figure-21



segments of the fourth leg: IV-leg-1, 46μ; IV-leg-2, 106μ; IV-leg-3, 146μ; IV-leg-4, 186μ; IV-leg-5, 266μ; IV-leg-6, 252μ.

Male: Length of the body 532μ; Length between the anterior end of first coxae to the posterior end of fourth coxae 412μ apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Median pair of gladularia located between fourth coxae and genital field fused with the fourth coxae. Dorsum soft. Genital field terminal; on either side of which there are glandularia, genital field 133μ in length and 119μ in width; genital plates two. Each carries five accetabulae. Dorsal length of the palpal segments: P-1, 13μ; P-II, 109μ; P-III, 39μ; P-IV, 106μ; P-V, 66μ. Pedipalp tarsus is nearly quadrate in lateral view with two large clawlets. Dorsal length of the segments of the first leg: I-leg-1, 59μ; I-leg-2, 146μ; I-leg-3, 199μ; I-leg-4, 266μ; I-leg-5, 172μ; I-leg-6, 159μ . The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 66μ; IV-leg-2, 146μ; IV-leg-3, 199μ; IV-leg-4, 266μ; IV-leg-5, 359μ; IV-leg-6, 319μ.

Occurrence: Chovoor, Pullazhy. Collection No: 22 and 37

Habitat: Male free-swimming, but female in fresh-water mussel.

Distribution: Kerala State.

Remarks: The male first reported by Cook (1967) from Trichur Kerala. Female collected from the mantle cavity of fresh water mussel and it is first

report. The pedipalp tarsus nearly quatrate in lateral view with two large clawlets.

22) ***Unionicola* (Pentatax) *armata* Walter 1929**

(Figure-22. Figs: A – E. Plate-V. Photograph 3b)

Female: Length of the body 798μ; length between the anterior end of first coxae to the posterior end of fourth coxae 425μ; apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Dorsum soft. Median pair of gladularia located between fourth coxae and genital field fused with the fourth coxae. Genital field terminal; genital field 107μ in length and 113μ in width; four genital plates; genital plates carries a spinous process. The anterior plates carries two genital acetabula posterior genital plates carries three accetabula. Dorsal length of the palpal segments: P-1, 19μ; P-II, 172μ; P-III, 66μ; P-IV, 146μ; P-V, 93μ. P-V pointed. Dorsal length of the segments of the first leg: I-leg-1, 66μ; I-leg-2, 119; I-leg-3, 159μ; I-leg-4, 206μ; I-leg-5, 219μ; I-leg-6, 159μ . The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 66μ; IV-leg-2, 133μ; IV-leg-3, 212μ; IV-leg-4, 266μ; IV-leg-5, 358μ; IV-leg-6, 332μ..

Occurrence: Perinkulum, Pongham. Collection No: 85

Figure-22

Figures: A-E, *Unionicola* (Pentatax) *armata* Walter

A. Palpal segments
B. Coxal region
C. First leg
D. Fourth leg
E. Female genital field

Figure-22

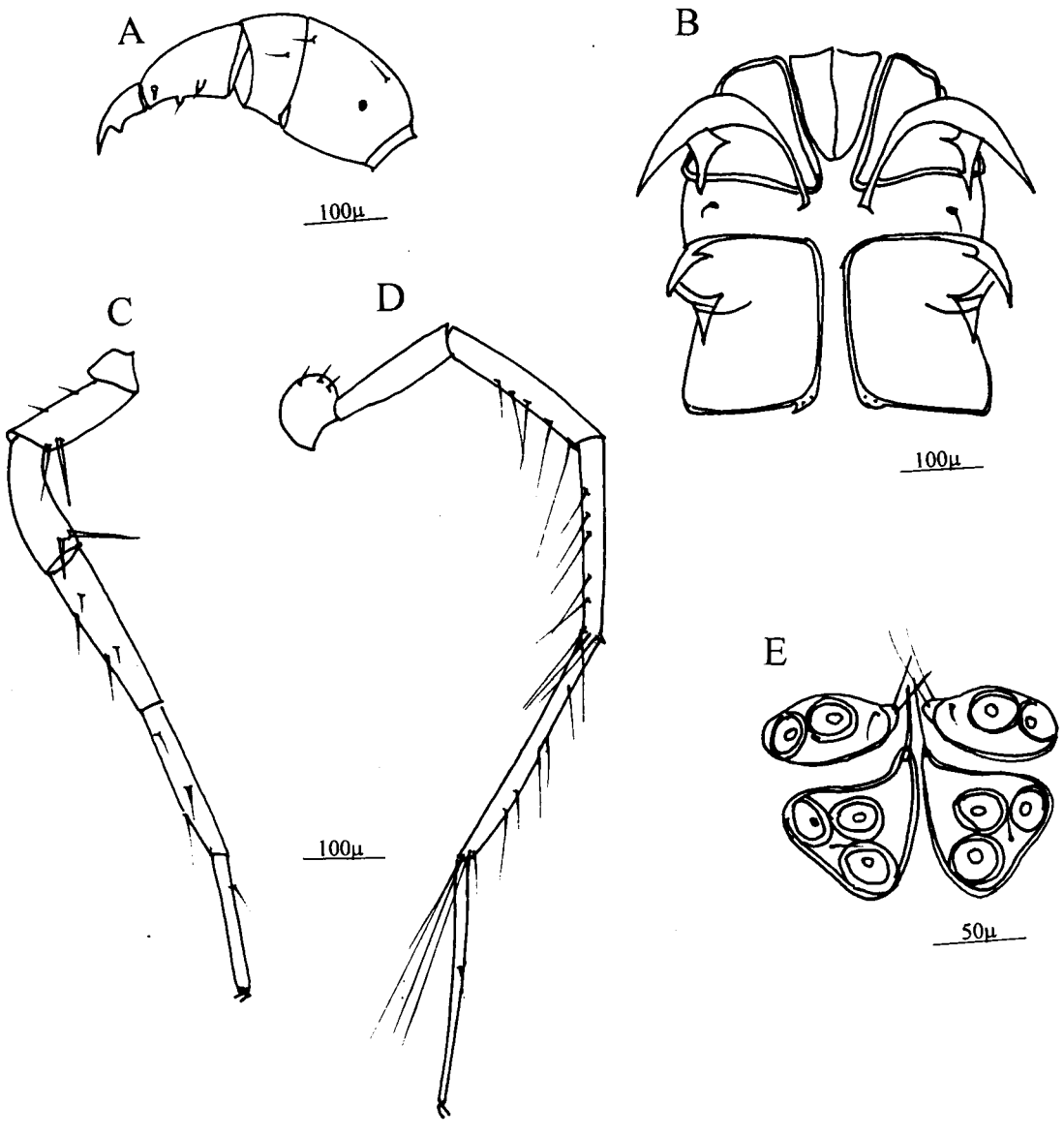
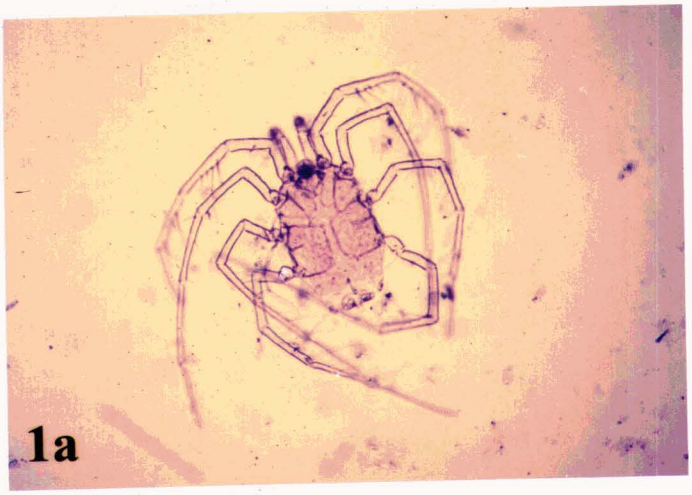


PLATE-V
(photos 1a- 4b)

1a- *Unionicola mohanasundarami* female
1b- *Unionicola mohanasundarami* male
2a- *Unionicola affinis* female
2b- *Unionicola affinis* male
3a- *Unionicola kantaka* female
3b- *Unionicola armata* female
4a- *Neumania nodosa* female
4b- *Neumania nodosa* male

Plate : V

126B


1a


1b


2a


2b


3a


3b


4a


4b

Habitat: Ponds

Distribution: Maharastra, Krnataka and Kerala States in India. Sumatra and Java.

Remarks: Anchoral apodemes from the sides of the second and third coxae is very characteristic. The palp is also very distinct compared to other species in this group. First report from Kerala State.

23) ***Unionicola* (Prasadatax) *diversipes* Viets 1926**

(Figure-23. Figs: A – J. Plate-VI. Photograph 2a-2b)

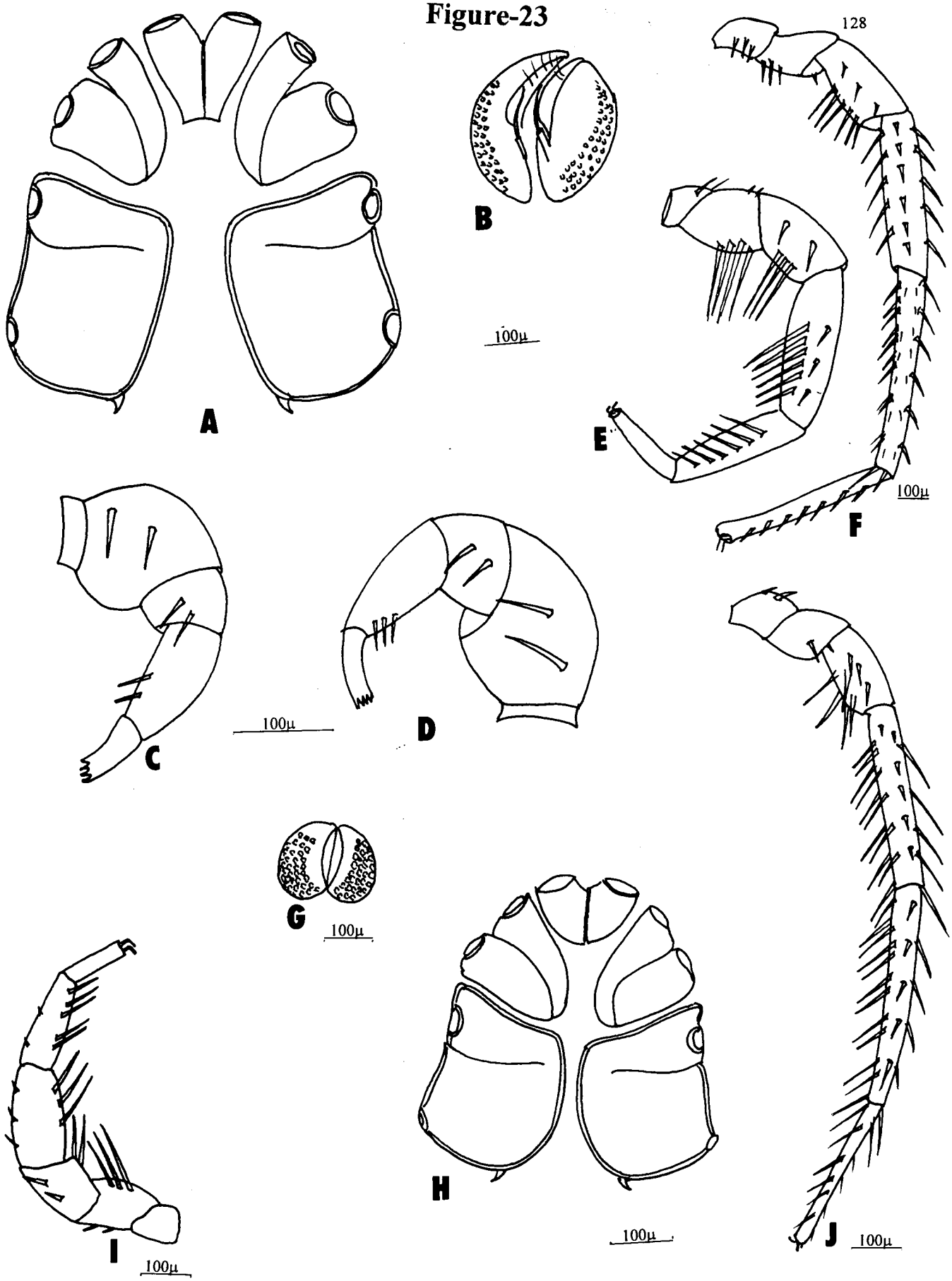
Female: Length of the body 1463μ; length between anterior end of first coxae and posterior end of fourth coxae 654μ; dorsum soft. Fourth coxae each with a short projection on medial portion of posterior end. Genital field terminal.Genital field 212μ in length, 308μ in width. Genital field consists of two sclerites, right and left. They carry genital acetabula which is numerous. The genital sclerites on medial portion, on the upper part is produced into a small flap like projection each of which carries two flagella like process. The lower portion of sclerites bears two projections which carries the long spinous process. The length of the palpal segments: P-I, 15μ; P-II, 212μ; P-III, 66μ; P-IV,146μ and P-V, 77μ.Ventral side of the P-IV with two small seatal tubercles towards

Figure-23

Figures: A- J, *Unionicola* (Prasadatax) *diversipes* Viets

A. Coxal region female
B. Female genital field
C. Palpal segments male
D. Palpal segments female
E. First leg female
F. Fourth leg female
G. Male genital field
H. Coxal region male
I. First leg male
J. Fourth leg male

Figure-23



the distal end and two seatal tubercle near the middle. Dorsal lengths of the segments of the first leg: 1-leg-1, 119μ; 1-leg-2, 154μ; 1-leg-3, 226μ; 1-leg-4, 385μ, 1-leg-5, 305μ; 1-leg-6, 186μ. Dorsal lengths of the segments of the fourth leg: IV-leg-1, 159μ; IV-leg-2, 172μ; IV-leg-3, 266μ; IV-leg-4, 505μ; IV-leg-5, 598μ; IV-leg-6, 532μ. Lack of swimming hairs on the segments is characteristic.

Male: Length of the body 1186μ; length between the anterior end of first coxae and the posterior end of the fourth coxae 539μ. Fourth coxae each with a short projection on meadial portion of posterior end. Genital field is terminal, length of the genital field 154μ in length, 215μ in width. Number of genital acetabula numerous. Dorsal length of the palpal segments: P-I, 30μ; P-II, 146μ; P-III, 61μ; P-IV, 107μ; P-V, 61μ. Ventral side of the P-IV is with two tubercles near the distal end and bear seatae. Dorsal length of distal ends of first leg: I-leg-1, 61μ; 1-leg-2, 107μ; 1-leg-3, 138μ; 1-leg-4, 199μ; 1-leg-5, 199μ; 1-leg-6, 133μ. Dorsal length of the segments of the fourth leg: IV-leg-1, 107μ; IV-leg-2, 154μ; IV-leg-3, 215μ; IV-leg-4, 385μ; IV-leg-5, 462μ; IV-leg-6, 400μ. Lack of swimming hairs on legs is characteristic.

Occurrence: Pullazy, Chavakkad. Collection No: 37 and 36

Habitat: Parasitic on fresh-water mussel, *Lamellidens marginalis*.

Distribution: India, Asia

Remarks: Parasitic in the mantle cavity of fresh water mussel. The number of genital acetabula is more compared to *U.brandti*. This species is illustrated by Viets (1926). They have very unusual nymps which are elongated (Plate-VIII, Photo-3b).

24) ***Unionicola* (Prasadatax) *brandti* Vidrine 1985**

(Figure-24. Figs: A – L. Plate-VI. Photograph 1a-1b)

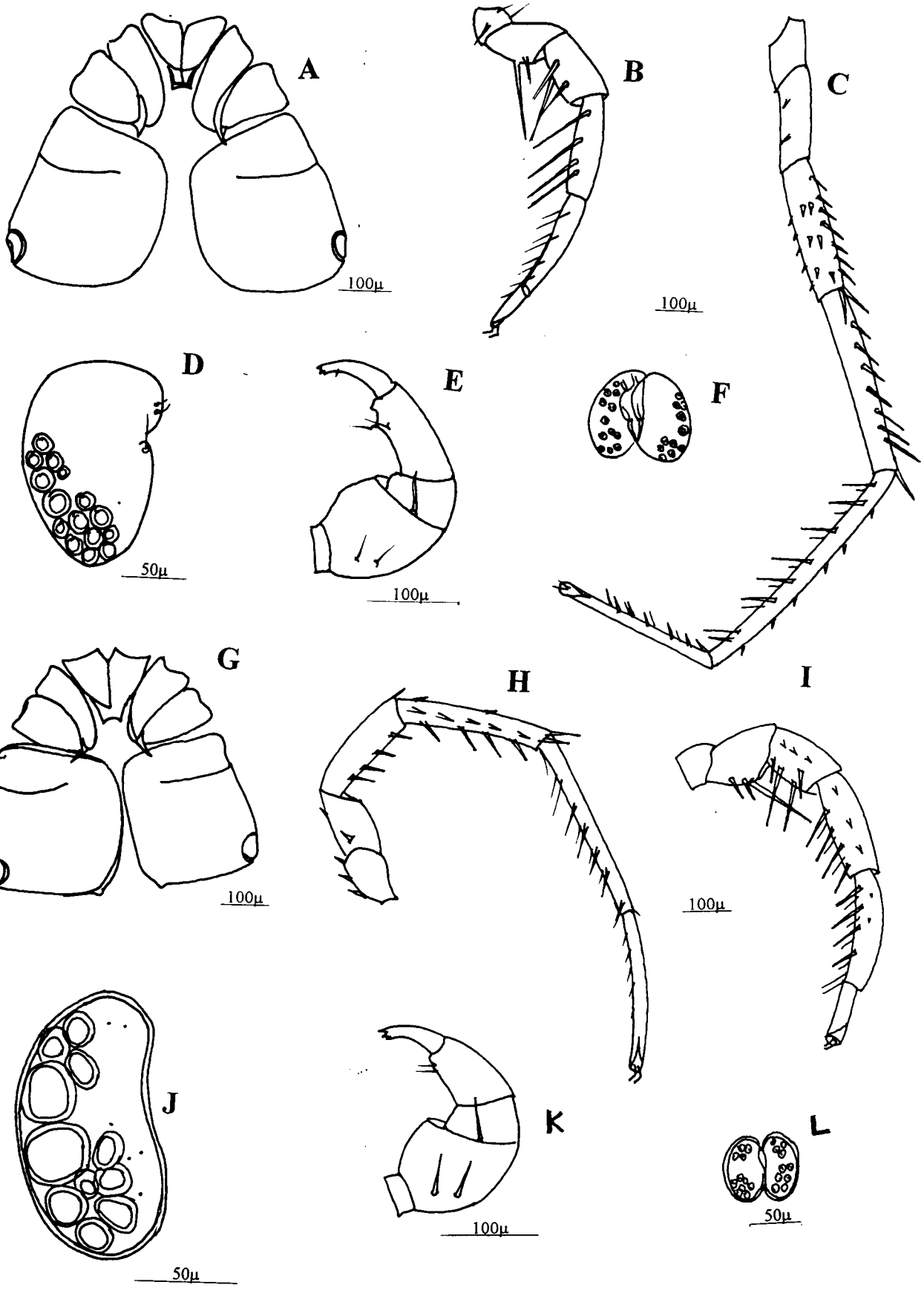
Female: Length of the body 1309μ; length between anterior end of the first coxae and posterior end of fourth coxae 523μ; dorsum soft; apodemes of first coxal group extending slightly posterior to the anterior margin of the third coxae; fourth coxae without a short projection on medial portion of posterior end; genital field terminal, genital field 161μ, in length, 184μ in width; The genital sclerites on medial portion, on the upper part is produced into a small flap like projection each of which carries two flagella like process. The lower portion of sclerites bears two projections which carries the short spinous process. Number of acetabula fifteen on each side. The length of the palpal segments: P-I, 30μ; P-II, 123μ; P-III, 77μ; P-IV, 144μ; P-V, 77μ; ventral side of the P-IV with two well developed seatal tubercle near the middle. Dorsal length of the segments of the first leg: I-leg-1, 61μ; I-leg-2, 123μ; I-leg-3, 154μ; I-leg-4, 215μ; I-leg-5, 215μ;

Figures-24

Figures: A-L, *Unionicola*(Prasadatax) *brandti* Vidrine

A Coxal region female
B First leg of female
C Fourth leg of female
D One half of the female genital field
E Palpal segments of female
F Female genital field
G Coxal region male
H Fourth leg male
I First leg male
J One half of the male genital field
K Palpal segments male
L Male genital field

Figure-24



I-leg-6, 92μ; figure shows the chaetotaxy of the first leg. Dorsal lengths of the distal segments of the fourth leg: IV-leg-1, 138μ; IV-leg-2, 154μ; IV-leg-3, 261μ; IV-leg-4, 385μ; IV-leg-5, 523μ; IV-leg-6, 338μ. Figure shows the chaetotaxy.

Male: Length of the body 800μ; length between anterior end of first coxae and posterior end of fourth coxae 425μ; dorsum soft; apodemes of first coxal groups extending posterior to the anterior margin of the third coxae. Genital field terminal, 123μ in length and 123μ in width. Numbers of acetabula 11 on each side. Dorsal lengths of the palpal segments: P-I, 30μ; P-II, 107μ; P-III, 46μ; P-IV, 92μ; P- V, 61μ; ventral side of the P-IV with two well developed setal tubercle near the middle. Dorsal length of the segments of the first leg: I-Leg-1, 66μ; I-leg-2, 93μ; I-leg-3, 133μ; I-leg-4, 180μ; I-leg-5, 199μ; I-leg-6, 99; structure of leg similar to female; dorsal length of the segments of the fourth leg: IV-leg-1, 119μ; IV-leg-2, 133μ; IV-leg-3, 212μ; IV-leg-4, 292μ; IV-leg-5, 385μ; IV-leg-6, 300μ, without swimming hairs.

Occurrence: Pullazhy. Collection No: 37

Habitat: Parasitic on fresh-water mussel, *Lamellidens marginalis*.

Distribution: Kerala State in India. Thailand.

Remarks: First report from India. Vidrine first reported it from Thailand in1985. Collection number.32 dated 25-06-96

25) ***Unionicola* (Imamurax) *scutigera* Viets 1926**

(Figure-25. Figs: A – K. Plate-VI. Photograph 4a-4b)

Female: Length of the body 924μ; length between anterior end and of first coxae and posterior end of fourth coxae 739μ.Dorsum Sclerotised. Apodemes of the second coxal group slightly posterior to the anterior margin of the third coxae. Inner margins of the third coxae fused with the ventral body wall sclerotization. Posterior margins of the fourth coxae 'V' shaped. Genital field terminal. It is 185μ in length and 215μ in width. Four genital sclerites, each bearing a spinous process. Sclerite bears 11/9 acelabulae on each side. Dorsal length of the palpal segments: P-1, 31μ; P-II, 123μ; P-III, 61μ; P-IV, 92μ; P-V, 46μ. The fourth palpal segments bear a tubercle with seata at the distal end. Dorsal length of the segments of the first leg: I-leg-1, 67μ; I-leg-2, 92μ; I-leg-3, 154μ; I-leg-4, 200μ; I-leg-5, 154; I-leg-6, 154μ. Figures show the proportions and chaetotaxy of the first leg. Dorsal lengths of the distal segments of the fourth leg: IV-leg-1, 119μ; IV-leg-2, 133μ; IV-leg-3, 169μ; IV-leg-4, 261μ; IV-leg-5, 308μ; IV-leg-6, 252μ.

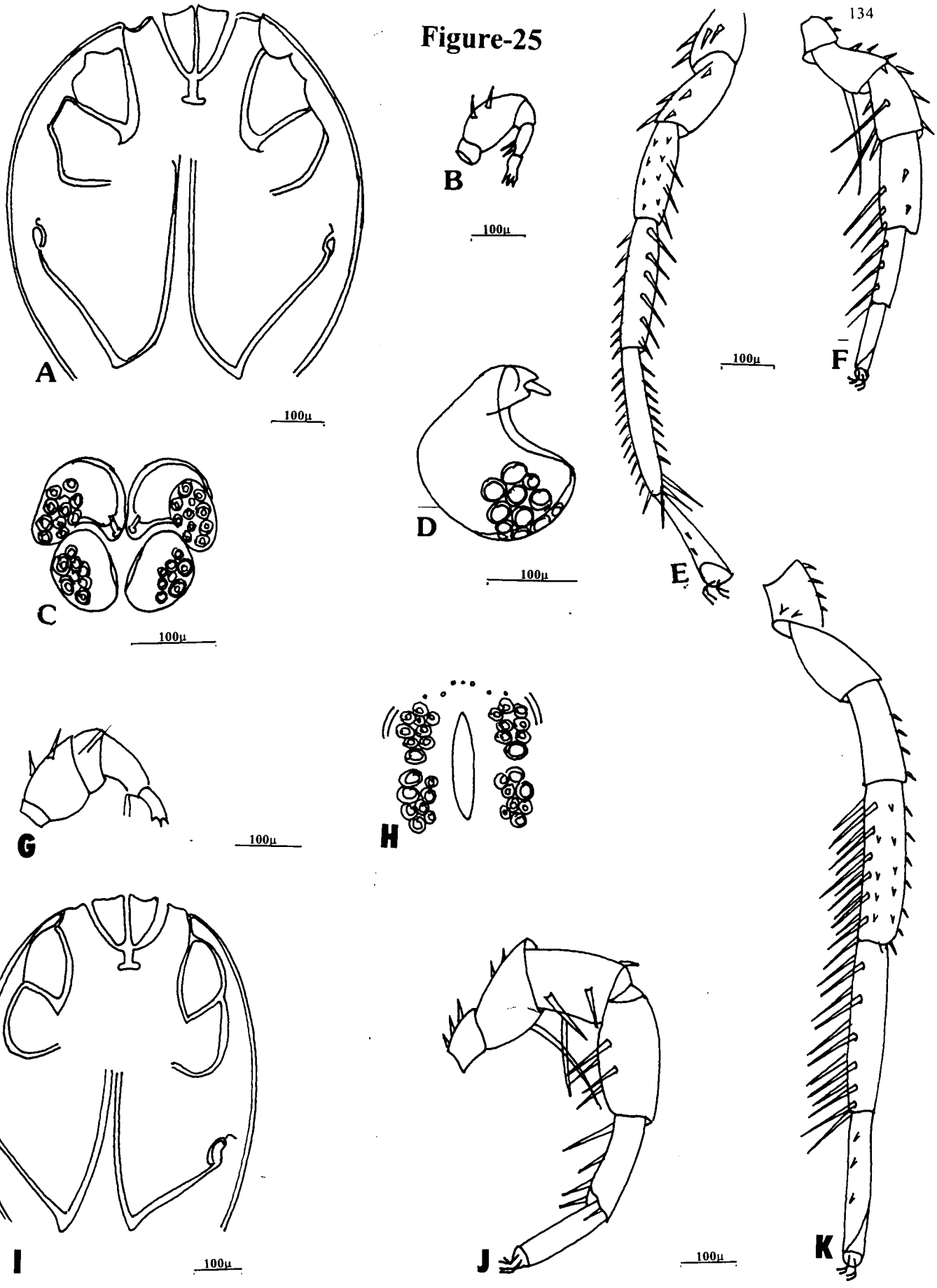
Male: Length of the body 893μ, length between anterior end of first coxae and posterior end of fourth coxae 740μ. Dorsum sclerotized. Coxal arrangement similar to female. The genital field terminal. Genital field 185μ in length

Figure-25

Figures: A- K, *Unionicola* (Immuratax) *Scutigera* Viets

A. Coxal region female
B. Palpal segments female
C. Female genital field
D. A single anterior female genital plate
E. Fourth leg female
F. First leg female
G. Palpal segments male
H. Male genital field
I. Coxal region male
J. First leg male
K. Fourth leg male

Figure-25



and 154μ in width number of genital acetabula 17 on each side. Genital sclerites completely fused with the body Sclerotization. Dorsal lengths of the palpal segments: P-I, 15μ; P-II, 123μ; P-III, 61μ; P-IV, 107; P-V, 61μ. The fourth palpal segments bear a tubercle with a seata at the distal end. Dorsal length of the segments of the first leg: I-leg-1, 31μ; I-leg-2, 77μ; I-leg-3, 154μ; I-leg-4, 200μ; I-leg-5, 154μ; I-leg-6, 154μ. Figure shows the cheatotaxy. Dorsal lengths of the segments of the fourth leg: IV-leg-1, 107μ; IV-leg-2, 107μ; IV-leg-3, 169μ; IV-leg-4, 261V; IV-leg-5, 308; IV-leg-6, 239μ. Figure shows the cheatotaxy.

Occurrence: Pullazy. Collection No: 37

Habitat: Parasitic on fresh-water mussel, *Lamellidens marginalis*

Distribution: India, Asia

Remarks: These mites can easily be distinguished from other forms by the posterior extension of the fourth coxae which is 'V' shaped and the complete sclerotization of the body.

26) ***Unionicola trichurensis*** n.sp.

(Figure-26. Figs: A – K. Plate-VI Photograph 3a-3b)

Female: Length of the body 878μ; dorsum sclerotized; apodemes of the first coxal group extending slightly posterior to the anterior margins of the third coxae. Part of the inner and posterior margins of third coxae, posterior margins

Figure-26

Figures: A- K, *Unionicola*(Immuratax) *trichurensis* n.sp

A. Fourth leg female
B. First leg female
C. Coxal region female
D. Palpal segments female
E. Half portion of female genitalia
F. Female genital field
G. Fourth leg male
H. First leg male
I. Coxal region male
J. Male genital field
K. Palpal segments male

Figure-26

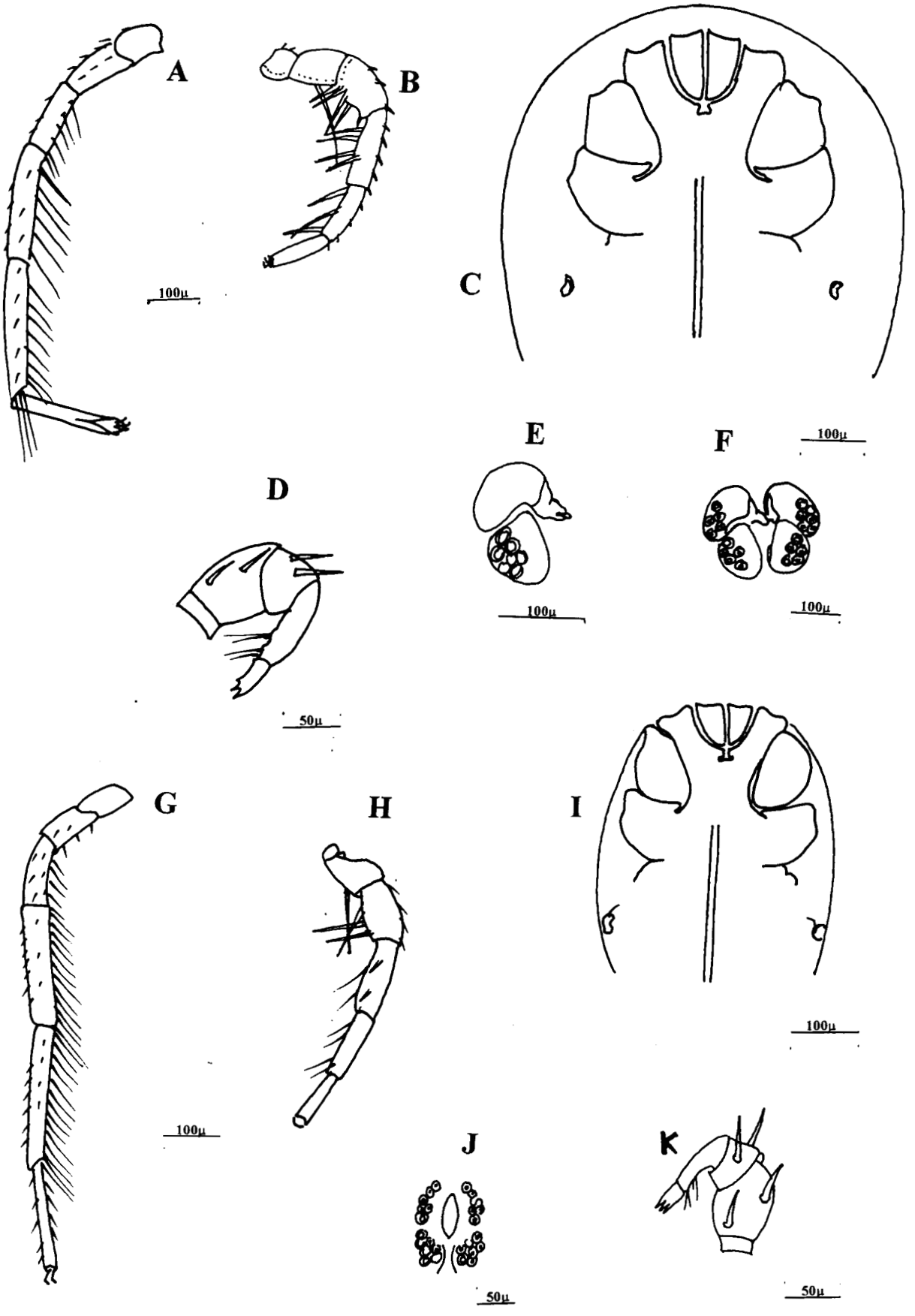


PLATE- VI
(Photos 1a- 4b)

1a- *Unionicola brandti* female
1b- *Unionicola brandti* male
2a- *Unionicola diversipes* female
2b- *Unionicola diversipes* male
3a- *Unionicola trichurensis* female
3b- *Unionicola trichurensis* male
4a- *Unionicola scutigera* female
4b- *Unionicola scutigera* male

Plate : VI

1a

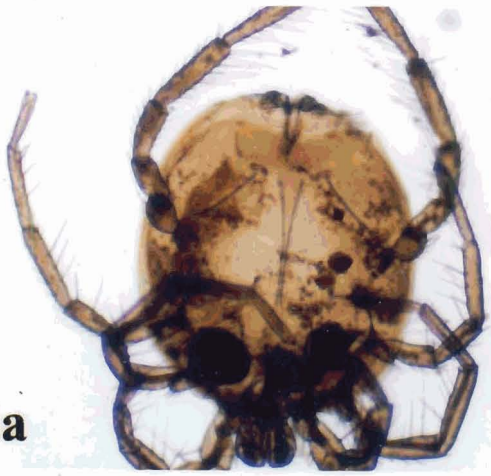
1b

2a

2b

3a

3b



4a

4b

of the fourth coxae imperceptibly fused with the ventral body wall scelerotization; The inner margins of third and fourth coxae form two parallel thickenings in the mid-ventral line. Genital field terminal; genital field 154μ in length and 200μ in width; four genital plates; each carries a spinous process; there are six genital acetabula on each dorsal genital plate and seven on each ventral genital plate. Dorsal length of the palpal segments: P-1, 30μ; P-II, 107μ; P-III, 50μ; P-IV, 107μ; P-V, 46μ. Ventral side of the P-IV segment with two small tubercles with seatae near distal end and a seatal tubercle near the middle. Dorsal length of the segments of the first leg: I-leg-1, 46μ; I-leg-2, 92μ; I-leg-3, 107μ; I-leg-4, 154μ; I-leg-5, 107μ; I-leg-6, 107μ . The figure shows the proportion and chaetotaxy of the first leg. Dorsal length of the segments of the fourth leg: IV-leg-1, 92μ; IV-leg-2, 100μ; IV-leg-3, 154μ; IV-leg-4, 254μ; IV-leg-5, 308μ; IV-leg-6, 246μ. Fourth leg carries numerous hairs

Male: The length of the body 770μ, the coxal part similar to female. Genital field terminal 123μ in length and 123μ in width. Genital acetabula fourteen on each side, Genital field with ornamentation. Dorsal length of the palpal segments: P-I, 15μ; P-II, 92μ; P-III, 34μ; P-IV, 92μ; P-V, 46μ. Ventral side of the P-IV segments bears two seatal tubercles at the distal end and a seatal tubercle in the middle. Dorsal length of the segments of the leg: I-leg-1, 30μ; I-leg-2, 92μ; I-leg-3, 116μ; I-leg-4, 169μ; I-leg-5, 138μ; I-leg-6, 107μ . The

chaetotaxy of the first leg is shown in the diagram. Dorsal length of the segments of the fourth leg: IV-leg1, 92μ; IV-leg-2, 107μ; IV-leg-3, 138μ; IV-leg-4, 239μ; IV-leg-5, 308μ; IV-leg-6, 226μ; the chaetotaxy is shown in the diagram.

Occurrence: Pullazy. Collection No: 37

Habitat: Parasitic on fresh-water mussel, *Lamellidens marginalis*

Distribution: India.

Remarks: This species shows similarities with *U.scutigera* in both the body wall is sceloritized. In the structure of legs and palps both of them shows general resemblace. But the posterior margins of the fourth coxe in *U.trichurensis* is 'V' shaped whereas in the case of *U. scutigera* there is no such markings.

Type: A holotype slide with female, INDIA: KERALA: Pullazhy, 12-04-2000 in a kole field, collected: John.C.C several paratype slides, with collection data same as type.

Sub family: NEUMANIINAE

Genus: NEUMANIA

27) ***Neumania* (s.s) *nodosa* Daday 1898**

(Figure-27. Figs: A – H. Plate-V. Photograph 4a-4b)

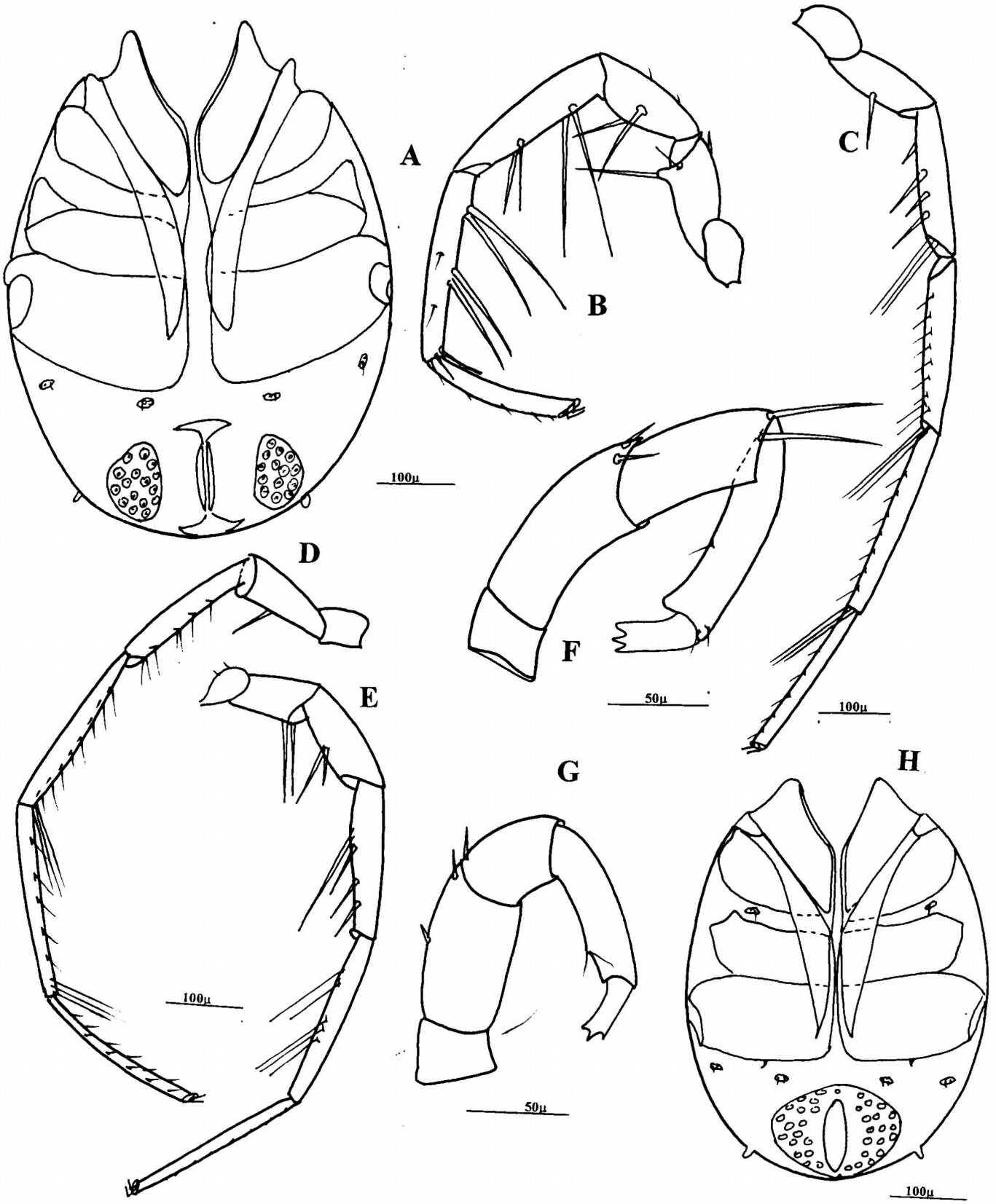
Female: Length of the body 731μ; length between anterior end of the first coxae and posterior end of fourth coxae 532μ; dorsum soft; apodemes of the first

Figure-27

Figures: A- H, *Neumania* (S.S) *nodosa* Daday

A. Coxal region female
B. First leg female
C. Fourth leg female
D. Fourth leg male
E. First leg male
F. Palpal segments female
G. Palpal segments male
H. Coxal region male

Figure-27



coxal group extending to middle of fourth coxae; coxal surface reticulate; genital field terminal, 146μ in length and 266μ in width; 18 genital acetabula present on each side; lengths of the palpal segments, P-I, 25μ; P-II, 112μ; P-III, 75μ; P-IV, 117μ; P-V, 40μ; dorsal length of the segments of the first leg, I-leg-1, 66μ; I-leg-2, 119μ; I-leg-3, 199μ; I-leg-4, 279μ; I-leg-5, 226μ; the figure shows the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg; IV-leg-1, 79μ; IV-leg-2, 133μ; IV-leg-3, 226μ; IV-leg-4, 266μ; IV-leg-5, 279μ., IV-leg-6, 266μ. IV-leg-3 , IV-leg-4, IV-leg-5 each with a distoventral , heavy pectinate seta.

Male: Length of the body 571μ.; length between anterior end of first coxae and posterior end of fourth coxae 425μ; dorsum soft,; apodemes of first coxal group extending to middle of fourth coxae; genital field 133μ in length and 199μ in width; genital acetabula 20 on each side; dorsal length of the palpal segments, P-1,26μ; P-II, 93μ; P-III, 60μ; P-IV, 93μ; P-V, 33μ. Dorsal length of the segments of the first leg, I-leg-1, 66μ; I-leg-2, 119μ; I-leg-3,146μ; I-leg-4, 212μ; I-leg-5, 266μ; I-leg-6, 252μ; dorsal length of the distal segments of the fourth leg, IV-leg-1, 66μ; IV-leg-2, 199μ; IV-leg-3, 212μ; IV-leg-4, 279μ; IV-leg-5, 292μ; IV-leg-6, 279μ; IV-leg-6 with three swimming hairs.

Occurrence: Puzhakal stream, Perinkulam pond, Chovoore pond, Thamarakulum, Kole Palakal, Rook Pool Thettaekad, Anavayal, Arampetta

panchayathkulum, Canal Vallakkadavu, Chanthamarakulam, Chittoor pond, Elanjikulam pond Feroke pond. Kole Muriad, Mattom pond, Meenachil river, Monastry pond, Muthukunnam canal Paddy field Mulamthuruthy, Palakal kulam, Papanssini, Pond Valiyaparambu stream AVT estate, Stream Karayamparambe, Stream Karumaloore, Thiruvanikulam Thrikkarikulanghara pond Vembanad kayal,Vllakkadavue, Well reubber estate. Colelction No:118, 85, 22,126, 43, 99, 3, 1,15,19, 28, 32, 33,42, 57, 59, 62,65, 79, 80, 83, 92, 107, 111, 112, 131, 132,139, 141 and 143

Habitat: Ponds, streams and pools.

Distribution: Maharastra, Rajasthan, Tamil Nadu, Karnataka and Kerala States in India. Ceylon Sumatra, Java, Japan Palau Island and Burma.

Remarks: *Neumania nodosa* was reported from Calicut, Kerala by Walter(1928) and this is the second report.

28) ***Neumania* (s.s) *ambigua* Piersig 1906**

(Figure-28. Figs: A – H. Plate-VII. Photograph 1a-1b)

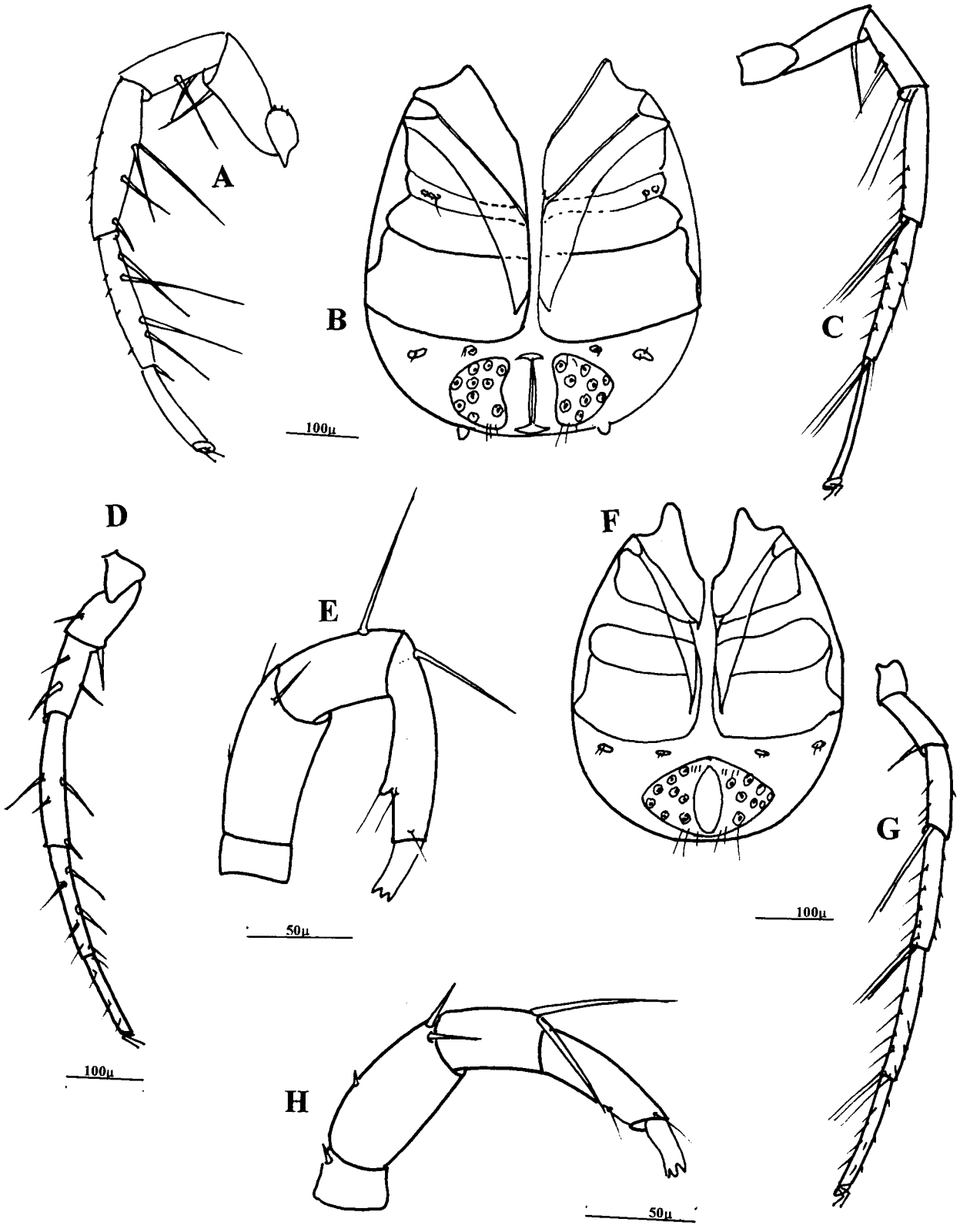
Female: Length of the body 532μ; length between anterior end of the first coxae and posterior end of fourth coxae 399μ; dorsum soft; apodemes of the fiest coxal group extending to middle of fourth coxae; coxal surface reticulate; genital field terminal, 95μ in length and 252μ in width; 9 genital acetabula present on

Figure-28

Figures: A- H, *Neumania*(S.S) *ambigua* Piersig

A. First leg female
B. Coxal region female
C. Fourth leg female
D. First leg male
E. Palpal segments female
F. Coxal region male
G. Fourth leg male
H. Palpal segments male

Figure-28



each side; lengths of the palpal segments, P-I, 25μ; P-II, 96μ; P-III, 53μ; P-IV, 93μ; P-V, 33μ; dorsal length of the segments of the first leg, I-leg-1, 66μ; I-leg-2, 119μ; I-leg-3, 146μ; I-leg-4, 212μ; I-leg-5, 199μ; I-leg-6,133,the figure shows the proportions and chaetotaxy of the first leg; dorsal lengths of the distal segments of the fourth leg; IV-leg-1, 79μ; IV-leg-2, 133μ; IV-leg-3, 133μ; IV-leg-4, 199μ; IV-leg-5, 212μ., IV-leg-6, 172μ. III-leg-3, III-leg-4, III-leg-5 each with one, six and three swimming hairs respectively. IV-leg-3,4,5 with two, three and three swimming hairs respectively.

Male: Length of the body 478μ.; length between anterior end of first coxae and posterior end of fourth coxae 325μ; dorsum soft; apodemes of first coxal group extending to middle of fourth coxae; genital field 119μ in length and 186μ in width; genital acetabula 8 on each side; dorsal length of the palpal segments, P-1, 26μ; P-II, 87μ; P-III, 50μ; P-IV, 75μ; P-V, 26μ. Dorsal length of the segments of the first leg, I-leg-1, 53μ; I-leg-2, 106μ; I-leg-3, 119μ; I-leg-4, 186μ; I-leg-5, 159μ; I-leg-6, 119μ; dorsal length of the distal segments of the fourth leg, IV-leg-1, 66μ; IV-leg-2, 106μ; IV-leg-3, 133μ; IV-leg-4, 172μ; IV-leg-5, 186μ; IV-leg-6, 172μ. IV-leg-3, 4 and 5 with two, three and three swimming hairs respectively.

Occurrence: Chovoor pond and stream AVT esatate. Collection No: 22, and 107

Habitat: Ponds

Distribution: Tamil Nadu, Karnataka and Kerala states in India and Thailand Singapore, Sumatra, Java, Philippines, Japan and Eastern Siberia.

Remarks: *Neumania ambigua* was reported from Calicut, Kerala by Walter (1928). This is the second report.

29) ***Neumania* (Ecpolopsis) *multiscutata bharatensis* Cook 1967**

(Figure-29. Figs: A – D. Plate-IV. Photograph 4b)

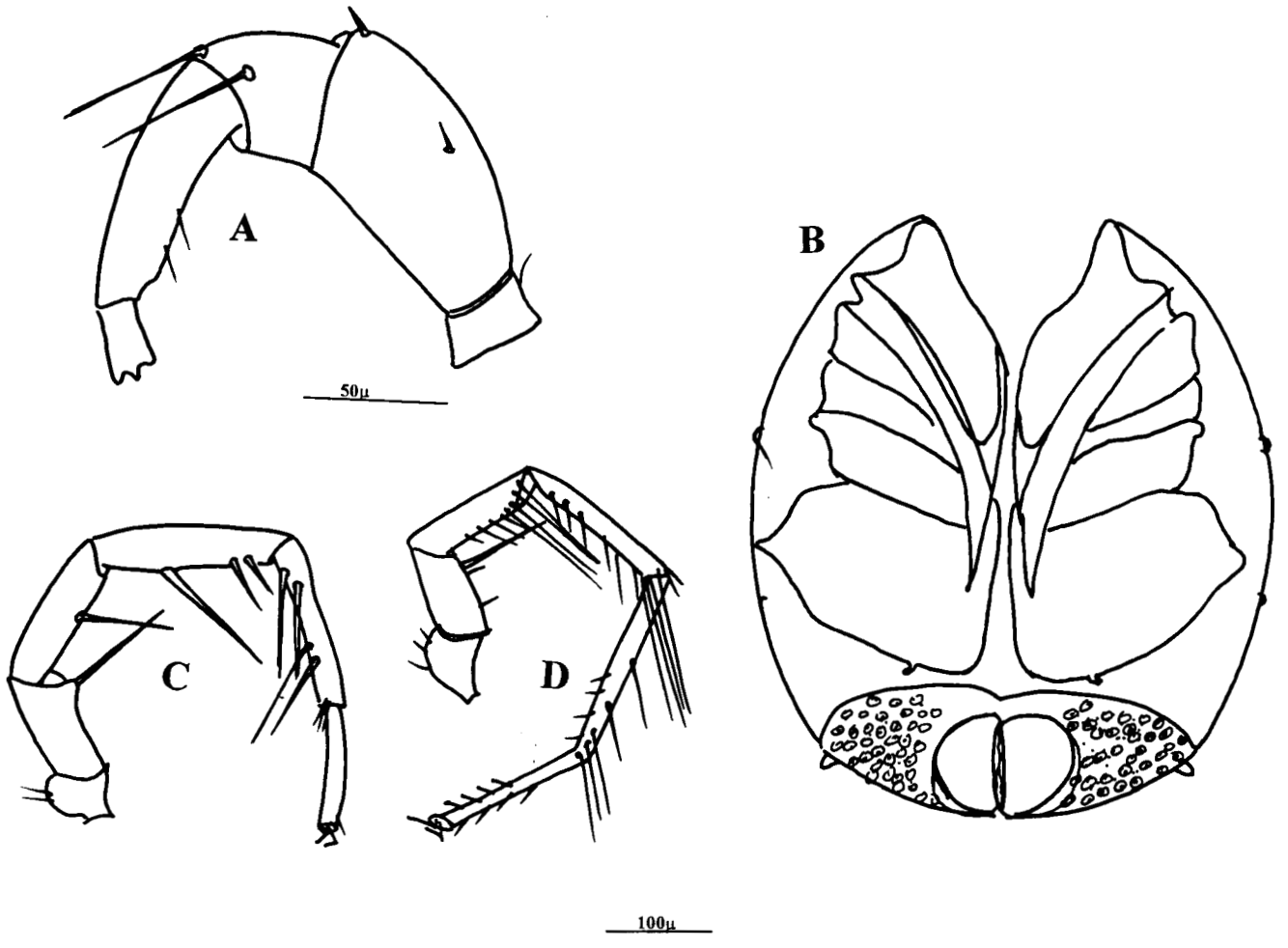
Female: Length of the body704μ; length between anterior end of first coxae and posterior end of fourth coxae 465μ; dorsum with enlarged muscle attachment platelets which are fused on their respective sides; apodemes of first coxal group extending posterior to the middle of the fourth coxae; coxal groups fused to from a ventral shield, but suture lines are visible; fourth coxae projecting in region of attachment of fourth legs; genital field 400μ in width; genital acetabula numerous; dorsal length of the palpal segments, P-I, 25μ; P-II, 107μ; P-III, 57μ; P-IV, 100μ; P-V, 25μ. Dorsal length of the segments of the first leg: I-leg-1, 53μ; I-leg-2, 119μ; I-leg-3, 133μ; I-leg-4, 186μ; I-leg-5, 186μ; I-leg-6, 133μ. Dorsal length of the segments of the fourth leg, IV-leg-1, 66μ; IV-leg-2, 106μ; IV-leg-3, 133μ; IV-leg-4, 172μ; IV-leg-5, 212μ; IV-leg-6, 165μ; IV-leg-3,4,5 with two, three, and three swimming hairs respectively.

Figure-29

Figures: A- D, *Neumania* (Ecpolopsis) *multiscuata bharatensis* Cook

A. Palpal segments female
B. Coxal region female
C. First leg female
D. Fourth leg female

Figure-29



Male: Not observed.

Occurrence: Vadakkumchery pond and Stream near Chaganassery. Collection No:137 and 108

Distribution: Karnataka State Kerala, in India. Sumatra

Remarks: This species can easily be identified by the heavily sclerotized body. It is first report from Kerala

Superfamily : ARRENUROIDEA
Family : ARRENURIDAE
Subfamily : ARRENURINAE
Genus : ARRENURUS

30) ***Arrenurus* (Megaluracarus) *rostratus* Daday 1898**

(Figure-30. Figs: A – H. Plate-VII. Photograph 3a-3b)

Female: Length of the body 798μ; width 598μ; at the anterior end of the body there is a well developed pointed rostrum; dorsal shield 400μ in length; dorsum with out projections; dorsal length of the palpal segments: P-I, 13μ; P-II, 45μ; P-III, 26μ; P-IV, 53μ; P-V, 32μ; dorsal length of the segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 93μ; I-leg-4, 106μ; I-leg-5, 106μ; I-leg-6,

Figure-30

Figures: A- H, *Arrenurus* (Megaluracarus) *rostratus* Daday

A. Fourth leg female
B. First leg female
C. Dorsal view female
D. Palpal segments female
E. First leg male
F. Fourth leg male
G. Palpal segments male
H. Dorsal view male

Figure-30

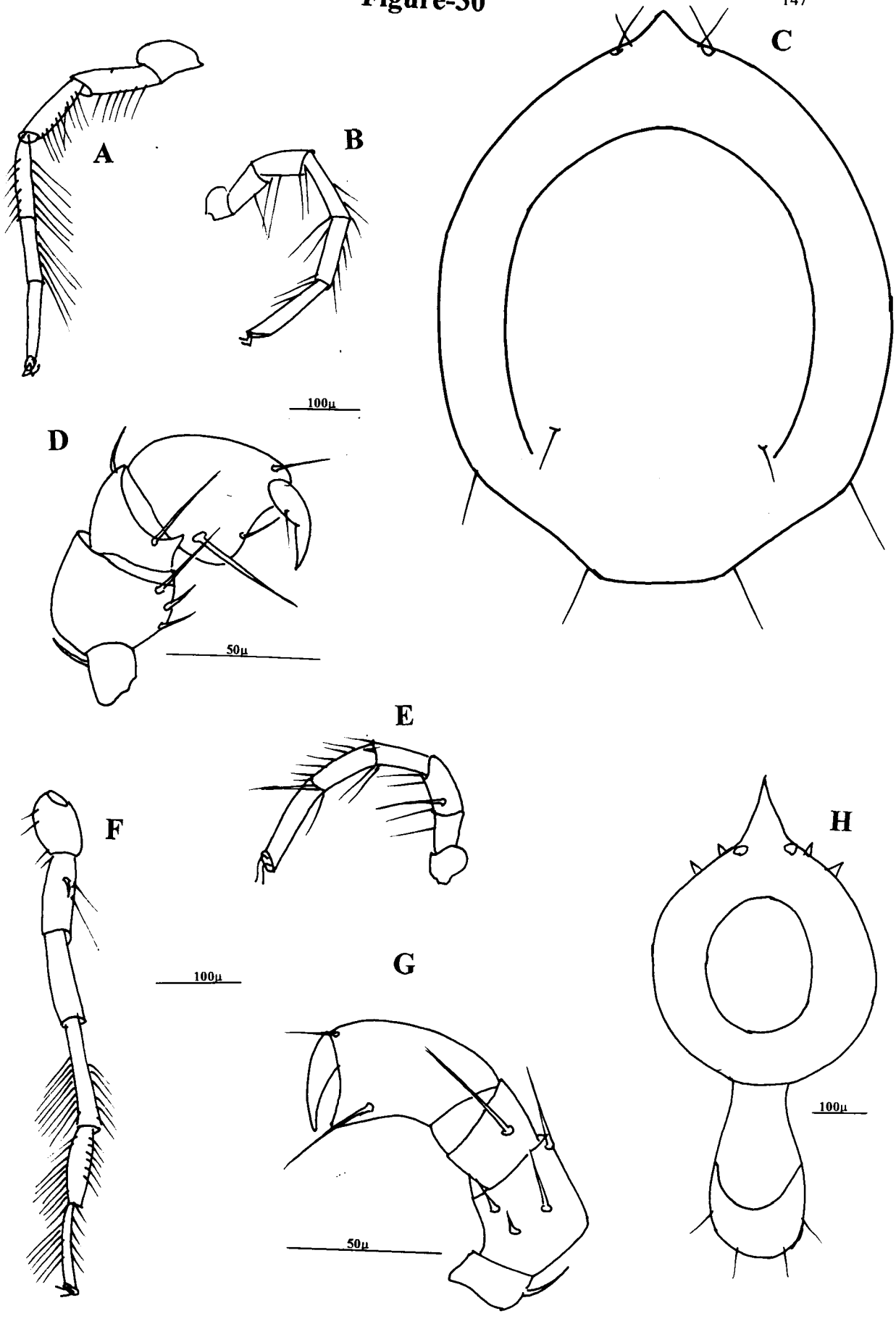
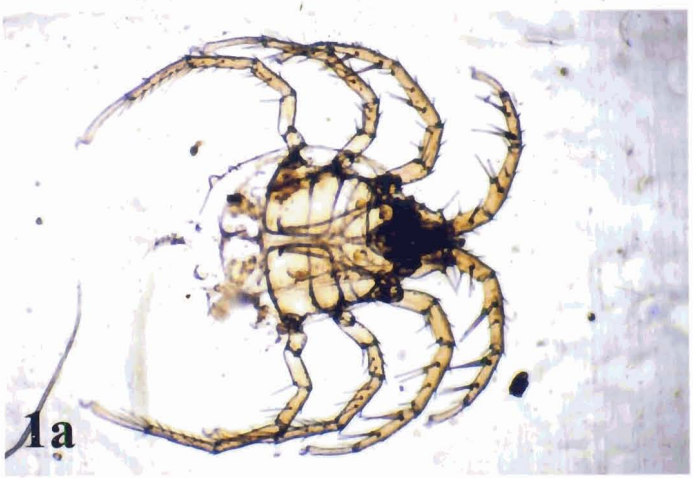


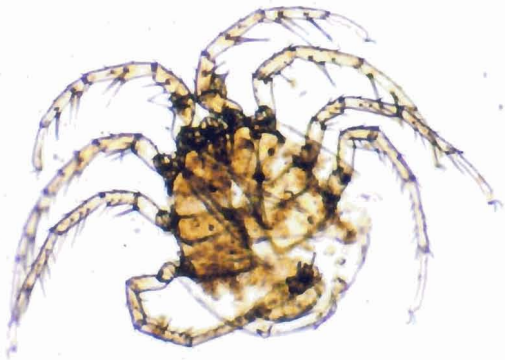
PLATE- VII
(photos 1a- 4b)

1a- *Neumania ambigua* female
1b- *Neumania ambigua* male
2a- *Arrenurus cylonicus* female
2b- *Arrenurus cylonicus* male
3a- *Arrenurus rostratus* female
3b- *Arrenurus rostratus* male
4a- *Arrenurus liberatus* male
4b- *Arrenurus caviger* male

Plate : VII



1a



1b

2a

2b

3a

3b

4a

4b

Figure-30

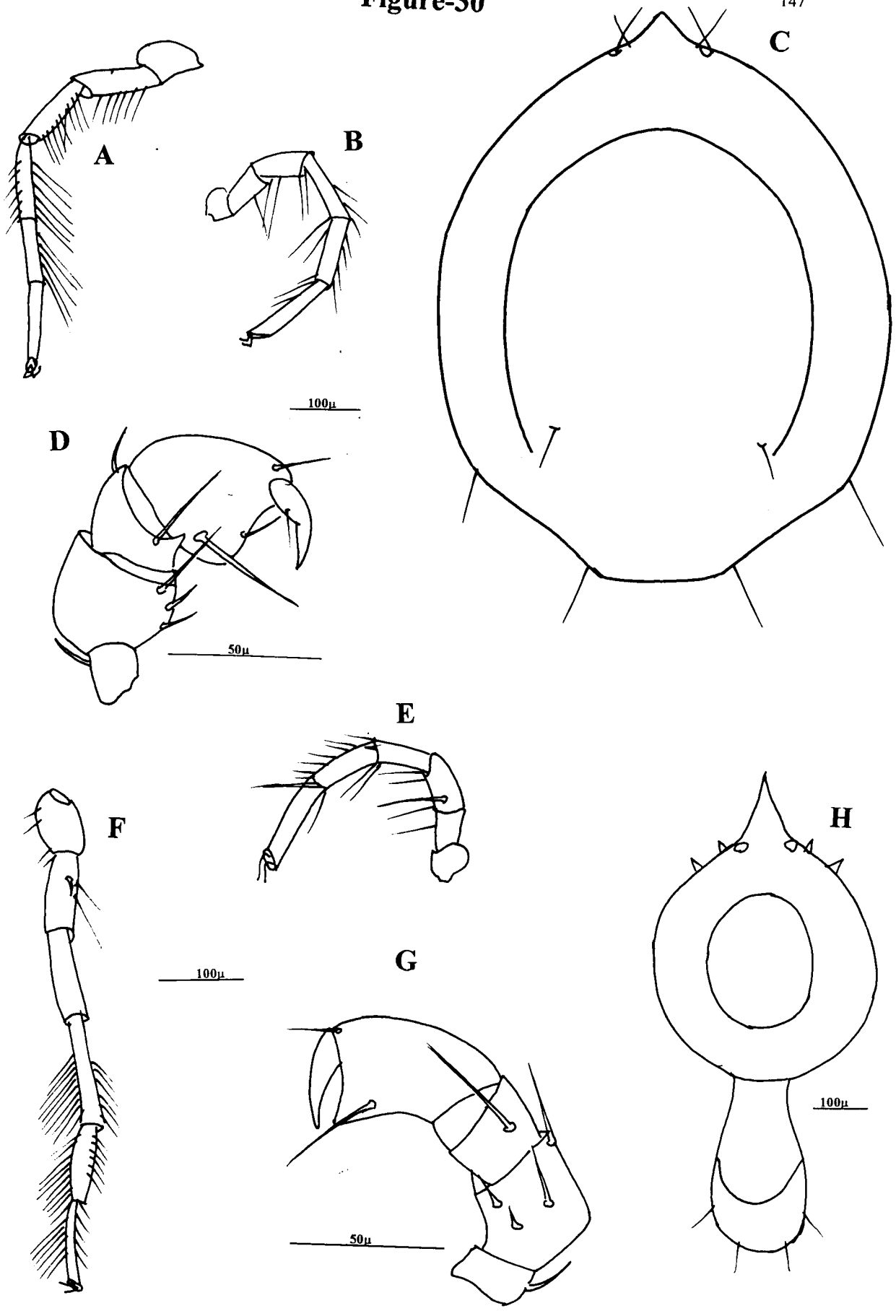


PLATE- VII
(photos 1a- 4b)

1a- *Neumania ambigua* female
1b- *Neumania ambigua* male
2a- *Arrenurus cylonicus* female
2b- *Arrenurus cylonicus* male
3a- *Arrenurus rostratus* female
3b- *Arrenurus rostratus* male
4a- *Arrenurus liberatus* male
4b- *Arrenurus caviger* male

I-leg-6, 119μ; dorsal length of the segments of fourth leg: IV-leg-1, 65μ; IV-leg-2, 93μ; IV-leg-3,106μ; IV-leg-4, 119μ; IV-leg-5, 93μ; IV-leg-6, 119μ.

Male: Length of the body 930μ; width of the body proper 412μ.; anterior end of the body produced into a pointed projection; posterior end of the body forms a cauda which is long and narrow; first and second coxae projecting beyond the body; dorsal shield 266μ in length and 212μ in width; dorsal furrow complete; dorsal length of the palpal segments: P-I, 13μ.; P-II, 45μ.; P-III, 32μ.; P-IV, 53μ.; P-V, 32μ.; dorsal length of the distal segments of the first leg: I-leg-1, 53μ.; I-leg-2, 65μ.; I-leg-3, 93μ.; I-leg-4, 106μ., I-leg-5, 106μ.; I-leg-6, 146μ.; the dorsal length of fourth leg: IV-leg-1, 79μ.; IV-leg-2, 93μ.; IV-leg-3, 106μ ; IV-leg-4, 146μ.; IV-leg-5, 119μ ; IV-leg-6, 119μ.

Occurrence: Chovoor pond, Monastery pond, Oochithrkulum, Perinkulam, Kottakulam, Kole Muriad, Mankudam kadavue, Paddy field Kaloor, Pond Valiayaparambu and Stream Karayamparambe Collection No: 22, 62, 70, 85, 45, 42,55, 71, 92 and 111

Habitat: Ponds, paddy fields and streams.

Distribution: Sumatra, Java, Singapore, China, Ceylon and India

31) ***Arrenurus* (Megaluracarus) *ceylonicus* Daday 1898**

(Figure-31. Figs: A – H. Plate-VII. Photograph 2a-2b)

Female: Length of the body 758μ; width of the body 744μ; anterior end without a pointed rostrum, dorsal shield fused ventrally, dorsal shield 417 in width, dorsum without projections, dorsal lengths of the distal segments of the palpal segments: P-I, 19μ; P-II, 56μ; P-III, 32μ; P-IV, 55μ; P-V, 45; P-II with numerous short slightly thickened setae; length of the segments of the first leg: I-leg-1, 26μ; I-leg-2, 52μ; I-leg-3, 79μ; I-leg-4, 106μ; I-leg-5, 106μ; I-leg-6,133μ; length of the segments of the fourth leg: IV-leg-1, 68μ; IV-leg-2, 90μ; IV-leg-3, 113μ; IV-leg-4, 136μ; IV-leg-5, 154μ; IV-leg-6, 154μ; swimming hairs present on second, third and fourth legs

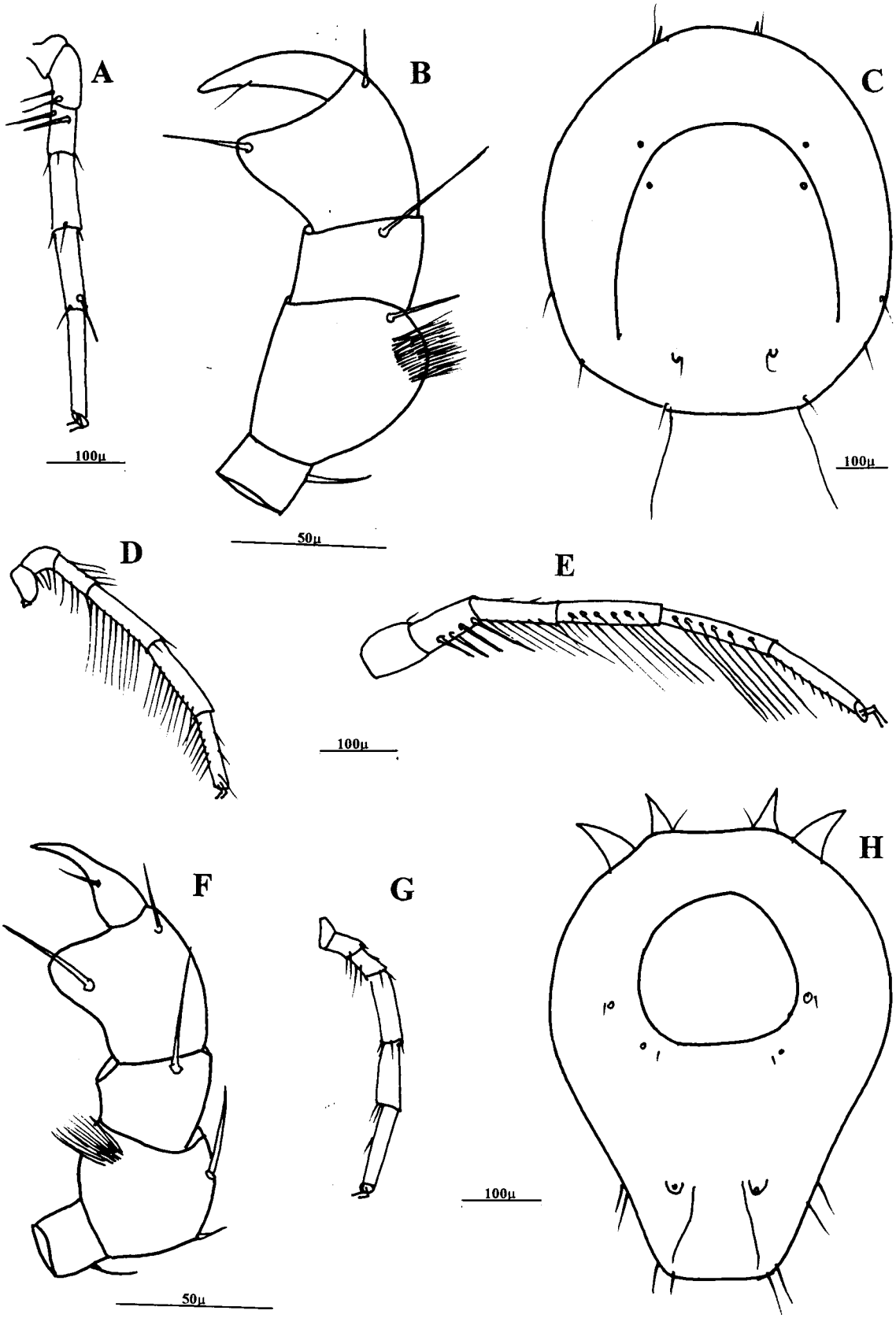
Male: Length of the body 665μ; width of the body proper 465μ; cauda short and not distinctly separated from the body proper; posterior end of the cauda truncate; a pair of large glandularia present near posterior end; dorsal shield 199μ in length and 220μ in width; dorsal plate widest posteriorly; dorsal furrow complete; dorsal length of palpal segments: P-I, 19μ; P-II, 53μ; P-III, 26μ; P-IV, 53μ; P-V, 39μ; P-II with numerous, short, slightly thickened setae; dorsal length of the segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 79μ; I-leg-4, 93; I-leg-5, 106μ; I-leg-6, 119μ; dorsal length of the segments of

Figure-31

Figures: A- H, *Arrenurus* (Megaluracarus) *ceylonicus* Daday

A. First leg female
B. Palpal segments female
C. Dorsal view female
D. Forth leg male
E. Fourth leg female
F. Palpal segments male
G. First leg male
H. Dorsal view male

Figure-31



the fourth leg: IV-leg-1, 53μ; IV-leg-2, 66μ; IV-leg-3, 66μ; IV-leg-4, 119μ; IV-leg-5, 119μ; IV-leg-6,93μ..

Occurence: Chovoor pond, Janakinayar kulum, Perinkulam , Cheroor paddy field, Stream Perunipalli , Thiruvinikulam, Stream Changanassery, Monastry Pond, Paddy field Oochira, Mattom pond, Muthuvattur pond, Paddy field Pananghode Collection No: 22, 39, 85, 72, 131, 108, 62, 76, 57, 66 and 74

Habitat: Ponds, Paddy fields and streams

Distribution: Karnataka and Kerala State in India. Sumatra, Java and Ceylon.

Remarks: Walter (1928) reported from Calicut, Kerala. Cook (1967) reported male from Gundlupet, Mysore. The male and female have a tuft of setae on their P-II which is very characterestic.

32) ***Arrenurus* (Megaluracarus) *bicoricodulus* Piersig 1906**

(Figure-32. Figs: A – D. Plate-VIII. Photograph 1a)

Male: Length of the body 798μ; width of the body proper 691μ; a short cauda present; width of the cauda 465μ; posterior end of the cauda with a broad convity; dorsal shield present, which is 305μ, in length and 345μ, in width; dorsal length of the palpal segments: P-I, 26μ; P-II, 70μ; P-III, 45μ; P-IV, 75μ; P-V, 45μ; P-V expanded distally; dorsal length of the segments of the first leg: I-

Figure-32

Figures: A- D, *Arrenurus* (Megaluracarus) *bicornicodulus* Piersig

A Palpal segments male
B Fourth leg male
C Dorsal view male
D First leg male

Figure-33

Figures: A- D, *Arrenurus* (Megaluracarus) *Caviger* Viets

A. Palpal segments male
B. Dorsal view male
C. Fourth leg male
D. First leg male

Figure-32

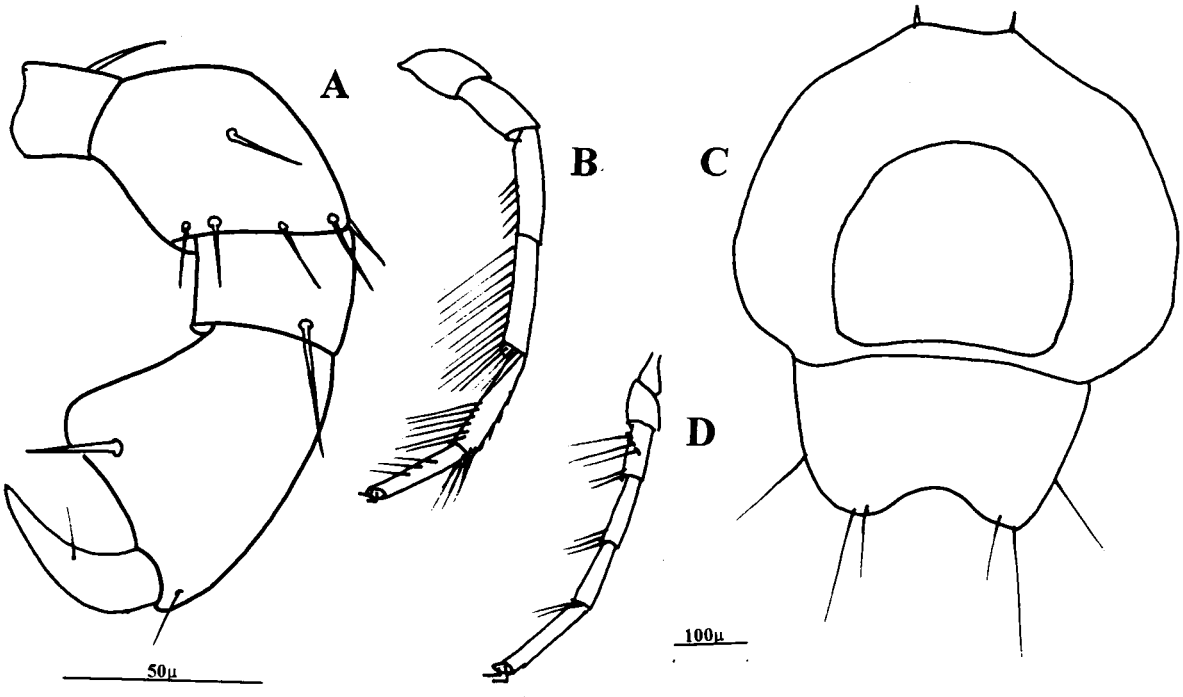
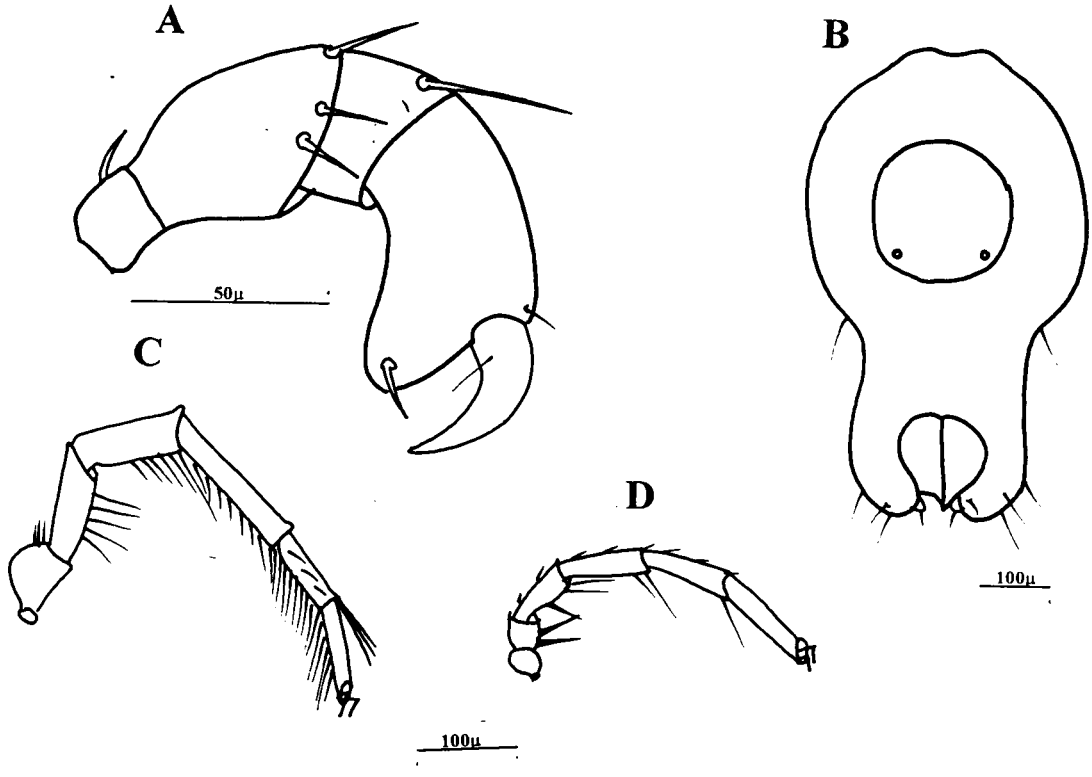


Figure-33



leg-1, 39μ; I-legh-2, 42μ; I-leg-3, 79μ; I-leg-4, 133μ; I-leg-5, 119μ; I-leg-6,160μ; dorsal length of the segments of the fourth leg: IV-leg-1, 79μ; IV-leg-2, 106μ; IV-leg-3, 146μ; IV-leg-4, 172μ; IV-leg-5, 172μ;, IV-leg-6,133μ; fourth leg with many swimming hairs.

Female: Not observed

Occurrence: Monastery pond, Canal-irrigation Nappanchira and Stream Changanassery. Collection No; 62, 12, and 108

Habitat: Ponds and irrigation canals

Distribution: Previously reported from Calicut, Kerala by Walter (1928). Reported from Gundlupet, Karnataka by Cook (1967). This species has previously been reported from Sumatra, Java, Singapore and Thailand

33) ***Arrenurus(Megaluracarus) caviger* Viets**

(Figure-33. Figs: A – D. Plate-VII. Photograph 4b)

Male: Length of the body 744μ; width of the body proper 465μ; anterior end of the body not projecting; cauda present which is long and broad; length of the cauda 290μ; posterior end of cauda produced in to a deep concavity; first and second coxae projecting anteriorly; dorsal shield 212μ in length and 199μ in width; Dorsal length of the palpal segments: P-I, 26μ; P-II, 53μ; P-III, 39μ;

P-IV, 66μ; P-V, 39μ; dorsal length of the segments of first leg: I-leg-1, 39μ; I-leg-2, 66μ; I-leg-3, 66μ; I-leg-4, 79μ; I-leg-5, 99μ; I-leg-6, 119μ; dorsal length of the segments of fourth leg: IV-leg-1, 79μ; IV-leg-2, 93μ; IV-leg-3, 119μ; IV-leg-4,159μ; IV-leg-5, 79μ; IV-leg-6, 93μ.

Female: Not observed

Occurrence: Chovoor. Collection No: 22

Habitat: Ponds

Distribution: Kerala State. Sri Lanka

Remarks: Frist report of *Arrenurus caviger* Viets from India. Fernado (1974) reported it from Sri Lanka.

34) ***Arrenurus* (Micruracarus) *madaraszi* Daday 1898**

(Figure-34. Figs: A – D. Plate-VIII. Photograph 1b)

Male: Length of the body 458μ; width 438μ; cauda small and gradually tapering posteriorly; dorsal shield 332μ, in length and 291μ, in width; at the posterior end of the cauda there is a concavity, with a well developed petiole; dorsal length of the palpal segments: P-I, 26μ; P-II, 53μ; P-III, 32μ; P-IV, 75μ; P-V, 39μ; dorsal length of the segments of the first leg: I-leg-1, 26μ; I-leg-2, 39μ; I-leg-3, 66μ; I-leg-4, 85μ; I-leg-5, 85μ; I-leg-6, 119μ; dorsal length of the

Figure-34

Figures: A- D, *Arrenurus* (Micruracarus) *madaraszi* Daday

A. Fourth leg male
B. First leg male
C. Dorsal view male
D. Palpal segments male

Figure-35

Figures: A- D, *Arrenurus* (s.s) *liberatus* Walter

A. First leg male
B. Fourth leg male
C. Dorsal view male
D. Palpal segments male

Figure-34

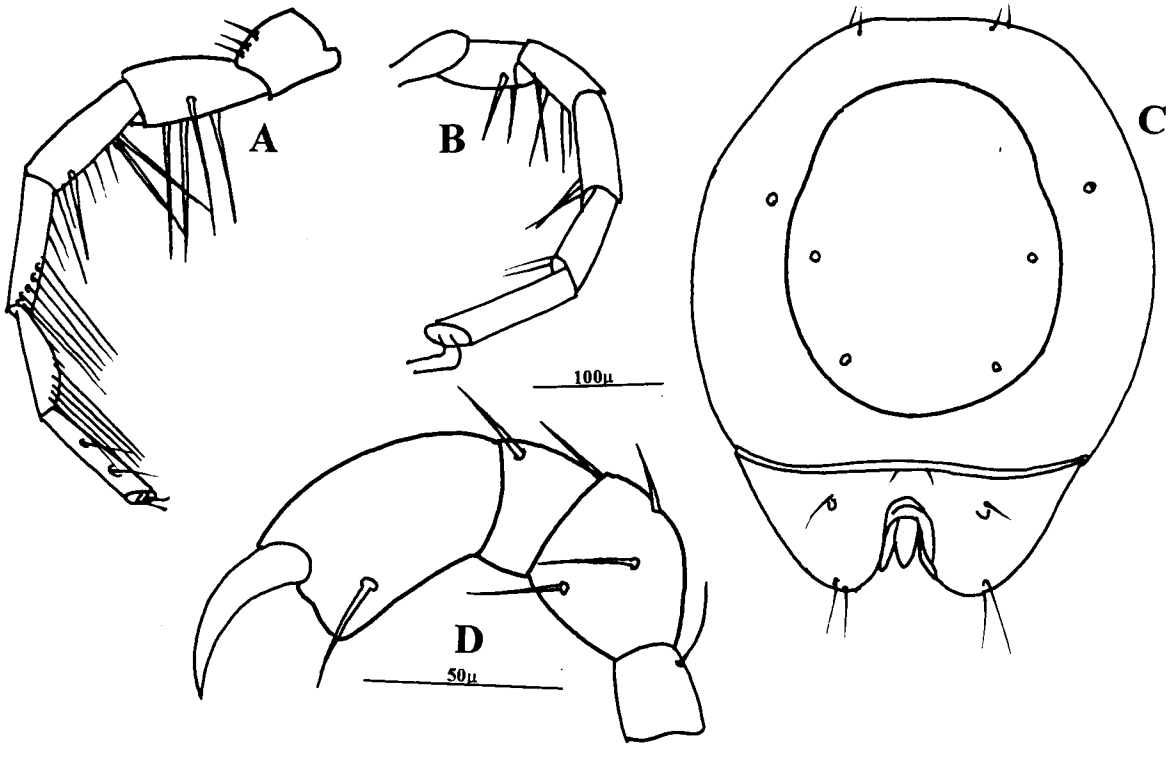
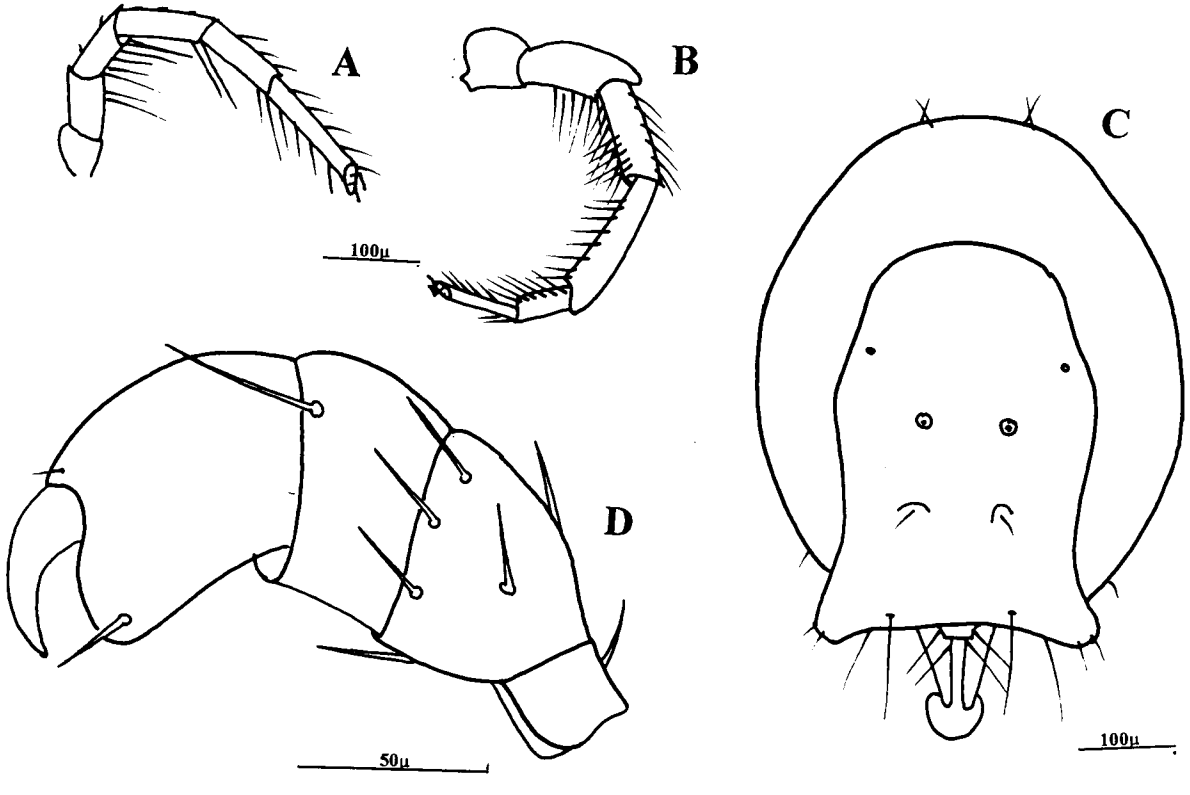


Figure-35



fourth leg: IV-leg-1, 65μ;, IV-leg-2, 75μ; IV-leg-3, 90μ; IV-leg-4, 113μ; IV-leg-5, 81μ; IV-leg-6, 90μ; fourth leg with several swimming hairs.

Female: Not observed

Occurrence: Edanad pond, Chovoor pond, Monatry pond, Changham.kulangara pond, Cheroor Pady field. Paddy field Mulamthuruthy. Collection No: 138, 22, 62, 17, 72 and 79

Habitat: Ponds and Paddy fields

Distribution: This species has been reported from India from Rajasthan state, Maharashtra, Karnanadaka, and Kerala States. This species has been reported from Ceylon, Singapore, China, Japan, Sumatra and Java.

Remaks: It is reported from Kerala for the first time.

35) ***Arrenurus* (s.s) *liberatus* Walter 1929**

(Figure-35. Figs: A – D. Plate-7. Photograph 4a)

Male: Length of the body including petiole 731μ; width of the body proper 465μ; cauda short, posteriorly directed caudal lobes present; width between the outer margins of the caudal lobes 319μ; anterior end of the body not projecting; petiole with a posterior hyaline area; dorsal length of palpal segments: P-I, 26μ; P-II, 66μ; P-III, 39μ; P-IV, 66μ; P-V, 39μ; dorsal length of

the segments of the first leg: I-leg-1, 39μ; I-leg-2, 53μ; I-leg-3, 79μ; I-leg-4, 93μ; I-leg-5, 105μ; I-leg-6, 147μ; dorsal length of the segments of the fourth leg: IV-leg-1, 53μ; IV-leg-2, 79μ; IV-leg-3, 133μ; IV-leg-4, 186μ; IV-leg-5, 66μ; IV-leg-6, 79μ;

Female: Not observed.

Occurrence: Kottakulam pond, Chovoor pond and Palakal Kole field. Collection No: 45, 22 and 43

Habitat: Ponds and Paddy fields

Distribution: Ceylon, Singapore, Sumatra, Java, Bali and India.

Remarks: Cook (1967) reported from Trichur and Karnataka State

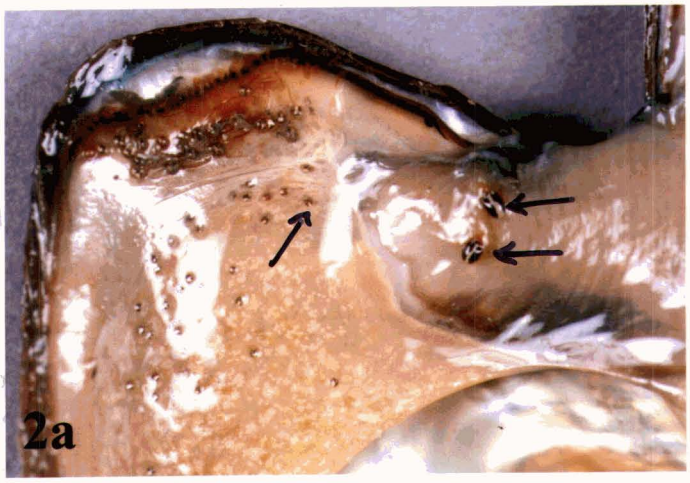
PLATE- VIII
(photos- 1a- 4b)

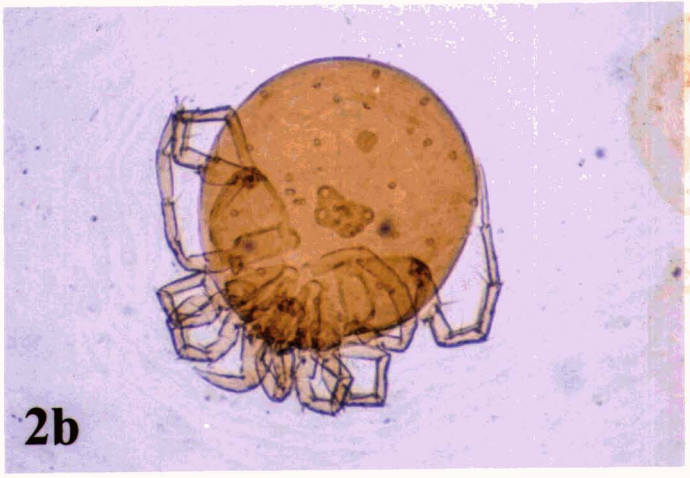
1a- *Arrenurus bicornicodulus* male
1b- *Arrenurus madaraszi* male
2a- Portion of mantle cavity of *Lamellidens marginalis*
(Two adult mites and a number of nymphs can be seen)
2b- Water mite nymph collected from *L. margimalis*
3a- Larva collected from *L.marginalis*
3b- Larva of *U.diversipes* from the mantle cavity
4a- *Ranatra sordidula* carrying various developmental stages of a water mite
4b- Larva of a water mite collected from *Ranatra sordidula*

Plate : VIII


1a

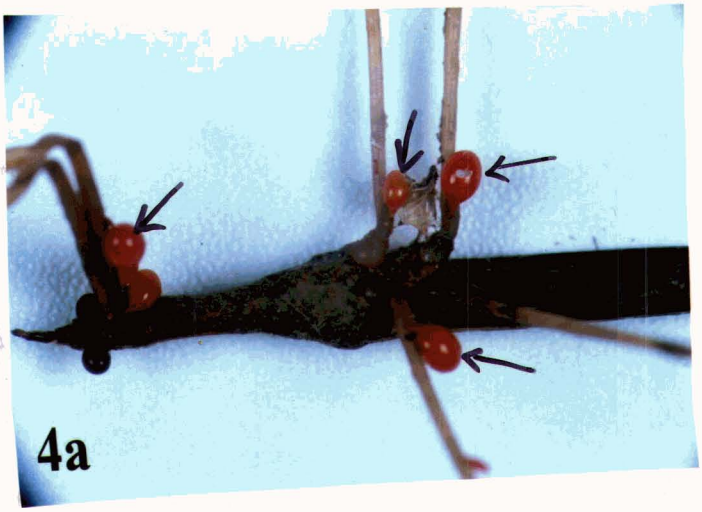

1b

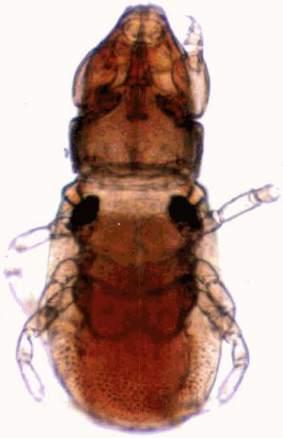

2a


2b


3a


3b


4a


4b

B. MITES ASSOCIATED WITH FRESH WATER MUSSEL -*Lamellidens marginalis* Lamark

(Class- Pelecypoda. Order- Unionoida. Family- Unionidae. Genus- *Lamellidens*)

B.1 INTODUCTION: Water mites represent a series of extensive adaptive radiation and occur in most fresh water habitat. Some members of the genus *Unionicola* are known for their unusual behaviour, that is they are parasites of fresh water mussel. Some species spend only their transforming stages in their molluscan host (transient) whereas others are permanent internal parasites (Baker, 1991). These mites are unique in that they spend part of their life cycle as larval parasites on chironomids and as nymphs and adults living symbiotically within fresh water bivalve molluscs. Mitchel (1965) made observations on the population of *Unionicola fossulata* (Walcot) in Michigan lake and found that 90 percentage of the host, *Lampsilis siliquoidea* were infected with these mites. He found most parasitized host carry only one or two female mites plus one males. Mitchell (1957) studied the status of *U.formosa* Dana and Whelpley; *U.wolcoti* Piersig that commonly parasitize mussels of the genus *Anodonta*. Davids(1973b) studied relation between the mites, *U. aculeate, U.bonzi, U.intermedia* and *U.ypselophora* and the mussels *Anodonta* and *Unio*. He observed that *U.aculeate* needs especially *Anodonta anatina* as a shelter for the tranformation stages.

U. bonzi needs *Unio pictorum. Unionicola intermedia* was found in both *Anodonta anatina* and *A. cygnea. Unionicola ypsilophora* was found in *Anodonta cygnea*, while their larvae have a parasitic dependence on chironomids (Hevers 1980). Baker (1987) studied the life history of *Unionicola ypsilophora* . He observed seasonal variation in the number of nymphs of *U.ypsilophora* in individual *A.cygnea*. Baker (1988) made observation on the seasonal dynamics of *Unionicola ypsilophora* and *U. intermedia.* Davids et al. (1988) made observations on the co-existing fresh water mussels *Anodonta cygnea* and *A. anatina* that serve as hosts for the water mites *Unionicola ypsilophora* and *U.intermedia*, repectively and found that male *U.ypsilophora* display a territorial behaviour. He observed that the males fight with other males and as a result, there is usually only one male per host. Baker et al (1991) studied the larval attachment of *U.aculeate* and *U.ypsilophora* on abdominal segments of Chironomid adult. Baker et al (1992) studied the seasonal changes in the population of *Unionicola intermedia* in the fresh water mussel *Anodonta anatima.* Majumder, and Paul (1988) did some work on larval development of *Unionicola* sp, a freshwater mite of *Lamellidens marginalis* from Bengal. No work had been reported in Kerala on water mites associated with *Lamellidens marginalis.* The present study is to find out different species of water mites associated with freshwater mussel *Lamellidens marginalis* and to study the incidence and abundance of the dominant species.

B.2 MATERIALS AND METHOD:

Fresh water mussels were collected from four different locations. They are from Alappad, Trichur (collection No: 34); Manalipuzha, Trichur (collection No:35); Choughat, Trichur (collection No: 36) and Pullazhy, Trichur (collection No:37). From Pullazy (collection number 37) periodic collections were made every two months. Eight such collections were made from August 2000 to October 2001. Twenty fresh water mussels of various sizes were collected at a time in the case of periodic collections. All hosts were examined by cutting the adductor muscle and the shells opened. The mantle, gill and body surface were examined carefully for the presence of mites. The nymphal stages encountered were also counted. The occurance of eggs on the gills was also noted. The adult mites and the nymphal stages were preserved in Koenike's fluid in separate bottles for each fresh water mussel. The identification of the adult mites was made after clearing them and mounting in glycerin jelly. These accounts were tabulated as per the routine system of tabulation for all the species. Female and male of each species were noted separately. The data obtained from the four different localities (Collection Nos.34; 35; 36; 37) is presented in Table No:1. The data obtained for the collections from the same locality (Pullazhy) were statisticaly analysed.

B.3 RESULT:

Five different species of water mites collected from the mantle cavity of the fresh water mussels obtained from the collection made from the four different localities. They are *U.diversipes*, *U.brandti*, *U.scutigera*, *U.kantaka* female and *U.trichurensis* a new species. The total number of each species collected from the four different localities is shown in Table.1. Female *U.kantaka* is not so far reported elsewhere and only a single specimen was obtained. The frequency of the presence of water mites associated with fresh water mussel *Lamellidens marginalis* varies from 0-4 per mussel. A total of 218 *U.bradti*, 35 *U.diversipes* and 17 *U.scutigera*, were collected during the period August 2000 to October 2001 from the mantle cavity of fresh water mussels. A total of 270 adults and 3595 nymphs were collected (Table 2). The dominant species was found to be *U.brandti* in that locality (Fig 36). Males and females were found in all the bimonthly collections of the year. A total of 160 fresh water mussels examined for the presence of various mites and the percentage of incidence of infection were found to be 78 % for *U.brandti*, 12.5 % for *U.diversipes* and 6.8 % for *U.scutigera*. Ninety percent of the total collection of fresh water mussel was found infected with any one of these mites(Table 3). The nymphal population increases considerably during the April segment (Fig. 37). Occurance of nymphal stages in the mantle cavity was observed (Plate- VIII, 2a 2b). Eggs and larval

stages were also found in the gill septum (Plate- VIII, 3a 3b). The percentage total of *U.brandti* female, male adults and nymphs is presented in the Table: 4. (Fig.37). Statistical analysis was done for each bimonthly collections and also for total collections in the case of *U.brandti* female, male, adults and all adults (Table 5,6,7,8 and 9). ANOVA showed that there was significant variation in the average number of *U.brandti* in the bimonthly samples (Table 10 and 11).

TABLE. 1. Total number of different species of mites collected from fresh water mussel in different localities

Species	Site No:1 Collection No:34 16-01-96		Site No: 2 Collection No:35 26-01-96		Site No: 3 Collection No:36 13-02-00		Site No: 4 Collection No:37 12-04-00	
	Female	Male	Female	Male	Female	Male	Female	Male
U.diversipes	13	14	1	0	0	0	0	0
U.brandti	1	1	5	2	6	6	4	6
U.scutigera	4	3	1	1	1	1	0	0
U.trichurensis	0	0	1	1	0	0	0	0
U.kantaka	0	0	1	1	0	0	0	0
Total	19	8	8	5	7	7	4	6
Number of Mussels examined	10		08		10		08	

TABLE . 2 Consolidated account of the different species of mites and total nymphs obtained during Aug-00 to Oct- 01(sample size 20)

	U.diversipes		*U.brandti*		*U.scutigera*		Adult	Nymph
	Female	Male	Female	Male	Female	Male	Total	Total
Aug-00	4	2	14	14	1	1	36	315
Oct-00	1	1	11	14	3	2	32	320
Dec-00	6	7	13	14	1	0	41	445
Feb-01	2	2	14	15	1	1	35	570
Apr-01	1	0	11	7	0	0	19	1125
Jun-01	1	1	19	19	0	0	40	80
Aug-01	1	1	16	15	2	2	37	365
Oct-01	3	2	10	12	2	1	30	375
Total	19	16	108	110	10	7	270	3595

TABLE. 3 Percentage of occurance of infection in the total collection of 160 fresh water mussels (sample size 20)

No.of mussels infected with	Aug-00	Oct-00	Dec-00	Feb-01	Apr-01	Jun-01	Aug-01	Oct-01	%
U.diversipes	4	1	7	2	1	1	1	3	12.5
U.brandti	15	16	14	15	13	19	18	15	78
U.scutigera	2	2	1	1	0	0	2	2	6.8
Any one of these mites	19	17	19	18	14	20	19	18	90

TABLE. 4. Percentage total of *U.brandti*, female, male, adult and nymphs. (Number of nymphs taken in proportion to the adult)

	Aug-00	Oct-00	Dec-00	Feb-01	Apr-01	Jun-01	Aug-01	Oct-01
Female	13	10.2	12	13	10.2	17.6	14.8	9
Male	12.7	12.7	12.7	13.6	6.4	17.3	13.6	11
Adult	13	11.5	12.3	13.3	8.2	17.4	14.2	10
Nymph	8.1	8.6	9.8	15.8	35.6	2.5	10.2	9.2

TABLE. 5 Mean, standard deviation and standard Error for individual collections of *U.brandti* female

Period	No: of Mussels	Average No: of mite (Mean)	Std.deviation	Std. Error	95%confidence interval for average No: of mite	
					Lower bound	Upper bound
Aug-00	20	0.7000	0.4702	0.1051	0.4800	0.9200
Oct-00	20	0.5500	0.5104	0.1141	0.3111	0.7889
Dec-00	20	0.6500	0.4894	0.1094	0.4210	0.8790
Feb-01	20	0.7000	0.4702	0.1051	0.4800	0.9200
Apr-01	20	0.5500	0.5104	0.1141	0.3111	0.7889
Jun-01	20	0.9500	0.2236	5.0000E-02	0.8453	1.0547
Aug-01	20	0.8000	0.4104	9.177E-02	0.6079	0.9921
Oct-01	20	0.5000	0.5130	0.1147	0.2599	0.7401
Total	160	0.6750	0.4698	3.714E-02	0.6016	0.7484

TABLE. 6. Mean, standard deviation and standard Error for individual collections of *U.brandti* male

Period	No: of Mussels	Average No: of mite (Mean)	Std.deviation	Std. Error	95%confidence interval for average No: of mite	
					Lower bound	Upper bound
Aug-00	20	0.7000	0.4702	0.1051	0.4800	0.9200
Oct-00	20	0.7000	0.4702	0.1051	0.4800	0.9200
Dec-00	20	0.7000	0.4702	0.1051	0.4800	0.9200
Feb-01	20	0.7500	0.4443	9.934E-02	0.5421	0.9579
Apr-01	20	0.3500	0.4894	0.1094	0.1210	0.5790
Jun-01	20	0.9500	0.2236	5.0000E-02	0.8453	1.0547
Aug-01	20	0.7500	0.4443	9.934E-02	0.5421	0.9579
Oct-01	20	0.6000	0.5026	0.1124	0.3648	0.8352
Total	160	0.6875	0.4650	3.676-E-02	0.6149	0.7601

TABLE. 7. Mean, standard deviation and standard Error for individual collections of *U.brandti* all adults

Period	No: of Mussels	Average No: of mite (Mean)	Std.deviation	Std. Error	95%confidence interval for average No: of mite	
					Lower bound	Upper bound
Aug-00	20	1.4000	0.8826	0.1974	0.9869	1.8131
Oct-00	20	1.2500	0.7864	0.1758	0.8820	1.6180
Dec-00	20	1.3500	0.8751	0.1957	0.9404	1.7596
Feb-01	20	1.4500	0.8256	0.1846	1.0636	1.8364
Apr-01	20	0.9000	0.7881	0.1762	0.5312	1.2688
Jun-01	20	1.9000	0.4472	1.000E-01	1.6907	2.1093
Aug-01	20	1.5500	0.6863	0.1535	1.2288	1.8712
Oct-01	20	1.1000	0.7881	0.1762	0.7312	1.4688
Total	160	1.3625	0.8048	6.362E-02	1.2368	1.4882

TABLE. 8. Mean, standard deviation and standard error for *U.brandti* female, male and adult

Species *U.brandti*	Mean	S.D.	S.E	95% Confidence Interval for mean
Female	0.6750	0.4698	0.0371	(0.6016, 0.7484)
Male	0.6875	0.4950	0.0368	(0.6149, 0.7601)
Adult	1.3625	0.8048	0.0638	(1.2368, 1.44882)

TABLE. 9 Mean, standard deviation, standard error for total mites (*U.diversipes, U.brandti and U.scutigera*)

Total Mites (Common)	Mean	S.D.	S.E.	95% confidence Interval for Mean
Adult	1.6875	0.7785	0.0615	(1.5659, 1.8091)
Nymph	22.5313	25.0973	1.9841	(18.16126, 26.4499)

TABLE .10 Seasonal variation in numbers of *U. brandti* per host mussel. The "F-test indicates the probability of variance between samples being greater than the variance within the samples. Each stage was tested independently.

ANOVA

U.brandti	.Mean No.of Mites / host	Total. S.S d.f.(159)	Between sample T,S.S.(df 7)	within sample En. s.s.(df 152)	F	Sig nifi can ce
Female	0.6750± 0.0734	35.100	3.100	32.000	2.104	0.046
Male	0.6875± 0.0726	34.375	3.975	30.400	2.839	0.008
Adult	1.3625± 0.1257	102.975	12.575	90.400	3.021	0.005

TABLE. 11 Seasonal variation all categories (*U.diversipes*, *U.scutigera* and *U. brandti*) of mites per host mussel taken together and all nymphal stages. The "F-test indicates the probability of variance between samples being greater than the variance within the samples. Each stage was tested independently.

ANOVA

All cate-gories	Mean No.of Mites / host	Total. S.S d.f.(159)	Between samples T,S.S.(df 7)	within sample En. s.s.(df 152)	F	Sig nifi can ce
Adult	1.6875±0.1216	93.375	17.175	79.200	4.709	0.00
Nymph	22.5313±3.9187	100149.8	32621.09	67528.75	10.49	0.00

Ref:

1. $F_{7,152}$ (α= 0.05) =2.0703
2. $F_{7, 152}$ (α=0.01) =2.7589

Figure 36

Graphic representation of *U.diversipes, U.brandti and U.scutigera* populations

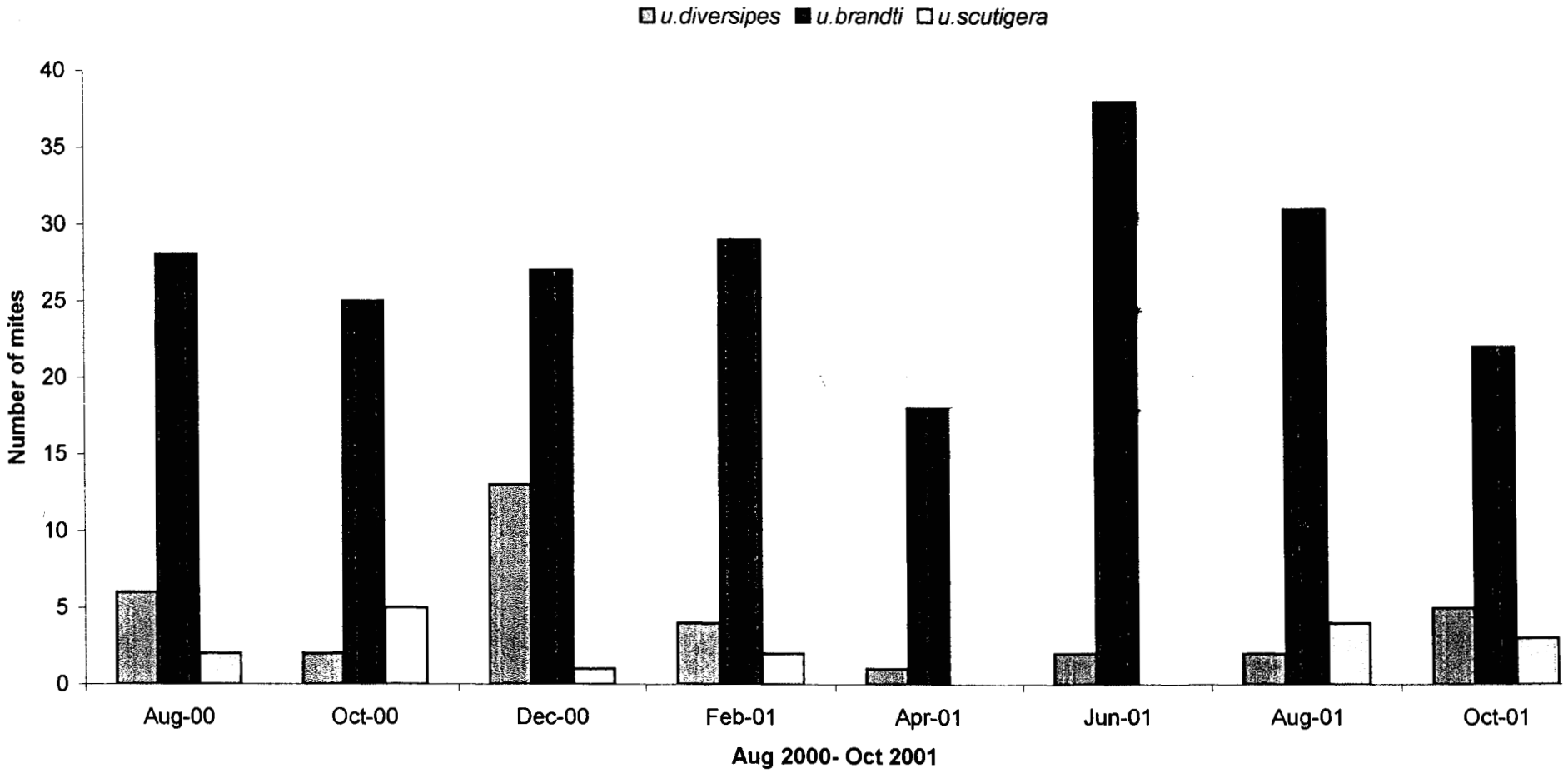
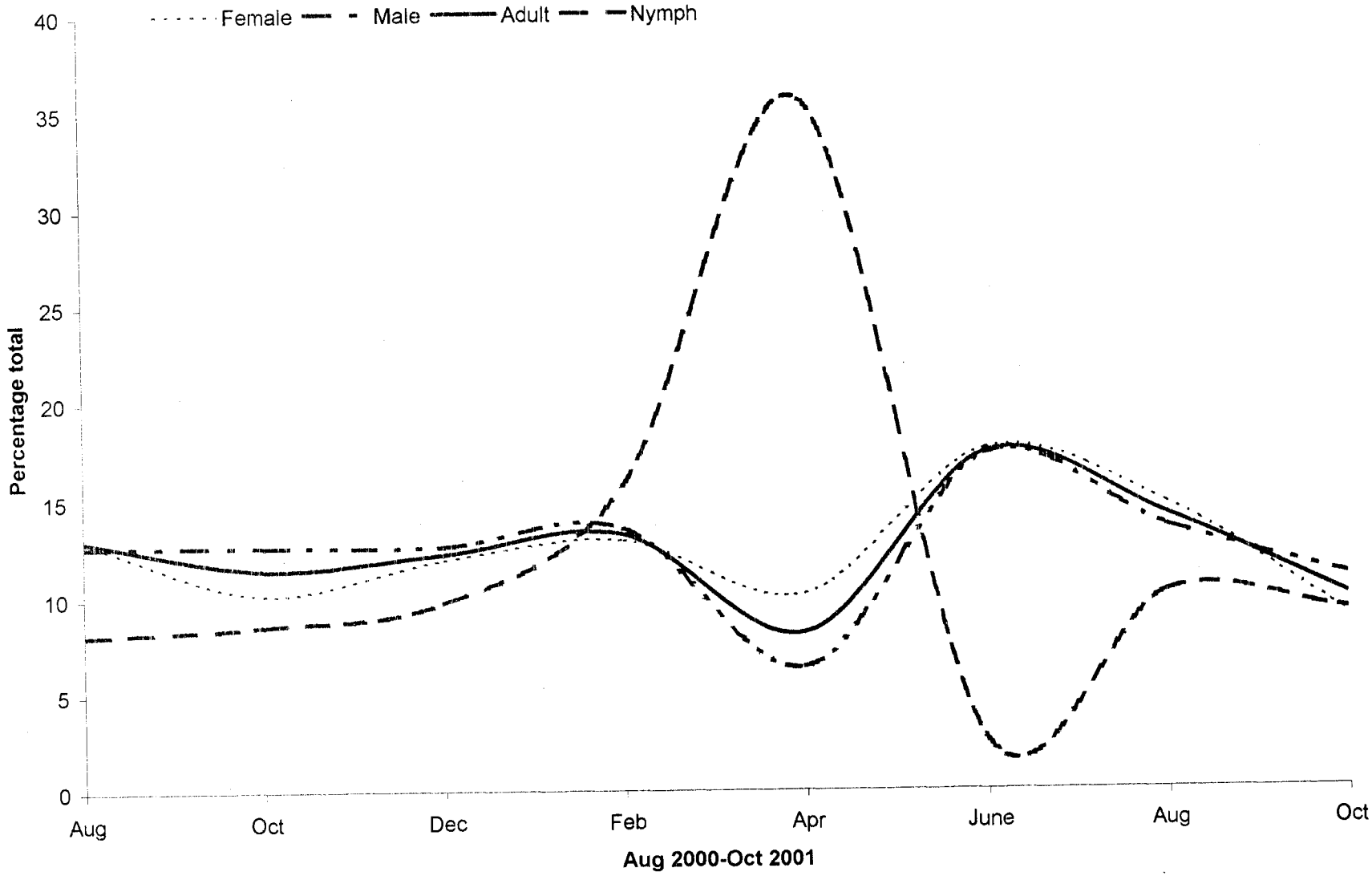


Figure 37

Graphic representation to show the population behaviour of *U.brandti*



DISCUSSION

DISCUSSION

An extensive collection of fresh water mites from Kerala was done during the research period. A total number of 144 collections were made from different localities, such as ponds, paddy fields, wells and rivers. Ecologically they belong to forest area, plain land and coastal area. The population of water mites in the coastal area was found much less compared to the other two. This may be due to salinity factor associated with coastal area. The temperature and P^H showed not much difference between localities. P^H varied from 5 to 7. Temperature showed variation from 26°C to 31°C in rainy season and in summer respectively. But in the same season there was no significant difference in the temperature among different localities. An exception to this is Devikulum and Nelliyampathy where the temperature was below 16°C due to the elevation of the locations. More water mites were collected from the plain lands and also from ponds. Water bodies with aquatic vegetation were found to be the most ideal habitat for water mites and they are practically absent without aquatic vegetation. Irrespective of the degree of swimming development, Hydracarina are clearly associated with the substrate and rarely stray from it. Specific gravity of the body is usually high and unless they cling to some object, they quickly fall to the bottom (Pennak, 1953). Water mites were also collected from the decaying vegetable

matter where there was no live aquatic vegetation at the time of collection. This decaying matter was mainly formed from fallen leaves of the trees near the banks of the water body. At the same time water mites were not always present in all water bodies where there is aquatic vegetation. Zero to five different species was obtained in individual collections. Average number of mites obtained was 20 to 30, but in one exceptional case, nearly 200 mites were collected from Nelliyampathy, in a small stagnant pool within the tea estate. This may be due to some favourable ecological condition in this region. Smith and Cook (1991) observed that water mite diversity was dramatically reduced in habitats that have been degraded by chemical pollution or physical disturbances. Smith et al (1996) has noted that water mites are useful indicators of change in biodiversity in these communities because of their high taxonomic diversity, abundance in all kinds of habitats and interactions with other organisms, especially insects.

During the period of collection 35 species belonging to ten families were collected. They include Hydrachnidae; Limnocharidae; Hydrophantidae; Hydrodromidae; Anisitsiellidae; Libertiidae; Limnisiidae; Hygrobatidae; Unionicolidae; and Arrenuridae. There are 13 subfamilies represented in the present study. They are Hydrachninae; Linocharinae; Mamersinae; Hydrodrominae; Nilotoniinae; Oxinae; Limnesiinae; Hygrobatinae; Attractidinae; Encentridophorinae; Unionicolinae; Neumaniinae and Arrenurinae

and they belong to 13 genera. Of this, the present study reported 19 species as new records from various localities of Kerala. They include males and females of *Hydrachna multipora; Mamersa genada*; *Limnesia lucifera uniseta*; *Limnesia burensis*; *Limnesia thobiasi*; *Hygrobates dadayi*; *Encentridophorus similis*; *Unionicola brandti*; *Unionicola diversipes*; *Unionicola scutigera*; *Unionicola mohanasundarami* and *Unionicola trichurensis* and males of *Hydrodroma tonapii*; and *Arrenurus caviger* and female of *Hydrachna similes*; *Hygrobates keralensis*; *Unionicloa kantaka*; and *Unionicola armata* and *Neumania multiscutata bharatensis*.The new Indian records include: male and female of *Unionicola brandti* and female of *Hydrachna similis*; *Hygobates keralensis*; *Unionicola kantaka* and three new species *Limnesia thobiasi*; *Unionicola mohanasundarami* and *Unionicola trichurensis*.

Males of *Hydrachna similes* from Trichur district of Kerala was reported by Cook (1967) while in the present study males and females were obtained. *Hydrachna multipora* obtained in the collections is a new report from Kerala. This may be the only water mite obtained in the present study which is deep red in colour. The larvae, and different developmental stages of this water mite was also obtained from the water bug *Ranatra sordidula*. Several authors have observed that after a short free-swimming period the larvae becomes attached to

aquatic insects (Pennak 1953; Davids, 1973b; Smith and Cook, 1991). The occurance of *Limnochares crinita* in Trichur district of Kerala is in agreement with the observations of Cook (1967). This may be the biggest water mite collected in the present study. Cook (1967) reported *Mamersa gennada* as a new species and it was obtained in the present study and reported for the first time from Kerala. *Hydrodroma monticola* reported from Calicut, Kerala by Walter (1928) and from Trichur, Kerala by Cook (1967) was also obtained in this study. Female *Hydrodroma tonapii* was reported by Cook (1967) and the male of it was obtained for the first time in the present study. *Nilotonia indica* was first reported from Calicut, Kerala by Walter (1928) was again obtained in this study. In the genus *Limnesia*, four species were obtained in which the three species, *L.lucifera uniseta*; *L. burensis* and *L. thobiasi* a new species are all new reports from Kerala, except *Limnesia lembangensis*(Cook,1967). *L. thobiasi* shows similarities to *L. patens* Viets and *L. lembangensis* in the case of number of genital acetabula. All of them have three genital acetabula. But the genital plates of *U. thobiasi* female are conspicously slender and elongated compared to its body size. The P-II in the case of *L. lembangensis* bears long narrow setal tubercle bearing a short spine like setae whereas in *U. thobiasi* P-II is with a short setal tubercle. *U. thobiasi* is comparatively much small in size. The length of the body is 598μ and the length between first coxae to fourth coxae 264μ in the case of female and these values for *U. patens* Viets is 1140μ and 623μ

respectively. In the case of *L. lembangensis* these values are 950μ and 505μ. In the case of males these values are 478μ and 232μ for *U. thobiasi*; 836μ and 448μ for *U. lambengensis*.

In the genus *Hygrobates*, Cook (1967) reported *H.grimshawi; H.hamatus bharatensis; H.keralensis* and *H.karekari*. In the present study *H.dadayi; H.hamatus bharatensis; H.keralensis* and *H.karekari* were obtained. Out of this *H.dadayi* is a new report from Kerala. In the genus *Atractides*, *Atractides biscutatus* was reported by Cook (1967) from Vayitri. This species was also obtained in the present study. *Encentridophorus similes* obtained in this study is a new report from Kerala. In the genus *Unionicola*, *U. crassipes* (Muller)was reported by Walter (1928) *U.affinis* and *U.kantaka* male by Cook(1967). In this study eight species, *U.affinis, U.mohanasundarami, U.kantaka, U. armata, U.diversipes*; *U.brandti*; *U.scutigera* and *U. trichurensis* were collected. All the four mites, *U.diversipes*; *U.brandti*; *U.scutigera* and *U.trichurensis* was associated with the fresh water mussel, *Lamelliden marginalis* were also new reports from Kerala. *U.kantaka* female was collected from the mantle cavity of *Lamellidens marginalis* is a new report. *U. armata* which is free swimming is also a new report from Kerala. *U. mohanasundarami,* new species is closely related to *U. setifera*. The spines on the appendages showed general resemblance with each other. Both female and male of *U.mohanasundarami* and *U.stifera*

have five pairs of genital acetabula. The genital field in the case of *U.setifera* male bears numerous setae, whereas in the case of *U.mohanasundarami* there is no numerous setae present. *U. mohanasundarami* is small in size. The length of the body as well as the length between the anterior end of first coxae to the posterior end of fourth coxae for female are 462μ, 305μ for *U.mohanasundarami* and 800μ and 464μ for *U.setifera* respectively. These measurements for the males are 460μ, 261μ for *U.mohanasundarami* and 653μ, 440μ for *U.setifera.* *U.trichurensis* is more closely related to *U.scutigera*. Both of them are found in the mantle cavity of fresh water mussel. In both the body wall is scelorotized. In the structure of legs and palps both of them shows general resemblance. But the posterior margin of the fourth coxae in *U.trichurensis* is 'V' shaped whereas in the case of *U.scutigera* there is no such marking. In *U. trichurensis* female there are nine genital acetabula on each ventral genital plate and eleven acetabula on each dorsal plate where as in *U.scutigera* each ventral and dorsal genital plates carries seven genital acetabula. In the case of male there are seventeen and fourteen acetabula on each side of *U.trichensis* and *U.scutigera* respectively.

Neumania nodosa and *Neumania ambigua* were reported by Walter(1928) from Calicut, Kerala and Cook (1967) reported *N.flagellata*; *N.ulbana* and *N.nodosa*. In this study three species were obtained ie *N.nodosa; N.ambigua* and *N. multiscutata*. *N. multiscutata* is a new record from Kerala. In the genus

Arrenurus, Walter(1928) reported *A.madaraszi, A. rostratus* Daday ; *A.ceylonicus* Daday and *A.bicornicodulus* from Calicut. *A.liberatus* was reported by Cook(1967) from a pond 20 miles south to Trichur. In the present study *A.madaraszi, A. rotratus* Daday ; *A. ceylonicus* Daday ; *A.bicornicodulus; A.liberatus* and *A.caviger* were obtained. Out of this *A.caviger* obtained in the present study is a new report from India.

The benefits obtained by a unionicolid living inside a mussel are obvious. They live in a protected, relatively stable environment, competition with other species is avoided, the active stages are provided with an unlimited supply of food (Baker, 1976) and the eggs and resting stages are protected within the shell. Like other parasites living under similar conditions, unionicolids require appropriate adaptations for the dispersal of the species, and the larval stage is highly specialized to perform this function (Baker et al 1991). The population of mites associated with fresh water mussel revealed that, *U.brandti*; *U.diveripes; U.scutigera*; *U.kantaka* and one new species of Unionicola occur in the mantle cavity of *Lamellidens marginalis*. But only female of *U.kantaka* was obtained from the mantle cavity. Vidrine (1996) strongly suspected that these are molluscan parasites. The male of *U.kantaka* collected as free swimming form during this study is in agreement with the observation of Cook (1967). All the members of this group were reported as free-swimming organisms (Vidrine, 1996).

In the eight bimonthly collections made from the same locality *U.brandti*; *U.diversipes* and *U.scutigera* were obtained from the mantle cavity of *Lamellidens marginalis*. In these bimonthly collections *U.kantaka* and the new species belonging to genus Unionicola were not obtained. Among the three species collected from *Lamellidens marginalis, U. brandti* was found to be the dominant species in this locality. The percentage of infection was found to be very high compared to the *U.diversipes* and *U.scutigera*. In most of the cases each mussel carries one male and one female and in some cases either one of them. It was observed only a single male was present in a mussel in combination with one or more female mites (Davids et al 1988). Maximum number of mites per mussel obtained was four in one case. Several *Unionid* species may harbour upto three different mite species (Jones and Baker, 1984, Downes, 1986). In the individual case the number of nymphs per host varied from zero to 100, but at its later stages of maturation, the number of adults occuring per host reduced to zero to four; with either male or female or both. This indicated that there was a significant loss between the nymph and adult stage (Baker, 1987). This may be an adaptation for its parasitic mode of life. Mitchell (1965) has observed that stable host-parasite system exist when the parasite population is limited so that it never takes more than the surplus productivity of its host population. Parasite numbers may be controlled by the action of environment variables on survivourship, or else behavioral traits of the parasite itself may limit survivorship (Mitchell, 1965).

The present study revealed the occurance of at least one male and one female per host. Dimock (1983) has made the observation that when two males were maintained together in the laboratory, one killed the other within 72 hours, and frequently within 24 hours. *U.brandti* and *U.diversipes* were never found to coexist in the same fresh water mussel except in one case where *U.scutigera* was found along with both *U.diversipes* and *U.brandti*. Since the nymphs of different species could not be identified separately, the number of nymphs of *U.brandti* was taken in proportion to the adult population. The population curve for the nymphs of *U.brandti* showed maximum peak during the April segment of the period of study, followed by a sudden fall in the curve. It may be related to the ending of the maturation of the nymphs to the adult. During this period there was a small fall in the curve of the adults, which may be due to death by old age or unfavourable conditions that may occur during this time. This may be also related to summer season. A reduction in the number of males was also observed when the curve was at its maximum for the nymphs. It may be due to the death of more males after the breeding season (Mitchell, 1965). Soon after the abundance of the nymphs there was the abundance of both male and female and maintains a steady nature for the curve. Thus it is clear that by this period the nymphs undergo maturation. Many studies showed that single male was found per host with more females (Mitchell,1965; Davids, 1973b; Hevers 1980; Baker, 1987) In the present study only a single female of *U.brandti* was obtained per host.

Larvae of *U.diversipes* which are elongated (greater than five times as long as wide) and bear two widely separated pairs of acetabula (Vidrine.1996) was collected from the mantle cavity. The nymphs found near the posterior end of mantle probably belongs to all the three species. Since the nymphs of different species could not be identified separately, the number of nymphs of one species can be calculated only in proportion to the adult population. A number of different stages from eggs and larvae were also found within the gill tissue.

Statistical analysis revealed that *U.brandti* population was the most dominant one. The overall bimonthly abundance of males was 0.6875±0.0726 males per mussel. The monthly mean ranged from 0.35(April-200 collection) to 0.95 (June-2001 collection). In the case of female the overall monthly abundance was .6750±0.0734. The monthly mean ranged from 0.5 (October-2001 collection) to 0.95 (June-200 collection). Thus maximum mean value for both male and female occurred in the month of June-2001. The overall mean abundance of nymphs was 22.5313±3.9187.ANOVA shows there was significant bimonthly variation in the number of all category of nymphs. In the case of *U.brandti* females and males also there is highly significant variation between bi-monthly samples. This is in agreement with the observations of Baker et al (1992) for the mite *Unionicola intermedia* in the mussel *Anodonta anatine*.

There are some water mites which are known to feed upon mosquito larvae and they check their population and can act as biological control agents (Gupta. 1991). Miyazaki (1936) reported *Arrenurus madaraszi* parasitising the mosquito *Anopheles sinensis* in Japan. Smith et al (1996) reported a number of species belonging *Arrenurus* genus having Culicidae as their parasitic host during larval stages. In India Rahman, et al. (1979) conducted studies on water mites (*Arrenurus* sp.) parasitizing *Anopheles annularis* Wulp. Sarkar et al (1986) observed the seasonal water mites (*Arrenurus* sp.) parasitism on Indian mosquitoes. Though in the present work no such encounters happened, there may be some possibility of using water mites in the biological control of mosquitoes.

The methodology adopted Cook and Mitchell(1952b) for the preparation of permanent slides found to have some problems in Kerala (India) climatic conditions. Even though preparation of slides in glycerine jelly is the best way to dissect and identify the animal, in summer it melts and parts move in various directions. Similarly in rainy season it absorbs moisture and volume increased and the jelly starts oozing out. Thus, prepared jelly mounted slides have to be kept in frigidaire to keep the cover slip and parts intact in position. Collections of this sort of slides may be stored for a long time in air-conditioned rooms, in a flat state.

SUMMARY

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Water samples were collected using a net of 0.3mm mesh size from different localities in Kerala. These samples were transferred into a white enamel tray and water mites picked out with a medicine dropper. The water mites thus collected were preserved in Koenike's solution. Slides were prepared in Glycerine jelly after clearing in Lundblad's soloution and identification was carried out based primarily on the structure of epimera, genital field, palps, first leg and the fourth leg. Population of water mites from different ecological areas of Kerala ie, forest; plain land and coastal area were surveyed for the presence of water mites. A total of 35 species of water mites were identified during the present study. They belong to 10 families and 13 sub families and 13 genera. Of this, the present study reported 19 species as new reports from Kerala. There are three new species described namely *L. thobiasi; U.mohanasundarami* and *U. Trichurensis*. More water mites were collected from plain lands. Parasitic association of larval stages on aquatic insects was also observed. Aquatic vegetation was found to be very essential for their survival except in the case of mites associated with fresh water mussel. A study of water mites associated with fresh water mussell *Lamellidens marginalis* was done. In one case *Lamellidens marginalis* was collected from four different localities and in the second case bimonthly periodic collections was made from the same locality. All the mussels

were examined by cutting the adductor muscle and the shells opened. There are five different species of water mites obtained from the mantle cavity of the mussel. The incidence of infection of fresh water mussel with these mites was very high. The number of mites per host was found to be limited. Different stages like egg, larva and nymphs were observed within the mantle cavity.

LIST OF MITES STUDIED

S.No:	Genus	Species	Subfamily	Family
1	*Hydrachna*	*H. similis* Cook	Hydrachninae	Hydrachnidae
2	*Hydrachna*	*H. multipora* Cook	Hydrachninae	Hydrachnidae
3	*Limnochares;*	*L. crinita* Koenike	Limnocharinae	Limnocharidae
4	*Mamersa*	*M. gennada* Cook	Mamersinae	Hydryphantidae
5	*Hydrodroma*	*H. moticola* Piersig	Hydrodrominae	Hydrodromidae
6	*Hydrodroma*	*H. tonapii* Cook	Hydrodrominae	Hydrodromidae
7	*Nilotonia*	*N. indica* Walter	Nilotoniinae	Anisitsiellidae
8	*Oxus*	*O. pictus* Daday	Oxinae	Leberatiidae
9	*Limnesia*	*L. lembangensis* Piersig	Limnesiinae	Limnesiidae

S.No:	Genus	Species	Subfamily	Family
10	*LimnesiaL. lucifera uniseta* Cook		Limnesiinae	Limnesiidae
11	*Limnesia*	*L.burensis* Imamura	Limnesiinae	Limnesiidae
12	*Limnesia*	*L. thobiasi* n.sp.	Limnesiinae	Limnesiidae
13	*Hygrobates*	*H. dadayi* Cook	Hygrobatinae	Hygrobatidae
14	*Hygrobates; H. hamatus bharatensis* Cook;		Hygrobatinae	Hygrobatidae
15	*Hygrobates*	*H. keralensis* Cook	Hygrobatinae	Hygrobatidae
16	*Hygrobates*	*H. karekari* Cook	Hygrobatinae	Hygrobatidae
17	*Atractides*	*A. biscutatus* Cook	Atractidinae	Hygrobatidae
18	*Encentridophorus;E. similis* Cook		Encentridophorinae	Unionicolidae
19	*Unionicola*	*U. affinis* Piersig	Unioniolinae	Unionicolidae
20	*Unionicola;U.mohansundarami* n.sp.		Unioniolinae	Unionicolidae
21	*Unionicola*	*U. kantaka* Cook	Unioniolinae	Unionicolidae
22	*Unionicola*	*U. armata* Walter	Unioniolinae	Unionicolidae

S.No:	Genus	Species	Subfamily	Family
23	*Unionicola*	*U. diversipes* Viets	Unioniolinae	Unionicolidae
24	*Unionicola*	*U. brandti* Vidrine	Unioniolinae	Unionicolidae
25	*Unionicola*	*U. scutigera* Viets	Unioniolinae	Unionicolidae
26	*Unionicola*	*U. trichurensis* n.sp.	Unioniolinae	Unionicolidae
27	*Neumania*	*N. nodosa* Daday	Neumaniinae	Unionicolidae
28	*Neumania*	*N. ambigua* Piersig	Neumaniinae	Unionicolidae
29	Neumania;	*N. Multiscutata bharatensis* Cook;	Neumaniinae	Unionicolidae
30	*Arrenurus*	*A. rostratus* Daday	Arrenurinae	Arrenuridae
31	*Arrenurus*	*A. ceylonicus* Daday	Arrenurinae	Arrenuridae
32	*Arrenurus*	*A. bicornicodulus* Piersig	Arrenurinae	Arrenuridae
33	*Arrenurus*	*A. caviger* Viets	Arrenurinae	Arrenuridae
34	*Arrenurus*	*A. madaraszi* Daday	Arrenurinae	Arrenuridae
35	*Arrenurus*	*A. liberatus* Walter	Arrenurinae	Arrenuridae

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APPENDIX

LIST OF WATER MITES SO FAR RECORDED FROM KERALA REGION WITH THEIR REFERENCE

S.No:	Genus	Species	Family	Reference
1	*Hydrachna*	*H. similis* Cook	Hydrachnidae	Cook, 1967
2	*Hydrachna*	*H. multipora* Cook	Hydrachnidae	New report
3	*Limnochares*	*L. crinita* Koenike	Limnocharidae	Cook, 1967
4	*Pseudoprotzia*	*P.papillata* Amma	Protiziidae	Amma, 1969
5	*Armothyas*	*A.indicus* Amma	Hydryphantidae	Amma, 1969
6	*Javathyas*	*J. cornipes* Cook	Hydryphantidae	Cook, 1967
7	*Mamersa*	*M. gennada* Cook	Hydryphantidae	New report
8	*Diplodontus*	*D. silvestrii* Daday	Hydrodromidae	Cook, 1967
9	*Hydrodroma*	*H. moticola* Piersig	Hydrodromidae	Walter, 1928; Cook, 1967
10	*Hydrodroma*	*H. tonapii* Cook	Hydrodromidae	Cook, 1967

S.No:	Genus	Species	Family	Reference
11	*Nilotonia*	*N. indica* Walter	Anisitsiellidae	Walter, 1928; Cook, 1967
12	*Mamersella*	*M. maryellenae* Cook	Anisitsiellidae	Cook, 1967
13	*Navamamersides*	*N. karekari* Cook	Anisitsiellidae	Cook, 1967
14	*Navamamersides*	*N. similis* Cook	Anisitsiellidae	Cook, 1967
15	*Nilgiriopsis*	*N. imamurai* Cook	Anisitsiellidae	Cook, 1967
16	*Platymamersopsis*	*N. mysorensis* Cook	Anisitsiellidae	Cook, 1967
17	*Oxus*	*O. orientalis* Walter	Lebertiidae	Walter, 1928
18	*Oxus*	*O. pictus* Daday	Lebertiidae	Cook, 1967
19	*Torrenticola*	*T. microdentifera* Cook	Torrenticolidae	Cook, 1967
20	*Torrenticola*	*T. indica* Cook	Torrenticolidae	Cook, 1967
21	*Torrenticola*	*T. mulherkarae* Cook	Torrenticolidae	Cook, 1967
22	*Torrenticola*	*T. pinapalpis* Cook	Torrenticolidae	Cook, 1967

S.No:	Genus	Species	Family	Reference
23	*Torrenticola*	*T. setivalvata* Cook	Torrenticolidae	Cook, 1967
24	*Torrenticola*	*T. nondescripta* Cook	Torrenticolidae	Cook, 1967
25	*Torrenticola*	*T. yosana* Cook	Torrenticolidae	Cook, 1967
26	*Torrenticola*	*T. devatta* Cook	Torrenticolidae	Cook, 1967
27	*Torrenticola*	*T. parvatiya* Cook	Torrenticolidae	Cook, 1967
28	*Torrenticola*	*T. sakina* Cook	Torrenticolidae	Cook, 1967
29	*Torrenticola*	*T. sucria* Cook	Torrenticolidae	Cook, 1967
30	*Torrenticola*	*T. apratima* Cook	Torrenticolidae	Cook, 1967
31	*Torrenticola*	*T. suvarna* Cook	Torrenticolidae	Cook, 1967
32	*Nicalimnesia*	*N. andha* Cook	Limnessiidae	Cook, 1967
33	*Limnesia*	*L. lembangensis* Piersig	Limnesiidae	Cook, 1967
34	*Limnesia*	*L. lucifera uniseta* Cook	Limnesiidae	New report

S.No:	Genus	Species	Family	Reference
35	*Limnesia*	*L.buruensis* Imamura	Limnesiidae	New report
36	*Limnesia*	*L. thobiasi* n.sp	Limnesiidae	New report
37	*Hygrobates*	*H. dadayi* Cook	Hygrobatidae	New report
38	*Hygrobates*	*H. grimshawi* Cook	Hygrobatidae	Cook 1967
39	*Hygrobates*	*H. hamatus bharatensis* Cook	Hygrobatidae	Cook 1967
40	*Hygrobates*	*H. keralensis* Cook	Hygrobatidae	Cook 1967
41	*Hygrobates*	*H. karekari* Cook	Hygrobatidae	Cook 1967
42	*Pseudatractides*	*P. pyriformis* Amma	Hygrobatidae	Amma 1969
43	*Atractides*	*A. vayitriensis* Cook	Hygrobatidae	Cook 1967
44	*Atractides*	*A. keralensis* Cook	Hygrobatidae	Cook 1967
45	*Atractides*	*A. orthoporus* Cook	Hygrobatidae	Cook 1967

S.No:	Genus	Species	Family	Reference
46	*Atractides*	*A. biscutatus* Cook	Hygrobatidae	Cook 1967
47	*Atractides*	*A. dorsoscutatus* Cook	Hygrobatidae	Cook 1967
48	*Encentridophorus*	*E. similis* Cook	Unionicolidae	New report
49	*Unionicola*	*U. crassipes* Muller	Unionicolodae	Walter 1928
50	*Unionicola*	*U. affinis* Piersig	Unionicolidae	Cook 1967
51	*Unionicola*	*U.mohanasundarami* n.sp	Unionicolidae	New report
52	*Unionicola*	*U. kantaka* Cook	Unionicolidae	Cook 1967
53	*Unionicola*	*U. armata* Walter	Unionicolidae	New report
54	*Unionicola*	*U. diversipes* Viets	Unionicolidae	New report
55	*Unionicola*	*U. brandti* Vidrine	Unionicolidae	New report
56	*Unionicola*	*U. scutigera* Viets	Unionicolidae	New report
57	*Unionicola*	*U. trichurensis* n.sp	Unionicolidae	New report

S.No:	Genus	Species	Family	Reference
58	*Neumania*	*N. armata* Amma	Unionicolodae	Amma 1969
59	*Neumania*	*N. nodosa* Daday	Unionicolidae	Walter 1928; Cook 1967
60	*Neumania*	*N. ambigua* piersig	Unionicolidae	Walter 1928
61	*Neumania*	*N. flagellata* Walter	Unionicolidae	Cook 1967
62	*Neumania*	*N. ulbana* Cook	Unionicolidae	Cook 1967
63	*Neumania*	*N. longipes* Walter	Unionicolidae	Walter 1928
64	*Neumania*	*N. pilosa* Koenike	Unionicolidae	Walter, 1928
65	*Neumania*	*N. Multiscutata bharatensis* Cook	Unionicolidae	New report
66	Piona	P. catama Cook	Pionidae	Cook, 1967
67	*Piona*	*P. pseudouncata* Piersig	Pionidae	Walter, 1928
68	*Javalbia*	*'Axonopsalbia'* Indica Cook	Axonopsidae	Cook, 1967
69	*Axonopsis*	*A. vayitriensis* Cook	Axonopsidae	Cook, 1967

S.No:	Genus	Species	Family	Reference
70	*Axonopsis*	*A. keralensis* Cook	Axonopsidae	Cook, 1967
71	*Axonopsis*	*A. vivarna* Cook.	Axonopsidae	Cook, 1967
72	*Axonopsis*	*A. projecta* Cook	Axonopsidae	Cook, 1967
73	*Axonopsis*	*A. angulata* Cook	Axonopsidae	Cook, 1967
74	*Axonopsis*	*A. latifrons* Walter	Axonopsidae	Walter, 1928
75	*Albia*	*A. suvarna* Cook	Axonopsidae	Cook, 1967
76	*Bharatalbia*	*B. sucirapalpis* Cook	Aturidae	Cook, 1967
77	*Kongsbergia*	*K. parvtiya* Cook	Aturidae	Cook, 1967
78	*Bharatohydracarus*	*B. longatus* Cook	Mediopsidae	Cook, 1967
79	*Bharatohydracarus*	*B. schwoerbeli* Cook	Mediopsidae	Cook, 1967
80	*Harpagopalpinae*	*H. indicus* Cook	Harpagopalpidae	Cook, 1967
81	*Africasia*	*A. rucira* Cook	Arrenuridae	Cook, 1967

S.No:	Genus	Species	Family	Reference
82	*Africasia*	*A. navia* Cook	Arrenuridae	Cook, 1967
83	*Africasia*	*A. ruska* Cook	Arrenuridae	Cook, 1967
84	*Africasia*	*A. pinguipalpis* Cook	Arrenuridae	Cook, 1967
85	*Arrenurus*	*A. rostratus* Daday	Arrenuridae	Walter,1928
86	*Arrenurus*	*A. ceylonicus* Daday	Arrenuridae	Walter, 1928
87	*Arrenurus*	*A. bicornicodulus* Piersig	Arrenuridae	Walter, 1928
88	*Arrenurus*	*A. madarasizi* Daday	Arrenuridae	Walter, 1928
89	*Arrenurus*	*A. micropetiolatus* Walter	Arrenuridae	Walter, 1928
90	*Arrenurus*	*A. liberatus* Walter	Arrenuridae	Cook, 1967
91	*Arrenurus*	*A. pseudoaffinis* Piersig	Arrenuridae	Walter, 1928
92	*Arrenurus*	*A. caviger* Viets	Arrenuridae	New report
93	*Arrenurus*	*A.mammifera* Amma	Arrenuridae	Amma, 1969

S.No:	Genus	Species	Family	Reference
94	*Arrenurus*	*A.incisifrons* Amma	Arrenuridae	Amma, 1969
95	*Arrenurus*	*A.quadrilobatus* Amma	Arrenuridae	Amma, 1969
96	*Arrenurus*	*A.incisicauda* Amma	Arrenuridae	Amma, 1969