CHAPTER I

SYSTEMATICS
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INTRODUCTION

As Simpson (1961) has aptly pointed out, taxonomy has an almost superscientific place among the sciences. The following passage of Hennig (1950), taken from Simpson (1961), emphasises the idea that systematics in the general sense is co-extensive with science - "...... In order now, to be able to judge correctly the position of systematics in the field of biology and the role that it is called upon to play in the solution of basic problems of this science, one must first make it clear that there is a systematics not only in biology, but that it is an integrating part of any science whatever".

Systematics is a dynamic science since the taxonomy of the flora and fauna are in a constant state of flux. No group of animals or plants can ever be said to have achieved their final status in taxonomy because new species are constantly being discovered in different parts of the world. Their discovery may ultimately lead to the diversification of an old genus into many new ones or the creation of a new genus to include the new species. The validity of a nominal species may also become questionable after a period of time. Hence, a revisionary work on the taxon has got to be carried out frequently so as to incorporate new discriminatory details and allocate new species to their proper taxonomic positions.

The taxonomy of isopods has been a subject of study since the early nineteenth century, but has been taken up rather seriously by taxonomists only during the past few decades. The works of Schioedte and Meinert (1879, 1881a, 1881b, 1884) and Sars (1882, 1885, 1899) have been of fundamental importance in formulating the modern classification of the order Isopoda. This classification has been supplemented and altered in accordance with the extension of our knowledge. Bowman and Abele (1982) have given a detailed classification of recent Crustacea.
Isopods of the Indian waters have received comparatively little attention than those from other parts of the world, especially their African and Australian counterparts, where continuous efforts are being made to study the isopod fauna. Stebbing (1904b, 1910, 1911), Chopra (1923, 1927, 1930), Barnard (1935, 1936) and Pillai (1954, 1955, 1961, 1962, 1964, 1965, 1966a,b,c, 1967) are the main contributors to our knowledge of Indian isopods. According to Pillai (1958) the number of species recorded from Indian waters stands at one hundred and ninety four. A few more have been added to the list since then. Though this number compares favourably with that of the African and Australian waters, yet it is certain that a more sustained and concentrated effort will yield better results and prove that the Indian isopod fauna is at least as rich as (if not richer than) that of Africa and Australia. Kensley (pers. comm.) has remarked that in all probability Indian isopods might be endemic. Hence, a thorough search could yield many species new to science or at least many new records from this region. Since the time of Pillai’s work, the taxonomic position of many species have undergone changes. Hence, after a gap of about twenty-five years it was deemed necessary to undertake the taxonomic study of isopods of the South-west coast of India.

During the course of this work, a need for more complete descriptions and illustrations was badly felt. Many of the recent works give only brief generic and specific diagnoses making it difficult to comprehend this subject, and make an accurate evaluation. Most of the original generic descriptions date back to the late nineteenth or early twentieth century and with the passage of time these original descriptions become difficult to procure. Hence, it was felt that a revisionary and redescriptive work with complete details and accurate illustrations would be desirable. The works of Brusca (1981), Schultz (1982), Bruce (1983) and Brusca and Iverson (1985) are welcome steps in that direction, giving detailed and lucid diagnoses and descriptions.

The recent voluminous literature on the taxonomy of isopods suggest that relentless pursuit to fill the existing lacunae in our knowledge is still continuing unimpeded and new genera and new species are being unearthed and added from different parts of the world at a rapid pace.
The taxonomic status of many of the species are still in a state of flux, being transferred from one genus to another or being synonymised with certain others. This state of dynamism emphasises the significance of detailed descriptions with accurate illustrations in revisionary works. It is felt that, the taxonomic status of certain families and genera are in dire need of a revision. The suborder Asellota and the family Cymothoidae need a thorough redescription.

The recent spurt in publication of monographs will certainly be of great help to taxonomists. Brusca (1981) has contributed greatly to the taxonomy of cymothoid isopods while Iverson (1982) has similarly revised the family Sphaeromatidae.

Of the nine suborders comprising the order Isopoda, only four have been represented in the present collection. The suborder Flabellifera is seen to be quite rich in the tropical waters. Families Cirolanidae, Corallanidae, Aegidae, Cymothoidae and Sphaeromatidae are well represented in the present collection while the family Serolidae which is very rare in the Indo-Pacific region and the family Limnoriidae comprising of wood boring forms are totally absent. The suborder Anthuridea is also quite poorly represented. The families Idoteidae (suborder Valvifera) and Janiriidae (suborder Asellota) represented in this collection are not very abundant in the tropical water. Only one representative from each of these suborders is included in this work, though a few more Asellotan isopods have been collected.

Of course, it must be confessed that, since, systematics was not the sole aspect of study taken up, more attention could not be paid to it, resulting in the recording of very few species. Collections were taken from the marine habitat of Cape Comorin, Vizhinjam and Kovalam, the brackish waters of Akathumuri Lake, Ashtamudi Lake and Cochin Backwaters, the freshwater situations of Kallada River, and also from the insular habitat of the Laccadive Islands.

The handful of species published in this work are some of the more common forms and those of controversial taxonomic position. A few others collected during the period of study have not been included for
want of proper identification, but these will, hopefully, be identified and published in due course. The aim of the present study has been to give as detailed and accurate descriptions and illustrations as possible, even though almost all these species have been reported earlier. All the illustrations given in the work are original and drawn by the author herself with the aid of a camera lucida.

The key used for separating the different suborders is that of Brusca and Iverson (1985). As for the genera and species, no single key can be cited, though Pillai's (1954, 1961, 1963, 1964, 1967) works proved invaluable and served as the guidelines for carrying out this work, since they deal with the isopods of the same region. However, the taxonomic position of various species has undergone considerable alterations since the publications of Pillai and these have been referred to in the remarks given for each species.

CLASSIFICATION

<table>
<thead>
<tr>
<th>Super Class</th>
<th>Class</th>
<th>Subclass</th>
<th>Superorder</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malacostraca</td>
<td>Eumalacostraca</td>
<td>Peracarida</td>
<td>Isopoda</td>
</tr>
</tbody>
</table>

ORDER - ISOPODA Latreille, 1817

Diagnosis:

Peracarida lacking a distinct carapace; first thoracic segment and rarely the second coalesced with the cephalon; body dorso-ventrally compressed; telson almost always fused with last pleonite to form a pleotelson; eyes sessile; first and second antennae uniramous (except in Bathynomus), with a minute scale or 'squama' in a few taxa; 'accessory flagellum' present on second antenna in some anthurids. Mandible with a multi-articulate palp usually a multi-dentate incisor process, a lacinia mobilis
which sometimes differ in the left and right mandibles and a highly variable molar process. Thoracic limbs without exopodites; first pair modified as maxillipeds with a short coxa (often divided) and a short lamellar epipod not enclosed within a branchial cavity, basis flattened and produced into an 'endite', palp of up to five articles; second thoracic limbs modified as maxillipeds only in Gnathiidae; remaining pairs all similar or variously modified, coxopodite always short, often fused with body and laterally expanded. Pleopods biramous, with flattened rami specialized for respiration, generally the second and sometimes also the first pair modified in the male. Heart located wholly or partially in the pleon. Maxillary glands usually present in adults. Young leave the brood pouch in the 'manca' stage, that is, before the appearance of last pair of pereopods.

The order Isopoda includes 9 suborders which may be identified based on the following key of Brusca and Iverson (1985).

**Key to suborders of order Isopoda**

1. Parasitic on other crustaceans; female much larger than male and with slightly to highly distorted bilateral symmetry; pereopods and pleopods present, absent or reduced
   -Not parasitic on crustaceans; females more or less same as males, with clear bilateral symmetry, pereopods and pleopods always well developed
      -------Epicaridea

2. With six free pereonites and five pairs of pereopods; two pairs of maxillipeds (second pair being flattened pylopods); mandibles of males grossly enlarged and extended beyond front of cephalon; mandible absent in females
   -With seven free pereonites and 6-7 pairs of pereopods; one pair of maxillipeds; mandibles not as above
      -------Gnathiidea

3. Body more or less compressed from side to side (as in gammarid amphipods); freshwater
   -------Phreatoicidea
- Body flattened dorso-ventrally or tubular, freshwater, marine, estuarine or terrestrial

4. Primarily terrestrial; first pair of antennae minute, rudimentary; pleopods tracheate
   - Oniscidea

   - Aquatic, first pair of antennae may be small, but never rudimentary; pleopods not tracheate

5. Uropods modified into a pair of covers folded under the pleon and covering the pleopods
   - Valvifera

   - Uropods not as above (lateral or terminal)

6. Body elongate, length greater than six times width; body tends to be tubular
   - Anthuridea

   - Body not elongate, length less than 4 times width; body dorso-ventrally flattened.

7. Length usually greater than 4 mm; uropods folded up and partially cover the pleotelson
   - Microcerberidea

   - Length usually less than 3 mm; uropods not as above, terminal; minute interstitial forms

8. Uropods lateral, hinged at sides of pleotelson to form a 'tail fan'; first or second pleopods almost never form operculate covers for remaining pleopods
   - Flabellifera
-Uropods terminal or nearly so (hinged on the posterior margin of pleotelson), minute and usually styliform; first or second pleopod often modified into thin opercular plates covering remaining pleopods in females.

---Asellota

In the present work, only four suborders are represented, viz., Valvifera, Anthuridea, Flabellifera and Asellota. The suborder Oniscidea which includes exclusively terrestrial isopods are not presented here because this work deals with aquatic isopods only. Among the aquatic isopods, representatives of the suborders Epicaridea, Gnathiidea, Phreatoicidea and Microcerberidea are not represented in the collection. Herein, more attention having been paid to the free-living isopods, the epicarideans, exclusively parasitic on crustaceans have not been reviewed. However, certain parasitic isopods belonging to the family Cymothoidae have been included mainly because their taxonomic position has been a matter of controversy. Members of the suborders Gnathiidea, Phreatoicidea and Microcerberidea were not obtained during the present collection, the latter two suborders being scarcely recorded from Indian waters. Of the suborders represented, the suborder Flabellifera has been observed to be dominating by and large, mainly because this is a large suborder, the members of which are more successful in the tropics.

**SUBORDER - VALVIFERA**

**Diagnosis:**

This suborder is the most distinct of all isopod taxa. The morphology of the pereopodal coxae, uropods and penes separate this suborder clearly from others. Body usually elongate. Mandible strong, incisor process blunt, palp absent; first maxilla biramous; second maxilla has three rami; maxilliped with large endite bearing one to several coupling hooks, palp three to five-jointed. Pereonal segments distinct. Only in the Valvifera do the pereopodal coxae extend ventrally to form the 'ventral coxal plates' and dorso-laterally to form the 'dorsal coxal plates'. Pleon segments more or less coalesced, rarely first two segments free, pleonites
3-6 together with the telson form a large pleotelson. Pleopods biramous, enclosed in a branchial cavity formed by ventrally situated uropods. The modification of the uropods to form an opercular covering for the pleopods is a remarkable adaptation exhibited by the valviferan isopods only. The opening of the vas deferens and the penes have been moved to the pleon, this arrangement being seen only in the suborder Valvifera and Oniscidea.

Remarks:

Members of this suborder are mostly marine with a few freshwater representatives. According to Schultz (1982) this suborder contains, about 500 species in 66 genera and 7 families.

The present collection includes a single species of valviferan isopod belonging to the family Idoteidae. The following is a note on Idoteidae.

**FAMILY - IDOTEIDAE**

**Diagnosis:**

Valviferan isopods with body somewhat depressed, more or less broad, ovate, oblong or elongate. Most species are eyed. First pair of antennae shorter than second, flagellum composed of 1-4 articles; second antenna when long never longer than body, flagellum multi-articulate reduced to a few vestigial articles or to a single large clavate article. Mouth parts well developed, maxilliped with very wide articles on palp; mandibles without palp. Pereon segments of uniform length, coxal plates sometimes distinct, sometimes coalesced with pereon segments. Pereopods ambulatory, anterior-most ones may occasionally be subchelate. Pleon segments mostly fused and only indicated laterally, sometimes with one or two free segments. Uropods uniramous or biramous. Penes fused basally, rarely separated at base.

**Remarks:**

Common in temperate littoral habitats but rare in tropics, abundant in seaweed of coastal regions. Specimens range from 3 to 120 mm long, but most are restricted to less than 30 mm length.
Genus - *Synidotea* Harger, 1878


*Synidotea* Benedict, 1897; Richardson, 1905; Collinge, 1917; Nierstrasz, 1941; Sheppard, 1957.

**Diagnosis:**

Flagellum of second antenna multi-articulate; palp of maxilliped 3-segmented; coxal plates of all pereonites firmly united with the segments; pleon composed of a single segment with a suture on either side near the base indicating another partly coalesced segment; single penial process present.

**Remarks:**

Idoteids are reportedly common in temperate littoral habitats but rare in tropical latitudes. This genus can be easily distinguished from all other genera of the family by a combination of characters - indistinct coxal plates, single-jointed pleon with a lateral suture line proximally, a single penial process and 5-jointed maxilliped. The present collection included only a single species, *S. fluviatilis* which is described below:

**Synidotea fluviatilis** Pillai, 1954

Pl. I, figs. 1 - 15


**Synonymy:**

*Synidotea variegata* Chilton, 1924; *Synidotea fluviatilis* Pillai, 1954; 1962; *Synidotea worliensis* Joshi and Bal, 1959.

**Material:**

A few male and female specimens were obtained from the oil tanker berth off Cochin.
Description (Female, 17.0 mm TL):

Body elongate, sides non-parallel. Anterior border of cephalon slightly concave. Eyes large, black, situated postero-laterally on the cephalon. Coxal plates firmly ankylosed with the pereon segments. Pereonite 4 broadest. Lateral margins of pereonites 1-4 produced outwards medially, that of posterior pereonites straight. Arcuate depressions of pereonites, distinct, narrow and deep in anterior segments, broad and shallow in posterior segments. Pleon comprised of a single segment with a suture on either side near the base, indicating another partially coalesced segment; posterior margin with a shallow median concavity.

First antenna stout, reaches up to the fourth peduncular segment of second antenna; peduncle 3-segmented, first segment enlarged bearing hairy setae laterally; flagellum uni-articulate bearing eight aesthetasc along the superior lateral margin and an apical tuft of setae. Peduncle of second antenna 5-segmented, proximal two segments small, fifth segment slender and longest; flagellum 23 or 24-segmented, distal margins of articles setose.

Mandible stout, incisor process, lacinia mobilis, setal row and molar process well developed, palp absent. Outer lobe of first maxilla bears six stout barbed spines apically, inner lateral margin hirsute; inner lobe slender, bears two stout plumose spines and a single spinele apically. Second maxilla comprised of three lobes with single, blunt, plumose spine on inner mid-lateral margin, inner four spines of innermost lobe plumose, rest stout and pointed; middle and outer lobes bear stout, dentate spines apically. Maxilliped 5-segmented, distal two segments fringed with long pointed setae among hairy setae, endite bears a single coupling hook laterally and plumose setae apically; epipodite thickly setose laterally.

Pereopods ambulatory. Pereopod 1 with plumose setae on inferior lateral margins of all segments; distal superior margin of merus bears a single stout spine; propodus not enlarged; superior lateral margin sparsely setose; dactylus bears secondary unguis. Posterior pereopods more or less similar to anterior ones in structure except that they are more slender. Propodus of pereopods 4-7 and the merus and carpus of pereopod 7 bear small barbed spines.
Pleopods slender, pleopods 1-3 with plumose marginal setae on both rami, pleopods 4 and 5 endopod non-setigerous.

Uropod consisting of a single, apically truncate ramus which is 2-segmented with three plumose spines on the outer margin near the segmentation.

Body dark brown with reticulate pigmentation all over its dorsal surface.

**Description** (Male, 16.0 mm TL):

Similar to the female except for the presence of male secondary sexual characters. Penes completely fused in mid-line to form a perfectly linguiform structure situated at the base of the pleon in a small excavation. Appendix masculina on endopod of pleopod 2 longer than the endopod, proximal part narrow, widening distally and then tapering to a point, distal quarter armed with tiny spinules.

**Distribution:**

Chilka Lake (Orissa), Quilon (Kerala).

**Remarks:**

*S. variegata* Collinge, 1917 is entirely different from *S. variegata* Chilton, 1924 and the difference between the two species has been reviewed by Monod (1924). Pillai (1954) thereby renamed *S. variegata* Chilton, 1924 as *S. fluviatilis*.

An elaborate description of the species is given by Pillai (1962). On comparison of the present specimens at my disposal with the description of Pillai (1962), the following few variations were observed -

(i) The outer lobe of first maxilla was observed to have six stout barbed spines while Pillai (1962) described nine short spines.

(ii) The single blunt plumose spine present on the inner lateral margin of the innermost lobe of the second maxilla was not mentioned by Pillai (1962).
(iii) The middle and outer lobes of the second maxilla were observed to carry stout, dentate spines while Pillai (1962) mentioned the presence of short, simple setae on the lobes.

S. fluviatilis can be easily differentiated from the very allied S. variegata Collinge based on the general shape of the second maxilla and uropod. In S. fluviatilis the first four pereonites are latero-medially produced while in S. variegata the lateral margins of the anterior pereonites are rounded. The outer lobe of the second maxilla is considerably produced outwards in S. variegata while it is not so in S. fluviatilis. The uropod is apically truncate in S. fluviatilis and narrowly rounded in S. variegata.

S. fluviatilis also resembles S. angulata Benedict rather closely. From the description of S. angulata given by Richardson (1903) the differences that stand out are the shape of the anterior margin of the cephalon which in S. angulata is deeply excavated and not so in S. fluviatilis; the dorsal surface of the cephalon of S. angulata bears tubercles unlike in S. fluviatilis; the first peduncular article of first antenna is enlarged in S. fluviatilis while it is not so in S. angulata; the shape of the terminal segment of the maxillipedal palp varies in the two species; maxillipedal endite of S. angulata lacks the single coupling hook found in S. fluviatilis; the terminal part of the pleon is narrowly rounded with a median excavation in S. angulata while it is almost subtruncate with a shallow median concavity in S. fluviatilis.

Ecological note:

This species has been reported as very common in the estuarine region of the Ashtamudi Lake (Quilon, Kerala) (Pillai, 1962). The present material was obtained from the marine habitat, on an oil tanker berth off Cochin, co-occurring with C. willeyi and C. fluviatilis. It has also been collected from Kovalam in association with algae. Thus, from the data available on its habitat preference, it may be surmised that this species favours marine or brackish water habitat to freshwater.
SUBORDER - ANTHURIDEA

Diagnosis:

Body elongate, narrow, cylindrical. Eyes small to large, sometimes totally absent. Antennae short with few flagellar articles; first antenna shorter than second, few flagellar articles (mature males have an extra-long 'bushy' first antenna in some species), peduncle of three articles; second antenna with peduncle of five articles, few to many flagellar articles. Mandibles with or without palp, other parts not well developed. First and second maxillae usually uniramous. Maxilliped with a small endite but no coupling hooks, palp of 0-5 articles (family distinction is based mostly on the shape of the maxilliped). Pereonites longer than wide, distinct coxal plates not evident. Pereopod 1 (sometimes 2 and 3) subchelate, others ambulatory. Pleon short, consisting of five pleonites plus pleotelson or six pleonites and telson, often some or all pleonites fused, although segmentation evident by lateral sutures or pigmentation pattern. Pleotelson or telson with or without statocyst. Uropods lateral, distinct, exopods arching over pleotelson.

Remarks:

Pereonites of anthurids possess minute dorsal pores, ridges or grooves. First antenna is sexually dimorphic. Many species are protogynic sequential hermaphrodites.

Members are benthic in mud or sand, in holes or tubes of tubicolous worms, marine, rarely freshwater. This suborder comprises of three families, viz., the Anthuridae, Paranthuridae and Hyssuridae. About 110 species in 60 genera are known (Schultz, 1982).

The two families Anthuridae and Paranthuridae are represented by one species each in the present collection.

Key to the families of the suborder Anthuridea:

1. Mouth parts modified to form the piercing or sucking type; mandibular incisor pointed, lacks teeth, mandibular palp composed
of 1-3 articles; first maxilla long, pointed, barbed stylets; maxilliped elongate and tapering with a reduced palp; single telsonic statocyst usually present

---Paranthuridae

-Mouth parts of the biting or chewing type (unmodified), apex of mandibular palp rounded, mandibular incisor usually toothed; maxillae distally multispinose; maxillipedal palp consists of four or fewer broad articles; statocyst present or absent

-----2

2. Body slender, about 15 times longer than wide; pleonites elongate, unfused; none of the pleopods operculate; pleotelson lacks statocyst

---Hyssuridae

-Body not as slender as the Hyssuridae, pleonites may or may not be fused; first pleopod larger than all others, exopod forming an operculum covering the other pleopods; a pair of statocyst always present

-----Anthuridae

FAMILY - PARANTHURIDAE

Diagnosis:

In paranthurids the mouth parts are modified for piercing and sucking, the mandibular incisor is acute tipped and lacks teeth, palp 1-3 jointed; first maxilla long pointed, barbed stylets; maxilliped elongate and tapering, palp reduced. A single telsonic statocyst usually present. There are 12 genera coming under this family.

Genus - Paranthura Bate & Westwood, 1868

Paranthura Bate and Westwood, 1868. British sessile - eyed Crustacea, 2 : 163, Paranthura Norman and Stebbing, 1886; Stebbing 1900a; Richarddson, 1905; Barnard, 1914a; 1925; Nierstrasz, 1941; Miller and Menzies, 1952; Pillai, 1966b; Kensley, 1982.
Diagnosis:

The main characters of this genus are the modified mouth parts - mandible terminating in an acute lancet-like structure; first maxilla simple with recurved teeth apically, maxillipedal palp of three segments; flagellum of first antenna multi-articulate in both sexes; flagellum of second antenna rudimentary in both sexes consisting of a single article; segments of pleon demarcated by lateral sutures.

Remarks:

According to Barnard (1925a) the presence of a single flattened flagellar segment of second antenna in both sexes is a main characteristic of the genus Paranthura. Also, in defining the genus Barnard (1925a) has stated that the maxilliped is three-segmented. However, variations in both these characters are observed in some species considered under this genus. Hence, it is felt that the generic diagnosis needs reconsideration making allowances for the exceptions, or a new subgenus be created to accommodate the species with anomalies. Pillai (1966b) has also remarked on the need of a division within the genus.

The hairy first antenna in the males, the character on which was based the name of the present species, is present in many other species belonging to different genera. This character is observed in Mesanthura protei Kensley, Colanthura pigmentata Kensley, Leptanthura tenuis Sars, Panathura macronesia Kensley and Diaphoranthura cracens Kensley. But, Mesanthura, Diaphoranthura and Panathura belong to the family anthuridae with normal mouth parts whereas Colanthura, Leptanthura and Paranthura belong to the family paranthuridae with modified mouth parts. Nevertheless, Paranthura can be distinguished from Leptanthura in having the fifth segment of posterior pereopods not underriding the sixth and from Colanthura in having the mandible well developed with a 3-jointed palp unlike the reduced palpless blunt lobe-like mandible of Colanthura.

Paranthura plumosa Pillai, 1966

Pl.I, figs. 16 - 36

Material:

Two male and female specimens were collected from the sand tubes of sabellid worms in the littoral region of Kovalam.

Description (Female, 6.0 mm TL):

Body elongate, slightly widening posteriorly up to pereonite 5, dorsal surface smooth. Cephalon almost square-shaped, anterior border bisinuate with a small antero-median rostrum; eyes large, black. Pereonites 1-4 subequal to one another in length; pereonite 7 shortest, postero-lateral corners slightly produced. Pleon composed of six segments, demarcated by lateral sutures; posterior margin of last pleonite with a dorso-median incision. Telson elongate, apex rounded, armed with marginal setae.

First antenna more slender than second; peduncle of first antenna 3-segmented, proximal segment longest, flagellum 6 or 7-segmented, each segment bears setae on its infero-lateral margin. Second antenna stout, peduncle 5-segmented, distal flagellar segments very indistinctly demarcated by tufts of setae.

Mouth parts modified. Mandible, a long drawn out process, narrowing towards apex, palp 3-segmented, middle segment longest, terminal segment bears a comb of setae; first maxilla slender, lancet-shaped with eleven backwardly directed dentations near its tip; maxilliped three-jointed with many long spines apically.

Anterior pereopods sub-prehensile; posterior ones ambulatory. Pereopod 1 large, merus produced dorsally and underrides carpus which in turn underrides the propodus, merus bears two spiny setae on its outward projection and a single one just below the base of the carpus; carpus roughly triangular in shape; propodus enlarged with a small lobe overhanging the carpus; propodal palm fringed with minute setae; dactylus long and slender, nearly reaching the base of the propodus when closed, inferior margin fringed with minute setae, single unguis present.

Pereopod 2 long; ischium long and slender; merus slightly produced as in pereopod 1; carpus triangular extending along the margin of propodus on the inner side for a short distance; propodus not as large as in pereopod
l, bears 7 fringed sensory spines arranged submarginally on its inferolateral margin; dactylus slender, bears minute setules along the inferolateral margin, secondary unguis present.

In the posterior pereopods, carpus does not underride the propodus; infero-lateral margins of carpus and propodus bears a few fringed sensory spines fewer than in the anterior pereopods.

Pleopods normal, both rami with marginal plumose setae.

Uropod characteristic of the family, endopod 2-segmented with a longer proximal segment and a shorter distal segment, round apically, bears long marginal setae, exceeds the telson in length; exopod reaches two-third the length of endopod, fringed with slender hairy setae marginally.

Body white with brownish branched chromatophores on the dorsal surface. Pereonite bears a transverse line of dark pigmentation near its anterior margin which recedes progressively towards the posterior margin in succeeding pereonites.

**Description** (Male, 8.0 mm TL):

Sexual dimorphism distinct. Male differs from the female in having a very feathery first antenna. The propodal palm of pereopod 1 is more densely setose in the male; propodal palm of pereopod 2 also bears more fringed sensory spines. The appendix masculina on endopod of pleopod 2 extends beyond the rami, narrower proximally and widening distally, apex tapering to a blunt point bearing spinules. In all other characters both sexes are alike.

**Distribution:**

Cape Comorin and Thankasseri (India).

**Remarks:**

The plumose first antenna of males, though not a generic character, is useful in distinguishing *P. plumosa* from most other species of the
genus *Paranthura*. Other characters of taxonomic value are (i) the second antenna, the flagellum of which is composed of a single large basal segment and a series of indistinct segments demarcated by tufts of setae in the females and four segments in the males (ii) three-segmented maxilliped (iii) pereopod I with merus dorsally produced, propodus roughly oval with a proximal basal expansion overhanging tip of carpus, palmar surface of propodus setose, dactylus long (iv) linguiform telson.

The present description is completely in consonance with that of Pillai (1966b). The close similarity between the females of *P. plumosa* Pillai, 1966; *P. bellicauda* Miller & Menzies, 1952 and *P. ostergaardi* Miller & Menzies, 1952 has been discussed by Pillai (1966b).

**Ecological note:**

This species was first reported from Quilon in the empty sand tubes of sabellid worms. During the present study also, the specimens were collected from the intertidal region of Kovalam, inhabiting empty sand tubes of sabellid worms. Huge colonies of such sand tubes were found erected in the intertidal region between rock faces.

This species has so far been reported from Kerala (South-west coast of India) only. However, it is not confirmed that this is an endemic species.

**FAMILY - ANTHURIDAE**

**Diagnosis:**

The anthurids have normal mouth parts (biting or chewing); mandibular incisor toothed, apex of mandibular palp rounded; first maxilla with a multi-spinose distal end; maxillipetal palp of four or fewer articles, as broad as the basipodite. First pleopod longer than others forming an operculum covering the other pleopods. A pair of telsonic statocysts always present. About 35 genera have been assigned to this family.

**Genus - Mesanthura Barnard, 1914**


Mesanthura Barnard, 1925; Kirtisinghe, 1931; Nierstrasz, 1941; Pillai, 1966b; Kensley, 1980b.
Diagnosis:

Anthurid isopod with normal mouth parts; mandibular palp 3-jointed; middle segment being the longest and slightly enlarged; first maxilla with conspicuous, recurved spines apically; maxilliped 5-jointed, third segment narrower than adjacent segments. Pleon segments completely fused. Prominent pigmentation present on the dorsal surface of the body.

Mesanthura maculata (Haswell, 1881)


Synonymy:

Haliophasma maculata Haswell, 1881; Anthura affinis Chilton, 1883; Mesanthura maculata Barnard, 1925a; Hale, 1929; Kirtisinghe, 1931; Nierstrasz, 1941; Hurley, 1961; Pillai, 1966b; Kensley, 1980b.

Material:

A few specimens were collected from among the algae of the rocky shore of Kovalam.

Description (Female, 4.0 mm TL):

Body elongate, almost parallel-sided. Cephalon somewhat square in shape, shorter than succeeding pereon segments, anterior margin bisinuate with a small antero-median rostrum, eyes large, black, situated antero-laterally. Pereonites 1-6 subequal in length, pereonite 7 shortest. Pleon subequal to pereonite 6, all segments completely fused. Telson rounded apically with a tuft of long setae postero-medially.

First antenna stout, flagellum 6-7 jointed, bearing long hairy setae on distal margin of each segment and apically. Second antenna slender, peduncle 3-jointed, flagellum 3-jointed with long hairy setae apically.

Mandible with incisor process feebly dentate, palp 3-segmented, middle segment longest and slightly dilated, single long spine on inferior
distal margin, terminal segment with a row of stout spines. First maxilla with an outer and inner lobe; outer lobe 5-dentate, inner lobe small, conical, with a single seta. Second maxilla a simple conical lobe-like structure with two long setae. Maxilliped 5-jointed, third segment narrower than adjacent segments, a characteristic feature of this genus.

Pereopod 1 stout, merus slightly produced outwards, with a couple of tiny spiny setae; carpus produced along the inferior lateral margin of the propodus, apex blunt, bears a few spiny setae; propodus enlarged with a small median setose lobe on its palm; dactylus short; distal end of propodus and dactylus bears few setae. Pereopod 2 not as stout as first; carpus underriding propodus; propodus not enlarged as in pereopod 1 but bears a small lobe on its infero-lateral margin near the distal end. Posterior pereopods more slender and longer, propodus lacking latero-median lobe, distinctly serrated along infero-lateral margins.

Pleopods 1-5 similar; endopod slender and long; exopod rounded; both rami setigerous.

Telsonic apex rounded, fringed with setae. Uropodal endopod almost reaching up to tip of telson, rounded apically, with setae, transversely divided into two segments; exopod reaching up to the tip of the basal segment of endopod, apically acute and setose.

Characteristic pigmentation; general body colour creamy-white with large blotches of dark pigmentation situated squarely on the dorsal surface of cephalon, pereonites, pleon and telson; the two segments of endopod bear similar coloured patches each.

**Distribution:**

Australia, New Zealand, South of Madagascar, Sri Lanka and India.

**Remarks:**

As Kensley (1980b) also mentioned, this species has not been described in detail except by Pillai (1966b). The colour pattern has often been the main criterion in distinguishing this species.
Pillai (1966b) has described that the first two pleon segments could be made out by lateral sutures. In the specimens presently examined, the pleon segments were completely fused which is in variance with Pillai’s description. Kensley (1980b) observed a proximal constriction on the pleon but no lateral sutures visible in dorsal view. The present material lacked the proximal constriction too. The lateral margins of the pleon were smooth with no constriction or demarcation of any sort.

The small median setose lobe present on the propodal palm of pereopod 1 in the present species was not mentioned by Pillai (1966b), but, Kensley (1980b) observed this character in his species.

On comparing the shape of the telson figured by Pillai (1966b) with that observed in the present species, a clear-cut difference in shape was noticeable. The telson in the present specimens is apically rounded while it meets at an angle in the figure shown by Pillai (1966b). However, the shape of the telson of the present species agrees with that of Kensley (1980b).

If the absence of a suture line on the pleon segment can be considered as a valid character for the creation of a new variety, then the present material can be bestowed with the status of a new variety. Certain other variations like the shape of the telson also can be taken into account.

**Ecological note:**

This species is found in abundance in association with algae in the littoral region. Pillai (1966b) reported this species from the intertidal region of Cape Comorin. The present material was procured from the littoral region of Kovalam.

The colour pattern of this species is striking making it very conspicuous.

No information on the biology of this species is known.
SUBORDER - FLABELLIFERA

Diagnosis:

Body of most flabelliferans depressed. Eyes well developed in most species but some are blind. First and second pairs of antennae well developed, rarely longer than body, flagellum multi-articulate. Mouth parts well developed, mandible with well developed incisor process, lacinia mobilis and molar process; palp usually 3-jointed; first maxilla biramous; second maxilla with three rami; maxilliped large, with a palp of five articles, one to many coupling hooks present, sometimes hook absent. Pereonal segments free with well developed coxal plates. Pereopods 1-7 usually ambulatory, prehensile in some families. Pleon usually consists of five free segments plus pleotelson although fusion of pleonites occur in some families reducing the pleon to any number of 'segments'. All five pleopods biramous, rami setigerous. Uropods usually biramous, the flattened rami forming a 'caudal fan' with the pleotelson.

Remarks:

This is the largest suborder of the order Isopoda and comprises of members which are primarily littoral or shallow benthic in habit. However, many species from deeper waters are also recorded. Freshwater, cave-dwelling and hot-spring species are also known. The 3000 species of flabelliferan isopods in about 175 genera have been assigned to 11 families of which five families represented in the Indian waters can be separated as follows:

Key to the families of Flabellifera known from the South-west coast of India

1. Pleon composed of five to six free pleonites plus telson
   - Pleon composed of not more than three segments, distinguishable by lateral sutures, plus telson
   ----Sphaeromatidae

2. Terminal article of maxilliped armed with hook-like setae

-----2

-----3
- Terminal article of maxilliped not armed with hook-like setae ----4

3. Body symmetrical; antennae have distinct peduncular and flagellar articles; only anterior three pereopods prehensile, posterior ones ambulatory; pleopods, telson and uropods marginally setose ----Aegidae

- Body mostly asymmetrical; antennae short, peduncle and flagellum not distinct; all pereopods prehensile; pleopods, telson and uropods lack marginal setae. ----Cymothoidae

4. Mandible distally narrowed, molar reduced ----Corallanidae

- Mandible distally stout, with conspicuous incisor process, molar very well developed ----Cirolanidae

FAMILY - SPHAEROMATIDAE

Diagnosis:

Flabelliferans with pleon of two distinct free somites including telson; pleonite 1 has suture lines indicating fusion of other somites. Body oval, convex. First antenna with peduncle of three articles and second antenna with peduncle of five articles. Mouth parts well developed; mandibles stout, lacinia mobilis and molar process well developed, palp of three articles; maxillipetal palp of five articles. Uropods lateral, exopod free and movable, endopod firmly attached to peduncle, immovable. Sexual dimorphism pronounced.

Remarks:

Members of this family differ from other isopods in several respects. The most obvious characteristic is their ability to roll into a sphere when handled. Unlike in other isopods, the fertilised eggs are deposited in an internal brood pouch. Another difference is the presence of a tubular channel on the ventral side of the pleotelson, probably for the passage of respiratory current from the pleonal vault. This family contains about 75 genera.
Sphaeromatids are common intertidal forms which occur in almost all the oceans of the world. Most of the species are marine, many are brackish water and a few are freshwater. They are typically crevice animals, commonly seen under rocks and in association with other organisms such as algae, sponges, barnacles, bryozoans etc. Some species bore into wood, laterite stones, soft clay etc., causing immense damage to underwater wooden structures and hence have been the subject of intense study.

The three valid subfamilies - Eubranchiatae, Hemibranchiatae and Platybranchiatae can be distinguished by the following key provided by Hurley and Jansen (1977).

**Key to the subfamilies of the family Sphaeromatidae**

1. Pleopods 4 and 5, both rami without wrinkles; pleopods 3 and 4 outer rami unsegmented; pleopod 5 outer rami may be segmented
   ----Platybranchiatae
   -Pleopods 4 and 5, one or both rami of each with transverse wrinkles; pleopods 3 and 4, outer rami may be two-segmented; pleopod 5 outer rami almost always partially or completely two-segmented
    ----2

2. Pleopods 4 and 5, inner ramus pleated, outer ramus membraneous, pleopods 3-5 outer rami may be two-segmented
   ----Hemibranchiatae
   -Pleopods 4 and 5, both rami pleated; pleopods 3 and 4, outer rami usually unsegmented; pleopod 5 outer ramus usually partly or completely segmented
    ----Eubranchiatae

**SUBFAMILY - PLATYBRANCHIATAE**

**Diagnosis:**

Pleopod 1 outer ramus rarely broad; pleopod 3 with plumose marginal setae on both rami as in pleopod 2, sometimes inner ramus nearly naked,
sometimes both rami naked; pleopods 4 and 5 both rami without transverse folds, outer rami unsegmented; pleopod 4 both rami without plumose setae mostly, inner ramus with a few short, terminal plumose setae sometimes, outer ramus rarely with long, plumose setae (Tecticeps); pleopod 5, both rami without marginal setae, outer ramus with squamiferous protuberances, in rare instances lacking spines or even absent altogether.

Genus - **Dies** Barnard, 1951

**Dies** Pillai, 1965.

**Diagnosis:**

Platybranchiate sphaeromatid with both rami of pleopods 4 and 5 not wrinkled or pleated; exopod of pleopod 3 two-segmented; exopod of pleopods 4 and 5 unsegmented. Epistome rectangular, visible on dorsal view. Uropodal exopod reduced; telsonic apex truncate. No sexual dimorphism.

**Type species:** **Dies** monodi Barnard, 1951.

**Remarks:**

Platybranchiate sphaeromatids are difficult to identify since many of the genera are still not completely and accurately described and moreover the difference between most genera are very slight. The rectangular epistome is considered a major distinguishing character of this genus. The genus **Dies** Barnard comprises of very few valid species. Of these, **D. quadricarinatus** Pillai is the only species recorded from Indian waters.

**Dies** quadricarinatus (Pillai, 1954)

Pl.II, figs. 14-34


**Synonymy:**

**Cassidinidea** quadricarinata Pillai, 1954; **Dies** quadricarinatus Pillai, 1965.
Material:

A few male and female specimens were collected from the Akathumuri and Ashtamudi Lakes.

Description (Female, 3.5 mm TL):

Body ovate, dorso-ventrally flattened; lateral margins of body hirsute, beset with a few short setae. Cephalon with anterior margin bisinuate; slightly longer than pereonite 1, bears two submedian tubercles dorsally; antero-median rostrum absent. Eyes small, black, located in eye lobes sunk into pereonite 1. Pereonite 1 longest; pereonite 2 subequal to pereonite 6; 3, 4 and 5 subequal to one another; 7 shortest. Coxal plates fused to pereonites, marked only by a faint longitudinal furrow from their respective segments. Pereonites bear four horizontal tubercles equidistantly placed giving the body a quadricarinate appearance. Pleon single segmented without any lateral sutures, bears four tubercles as in pereonites. Telson, a broad-based triangle, lateral corners covering the base of the uropod, apex with a slight median concavity beset with minute hairs and setae, proximal dorsal surface slightly tumified, bears four tubercles arranged as in pereonites and pleonite, inner two tubercles followed by longitudinal rows of tubercles up to the tip of telson.

Epistome visible from dorsal view, rectangular, slightly convex anteriorly with setae and hairs, arms cover almost half of the upper lip laterally.

Peduncle of first antenna 3-segmented, proximal two segments large, inferior lateral margin bears hairs and a few slender setae, superior distal margin of second peduncular segment bears a few slender setae, third peduncular segment slender and narrow, proximal inferior margin bears a few hairs, distal margin with few setae. Flagellum of first antenna 6-segmented, with setae along the outer distal margin and apically. Peduncle of second antenna 5-segmented, distal two segments equal in length to the proximal three joined together; flagellum of second antenna 6-7 segmented, bearing setae along the outer distal margins.
Incisor process of mandible five dentate; spine-row with five spines; molar process well developed; palp 3-segmented, proximal segment longest, the two distal segments bear a few pectinate setae. First maxilla of two lobes, inner lobe with four pectinate setae and a spinule apically, outer lobe with two barbed and seven blunt spines apically. Inner lobe of second maxilla bears five setae of which four are pectinate, middle and outer lobes bear four serrulate spines each.

Endite of maxilliped with a single coupling hook laterally, seven pectinate setae and three stout, blunt spines apically; segments 2-4 of palp slightly lobed, inner distal margins bear short spiny setae, terminal segment bears spiny setae apically.

Basis of pereopod 1 bears short, hairy setae on the superior lateral margin; inferior lateral margins of ischium and merus bear small spiny setae; superior distal margin of merus bears a single spine; carpus slightly immersed in merus; propodus long bearing a plumose spine on its outer distal corner, a small barbed spine on its inner distal margin, a large barbed spine present submarginally towards the inner margin in its distal half; dactylus biunguiculate. In the succeeding pereopods, ischium shortened, hairs on the superior lateral margin of basis becomes fewer progressively, propodus lacks the barbed spines. Pereopods 6 and 7 more slender than preceding ones; basis of pereopod 7 very long; ischium, merus and carpus bear a spine each on the superior distal margin; carpus bears a stout spine on its inner distal corner and two slender spines on its distal margin; dactylus biunguiculate.

Both rami of pleopods 1-3 bear plumose marginal setae; exopod of pleopod 3 two-jointed; exopod of pleopod 5 with three thickened spiny areas, both rami unjointed.

Endopod of uropod long and lanceolate, reaching up to telsonic apex with marginal hairs and setae, exopod small, about a quarter of endopod, lodged within a shallow excavation on the proximal margin of endopod.

Body dark brown in colouration.
**Description** (Male, 3.7 mm TL):

Similar to female in all details. Appendix masculina on endopod of pleopod 2 long and reflexed at base, distal margin serrulate and apex pointed.

**Distribution:**

South-west coast of India.

**Remarks:**

The present material exactly resembles the description of Pillai (1965). The quadricarinate appearance of the body easily distinguishes this species from the type species *D. monodi* Barnard.

**Ecological note:**

This species was found in co-habitation with the timber-boring sphaeromatids, viz., *Sphaeroma terebrans* and *S. annandalei* and the cirolanid, *Cirolana willeyi* on laterite stones in the Akathumuri Lake, a brackish water body. *D. quadricarinatus* along with *C. willeyi* shares the bores of the sphaeromatids. *C. willeyi* predominates in these bores. Submerged timber was also found inhabited by these species. It is possible that such a habitat is advantageous to this species as it affords protection from larger predators for these minute animals.

This species has also been reported to survive in almost freshwater conditions in the Veli Lake (Pillai; 1965) and hence, it is suggestive that this species is an euryhaline form. Detailed biological study of this species is yet to be carried out.

**SUBFAMILY - HEMIBRANCHIATAE**

**Diagnosis:**

Pleopod 1, inner ramus at least rather broad; pleopod 3 both rami with long plumose setae at least on distal margin; pleopods 4 and 5,
inner rami thick and fleshy with transverse folds, outer rami membra­neous, two-segmented, both rami without plumose marginal setae; pleopod 5 outer ramus with high apical, squamiferous protuberance.

Key to the genera of the subfamily Hemibranchiatae from the South-west coast of India

1. Telsonic apex entire with no notch or foramen in either male or female
   - Telsonic apex with a notch or foramen in either male or female or both, with or without a median lobe

2. Pleotelsonic apex with a slit in male, entire in female; outer rami of pleopod 3 single-jointed; penes entirely fused along the proximal half of their length
   - Pleotelsonic apex with a notch in male or female, often with a median lobe, outer rami of pleopod 3 two-jointed; penes not fused

Genus - Sphaeroma Latreille, 1802

Sphaeroma Latreille, 1802; Stebbing, 1904a; Hansen, 1905a; Richardson, 1905; Barnard, 1940; Pillai, 1961; Hurley and Jansen, 1977; Kensley, 1978b.

Diagnosis:

Hemibranchiate sphaeromatid, capable of rolling into a ball; no sexual dimorphism; posterior margin of pleotelson not notched in both sexes. Both rami of uropod similar, outer ramus denticulate along outer margin, movable; inner branch immovable. Endopod of pleopod 2 of mature males with well developed appendix masculina in most species; endopod of pleopod 3 unsegmented. All pereopods ambulatory; pereopods 1-3 with long hairy setae on ischium and merus. Articles 2-4 of maxillipedal palp
not lobed, but bearing exceedingly long hairs.

**Type Species:** *Sphaeroma serratum* (Fabricius, 1787).

**Remarks:**

*Sphaeroma* Bate, 1866 has been extensively studied by Stebbing (1900a, 1904a, 1911), Hansen (1905), Baker (1926, 1928), Monod (1931), Pillai (1955, 1961), John (1968), Hurley and Jansen (1977) and Iverson (1982). The study of Indian species of this genus began with the description of *S. vastator* by Bate (1866). Four species and a variety of this genus has been reported from the Indian waters, viz., *S. terebrans, S. triste, S. walkeri, S. annandalei* and *S. annandalei travancorensis*. Of these, *S. triste* is a purely marine form, *S. walkeri* is predominantly marine with sparse occurrence in brackish water. Remaining three species flourish in brackish water habitats.

The major distinguishing features of the genus are:

(i) No sexual dimorphism, posterior margin of pleotelson not notched in both sexes.

(ii) Pereopods 1-3 with long plumose setae on articles 3-4.

(iii) Maxillipedal palp with articles 2-4 not lobed, bearing exceedingly long hairs.

Certain representatives of this genus are major timber borers and hence their mouth parts are modified - the incisor process of the mandible being strongly chitinised, probably for the purpose of gnawing.

The closely related genus of *Sphaeroma* is *Exosphaeroma* Stebbing, 1900. The main differences between the two genera are the lack of plumose setae on the pereopods and the lobed segments of the maxillipedal palp in *Exosphaeroma*. In the present collection only two species were obtained which are described below.

*Sphaeroma terebrans* Bate, 1866

*Pl. III, figs. 1-19*


*Sphaeroma terebrans* Stebbing, 1904a; Barnard, 1920, 1940; Calman, 1921; Barter, 1926; Monod, 1931; Pillai, 1955, 1961 (with complete synonymy); Kensley, 1978b.
Description (Female, 11.0 mm TL):

Body oblong, almost parallel-sided. Cephalon longer than succeeding pereon segments with a small antero-median rostrum; postero-lateral corners produced, eyes small. Pereonites 2-7 with a transverse ridge situated anteriorly in the anterior pereonites and slightly shifting progressively backwards in the posterior pereonites. Pereonites 6-7 bear four tubercles each, two submedian and two lateral with a bunch of long thin hairs. Composite pleon bears four tubercles, two submedian and two lateral as in the posterior pereonites, three oblique lateral sutures visible. Telson proximal part slightly bulged, four tubercles present, two submedian and two lateral; dorsal surface of telson pustulose, the pustules being surmounted by hairs, apex rounded, slightly curved upwards with minute apical hairs.

Peduncle of first antenna 3-jointed, proximal segment large, distal segment long and slender, flagellum 8 or 9-segmented with tufts of aesthetascs and setae at the distal superior margin of each segment. Peduncle of second antenna 5-segmented, flagellum 11-segmented; superior lateral margins of peduncular segments fringed with hairy setae; distal superior margins of flagellar segments armed with setae.

Mandible with a bidentate incisor process; lacinia mobilis, setal row and molar process well developed; palp 3-segmented; first segment longest, middle segment with three distal pectinate spines, distalmost segment bears a comb of setae. First maxilla of two lobes, hirsute laterally; outer lobe bears nine stout dentate and three simple spines apically and a slender medial pectinate spine; inner lobe bears four pectinate spines and a spinule apically. Second maxilla with three triangular lobes, inner lobe armed with long, slender pectinate setae; middle and outer lobes with long, slender setae; outer margin of outer lobe hirsute. Maxilliped with stout sympod; endite somewhat leaf shaped, inner lateral margin and apex armed with slender, spiny setae; palp 5-segmented, inner border of segments not produced but with a thick matting of hairs.

All pereopods ambulatory, characteristic of the genus. Pereopod 1, basis long; ischiium one and a half times as long as basis; merus half
as long as ischium; carpus small, triangular; outer lateral margins of ischium and merus bear long hairs; outer distal margin of propodus hairy; dactylus short; infero-lateral margin irregularly spiny, biunguiculate. Pereopods 2 and 3 very similar. Pereopods 4 and 5 short and stout; all segments of pereopod 5 hairy and shorter in comparison to that of anterior pereopods. Posterior pereopods more slender, hair on basis, ischium, merus, carpus and propodus; propodus lacks spines. Carpus of pereopod 7 bears stout barbed spines on the distal margin; inferior lateral margin of propodus armed with spinules; dactylus biunguiculate.

Pereopods 1-3 similar, peduncle with three coupling hooks; endopod triangular; exopod subtruncate apically; both rami with plumose marginal setae. Exopod of pleopod 4 two-jointed; proximal half of outer margin bearing small, slender spiny setae interspersed between short hairy setae; endopod fleshy and pleated. Exopod of pleopod 5 two-segmented, basal segment with one and distal segment with three thickened spiny areas, proximal half of outer margin with slender, spiny setae, endopod fleshy and pleated.

Uropod with exopod and endopod firmly attached to the telson; exopod outer border five-dentate, apex bears setae; endopod apex acute, hirsute.

Colour of body pale brown in preserved specimens.

**Distribution:**

Mediterranean, Africa, Congo, Mozambique, Zanzibar, Sri Lanka, Queensland, Florida, Brazil and India.

**Remarks:**

*S. terebrans* exhibits a wide range of distribution having been recorded from such widely separated localities as Brazil and India. Formerly, the specimens from Brazil were described as *S. terebrans* and that from India as *S. vastator*. Richardson (1905) described *S. destructor* from Florida, but, later the latter two species were synonymised to *S. terebrans* by Stebbing (1904a). Richardson (1905) argued at length against synonymising *S. destructor* and *S. terebrans*. However, this synonymy has been widely
accepted. The slightly upturned telsonic apex, the minutely tuberculate dorsal surface of telson and the pattern of tuberculation on the posterior body surface all point to the conclusion that *S. destructor* is *S. terebrans*. However, the number of setae on the first maxilla seems to differ slightly in the two species according to the description of Stebbing (1904a) and Richardson (1905). Pillai (1961) has pointed out that this appendage is evidently subject to some variation.

Some of the other species of *Sphaeroma* commonly reported from Indian waters are *S. walkeri*, *S. triste*, *S. annandalei* and *S. annandalei travancorensis*, the main difference between these species is the pattern of tuberculation on the pereon, pleon and telson. *S. walkeri* has the entire dorsal surface of the body tuberculate, telson with longitudinal rows of tubercles, *S. triste* has two submedian tubercles on pereonite 7, *S. annandalei* with a 'v' shaped arrangement of tubercles, this arrangement being flanked on either side by a longitudinal row of three tubercles; *S. annandalei travancorensis* has a tuberculation very similar to *S. annandalei* but the lateral longitudinal row consists of two instead of three tubercles. The epistome is another distinguishing character. The epistome of *S. walkeri* is broad throughout with a subapical constriction, angular apex and short arms; that of *S. triste* is triangular with a pointed apex and comparatively longer arms almost completely enclosing the upper lip, that of *S. annandalei* and *S. annandalei travancorensis* are broad basally, apically produced, apical and lateral margins setose, arms slightly broad, embracing more than half of upper lip. The first maxilla differs in *S. terebrans* and *S. annandalei* in that the inner lobe is quadrate in the latter and almost triangular in the former.

**Ecological note:**

This species is a true borer. In India, this species has been recorded only from Kerala and Karwar, both brackish water localities. It has never been reported from the open sea. This species is abundant in the backwaters of Kerala, ranging from the bar-mouth with very high salinity to the region of freshwater. However, it has never been reported from any water body unconnected with the sea. The damage caused by this
species to all sorts of submerged timber is considerable. The attack has been observed to be more heavy in the intertidal limits.

This species usually lives singly, in burrows just enough to accommodate a single individual. Hence, it is presumed that pairing occurs outside the burrow. Breeding is continuous and each female reportedly produces more than one brood a year. Each brood carries 20-48 eggs (Venkatakrishnan and Nair, 1973a). This accounts for the great intensity of this species in Indian waters. The phenomenon of mixed brood is exhibited by this species.

Controversial opinions on the presence of the enzyme cellulase in *Sphaeroma* have been given. Ayyar (1982) based on experimental evidence conclusively stated that cellulase is present in *Sphaeroma* and it is autochthonous in origin. It can thus be inferred that *Sphaeroma* bores mainly for food and protection.

In the Akathumuri Lake, *S. terebrans* was found along with *S. annandalei* in bores made on laterite blocks used to build bunds along the water front. This habitat is probably for protection alone and not for sustenance.

**Sphaeroma annandalei** Stebbing, 1911

Pl. III, figs. 20-35


*Sphaeroma annandalei* Stebbing, 1911; Barnard, 1936; 1940; Pillai, 1954; 1955; 1961.

**Material:**

Many specimens were collected from submerged timber and laterite blocks of Kadinamkulam and Akathumuri Lakes.

**Description** (Male 11.0 mm TL):

Body almost parallel-sided, oblong. Cephalon anterior margin slightly bisinuate, with a small antero-median rostrum; eyes small. Pereon segments subequal to one other in length, pereonites 2-4 with an indistinct
submarginal, transverse ridge; in the posterior pereonites this ridge gets cut up into transversely elongated tubercles which becomes progressively prominent posteriorly. Coxal plates of all pereonites fused with the respective pereonites, with a matting of minute setae on its lateral margins. Composite pleon with 3 oblique lateral sutures, bearing two submarginal tubercles dorsally. Proximal dorsal surface of telson slightly bulged with two pairs of submedian tubercles arranged longitudinally, followed by a median tubercle; this arrangement of tubercles is flanked by a longitudinal row of three tubercles on either side; apex semicircular.

First antenna with a 3-jointed peduncle, proximal two segments short, distal one long, slender, flagellum 10-segmented, distal superior margins of segments bear clusters of aesthetasc. Peduncle of second antenna 5-jointed, flagellum 16-17 segmented with tufts of setae on their distal superior margin.

Epistome broad basally, apex produced; apical and lateral margins setose; arms slightly broad embracing more than half of the upper lip.

Mandible with a well developed bidentate incisor process, lacinia mobilis, setal row and molar process; palp 3-segmented, distal two segments with pectinate setae. First maxilla of two lobes; outer lobe very hairy, apex with eleven spines, outer five blunt, stout and not barbed, middle four with barbs on inner side only and the innermost two barbed on both sides; inner lobe with three stout setae with stiff hairs distally and two small setules at the base of these, inner margin slightly hairy. Inner lobe of second maxilla quadrate in shape with long plumose setae latero-distally; inner and middle lobes triangular, armed with sharp slender setae; exposed surface of all three lobes with stiff hairs. Maxillipedal endite is a long, narrow process, slightly bend at the distal tip, apex and lateral margins armed with barbed spines; palp 5-segmented, terminal segment longest, infero-lateral margins of the last four articles with long hairs.

All pereopods ambulatory. Pereopods 1-3 long, slender, almost similar in structure. Pereopod 1 with basis and ischium very long and slender; merus half the length of ischium; superior lateral margins of ischium
and merus with long setae; carpus triangular with two spines on its infero-distal margin; propodus with a stout spine distally and a few subsidiary spines, distal superior margin of propodus with a tuft of long setae; dactylus biunguiculate. Pereopods 2 and 3 very similar to first, except that they are more setose and spiny and the carpus is longer and not immersed. Pereopods 4 and 5 short and stout; superior lateral margin of basis setose; lateral margins of ischium and merus setose; superior distal margin of merus with slender spines; infero-lateral margin of carpus and propodus setose; dactylus short, stout, biunguiculate. Pereopods 6 and 7 more slender and longer than pereopods 4 and 5. Lateral margins of basis, ischium, merus, carpus and propodus setose; infero-lateral margins of merus, carpus and propodus bear slender spines amidst setae; superior distal margin of merus armed with long, slender spines; distal margin of carpus bear slender, pectinate spines; dactylus short, biunguiculate.

Pleopods 1-3 with endopod triangular and exopod subtruncate apically; appendix masculina on endopod of pleopod 2 longer than ramus, apex rounded with tiny spinules on lateral margins. Pleopod 4 exopod two-jointed; endopod fleshy, pleated. Pleopod 5 exopod two-jointed with three thickened spiny areas, endopod fleshy, pleated.

Penial processes on seventh sternite in the form of mammiform papillae.

Uropods firmly attached to telson, endopod immovable, exopod movable with five dentate setose outer margin.

**Distribution:**

Zululand and Natal (South Africa), Kerala, Ganges Delta and Port Canning (India).

**Remarks:**

*S. annandalei* was first described by Stebbing in 1911 based on specimens collected by Annandale from Calcutta.

Stebbing's original description could not be procured and hence, comparison of the present description with that of the original one could
not be made. However, the description of the present specimen is exactly similar to the description of Pillai (1961). The tuberculation on the pleon and telson is characteristic of this species and is very similar to that described by Stebbing (Pillai, 1961). The telson has two submedian pairs of tubercles in succession followed by a single median tubercles, flanked on either side by a longitudinal row of three tubercles, besides a few more laterally. The tubercles on the pleon are almost conical in the present species, as was observed by Pillai (1961) and not transversely elongated as described by Barnard (1940).

The incisor process of the mandible is consolidated but the two teeth were observed to be fairly evident and not just "faintly indicated" as described by Pillai (1961).

Pillai (1961) has described a new variety of Sphaeroma annandalei namely S. annandalei travancorensis reported to be common in the estuarine region of Ashtamudi and Kayamkulam Lakes, Cochin and Neendakara. This variety differs from the species mainly in the pattern of tuberculation of the telson. The telson in S. annandalei travancorensis has five tubercles as in S. annandalei but the lateral longitudinal row is composed of only two tubercles compared to three in S. annandalei, the first submedian pair of tubercles is also smaller than the second in the former compared to the similar sized pairs of the latter. The telson surface is completely pustulose in the variety. Mouth parts are very similar but the outer lobe of first maxilla is less hairy, with 12 barbed spines and inner lobe with 3 blunt and 2 small setae with stiff hairs in S. annandalei travancorensis. The distal spine of propodus of pereopod 1 is also differently shaped, the number of spines on pereopod 7 too varies slightly in the two. Appendix masculina spiny in S. annandalei travancorensis and bears a stout seta a little away from the tip.

The close similarity of the present material to that described by Pillai (1961) confirms that this species is S. annandalei. S. annandalei travancorensis has not been obtained in the collections during the present study.
Ecological note:

*S. annandalei* is very abundant in the backwater systems of Kerala and is a true timber borer causing considerable damage. This species, though common in estuarine habitat, can be found in typically marine environment, too. It is usually found along with *S. terebrans*.

Breeding is continuous in this species, an average female producing 19-101 eggs (Venkatakrishnan and Nair, 1973a). Mixed broods are a common phenomenon in this species.

*S. annandalei* and *S. terebrans* have been studied extensively in India mainly because of their peculiar mode of living and the threat imposed on the wood industry by them.

Genus - *Dynoides* Barnard, 1914


Synonymy:

*Dynoides* Nierstrasz, 1931; Pillai, 1954; Loyola e Silva, 1960; Kussakin, 1979; Bruce, 1980b; 1982a; Carvacho, 1985; *Paradynoides* Loyola e Silva, 1960; *Dynoidella* Pillai, 1965; Nishimura, 1976.

Diagnosis:

This genus has got a set of very distinct characters - the fourth, fifth and sixth articles of maxilliped lobed; anterior pereopods lack natatory setae; exopod of pleopod 3 unsegmented in male but two-jointed in female; penes fused along the proximal half of their length; telson with a slit having denticulate sides in male; exopod with its lateral margin folded; pleon with or without a median process; margins of coxae bear minute closely knit hairy setae; pereonite 7 unarmed.

Type species: *Dynoides serratisinus* Barnard, 1914.
Remarks:

The genus *Dynoides* is not a very widely occurring one. So far only seven species of this genus— *D. serratisinus* Barnard, 1914; *D. barnardi* Baker, 1928; *D. dentisinus* Shen, 1929; *D. amblysinus* Pillai, 1954; *D. castroi* Loyola e Silva, 1960; *D. brevispina* Bruce, 1980 and *D. viridis* Bruce, 1982, have been recorded.

Bruce (1980b) and Carvacho (1985) reviewed the genus *Dynoides* and gave a generic diagnosis with which the present material agrees completely. The strongly reflexed appendix masculina and the proximally fused penes are considered as the main characters of taxonomic value. Carvacho (1985) also discussed the taxonomic status of the genera *Parady­noides* Loyola e Silva, *Dynoidella* Nishimura and *Dynoidella* Pillai. The former two genera were created for *Parady­noides braziliensis* and *D. conchicola* respectively, based on the biarticulate exopod of pleopod 3. Carvacho (1985) has stated that both the species were described based on juvenile specimens. The males of *Dynoides* are known to lose the segmentation of the exopod of pleopod 3 on reaching maturity (Bruce, 1980b) and hence, this character cannot be relied upon. The genus *Dynoidella* Pillai was created to accommodate *D. amblysinus* which lacked a median pleonal process. However, the median pleonal process has been stated to be a character of no generic importance by Hansen (1905a), Bruce (1980b, 1982a) and Carvacho (1985). Therefore, it is conclusively proved that *Parady­noides* and *Dynoidella* are junior synonyms of *Dynoides*.

*Dynoides* can be differentiated from other genera of the family *Spha­eromatidae* based on a combination of characters, viz.: presence of proximally fused penes, strongly reflexed appendix masculina, closely set setae on the epimera and the form of the telsonic sinus.

*Dynoides amblysinus* Pillai, 1954

Pl. IV, figs. 1 - 20
Synonymy:

*Dynoides amblysinus* Pillai, 1954; *Dynoidella amblysinus* Pillai, 1965.

Material:

Four male specimens were obtained among algae from Vizhinjam.

Description (Male, 3.5 mm TL):

Body almost oblong in shape; dorsal surface strongly convex; cephalon large, longer than succeeding pereonites; eyes large, black; anterior border of cephalon bisinuate with a small antero-median rostrum. Pereonite 1 longest, pereonites 2, 3 and 7 subequal to one another while pereonites 4-6 subequal to one another. Coxal plates well developed with a matting of minute hairs on lateral margins. Pleon two-segmented, made distinct by lateral sutures. Telson a broad-based triangle, dorsal proximal part tumid showing two independent bulgings one on either side of mid-line, studded with fragile tubercular spines, more concentrated towards the periphery. The tumescence bears small peripheral spiny setae. Telsonic apex bears a narrow channel-like slit with denticulate lateral margins, diverging apically and widening proximally into a transverse foramen with an antero-median lobe bearing a few stiff setae; apex and lateral margins of telson setose. Uropods well developed, overreaches telson; endopod truncate apically bearing minute setae; exopod rounded apically, marginal setae present, lateral margins folded.

Peduncle of first antenna 3-jointed, first segment longest and equal to the other two combined; flagellum of 11-12 segments with aesthetascs and setae at the distal inferior margin of each segment. Second antenna with 5 peduncular segments, fifth segment longest; flagellum 13-segmented with setae along the distal inferior margin of each segment.

Mandible with a quadridentate incisor process, lacinia mobilis, setal row and molar process well developed; mandibular palp 3-segmented, second segment bears two stout pectinate setae, last segment with a comb of setae. Outer lobe of first maxilla with five blunt spines and four barbed spines; inner lobe with four barbed setae and a single sharp
spinule. Innermost lobe of second maxilla has seven sharp, barbed spines; middle and outer lobes have three stout serrated spines each. Maxilliped 7-segmented, segments 4-6 lobed; endite bears seven sharp plumose spines and three blunt stout spines apically and a single coupling hook mid-laterally; palp setose.

Pereopod 1 short but stout, ischium elongate with two spiny setae on its distal inferior margin; merus bears two distal superior and inferior lateral spines each; carpus underriding propodus, bears two sharp inferior distal spines; propodus long with a stout spine near the distal inferior apex, three minute spiny setae along the infero-lateral margin and two spiny setae near its distal superior margin; dactylus biunguiculate. Pereopods 3-7 possessing a matting of thick bushy hairs along the infero-lateral margins of merus, carpus and propodus. All pereopods biunguiculate. Pereopod 7 carpus elongate, not underriding propodus; apart from the spines on the inferior and superior margins of the segments, carpus bears two stout pectinate spines on the distal superior margin.

Exopod of pleopod 1 longer than endopod, rounded apically; endopod slightly broader than long, broadly rounded apically, both rami with marginal plumose setae. Pleopod 2 with appendix masculina which overreaches endopod by 2/3 its length; it is reflexed at the middle with the basal part short and stout and distal part tapering towards the apex. Both rami of pleopod 3 membraneous, unjointed. Exopod of pleopod 4 two-jointed, endopod pleated. Exopod of pleopod 5 membraneous with three thickened spiny areas, one on the inner mid-lateral margin and two near the apex; endopod pleated; both rami unjointed.

Both rami of uropod subtruncated with marginal setae. Exopod with its lateral margin folded.

Penes present on the sternite of pereonite 7, fused in the proximal half, distal outer margins with spinules.

Body dark grey in colour with small black reticulate chromatophores distributed all along the length of the body; exopod of uropods devoid of chromatophores.
Distribution:

Cape Comorin and Vizhinjam (South-west coast of India).

Remarks:

The present material agrees with the description of Pillai (1965). Nevertheless, some minor variations have been noticed. The distal tips of the telsonic sinus are shown to be slightly diverged in Pillai's (1965) illustration but are almost apposed to each other in the present material. However, rest of the details like mouth part morphology, structure of appendages, structure of male secondary sexual characters and the form of the telsonic sinus confirm that this species is *D. amblysinus* Pillai.

*D. amblysinus* Pillai and *D. castroi* Loyola e Silva are the only two valid species of this genus which lack a median pleonal process and thus can be easily differentiated from all the other species of this genus. *D. amblysinus* can be differentiated from *D. castroi* mainly in the form of the telsonic sinus, a major distinguishing character useful in separating males of different species.

Bruce (1980b) has concluded that *D. conchicola* Nishimura is a junior synonym of *D. dentisinus* Shen, after making a comparative study of the two species. Therefore, it can be concluded that *Dynoides* contains only seven valid species.

Ecological note:

This is a marine species and has so far been recorded only from the South-west coast of India. Pillai (1965) collected three males from Cape Comorin and a single male from Vizhinjam. Presently, four males were collected among algae from Vizhinjam. This species is probably epifaunal. Other species of *Dynoides* have been collected from various habitats - *D. barnardi* from submerged timber, *D. dentisinus* and *D. viridis* from calcareous tubes of polychaetes (Bruce, 1982a). However, all these species are reportedly epifaunal, their colour matching their habitat.
Genus - *Cymodoce* Leach, 1814

*Cymodoce* Leach, 1814; Stebbing, 1902; 1904a; 1905; Hansen, 1905a; Barnard, 1914a; 1940; Baker, 1926; 1928; Nierstrasz, 1931; Pillai, 1954; 1958; Hurley and Jansen, 1977; Kensley, 1978b.

Diagnosis:

Hemibranchiate sphaeromatid with marked sexual dimorphism. Pletelsonic apex with a notch in both sexes, usually divided by a median lobe. Both the uropod rami well developed. Exopod of pleopod 3 two-jointed. Males with or without a mesial process on pleonite 1. Mouth parts of adult female often modified and reduced.

Remarks:

The genus *Cymodoce* was first described by Leach in 1814. Only three species under this genus have been recorded from Indian waters. Miers (1884) described *C. longistylis* from the Indo-Pacific Ocean. Tattersall (1922) recorded *C. mammifera* Haswell and *C. pelsarti* Tattersall from the Indian Ocean. Pillai (1965) redescribed *C. longistylis*.

The members of this genus exhibit great sexual dimorphism as seen in many other sphaeromatids. Males are used for identifying the species.

Type species: *Cymodoce truncata* Leach, 1814.

*Cymodoce longistylis* Miers, 1884

Pl. IV, figs. 21-27 & Pl. V, figs. 1-12

*Cymodoce longistylis* Miers, 1884 : 306.

*Cymodoce longistylis* Hansen, 1905a; Richardson, 1910; Baker, 1928; Nierstrasz, 1931; Monod, 1934; Barnard, 1936; Pillai, 1954; 1965.

Material:

Seven male specimens were collected from the Kavratti islands.
Description (Male, 9.0 mm TL):

Body strongly convex, almost parallel-sided. Anterior margin of cephalon slightly bisinuate, antero-median rostrum present. Eyes large, dark brown. Posterior half of body minutely tuberculate and thickly hirsute. Pereonite 1 longest, 2-7 subequal to one other. Coxal plates firmly united with the pereonites having a hirsute lateral margin. Pereonites 4-7 bear two transverse rows of minute tubercles one on the posterior margin, the other submarginal. Width of pleon almost equals pereon, two lateral sutures visible. Composite pleon bears a transverse median row of eight tubercles, posterior margin of pleon has two larger submedian and two smaller lateral tubercles, bearing a pencil of setae, along their posterior margin. Telson with distinct ridges and spines. From the larger submedian tubercles of the pleon arise two strong ridges running posteriorward on the telson, fringed with hairy setae, which ends in a double spine carrying long hairs. The groove between the ridges contains two longitudinal rows of 2-3 minute tubercles; tubercles are present on the outer lateral side of ridges too. Posterior apex of telson bifid with a median lobe in between; median lobe notched apically and extends beyond the lateral lobes; thickly setose apically, lateral lobes setose. Median boss on anterior dorsal telson bordered by slender setae.

Epistome produced into a small blunt process apically; anterior part spinous; arms short; lateral margins slightly sinuate; upper lip extends beyond the arms of the epistome.

Peduncle of first antenna 3-jointed; proximal articles being very long and stout, distal one slender and long; flagellum 19-segmented, distal margin of each segment bearing aesthetascs. Peduncle of second antenna 5-jointed; flagellum 24-jointed, each article with tufts of setae at the distal margins.

Mandible with a well developed incisor process, lacinia mobilis, setal row and molar process; palp 3-segmented, distal two segments with a comb of pectinate setae. Inner lobe of first maxilla with four pectinate spines and a spinule; outer lobe with a few blunt, serrated spines. Second maxilla of three lobes, innermost lobe with pectinate spines; middle and
outer lobes bear slender, pointed spines. Maxillipeda palpal 5-jointed, second to fourth articles lobed, inner apical margins of the segments bear long setae; endite armed with a few pectinate setae apically.

Pereopod I stout, inferior margin of merus bears five stout spines and one sharp, slender spine among hairy setae; carpus triangular, immersed in propodus with four stout spines along the inferior margin which has a matting of fine hairs; propodus bears four stout spines along its inferior margin; inferior margin of dactylus lined with slender hairs, dactylus biunguiculate. Pereopod 2 slender and long; inferior margins of merus, carpus and propodus with stout spines as in pereopod I and thick hairy setae; carpus not immersed in propodus. Pereopod 7 spinous, superior margin of ischium slightly emarginate near the distal end, bears five slender sharp spines; inferior margin of merus fringed with tiny hair-like setae amongst which are stout spines; inferior margins of carpus and propodus bear nine and four spines respectively; distal margin of carpus bears five spines distally, of which two are pectinate; dactylus biunguiculate.

Endopod of pleopod 2 bears an appendix masculinum twice the length of the rami, proximally stout with serrulate margin, tapers distally into a pointed apex with minute spinules. Exopod of pleopod 3-5 thin and membraneous, distinctly 2-jointed, exopod of pleopod 4 bears a single apical seta, its outer margin sparsely setose; endopod bears an apical lobe. Exopod of pleopod 5, outer margin sparsely setose and bears four thickened spiny areas; endopod inner margin hairy.

Penes of the seventh sternite long with spinules along its outer border.

Distribution:

Singapore, New South Wales, Indo-China, East Indies, Torres Strait and India.

Remarks:

The species exhibits extreme sexual dimorphism. Since Mier's original description of the species was not available, it was not possible to compare
the species presently obtained with that of Miers (1884). This species is, however, exactly similar to the description of Pillai (1965).

The prominently tuberculate and hirsute body distinguishes this species from most other species of the genus. The double carinae and the median lobe near the apex of the telson are the main distinguishing features. *C. mammifera* is distinctly less tuberculate and hirsute; the telsonic apex is triangular rather than bifid and the median lobe near the apex of telson present in *C. longistylis* is lacking in *C. mammifera*. *C. pelsarti* Tattersall is said to differ from *C. longistylis* in the presence of a spine on the distal median boss of telson.

As no females were obtained, it was not possible to comment on the sexual dimorphism evident in the species. Pillai (1965) observed that the female of *C. longistylis* shows a superficial resemblance to the males of *C. bicarinata* Stebbing and *C. mammifera* Haswell.

**Ecological note:**

This is a marine species enjoying a wide range of distribution. It has been reported from the littoral region at Quilon. The present material was provided by Mr. Dharmaraj, a senior colleague, who collected it from the Kavratti islands. It may be mentioned here that this is only a small part of his voluminous collection and hence appropriate note on its ecology cannot be given.

**SUBFAMILY - EUBRANCHIATAE**

**Diagnosis:**

Pleopod 1, inner ramus at least rather broad; pleopod 3 both rami with closely set, long, plumose setae on distal margin; pleopods 4 and 5, both rami subsimilar with deep essentially transverse folds, often fleshy, without plumose marginal setae; pleopod 5, outer ramus distinctly or partially two-segmented, with very high sub-apical squamiferous protuberance; pleotelson at least emarginate, generally with a notch or slit terminating in a foramen.
The genera coming under this subfamily fall into two groups, those with pleopod 3 outer ramus unsegmented and those with outer ramus two-segmented.

Genus - *Dynamenella* Hansen, 1905


*Dynamenella* Barnard, 1914 a; 1940; Baker, 1928; Nierstrasz, 1931; Pillai, 1954; 1965; Hurley and Jansen, 1977.

**Diagnosis:**

*Dynamenella* is a eubranchiate sphaeromatid, characterised by a semi-circular or oblong notch at the pleotelsonic apex in the female and a notch which is narrow distally but widens proximally into a transverse foramen in the male. Both sexes lack pereonal and pleonal processes. Both rami of uropods lamellar. All pereopods with secondary unguis on dactylus. Exopod of pleopod 3 with or without articulation. Sexual dimorphism distinct.

**Type species:** *Dynamenella perforata* Hansen, 1905.

**Remarks:**

The presence or absence of an articulation on the exopod of pleopod 3 is a controversial character of this genus. Hansen (1905a) divided the eubranchiate sphaeromatidae into two groups based on the presence or absence of this character. *Dynamenella* was thus put into the group with the exopod of pleopod 3 inarticulated. However, Pires (1980b) has pointed out that there are many species included in *Dynamenella* which exhibit this character and many others that do not. Harrison and Holdich (1982) reviewed this genus and opined that except *D. platura* all the Old World species lack an exopodal articulation while the New World species possess one. No comment on this is being made, at present, because it has not been possible to study all the species belonging to this genus.
Dynamenella quilonensis Pillai, 1954
Pl. V, figs. 13 - 29

core, 3 (1) Ser.C: 11.

Synonymy:

Dynamenella quilonensis Pillai, 1954; 1965; Dynamenella tuberculata
Pillai, 1958.

Material:

Four male and one female specimen were obtained from Kovalam
associated with algae.

Description (Male, 4.3 mm TL):

Body almost parallel-sided, being about half as broad as long. Anterior
margin of cephalon bisinuate; eyes round and black. Coxal plates well
developed with short hairs bordering their lateral margins, united firmly
with the pereon segments. Posterior margin of pereonite 7 bears a slight
indentation medially. Pleon consists of two segments made distinct by
lateral sutures. Telson, a broad-based triangle with a narrow and deep
slit at its apex, the slit widens proximally into a semicircular transverse
foramen, its anterior margin hairy; dorsal surface bears two tumefactions,
lateral to mid-line. The tumefactions bear tubercles, the peripheral ones
larger and arranged in a definite configuration, inner ones smaller.

Peduncle of first antenna 3-segmented; flagellum 8-segmented, distal
articles bear groups of aesthetascs. Peduncle of second antenna 5-jointed;
flagellum 12-13-segmented.

Epistome broad, anterior apex rounded, arms slender, long, slightly
curved outwards apically and covering more than half the upper lip, upper
lip bears long setae marginally.

Mandible bears a tridentate incisor process, lacinia mobilis, setal
row and molar process well developed; palp 3-segmented, terminal segment
smallest bearing a comb of eight pectinate setae, middle segment bears four pectinate setae. First maxilla bears two lobes, inner lobe with four barbed spines and spinule apically, outer lobe has four blunt and four denticulate spines apically. Second maxilla of three lobes, innermost bears six stout barbed setae, middle and outermost lobes bear stout denticulate spines. Endite of maxilliped has a single coupling hook laterally and four blunt spines interspersed with pectinate setae apically, palp 4-segmented, proximal two segments lobed, terminal two segments slender, all articles stiffly setose.

All pereopods with a thick matting of hairs along the inferior margins of merus, carpus and propodus, beset with a few slender, sharp spines. Pereopods 1-3 stout; pereopod 1 stouter than others; distal superior margin of merus bears three spines; carpus triangular, immersed in merus; propodus stout; secondary unguis present on dactylus, with 3-4 slender setae near its base. Pereopods 4-7 more slender and spiny than the preceding ones. Merus of pereopod 6 has four stout spines at the distal superior margin; carpus bears a denticulate spine and a smaller spiny seta at the superior distal margin; superior margin of propodus with two spines, one proximal and the other distal; inferior margins of merus, carpus and propodus bears a thick matting of hairs with long, slender spines amidst it. Pereopod 7 similar to the preceding ones except that there are a larger number of spines present.

Peduncle of pleopod 1 bears three coupling hooks, endopod is almost triangular, tapering towards the apex; exopod rectangular with the broad apex somewhat truncated; both rami with plumose marginal setae. Pleopod 2 similar to first regarding coupling hooks, appendix masculina with a stout base, distal end tapers into a blunt, slender apex. Both rami of pleopod 3 single-segmented, with plumose setae marginally, exopod somewhat rhomboidal. Both rami of pleopod 4 unsegmented but pleated, hirsute laterally. Both rami of pleopod 5 unsegmented, exopod with three thickened spiny areas near its apex, hirsute lateral margins.

Both rami of uropods almost equal in length with serrated margins, falling slightly short of telson.

Penes long, slender, tapering distally, apically blunt, closely apposed to each other.
Body dark grey due to dark chromatophores forming distinct reticulate patterns over the whole length of the body.

**Distribution:**

Ashtamudi Lake and Kovalam (South-west coast of India).

**Remarks:**

The description of *D. quilonensis* is available only from the works of Pillai (1954, 1965). *D. tuberculata* of Pillai (1958) is essentially *D. quilonensis* because the presence of two submedian tubercles on pereonite 7 and pleon, characteristic to the former species cannot be taken as a valid character for creating a new species. All other details are exactly similar in the two descriptions. Hence, *D. tuberculata* is probably a synonym of *D. quilonensis*.

*D. quilonensis* resembles *D. dianae* in the general morphology of the pleotelsonic apex. However, in *D. dianae*, a median lobe is present in the foramen unlike in *D. quilonensis*. The ornamentation of the pleotelson and the transverse ridges on the pereon of *D. dianae* are other distinguishing characters since they are absent in *D. quilonensis*. The structure of the appendix masculina also varies slightly in the two species. The exopod of pleopod 3 is biarticulated in *D. dianae* but non-articulated in *D. quilonensis* and this is one of the major distinguishing characters.

The pleotelsonic apex of male *D. quilonensis* also shows considerable resemblance to that of *D. josephi* as was noted from the description of Brusca and Iverson (1985). However, since the description given is too brief, a detailed comparison of the two species is not possible. The sculpturing on the dorsal surface of the pleotelson seems to differ in the two species. *D. josephi* has been reported from certain islands along the Gulf of Panama as well as the coastal northern and Pacific Costa Rica.

**Ecological note:**

This species has been reported from the estuarine region of the Ashtamudi Lake (Pillai, 1965) and presently from the marine habitat of Kovalam.
Hence, it is probably capable of tolerating wide salinity fluctuations. These animals were found in association with algae along with certain other isopods like *Mesanthura maculata*.

The biology of this species has not been attempted.

**FAMILY - AEGIDAE**

**Diagnosis:**

Body more or less broad, flattened, almost cirolanid-like but large. Antennae well developed with well defined peduncle and multi-articulate flagellum. Eyes large, well developed, rarely absent. Mouth parts well developed, mandibles without molar process or lacinia mobilis, palp three-jointed, first maxilla a single, slender stylet with stout apical spines; second maxilla bilobed with stout apical spines; maxillipedal palp of 2-5 articles, terminal article armed with strong, recurved spines. Pereon with well developed coxal plates on all segments except the first. First three pairs of pereopods prehensile, posterior ones ambulatory. Pleon composed of four or five well defined segments plus pleotelson. Pleopods with plumose marginal setae. Pleotelson and uropods with marginal setae and spines, peduncle of uropod with inner margin produced into an acute process.

**Remarks:**

Members of this family are semi-parasitic forms, active predators on fishes and exhibit a scavenging mode of feeding sometimes.

This family includes five genera, *Aega*, *Rocinela*, *Syscenus*, *Barybrotes* and *Alitropus* of which the latter two are recorded in the present collection.

**Key to the genera of the family Aegidae from the South-west coast of India**

1. Median point of head covering bases of antennae; maxilliped 3-jointed; coxal plates highly reduced.

   --- *Alitropus*

-Median point of head separating bases of antennae; maxilliped 5-6 jointed; coxal plates well developed, though not produced.

   --- *Barybrotes*
Genus - *Alitropus* Milne-Edwards, 1840

*Alitropus* Milne-Edwards, 1840 : 263.
*Alitropus* Schioedte and Meinert, 1879; Weber, 1892; Stebbing, 1911; Ingle and Fernando, 1964; Pillai, 1967; Bruce, 1983.

**Diagnosis:**

Aegid isopod with no frontal cephalic projection, maxillipedal palp of 3 articles, anterior pereopods slender, lacking massive propodus, coxal plates on pereonites 5-7 considerably reduced. The combination of the above mentioned characters clearly separates this genus from other genera of the family Aegidae.

**Type species:** *Alitropus typus* M. Edwards, 1840.

**Remarks:**

The genus *Alitropus* is so far considered to be monospecific. A review of the validity of this genus was made by Ingle and Fernando (1964). *Alitropus* differs from *Rocinela* in lacking a frontal cephalic projection and slender pereopods lacking an enlarged propodus. Bruce (1983) is of the view that the highly reduced coxae on pereonites 5-7 separates *Alitropus* from the other aegid genera. Schioedte and Meinert added another species *A. faveolatus* to this genus but this addition was assumed to be based on the male of *A. typus*, this species exhibiting considerable sexual dimorphism in the shape of the body.

*Alitropus typus* M. Edwards, 1840

Pl. VI, figs. 1-12

*Alitropus typus* M.Edwards, 1840 : 263.

**Synonymy:**

*Alitropus typus* M. Edwards, 1840; Schioedte and Meinert, 1879; Weber, 1892; Stebbing, 1911; Ingle and Fernando, 1964; Pillai, 1967; Moreira and
Sadowsky, 1978; Bruce, 1983; Rocinela mundana Lanchester, 1902; Rocinela orientalis Chilton, 1924; Rocinela simplex Chilton, 1926; Alitropus dimorphus Pillai, 1954.

Material:

Numerous male, female and juvenile specimens were collected from the Museum pond, Trivandrum.

Description (Female, 15.0 mm TL):

Body comparatively long, almost obovate. Antero-median part of cephalon produced into an acute triangle. Eyes large, brownish black. Bases of antennae concealed beneath the median point of cephalon. Antero-lateral corners of pereonite 1 produced. Postero-lateral corners of each pereonite produced only slightly. Coxal plates reduced, visible clearly only laterally, lateral margins setose. Pereonite 1 as long as cephalon, pereonites 2-4 subequal, pereonites 5 and 6 longer than preceding segments, pereonite 6 longest and broadest. Pleon of five segments, abruptly narrower than pereon, lateral parts drawn out into acute processes.

First antenna short, reaching slightly beyond posterior margin of cephalon, peduncle 3-segmented, first article enlarged, third segment long and slender, superior distal margin setose; flagellum 6-jointed, superior distal margin setose, single seta apically. Peduncle of second antenna 5-segmented, distal two segments long and slender, the superior distal corners of the distal two segments bear minute setae; flagellum 13-14-segmented with groups of minute setae on the superior distal corner of each segment, apex setose.

Mandibular apex narrow; palp 3-segmented, middle and distal segments with a row of pectinate setae laterally. First maxilla with a slightly curved apex, with two stout and three elongated spines. Outer lobe of second maxilla large, apex slightly serrated, inner lobe immersed into its lateral side, with two stout hook-like spines apically and three minute setae. Maxilliped 4-segmented, apical segment with five, stout, hooked spines.
Anterior pereopods very simple. The proximal superior lateral margin of basis bears a few setae, ischium and merus with two spiny setae on their superior distal corners each; carpus slightly immersed in merus, propodus long and slender with two minute setae at its superior lateral margin; dactylus falcate with a single unguis. The number of spines progressively increases in the posterior pereopods. The basis of pereopod 4 bears a single long spine on its inferior distal margin; infero-lateral margin of ischium bears four groups of stout spines marginally and two spines submarginally and the superior distal margin has a single long spine and two stout forked spines; merus and carpus elongated bearing groups of stout spines on its inferior lateral margins and forked spines on its superior distal margin; carpus bears a slender spiny seta with forked tip at its superior distal corner; propodus with three equidistantly spaced stout spines along its inferior lateral margin and three slender spiny setae on its superior distal corner; dactylus bears two slender spines near its distal margin, single unguis present. The remaining posterior pereopods are similar except for the presence of more spines.

Endopod of pleopod 1 truncate; exopod broadly rounded; both rami marginally plumose. Pleopods 2-5 similar with a truncate rami, endopod bears numerous small spines studding its inner lateral margin; exopod with marginal plumose setae.

Telson broader than pleon, broadly rounded apically bearing six stout spines among long setae. Uropods well developed with a long peduncle, exopod long and narrow, slightly shorter than endopod, outer margin armed with six spines among long spiny setae; endopod slightly rounded, apex bears six spines and long spiny setae, margin serrated.

Body dark grey with reticulate chromatophores scattered in a distinctive pattern.

Description (Male, 14.0 mm TL):

The male differs from the female in the general shape of the body, the former being more slender than the latter. Pereonite 7 is longer in the female. Penes in the form of mammiform papillae present on the seventh sternite. Appendix masculina shorter than endopod of pleopod 2
Distribution:

Sri Lanka to Thailand, South-East Asia, Malaysia, Eastern Australia and India.

Remarks:

The morphology of the mouth parts of *A. typus* seems variable as noted in the descriptions available. As seen from Pillai's (1967) description, the last segment of the mandibular palp bears a single apical seta. In the present material, the last segment of the mandibular palp bears a comb of setae which very closely resembles the figure by Bruce (1983) except that the setae are pectinate. The first maxilla also differs from that described by Pillai (1967) and Bruce (1983) in having two apical stout tooth and three elongated spines. The second maxilla has been described to have three spines on its inner lobe (Pillai, 1967) and two hooked spines on the endopod and one spine on the exopod (Bruce, 1983). The present specimen reveals two hooked spines and three small spiny setae on the inner lobe of the maxilla. The maxillipedal terminal article has got five hooked spines as was observed by Bruce (1983) but Pillai (1967) has mentioned only three hooked spines. Despite these variations in the number of spines of the mouth parts, it is evident from the rest of the details that the present material is *A. typus*.

Ecological note:

*A. typus* is principally a freshwater species. Pillai (1967) collected it from a freshwater and slightly brackish water habitat. Nair (1980) collected it from the freshwater Museum pond, Trivandrum and Bruce (1983) reported its occurrence in Australian freshwater habitats.

The juveniles are ectoparasitic on fishes till they attain sexual maturity. The adults are, however, free-living and cling to a fish only for the purpose of feeding. They are a menace to the fish population since they cause lesions on the gills, opercular region, buccal cavity and body surface of the host. This isopod thus affects the host fish indirectly by providing favourable conditions for fungal attack on the already injured area of the body.
When introduced into an aquarium tank, this isopod is seen to cling to a fish.

Certain aspects of the biology of this species along with its hematological and biochemical parameters have been efficiently dealt with by Nair (1980).

**Genus - Barybrotes Sch. & Mein., 1879**

_Barybrotes_ Schioedte and Meinert, 1879. _Naturhistorik Tidsskrift_, 12 : 281.

_Barybrotes_ Hansen, 1890; Richardson, 1910; Nierstrasz, 1931; Monod, 1934; Pillai, 1967.

**Diagnosis:**

Body elongate, compact. Eyes large, almost contiguous. Median point of head separating bases of antennae. Basal peduncular segment of first antenna expanded and visible dorsally. Pereon segments with dorso-lateral clefts, coxal plates well developed. Mandible with 3-segmented palp; second maxilla with recurved spines apically; maxilliped 6-jointed. Pereopods characteristic, anterior pereopods with long natatory setae and few fringed sensory spines on ischium merus, carpus and propodus. Posterior pereopods, all articles from basis to propodus bear long natatory setae. Pleopodal rami setigerous.

**Type species:** _Barybrotes indus_ Sch. & Mein., 1879.

**Remarks:**

The genus _Barybrotes_ is monotypic including a single species, _B. indus_. This genus was first included under the family Corallanidae by Schioedte and Meinert (1879). Hansen (1890) created a new family Barybrotidae for this genus. However, Pillai (1967) placed _Barybrotes_ under the family Aegidae along with the genera _Aega_, _Rocinela_, _Syscenus_ and _Alitropus_. The genus _Barybrotes_ can be easily distinguished from the other members of the family by the antero-median rostrum which separates...
the bases of the antennae, not concealing them, the morphology of the mouth parts and the long natatory setae on the pereopods.

**Barybrotes indus** Sch. & Mein., 1879

*Pl.VI, figs. 13-23*


*Barybrotes indus* Monod, 1934; Barnard, 1936; Pillai, 1967.

**Material:**

Collected as ectoparasites of certain fishes from Shangumughom, Trivandrum. Host unknown.

**Description** (Ov. female, 22.0 mm TL):

Body elongate, slender, almost parallel-sided. Cephalon with an antero-median rostrum. Eyes large, black, almost contiguous. Pereonite 1 longer than pereonites 2 and 3, subequal to cephalon; pereonites 4 and 5 longer than others; pereonites 6 and 7 shorter, subequal to 3 and 4. Coxal plates of anterior pereonites well developed, those of posterior pereonites extending beyond posterior margin of respective segments. Pleon 5-segmented; pleonite 4 covering 5 laterally. Telson subtruncate apically, with 6-7 spines and long setae.

Peduncle of first antenna two-jointed, proximal segment large and visible dorsally with a plumose spine on distal inferior margin; flagellum 7-jointed; distal composite flagellar segment with three tufts of setae, distal segments bear aesthetascs. Peduncle of second antenna 5-segmented, distal peduncular segment with two plumose setae on distal inferior margin; flagellum 39-40-segmented, each article with setae on its distal inferior and distal superior margins.

Mandible with a tridentate incisor process; reduced molar process; palp 3-segmented, proximal segment longest, distal margin setose, middle and distal segments with a comb of setae. First maxilla long narrow, with two hook-like spines latero-distally and seven recurved spines apically.
Maxilliped 6-segmented, fourth segment slightly immersed in third, carrying four long spiny setae distally, fifth segment with a small lobe-like structure with four long spines; terminal segment smallest, apex bears five curved hook-like spines and three slender minute spines.

Anterior percopods prehensile; posterior ones ambulatory and more setose. Lateral margins of ischium, merus, carpus and propodus of pereopods 1-3 with long slender natatory setae; inferior lateral margins of merus, carpus and propodus also bears fringed sensory spines; dactylus falcate, uniunguiculate. Posterior pereopods extremely setose; lateral margins of all segments from basis to propodus armed with long natatory setae.

Pleopods 1-5 similar, endopod subtruncate or broadly rounded, exopod with an angular apex; both rami setigerous.

Uropod falls short of telsonic apex, exopod with acute apex bearing seven marginal spines and numerous long setae; endopod with rounded apex, beset with seven spines and long setae marginally.

Body dark brown in preserved specimens.

Description (Male, 20.0 mm TL):

Very similar to the female. Appendix masculina slightly shorter than endopod of pleopod 2, apex rounded, distal part slightly curved inwards.

Distribution:

Java Sea, Gasper Strait, South China Sea, Phillipines, Indo-China and India.

Remarks:

The present material is completely in conformity with the description of Pillai (1967). The mouth parts and pereopods, the characters of taxonomic value are exactly similar to that described by Pillai (1967).

Ecological note:

The host of the material examined is unknown as the specimens were brought to the laboratory by a local fisherman, detached from the host,
but was said to be ectoparasitic. Pillai (1958) has stated that *B. indus* has never been reported as an ectoparasite. Pillai (1967) reported this species from the gills of *Mobula diabolus*.

**FAMILY - CYMOTHOIDAE**

**Diagnosis:**

Body often asymmetrical; cephalon and antennae small, peduncle not distinct from flagellum; eyes present or absent. Mandible lacking molar process and lacinia mobilis, incisor blade-like, palp 3-jointed; first and second maxillae with robust, recurved, terminal and subterminal spines; maxillipetal palp of 2-3 articles, terminal segment with strong recurved spines apically. All pereopods distinctly prehensile, with dactylus longer than propodus; base of posterior pereopods often with elevated carinae and grooved to receive ischium. Pleon usually six-segmented with a few exceptions. Pleopod rami bear 'accessory lamellae' probably an adaptation to increase their respiratory capabilities in response to their immobile parasitic lifestyle, appendix masculinum is reduced and simplified, lacking spines and denticles, totally absent in some species. Pleopods and uropods lack marginal setae.

**Remarks:**

Cymothoids are ectosymbionts on marine, freshwater and brackish water fishes. The position of the parasite on the host is usually species-specific. All species belonging to this family are probably protandrous hermaphrodites. Sex-reversal is a common phenomenon in members of this family. Host-specificity is strong in some species and weak in others. Brusca (1981) has elaborated on the natural history and evolution of this family.

The taxonomy of this family is fraught with controversy even though many revisionary works have been carried out time and again. Many characters used to separate species exhibit polymorphism and hence the confusion in interspecific definitions. Brusca (1981) considers the morphology
of the coxal plates, certain characteristics of pereopods, pleopods, uropods and second maxillae as relevant taxonomic characters. It is a large family with over 42 genera and 250 species.

Key to the genera of the family Cymothoidae from the South-west coast of India.

1. Cephalon not immersed in pereonite I; posterior margin of cephalon distinctly trisinuate; postero-lateral angles of pereonites 2-6 produced, increasingly so posteriorly; coxal plates long, extending up to or falling just short of posterior border of respective segment

---Nerocila

-Cephalon immersed in pereonite I, posterior margin of cephalon not distinctly trisinuate; postero-lateral angles of pereonites not conspicuously produced; coxal plates do not extend beyond posterior margin of respective pereonites

----2

2. Body hunched, highly asymmetrical, posterior pereonites flattened on one side and dilated on the other; first pair of antennae narrowly separated at base; pleon immersed in pereon but not narrower

---Agarna

-Body only slightly asymmetrical, bases of first antennae widely separated; pleon may or may not be narrower than pereon

----3

3. Body asymmetrical, not hunched; pleon abruptly narrower than pereon; mandibular palp stout, 3-segmented

---Cymothoa

-Body very slightly asymmetrical; pleon almost as broad as pereon; pereonite I produced into lobes antero-laterally; mandibular palp stout, non-segmented or indistinctly segmented

----Joryma
Genus - **Nerocila** Leach, 1818

Nerocila Leach, 1818; Schioedte and Meinert, 1881a; Stebbing, 1902; Nierstrasz, 1915; Hale, 1926; Monod, 1931; Barnard, 1936; 1940; Brusca, 1981; Bowman and Tareen, 1983; Brusca and Iverson, 1985.

**Diagnosis:**

Body more depressed than in most other cymothoids, relaxed. Cephalon anterior margin convex or concave; not projected anteriorly; not immersed, or only slightly immersed in pereonite 1; posterior border produced into three lobes; anterior border of pereonite 1 correspondingly trilobate. First antennae nearly contiguous at base. Postero-lateral angles of pereonites weakly to strongly produced, increasingly so posteriorly. Coxal plates well developed, prominent, generally extended almost to or beyond posterior angle of respective segment; pleon not immersed in pereon; pereonites 1 and 2 extended postero-laterally. Pleopods with small lamellar accessory gills, pleopods 3-5 thrown into deep pockets or folds. Uropods extended beyond posterior border of pleotelson.

The identification of species of this genus is difficult for want of well defined characters.

**Remarks:**

The genus **Nerocila** can be very easily distinguished from other cymothoid genera by a combination of characters. Brusca (1981) has given a detailed description of the genus **Nerocila** discussing the problem in defining species limits. Characters of taxonomic value in identifying species of this genus are the development of postero-lateral angles of pereonites and coxal plates and the pleopods with lamellar accessory gills. The mouth parts are considered of little taxonomic value in species identification and hence, are rarely figured in descriptions.

**Nerocila (Nerocila) phaiopleura** Bleeker, 1857

Pl. VII, figs. 1-14

Synonymy:

*Nerocila phaiopleura* Bleeker, 1857; Bowman and Tareen, 1983 (with complete synonymy); *Nerocila phaeopleura* Miers, 1880; Schioedte and Meinert, 1881; Gerstaecker, 1882; Nierstrasz, 1915; Barnard, 1925b; Chilton, 1926; Monod, 1934; Serène, 1937; Morton, 1974; Kensley, 1978b; Bruce, 1982c.

Material:

One ovigerous female and one transition stage specimen were collected. Host unknown.

**Description (Ov. female, 15.0 mm TL):**

Body obovate. Anterior border of cephalon broadly rounded; posterior margin prominently trisinuate. Eyes large, brownish black. Pereonite 1 anterior margin trilobate, antero-lateral corners produced slightly, subequal to pereonite 7; pereonites 2–3 subequal to one another; 4 slightly longer; 5 and 6 subequal to each other and longer than other pereonites. Coxal plates well developed on all pereonites, apex acute, that of posterior ones extend beyond the limit of the respective pereonite. Postero-lateral corners of pereonite 7 produced. Pleon narrower than pereon; not immersed in pereon; all pleonites equal in length; pleonites 1 and 2 with lateral processes. Telson triangular, apex bluntly tapering.

First antenna slender, 9-jointed; second antenna 13-jointed, third article longest, apically setose.

Mandibular incisor blunt, well developed; molar process well developed; palp slender, 3-jointed, proximal segment longest. Second maxilla, outer lobe with two and inner lobe with a single hooked spine. Maxilliped with four hook-like spines apically.

All pereopods prehensile; similar in structure; ischium stout; carpus immersed in merus. Pereopods 1–5 with a small swelling on the proximal superior margin of dactylus; dactylus falcate reaching up to the fifth segment. Pereopod 7 with a single spine on distal inferior margins of ischium, merus, and carpus and three spines on inferior lateral margin of propodus.
Pleopodal rami non-setigerous; accessory lamellae of pleopods 1 and 2 broad, membranous; that of 3-5 more or less pleated or wrinkled.

Uropodal rami long and slender; exopod slightly shorter than twice length of endopod; both rami overreaching telsonic apex; exopod with a stripe of dark pigmentation continued on to the lateral parts of pleon and posterior pereonites.

Body white with tiny, dark, branched chromatophores arranged in transverse rows along the posterior margins of segments.

Description (Transition stage, 13.0 mm TL):

Head triangular; pereonites 1-4 short, broadening progressively posteriorwards; pereonite 1 longest, 4 shortest; pereonites 5-7 abruptly broader. Coxal plates well developed. Pleonites subequal in length; ventral process of pleonites 1 and 2 broad. Telson triangular, apex tapering to a blunt point. Uropodal rami slender, long; exopod longer than endopod, overreaching telson.

Distribution:

Hong kong, Tale Sap, Thailand, Gulf of Siam, Jakarta, Java, Sumatra, Natal, Kuwait and India.

Remarks:

Comparison of the present material with the descriptions of Pillai (1958) throws light on a few variations in structure of the mandible and pereopods. Pillai (1958) has described the mandibular palp as consisting of two segments, while in the material under study, three segments were clearly observed. Other descriptions on the species are concise and hence, this character could not be compared. The merus of pereopod 7 bears one, carpus two and propodus four spines according to Pillai (1958), whereas, in the present material, the ischium, merus and carpus bears one spine each and propodus three spines. Brusca (1981) has, however, warned that literature mentioning presence or absence of spination should not be relied
upon entirely, especially if information on sex is not provided, as, in juveniles and males, pereopodal spines are progressively lost with succeeding instars.

Bleeker (1857) first described this species as *N. phaiopleura* meaning 'dusky side'. Later authors, however, have taken heed to use the correct Latin spelling, *phaeopleura*. Bowman and Tareen (1983) reverted to the original spelling, since, according to them, ICZN Article 32 (a) states that improper latinization is not an inadvertent error. Hence, they considered *phaeopleura* as the correct original spelling and this has been adopted in the present study, too.

**Ecological note:**

It is a parasite which has been recorded from the following hosts - 'Spratelle kowale' and 'Spratelle tembang' (Bleeker, 1857), *Chirocentrus dorab* (Forskal) (Barnard, 1929b; Bowman and Tareen, 1983), *Dussumieria acuta* Cuv. & Val. (Monod, 1934; Bowman and Tareen, 1983), *Xiphias gladius* Linnaeus (Barnard, 1936), *Sardinella gibbosa* (Bleeker), *S. perforata* (Cantor), *Dussumieria hasselti* Bleeker, *Decapterus maruadsi* (Temminck and Schlegel) (Morton, 1974) and *Sardinella zunasi* (Bleeker) (Bruce, 1982c).

The position of the parasite on the host is seen to vary. Morton (1974) reported a constant position for *N. phaiopleura* on four host species of fishes. The parasite was always found overlying the lateral line, on the posterior third of the body, facing the head of the fish. In *Dussumieria acuta* this species attaches behind the operculum and above the pectoral fin (Bowman and Tareen, 1983).

**Genus - Agarna Sch. & Mein., 1884**


**Diagnosis:**

Body compressed from side to side; hunched; highly asymmetrical; one side of posterior segments of thorax flattened and dilated. Cephalon
deeply immersed in pereonite 1; first antenna narrowly separated at base, almost contiguous; compressed. Anterior margin of pereonite 1 sinuated; coxal plates present on all pereonites except the first, although the lateral pereonite expansions and overlapping of the coxae give the impression that pereonite 4 has two pairs of coxal plates and pereonite 7 totally lacks them. Pleon immersed in the pereon but narrower.

**Type species: Agarna carinata** Sch. & Mein., 1884.

**Remarks:**

The status of the genus *Agarna* is very controversial. According to Richardson's (1905) diagnosis, this genus has coxal plates on all pereon segments except pereonites 1 and 7, pereonite 4 has two pairs of coxae. Bowman and Tareen (1983), however, have pointed out the inaccuracy of this observation and stated that each pereonite has one pair of coxal plates, although overlapping of coxae and lateral pereonite expansions conceals this arrangement. Moreover, the posterior coxae occupy the anterior halves of the pereonite, thus giving the impression that they belong to the preceding pereonite. The observation of Bowman and Tareen (1983) is more accurate.

The hunched asymmetrical pereon with the posterior pereonites flattened and laterally expanded on one side is diagnostic of this genus.

*Agarna engraulidis* Barnard, 1936

Pl. VII, figs. 15-28.


**Synonymy:**

*Agarna engraulidis* Barnard, 1936; *Livoneca engraulidis* Pillai, 1964; *Joryma engraulidis* Bowman and Tareen, 1983.

**Material:**

Numerous male and female specimens were collected from the branchial cavity of *Thryssa setirostris*.
Description (Female, 14.0 mm TL):

Body highly asymmetrical, one side shorter than the other (depending on which branchial cavity is occupied). Cephalon small, triangular, immersed in pereonite 1, eyes small. Anterior margin of pereonite 1 excavated to receive cephalon; antero-lateral corners produced; postero-lateral corners of all pereonites produced; pereonite 1 longest, 5 broadest. Coxal plates of pereonites 1-3 visible in dorsal view, those of 4-7 partially concealed by the postero-lateral projections of preceding pereonites. Pereon hunched, the hump attaining maximum height in pereonite 4. Pleon almost as broad as pereon; pleonite 1 partly concealed by pereonite 7. Telson broadly rounded apically.

First antenna longer and stouter than second antenna, widely separated at base, 8-jointed, distal segment bearing aesthetascs. Second antenna more slender, 11-segmented, terminal segment with apical setae.

Incisor process of mandible hooked; palp stout, 3-segmented. First maxilla slender, tubular, bears four spines apically. Second maxilla outer lobe with three and inner lobe with four hooked spines. Maxilliped 3-segmented, terminal segment bears four apical hook-like spines.

All pereopods prehensile, progressively increases in size posteriorwards, similar in structure. Carpus of anterior pereopods greatly immersed and only slightly so in posterior pereopods; dactylus falcate.

Pleopods with digitiform accessory gills near the peduncle.

Uropods with peduncle well developed exopod; and endopod cylindrical, falling short of telson.

Pigmentation faded in preserved specimens, light brownish tan prevails.

Description (Male, 9.0 mm TL):

Body slender, compressed laterally. Cephalon rounded anteriorly; eyes large. Pereonite 1, longest, coxal plates visible on all pereonites. Pleon as wide as pereon and slightly immersed in it. Telson as wide as pleon, apex narrowly rounded. Uropod falling short of telson, exopod longer than endopod.
Distribution: Orissa and Kerala (India).

Remarks:

_A. engraulidis_ doubtfully placed under _Agarna_ by Barnard (1936) was transferred to the genus _Livoneca_ (lapsus for _Lironeca_) by Pillai (1964). But, it is observed that this species fits the generic diagnosis (barring the coxal plate arrangement) of _Agarna_ as given by Richardson (1905), except that the antennae are widely separated at base. In this latter character, this species resembles _Lironeca_, but the hunched, asymmetrical pereon of this species, a distinguishing generic feature of _Agarna_ aptly places it in the latter genus. Bowman and Tareen (1983) based on Pillai's (1964) description of _L. engraulidis_ transferred this species to a new genus _Joryma_. However, according to the generic diagnosis of _Joryma_, the mandibular palp is enlarged, very stout, indistinctly or non-segmented, whereas in Pillai's (1958) description of _L. engraulidis_ the mandibular palp is slender and 3-segmented as in the present material. Also, the hunched pereon which is not mentioned in Pillai's description but observed in the present material, excludes this species from the genus _Joryma_. Hence, it is suggested that, this species be restored to its original genus _Agarna_ with which it has more affinities.

Brusca (pers. comm.) has stated that _Agarna_ is an old and neglected genus that is nomenclaturally valid, but will probably be synonymised with _Lironeca_. In this respect, it is felt that if the distance between the base of antennae is considered the only major criterion in separating the two genera, then a synonymy between the two should be brought about.

Ecological note:

_A. engraulidis_ is a branchial parasite of marine teleosts. The recorded hosts of this parasite are _Engraulis setirostris_ (Cuv. & Val., 1848) (Barnard, 1936) and _Anchoviella zollingeri_ (Pillai, 1958, 1961). Presently it was recorded from _Thryssa setirostris_ (Broussonet, 1782) (= _Thryssocles setirostris_ Fowler, 1941; = _Engraulis setirostris_ Cuv. & Val., 1848).
During the present study, this species was usually found attached to the upper part of the branchial chamber, the head of the parasite towards the head of the host.

This species has so far been recorded from Indian waters only. The genus *Agarna* is not very widely distributed, but seems to be more prevalent in this area. Investigations on this genus is limited and therefore, it is felt that this genus should be thoroughly reviewed and revised.

*Agarna malayi* Tiwari, 1952

Pl. VIII, figs. 1-11


**Synonymy:**


**Material:**

Many male and female specimens were collected from the branchial cavity of *Valamugil cunnesius* and *V. speigleri*.

**Description** (Female, 18.0 mm TL):

Body highly asymmetrical, one side longer than the other. Cephalon immersed in pereonite 1, pereonite 1 longest, anterior margin deeply trisinuate, antero-lateral angles produced; postero-lateral angles of all pereonites rounded; pereonites 3-6 enlarged on one side to give a hunched appearance to body; coxal plates well developed, first two small, posterior ones extending up to posterior margins of respective segments. Pleon broader than pereonite 7 and telson; pleonites 1 and 2 immersed in pereonite 7; pleonites 1-4 subequal to one another in length; pleonite 5 longest. Telson rectangular, more than \( \frac{1}{2} \) times broader than long, faint dorso-median carina observed, dorsal surface faintly pustulose.

First antenna stout, 8-jointed; almost contiguous at base. Second antenna stout, 11-jointed, bears few setae apically.
Incisor process of mandible tapering; palp 3-segmented, stout, apical segment bears tiny spiny setae. First maxilla long, slender, bears three stout spines apically. Second maxilla outer lobe with two and inner lobe with a single hooked spine; distal surface minutely spiny. Maxilliped 4-segmented, terminal segment with three hook-like spines.

All pereopods prehensile, similar in structure; ischium stout; carpus slightly immersed in merus; dactylus falcate, uniunguiculate.

All pleopods identical, rami non-setigerous, rounded apically.

Uropods flattened, cylindrical, exopod longer than endopod, slightly overreaching telson.

Colour light brown in preserved specimens.

Description (Male, 18.0 mm TL):

Body almost parallel-sided, not enlarged on one side. Anterior margin of cephalon subtruncated; eyes large, black. Anterior margin of pereonite 1 truncate; pereonite 1 longest; pereonite 4 shortest. Coxal plates visible on all pereonites dorsally. Pleon narrower than pereon; first pleonite immersed in pereon. Telson, a broad-based triangle, apically rounded, but slightly drawn out. Uropodal peduncle reaching 1/3 length of telson; rami long, cylindrical. Appendix masculina on endopod of pleopod 2 well developed, 3/4 length of endopod.

Distribution: Bay of Bengal, Vizhinjam (India).

Remarks:

_A. malayi_ has been reported in the gill chamber of the clupeid, Nematatalosa nasus (Bloch, 1795) from the Bay of Bengal by Tiwari (1952). *Indusa malayi* reported from the gill chamber of _Mugil ophuysenii_ Bleeker, 1859 is essentially _A. malayi_. On transferring this species to _Indusa_, Pillai's (1958, 1964) conviction was that, in _Agarna_, pereonite 4 has two epimera while pereonite 7 totally lacks it as was observed by Richardson (1905), too. The inaccuracy of this statement has been pointed out (vide infra). The diagnoses of _Agarna_ and _Indusa_ given by Richardson (1905) and Pillai
(1958) seems confusing and contradictory. Moreover, the coxal plate arrangement is not a generic character of importance and hence, there seems to be no justification in the transference of this species from Agarna to Indusa, though it must be conceded that the coxal plates are differently arranged in A. carinata (type species) and A. malayi. Moreover, the humped pereon of this material, an important generic feature of Agarna, confirms it to that genus.

Taking into account all these, the author thinks it best, to follow the proposal of Bowman and Tareen (1983) and reassign the species to its original genus Agarna.

Pillai (1954, 1958) described Indusa pustulosa from the gill chamber of the clupeid Anodontosoma chacunda (Ham. & Buch., 1822) and reported it to be closely allied to I. malayi. The main differences between these two species are the presence of pustules on the dorsal surface of the telson in the former species and some minor variations in the mouth part morphology. It must be noted here that the pustules on the telson has been depicted by Tiwari (1952) in his illustration of A. malayi, though not mentioned in the description. Hence, this character cannot be used for separating the two species. Numerous specimens of A. malayi collected from Valamugil sp. were studied presently and it was observed that the pustulose telson is a highly variable character. It can be extremely difficult to notice the pustules because they can be very apparent or almost invisible as a function of the light incidence. The minor differences in the mouth part morphology reported in the two species can probably be intraspecific variations. Such variations were noticed in the size, shape of telson and length of uropods and hence, these features are of little taxonomic value. Therefore, I. pustulosa of Pillai (1954, 1958) is essentially A. malayi.

Ecological note:

This species is a branchial parasite and has been reported by Tiwari (1952) from the clupeid Nematalosa nasus and from the Mugilid, Mugil ophuysenii by Pillai (1964). Valamugil cunnesius and V. speigleri reported, in the present study, are new host records. A. malayi was always attached to the lower half of the branchial chamber with its head towards the
head of the host, one side of its body being closely apposed to the lower wall of the gill chamber.

**Genus - Cymothoa Fabricius, 1787**

Genus - Cymothoa Fabricius, 1787; Schioedte and Meinert, 1884; Richardson, 1905; Hale, 1926; Nierstrasz, 1931; Brusca, 1981; Bowman and Tareen, 1983; Brusca and Iverson, 1985.

**Diagnosis:**

Body ovate, cephalon immersed in pereonite 1; first antennae widely separated at base, basal articles not expanded, compressed. Pereonite 1 manifestly longer than pereonite 2; anterior margin broadly excavated to receive cephalon, antero-lateral angles short or produced; coxal plates distinct on all pereonites except pereonite 1, posterior ones reach the posterior margins of segments or extend beyond them. Pleon deeply immersed in pereon, narrower than pereon, pleonites increasing in length and width posteriorwards, pereopods short, prehensile, carina of posterior pairs considerably high.

**Remarks:**

*Cymothoa* is one of the most poorly studied genus of the family Cymothoidae. 30 species of *Cymothoa* have so far been described, including a few species whose specific status is yet to be assessed. Taxonomic characters useful in separating the different species are primarily the shape of the pereonites and coxae.

**Cymothoa eremita** (Brünnich, 1783)

Pl.VIII, figs. 12-20

Synonymy:

*Oniscus eremita* Brünnich, 1783; *Cymothoa eremita* Schioedte and Meinert, 1884; Stebbing, 1910; Boone, 1930; Nierstrasz, 1931; Trilles, 1975; Bowman and Tareen, 1983.

Material:

Many large ovigerous females were collected from the mouth of *Parastromateus niger*, caught from Vizhinjam (Trivandrum).

Description (Ov. female, 45.0 mm TL):

Body almost oval, dorsal surface highly convex. Cephalon quadrate, anterior margin with a shallow, median concavity, eyes absent. Pereonite 1 longest, antero-lateral corners produced, pereonite 4 broadest. Coxal plates visible on all pereonites appearing almost quadrangular in pereonites 1 and 2 and crescentic in the posterior pereonites. Pleon considerably narrower than the pereon, slightly immersed in it, posterior border of pleonite 5 slightly produced dorso-medially. Telson broad, more than twice as broad as long, posterior margin of telson with a slight emargination medially, dorso-median carina faintly visible.

First antenna stouter and longer than second antenna, both consisting of eight segments.

Mandible with a well developed incisor and molar process; palp 3-segmented, proximal segment largest, distal segment smallest. First maxilla slender, tubular with four stout spines apically. Outer lobe of second maxilla with six hook-like spines apically while the inner lobe bears a single spine, distal part of both lobes spiny. Terminal segment of maxillipede bears six hooked spines, lateral margins spinous.

All pereopods prehensile, short and stout; basis and ischium of pereopods large; carpus and merus small and immersed; dactylus falcate.

Uropods not reaching telsonic apex, rami subequal.

Distribution:

Widely distributed in the Indo-Pacific ranging from Japan through Pescadores, Phillipines and Indonesia to Cape York Peninsula, Australia.
and east to the Society Islands. On the west it has been reported from Singapore, Malaysia, Bangkok, Sri Lanka, Indian Peninsula, Mauritius, Seychelles and the Red Sea according to Bowman and Tareen (1983).

Remarks:

As of present, many nominal species of Cymothoa, namely C. eremita Brünnich 1783; C. stromatei Bleeker, 1857; C. borbonica Sch. & Mein., 1884; C. exima Sch. & Mein., 1884 and C. truncata Sch. & Mein., 1884 cannot be easily distinguished from one another mainly because all these species are characterised by their large size, quadrate head, moderately wide amphicephalic process of pereonite 1 and a short but wide telson. Hence, the validity of the latter four species are still questionable.

The present material is very similar to that described by Pillai (1958). Bowman and Tareen (1983) have reported this species from Pampus argenteus and Sphyraena obtusata. The parasites from these different hosts exhibit slight variations in the shape of the cephalon, pereonites 1 and 7 and telson, as can be made out from the illustration. The material presently examined appears more like the specimen collected from Pampus argenteus. Since, detailed description of the various body parts are not presented, comparison could only be made from the illustration.

Ecological note:

While most species of Cymothoa have been recorded from a single host species, several are known to infest numerous species, eg., C. exigua and C. oestrum. C. eremita is one such species which exhibits a very low degree of host specificity. It was presently found parasitic on Parastromateus niger. The parasite was found in the buccal cavity, clinging to the tongue of the host with its head pointing inwards. About 90% of the fishes examined from the Vizhinjam Bay (Trivandrum) were infested by this parasite. Trilles (1975) has listed ten species of recorded hosts belonging to six different genera. Bowman and Tareen (1983) have supplemented this list by reporting two new hosts - Pampus argenteus and Sphyraena obtusata from the coast of Kuwait.
All the infested fishes which were examined were found to be in a perfectly healthy condition. There was no noticeable lowering in the general well being of the host.

**Genus - Joryma Bowman & Tareen, 1983**


**Diagnosis:**

Pereonite 1 produced into lobes antero-laterally; coxae of pereonites 2 and 3 enlarged, much larger than remaining coxae, area median to coxae inflated. Pleon nearly as wide as pereon; pleonite 1 partly or completely covered by pereonite 7. Antennae well separated at base. Mandibular palp enlarged, stout, indistinctly or non-segmented.

**Type species:** *Joryma sawayah* Bowman and Tareen, 1983.

*Joryma brachysoma* (Pillai, 1964)  
Pl. VIII, figs. 21-36


**Synonymy:**

*Agarna brachysoma* Pillai, 1964; *Joryma brachysoma* Bowman and Tareen, 1983.

**Material:**

A few females and males were collected from the branchial cavity of *Ilisha melastoma* (Schneider, 1801).

**Description** (Female, 29.0 mm TL):

Body oblong, slightly asymmetrical. Cephalon immersed in pereonite 1, anterior margin broadly rounded; eyes large, black, widely separated. Pereonite 1 longest, antero-lateral corners produced into lobes, anterior
margin slightly excavated to receive cephalon; pereonites 2-7 almost subequal to one another in length. Coxal plates visible on all pereonites on dorsal view; coxae of pereonites 2 and 3 well developed, posterior ones situated antero-laterally. Pleon almost as broad as pereon, pleonite 1 immersed in pereonite 7, lateral margins concealed by pereonite 7; all pleonites equal in length. Telson triangular, apex acutely drawn out; dorsal carina visible.

First antenna stout, 8-jointed, widely separated at base, distal segment bearing aesthetascs. Second antenna more slender, 11-jointed, apically slightly setose.

Incisor process of mandible hooked slightly, palp stout, indistinctly 3-segmented, apical segment possesses a tiny lobe like structure. First maxilla slender with five spines apically. Second maxilla, outer lobe with two and inner lobe with one hooked apical spine, distal surface minutely spiny. Maxilliped 3-segmented, terminal segment with four hooked spines.

All pereopods prehensile, similar in structure; ischium stout; carpus immersed in merus; dactylus long, falcate, uniunguiculate, reaching up to the fourth pereopodal segment in anterior pereopods and fifth segment in posterior pereopods.

Pleopodal rami non-setigerous, pleopod 1 bears three and pleopods 2-5 bear a single digitiform accessory gill.

Uropods short, peduncle well developed, exopod longer than endopod, extending up to 3/4 length of the telson; both rami almost lanceolate.

Description (Male, 14.5 mm TL):

Body obovate, slender, symmetrical. Cephalon slightly immersed in pereonite 1, roughly triangular, anterior margin rounded; eyes large, black. Pereonites subequal to one another in length, pereonite 4 broadest. Coxal plates of anterior pereonites clearly visible in dorsal view, those of posterior pereonites visible only in the anterior half of the segment. Pleon much narrower than pereon, all segments subequal to one another. Telson triangular, apex acutely blunt. Uropod almost reaching telsonic apex, both rami slender, lanceolate, endopod slightly shorter than exopod.
**Distribution:**

Vizhinjam (Trivandrum).

**Remarks:**

Pillai (1958, 1964) described *Agarna brachysoma*, a gill chamber parasite of *Ilisha brachysoma* (Bleeker, 1852). Recently, Bowman and Tareen (1983) transferred this species to the genus *Joryma*. Numerous specimens of this species were collected from the gill chamber of *Ilisha melastoma* (Schneider, 1801) (= *I. indica* (Swainson, 1839); = *I. brachysoma*) during the present study.

Taking into consideration the fact that the important generic feature of *Agarna* is the hunched asymmetrical pereon with posterior pereonites flattened and expanded laterally on one side - a character not observed in the present species - and also the consonance between the present species and the generic diagnosis of *Joryma*, the suggestion of Bowman & Tareen (1983) to include this species under *J. brachysoma* is herein accepted. However, Bowman & Tareen (1983) have given the year of publication of *A. brachysoma* by Pillai as 1954. It must be mentioned here that Pillai's 1954 publication does not include the species *A. brachysoma*. The first description of this species is in his unpublished work of 1958 and later in his 1964 publication.

Bowman and Tareen (1983) grouped four species under the genus *Joryma*, *Agarna engraulidis*, *A. brachysoma*, *A. tartoor* and *Jorymasawayah*. The differences between these four species delineated in Table 2 of Bowman and Tareen (1983) are not sufficiently distinguishing and can be intra-specific variations.

In the author's opinion, it is thought reasonable to retain *A. engraulidis* in its original genus *Agarna* (vide infra). Concerning the following two species, Pillai (1958, 1964) reported that *A. brachysoma* (parasitic on *I. melastoma*) and *A. tartoor* (parasitic on *O. tardoore*) are closely related and difficult to differentiate. The main differences noted were (i) the shape of the telson, which has an acuminate apex in the latter species and a less pointed apex in the former (ii) the cephalon hidden
in dorsal view in *A. tartoor* and (iii) principally, the structure of the mandibular palp, which presents well defined segments in *A. brachysoma* and indistinct ones in *A. tartoor*. But, examination of the material on hand disclosed that the former two characters could vary intraspecifically. Thus, it is evident that the segmentation of the mandibular palp is the only major character differentiating the two species. This character has also been observed to be the only main difference between *J. brachysoma* and *J. sawayah*, the palp being reportedly non-segmented in the latter species. It is possible, that the difference in this one character in the three species is a function of the host (*I. melastoma* in the case of *J. brachysoma* or *O. tardoore* in *A. tartoor*) or of locality (*J. sawayah* being reported from Arabian Gulf of Kuwait and *J. brachysoma* from India). Hence, it is possible that these three species are conspecific. The similarity between *J. brachysoma* and *J. sawayah* is particularly striking having been reported from the same host species.

**Ecological note:**

From the record of Pillai (1964) and also the present study, it is evident that this species is host-specific. It has been reported as a branchial parasite of *I. melastoma* only. This species is usually found attached to the lower half of the branchial chamber, one side of its body closely apposed to the lower wall of the gill cavity, with its head pointing anteriorly.

**FAMILY - CORALLANIDAE**

**Diagnosis:**

Body symmetrical; dorsum moderately arched, very often with setae, spines or tubercles; eyes usually large. First antenna with 2-3 jointed peduncle, second antenna with 5-articulated peduncle; flagellum of both antennae multi-articulate. Frontal lamina narrow, clypeus generally wide, labrum narrower than clypeus. Mandible with narrow 2-3 dentate incisor process, lacinia mobilis reduced or absent, molar process rarely present, usually vestigial, represented by a small fleshy lobe, palp 3-jointed. First
maxilla outer lobe simple or falcate with one to several terminal spines, inner lobe simple. Second maxilla reduced, 1-2 lobed, without stout spines. Maxilliped lacking endite, palp slender, 4-5 jointed. Pereonites 2-7 with distinct coxae; pereopods 1-3 usually prehensile, rarely ambulatory; 4-7 ambulatory. Pleon of 5 segments and pleotelson; pleopods biramous, coupling hooks present on inner margin of pleopodal peduncles 1-4.

Remarks:

Bruce et al. (1982) have reviewed the taxonomic history of the family and have synonymised the family Excorallanidae with the Corallanidae. This family closely resembles three other Flabelliferan families, viz., the Cirolanidae, Aegidae and Cymothoidae, but can be separated from these by the morphology of the mouth parts. The large eyes, distinct coxae and the heavy setosity or tuberculation are useful field characters that help in distinguishing corallanids from the cirolanids. Brusca (1981) has tentatively considered the inclusion of the family Corallanidae in the evolutionary lineage between the families Cirolanidae and Aegidae. This family now includes six valid genera, namely, Corallana, Tachaea, Alcirona, Lanocira, Argathona and Austroargathona.

Genus - **Corallana** Dana, 1853


Corallana Schioedte and Meinert, 1879; Stebbing, 1904a, b; Barnard, 1914a; Nierstrasz, 1931; Pillai, 1967; Kensley, 1978b; Bruce, 1982b.

Diagnosis:

Type species: *Corallana hirticauda* Dana, 1853.

Remarks:

The family Corallanidae has a tumultous taxonomic history. Bruce *et al.* (1982) has discussed the status of the families Corallanidae and Excorallanidae and ultimately synonymised the latter with the former. The genus *Corallana* has been redescribed by Bruce (1982b). The species *C. nodosa* is probably the best known species of the genus presumably because it is more widespread than most other species of the genus.

Bruce (1982b) has suggested that detailed descriptions of mouth parts and pleopods may yield useful taxonomic knowledge, as, very few species of *Corallana* has been redescribed. Difficulty in identification of corallanid species was very badly felt during the present study, too, for want of adequate detailed descriptions.

*Corallana nodosa* Sch. & Mein., 1879.

Pl. IX, figs. 1-12


*Corallana nodosa* Hansen, 1890; Stebbing, 1904a; Nierstrasz, 1931; Pillai, 1954; 1961; 1967; Bruce, 1982b.

Material:

Many specimens were collected from the Akathumuri and Ashtamudi Lakes.

Description (Male, 9.5 mm TL):

Body almost oblong. Anterior margin of cephalon rounded, no anteromedian rostrum. Cephalon bears a large horn-like tubercle in front of each eye; eyes large, black. Base of first antennae enlarged, visible dorsally. Coxal plates of pereonites well developed; those of pereonites 3-7 extending beyond posterior margin of respective segment with oblique ridges, apices and lateral margins of coxae setose. Pereonites 1-6 subequal
to one another in length, pereonite 7 shortest; pereonites 5 and 6 bear two pairs and pereonite 7 bears a single pair of tubercles on the posterior margin, outer pair larger than the inner in the former pereonite; posterior margins of pereonites 4-7 minutely setose. Pleon well developed; pleonite 1 partially covered by pereonite 7; pleonites 2-4 with a single pair of sublateral tubercles on posterior margin; pleonite 4 overlaps 5 laterally. Telson with lateral margins faintly bisinuate; apex narrowly rounded studded with ten short, stout spines amidst long setae.

Frontal lamina absent. Peduncle of first antenna 3-jointed, proximal segment enlarged, flagellum 11-jointed. Peduncle of second antenna 5-jointed; flagellum 26-jointed, superior distal corners of segments bear setae. Mandible with a well-developed incisor process; molar reduced; palp well developed, 3-segmented, middle segment longest, terminal segment bears a comb of setae. First maxilla moderately falcate. Second maxilla in the form of a tiny lobe with tapering apex, single seta apically. Maxilliped 7-segmented, second segment much longer than broad, segments 4-7 with spines and setae distally, segment 6 produced inwardly.

All pereopods ambulatory. Pereopod 1 superior margins of ischium and merus bears spines; merus bears four blunt tubercles and several spines infero-laterally; carpus immersed in merus; propodus stout; dactylus uniunguiculate. Pereopods 1-3 almost similar. Pereopods 4-7 long, slender and more spiny; infero-lateral margins of ischium, merus, carpus and propodus of pereopod 7 with several slender pectinate spines.

Pleopods 1-3 both rami setigerous; appendix masculina on endopod of pleopod 2 slender, straight, apex rounded, nearly reaching tip of rami, endopods of pleopods 4 and 5 non-setigerous.

Uropod overreaching telson, exopod slender, cylindrical, longer than endopod, bears four inner and six outer marginal spines amidst setae; exopod rounded, ten short marginal spines along with setae.

Body pale brown with scattered reticulate chromatophores.

Description (Female, 9.0 mm TL):
Female resembles the male very closely except for a few characters. Horn-like tubercles in front of eyes not as well developed as in male.
First peduncular segment of first antenna not much enlarged; flagellum of second antenna less plumose. Body generally less setose.

Distribution:

Phillipines, Sri Lanka, Western Australia and India.

Remarks:

*C. nodosa* is easily distinguishable by the cephalic tubercles and processes on the dorsal surface of pereonites 5-7. The description given by Pillai (1967) is too brief and hence, a detailed comparative account, could not be given. However, it is evident from the available data that the present material tallies with that of Pillai (1967). Bruce (1982b) has given a very concise note on the main characteristics of this species. He has mentioned dorsal processes on pereonites 6 and 7 only, whereas, the material presently examined has processes on pereonites 5-7. The endopod of pleopods 3-5 has also been observed to be non-setigerous (Bruce, 1982b) but in the material under study, the endopod of pleopod 3 bears setae while that of pleopod 4 and 5 totally lacks it.

Ecological note:

Pillai (1967) collected this species from the Veli lake, Trivandrum, a brackish water lake, when the salinity was nearly that of freshwater. Bruce (1982b) reported this species from Nina Bay, Hutchinbrook Island, North Queensland in the brackish reaches of the creek. The present material was obtained from the Akathumuri and Ashtamudi lakes, both of which are brackish in nature. Hence, it can be inferred that *C. nodosa* is an euryhaline species.

In the Akathumuri Lake, this species was found on laterite stones along with the boring sphaeromatids, *Sphaeroma terebrans* and *S. annandaleni* and *Cirolana willeyi* and *Dies quadricarinatus*. Personal observation in the laboratory revealed that this species is a voracious carnivore, the strong mandibles being used for rasping.
FAMILY - CIROLANIDAE

Diagnosis:

Body more or less semi-cylindrical. Eyes small, lateral. Antennae unequal in length, peduncle and flagellum well-defined. Labrum large, two or three times wider than longer; clypeus large, wide, short, triangular. Mandible wide throughout their length, lacinia mobilis and molar process well developed, latter being an expanded saw-toothed structure, palp 3-jointed. First maxilla composed of two lobes - an inner and outer. Second maxilla composed of an inner and outer lobe, the latter being partly or entirely bifurcate, the lobes of the first and second maxillae articulate on a protopod. Maxilliped well developed bearing an endite and 4-5 articulated palp armed with setae but never furnished with hooks. Pereonites 2-7 with distinct coxal plates. First three pereopods may be prehensile, usually all pereopods ambulatory. Pleon with five distinct segments plus pleotelson. Uropodal rami well developed, lateral, together with pleotelson forming a well developed caudal fan; pleotelson and uropods with marginal setae or spines.

Remarks:

Cirolanids are mainly free-living predators, often exhibiting a scavenging mode of feeding. They are found the world over in diverse habitats. One species, Natatolana borealis Lilljeborg has been reported to infest the gills and hearts of various sharks and rays in the Atlantic. The family earlier consisted of very few genera, numerous species having been uncritically placed in the genus Cirolana. However, Bowman (1975, 1977b) and Bruce (1981a,b) have added many other genera to the family and it presently contains 300 valid species under 44 genera (Brusca and Iverson, 1985).
Genus - *Cirolana* Leach, 1818

*Cirolana* Leach, 1818 : 347.

**Synonymy:**

*Cirolana* Stebbing, 1893; Richardson, 1899; Monod, 1930; Menzies 1962a; Kensley, 1978b; Holdich *et al.*, 1981; Bruce, 1981b (with complete synonymy); *Nelocira* Leach, 1818.

**Diagnosis:**

*Cirolanidae* with rostral point minute or absent. Peduncle of first antenna 3-jointed, article 1 not articulated at right angles to remainder of first antenna. Frontal lamina twice as long as broad, clypeus flat. Mandible with broad, tridentate incisor, palp extending beyond cutting edges, molar process well developed. First maxilla with robust spines on gnathal surface of exopod, endopod with three plumose spines. Second maxilla entire. Maxilliped with broad palp segments, endite with two coupling hooks. Pereopods ambulatory. All pleopods setigerous except endopod of pleopod 5. Appendix masculina arising basally. Pleonite 5 encompassed by pleonite 4 laterally, pleonite 3 with lateral margins often produced to pleonite 5. Uropodal peduncle produced along inner margin of endopod.

**Remarks:**

The genus *Cirolana* has till very recently been the receptacle for almost all species belonging to this family. But, recently, many new genera have been added to this family and many species previously relegated to the genus *Cirolana* have been accommodated in the new genera. Still the genus remained loosely defined with the interrelationships between genera and species not clarified and the genus itself not properly diagnosed. Bruce (1981b) has given a very detailed and clear cut review of this genus with lucid diagnosis. In his opinion, the shape of the frontal lamina, pleon and pleotelson are adequate for species determination, but is far from adequate for discussing intergeneric or interspecific relationships. All appendages including the mouth parts and pleopods are
of considerable taxonomic importance in separating species of the genus. The antero-clypeal region is also another character of considerable taxonomic value.

Type species: *Cirolana cranchii* Leach, 1818.

*Cirolana bovina* Barnard, 1940


*Cirolana bovina* Pillai, 1961; 1967.

Material:

Many specimens were obtained from the littoral region of Kovalam.

**Description** (Female, 10.0 mm TL):

Body oblong, almost parallel-sided. Surface of pereon, pleon and telson minutely pitted. Anterior border of cephalon rounded, no antero-median rostrum. Pereonite 1 longest, antero-lateral corners slightly sinuate; pereonite 3 shortest. Coxal plates well developed, with oblique ridges; rectangular in lateral view and triangular in dorsal view; posterior coxal plates extend beyond the posterior margin of respective segments. Posterior margin of last two pereonites feebly crenulate. Pleonite 1 immersed in pereonite 7, posterior margins of pleonites 2 and 3 minutely crenulate, that of pleonite 4 and 5 bears a horizontal row of tubercles, the median ones larger than lateral ones. Pleonite 4 overlaps 5 laterally. Telson, a broad-based triangle, two large dorsal tubercles situated submedially in the proximal region, lateral margins sinuate towards proximal end, apex narrowly rounded; eight short, stout spines among short setae apically.

Frontal lamina almost pentagonal, slightly longer than broad.

First antenna slender and short, peduncle 3-jointed; flagellum 12-jointed; superior distal margins of segments bear aesthetascs. Second antenna reaches up to anterior border of pereonite 2, peduncle 5-segmented; flagellum 24-jointed, terminal segment of flagellum formed by coalition of two segments; superior distal border of articles with hairy setae.
Mandible with strong, tridentate incisor, lacinia mobilis, spine row and molar process well developed; palp 3-segmented, middle segment longest, distal two segments with a comb of setae. First maxilla of two lobes; outer lobe large, bears ten stout spines apically and three spinules on inner lateral margin; inner lobe with three large plumose setae apically, two spinules present on outer lateral margin. Second maxilla, outer lobe large with 18 apical spines of which seven are pectinate and the remaining slender sharp spines; middle lobe with four spines. Maxilliped 7-segmented, endite with two coupling hooks laterally and five plumose setae apically, fifth segment largest, sixth slightly lobed inwards, all segments bear slender marginal spines, terminal segment bears seven barbed spines and many slender spines.

All pereopods ambulatory. Pereopods 1-3, inferior lateral margins of merus, carpus and propodus armed with large blunt fringed sensory spines, distal superior margin of ischium and merus bears a single fringed sensory spine and a pointed spine each. Infero-lateral margins of ischium, merus, carpus and propodus of pereopod 4 spiny, fringed sensory spines on ischium arranged in three sets, that of merus and carpus arranged in two sets each; distal superior margins of these segments bear groups of fringed sensory spines; dactylus uniunguicate. Posterior pereopods more spiny than anterior ones. Superior lateral margin of basis of pereopod 7 dotted with spinules; arrangement of spines on infero-lateral margin similar to pereopod 4; distal superior margin of ischium bear slender pointed spines; that of merus and carpus bear clusters of pectinate spines; that of propodus armed with two fringed sensory spines.

Both rami of pleopods 1-4 with plumose marginal setae; endopod of pleopod 5 non-setigerous; 3-4 coupling hooks present on peduncle of all pleopods.

Uropods almost reaching tip of telson; endopod rounded apically, with ten stout spines among setae; exopod narrow with an acute tip bearing four stout spines among setae.

Colour pale brown with a slight greenish tint.
Description (Male, 11.5 mm TL):

Similar to female except for the secondary sexual characters, appendix masculina arising from base of endopod of pleopod 2, slightly overreaching pleopodal rami, slender, apically blunt, distal 1/3rd armed with tiny spinules. Penes on seventh sternite in the form of mammiform papillae.

Distribution:

South Africa and India.

Remarks:

The present material agrees closely with the description of Pillai (1961, 1967). Both these descriptions being too brief, a comparative study of the mouth parts and pereopods could not be made. However, the ornamentation of the body surface, a character of considerable taxonomic value, in cirolanids, confirms that this species is *C. bovina*. *C. pleonastica* recorded from Madras by Sreenivasan (1955) has been reported to be *C. bovina* (Pillai, 1961).

Ecological note:

It is a typically marine species and is quite prevalent in the littoral region of Kerala and Madras (India). The present material collected from Kovalam (Kerala) was found in association with algae.

The biology of this species is not known.

*Cirolana willeyi* Stebbing, 1904
Pl. X, figs. 1-17


Synonymy:

*Cirolana willeyi* Barnard, 1935; Pillai 1961; 1967; *Cirolana nigra* Chilton, 1924; *Anopsilana willeyi* Bruce, 1981b.
Material:

Many specimens were collected from the Akathumuri Lake and Cochin Backwaters.

**Description (Male, 11.0 mm TL):**

Body elongate ovate. Cephalon with an antero-median rostrum, posterior margin faintly sinuate medially. Eyes large, black. Cephalon bears three tubercles, one median and two lateral. Pereonite 1 slightly longer than succeeding pereonites; bears six tubercles, two lie submedially in the anterior half of the segment, posterior to these are two larger ones flanked laterally on either side by two smaller tubercles. Pereonites 2-5 are subequal to one another, pereonite 6 slightly larger, pereonite 7 shortest. Coxal plates of pereon segments 2-7 well developed, those of the posterior segments extending beyond the posterior margin of their respective segments, coxal plates bear minute setae laterally. Pereon segments 2-7 bear tiny tubercles on the posterior margin, 13 on the fifth and sixth and 11 on the seventh. Pleon composed of five free segments, last four have small tubercles on their posterior margins; pleonites 2-4 have five tubercles each, median one larger than lateral ones, pleonite 3 extends laterally to cover 4 which in turn covers pleonite 5. Pleonite 5 has three tubercles, one median and two lateral. Telson a broad-based triangle having eight spines apically. No tubercles on telson.

Frontal lamina with sides straight, meeting anteriorly at an acute angle.

First antenna comprises of three peduncular segments and eleven flagellar segments, flagellar segments bear aesthetascos on the superior distal margin. Second antenna consists of five peduncular and 27 flagellar segments, flagellar segments fringed with tufts of long slender setae.

Mandible with very well developed incisor process, lacinia mobilis, setal row and molar process, palp segmented, distal two segments bearing a comb of pectinate setae. First maxilla of two lobes; inner lobe with three stout plumose processes, outer lobe with 10-11 stout, toothed spines. Second maxilla three lobed, innermost lobe large, bears eight stout plumose spines and four slender spines; two outermost lobes bear 5-6 spines.
First pereopod stout and subchelate; merus bears six blunt spines along its inferior lateral margin, a characteristic feature; carpus immersed in the merus, bears two slender spines; propodus bears two fringed sensory spines near its distal inferior margin, dactylus uniunguiculate. Pereopods 2 and 3 very similar except for the presence of more spines on the ischium and merus. Pereopods 4-7 more spinous, inferior lateral margins of ischium, merus, carpus and propodus of the posterior pereopods armed with groups of stout spines; ischium bears four sets; merus and carpus bear two sets each and propodus bears three groups of spines.

Pleopods 1,2 and 4 normal, rami fringed with marginal plumose setae; exopod of pleopods 3 and 5 biarticulate, margins bear plumose setae; endopod of pleopods 3-5 lack marginal setae; appendix masculina on endopod of second pleopod longer than the rami, apex tapers into a narrow process.

Penes on the seventh sternite in the form of mammiform papillae.

Uropodal peduncle extends along the inner margin of the endopod; endopod of uropod round apically with twelve spines amidst long setae; overreaches the telson; exopod narrow and cylindrical with an acute apex, bears twelve spines, four on the inner margin and eight on the outer.

Characteristic colour pattern observed with a dark patch of pigmentation medially, extending the whole length of the pereon, widening distally so that in the last three pereon segments two longitudinal patches of dark pigmentation visible. Laterally reticulate pigmentation visible against an yellow background. Telson blackish dorsally. General body colouration dark grey.

**Distribution:**

Sri Lanka, Chilka Lake and Kerala (India).

**Remarks:**

The tuberculation noticed on the cephalon and first pereon segment in the present specimens has not been described by Pillai (1958) while describing the species. This is more prominent in the males. Since the
original description of the species by Stebbing was not available, a compari-
sion with Stebbing's species was unable to be made and hence, it cannot
be said with certainty whether this tuberculation is a significant character
or not.

The absence of tubercles on the telson of this species and the arra-
gement of tubercles on the pereon and pleon are characteristic features
which distinguish this species from all others. The characteristic pigmen-
tation also make this species very obvious.

Bruce (1981b) transferred C. willeyi to the genus Anopsilana Paulian
and Debouteville, 1956. The characters based on which this transference
was carried out are endopods of pleopods 3-5 non-setigerous and slightly
smaller than exopods, penes absent. Examination of the present material
revealed a variation in the case of the latter character. Penes were noti-
ced as minute mammiform papillae in the material under observation.
Barnard (1940) too has illustrated the penes of C. willeyi. Since, this
character is at variance with the generic diagnosis of Paulian and Debou-
teville (1956), it is herein proposed to retain C. willeyi under the genus
Cirolana Leach till further clarification or information is made avilable.
However, it is suggested that if the presence or absence of penes is not
considered an important generic character, then this species can be acco-
modated in Anopsilana based on the endopods of pleopod 3-5.

Ecological note:

This species is very common in the brackish water localities of Kerala
and Chilka lake (Orissa). In the backwaters of Kerala, this species is
often found in association with the boring sphaeromatids, Sphaeroma
terebrans and S. annandalei on submerged timber. In the Akathumuri
Lake, it was found in the bores on laterite stones made by the boring
sphaeromatids. This species is a truly euryhaline form capable of surviving
in freshwater conditions too.

Their wide spread occurrence in the Kerala backwaters coupled with
their association with the timber boring sphaeromatids instigated the
study of certain aspects of its biology (vide supra).
Cirolana fluviatilis Stebbing, 1902
Pl. X, figs. 18-33


Synonymy:

Cirolana fluviatilis Barnard 1920; 1935; 1940; Pillai, 1961 (with complete synonymy); Cirolana pleonastica Chilton, 1924; 1926.

Material:

Several specimens collected from the oil tanker berth off Cochin Backwaters.

Description (Male, 10.0 mm TL):

Body almost oval-shaped. Anterior margin of cephalon rounded with no antero-median rostrum. Eyes large brownish black in colour. Antero-lateral corners of the first pereon segment produced. First pereonite longest; pereonites 2-6 subequal to one another in length, slightly shorter than the first; pereonite 7 shortest; coxal plates of pereonites 3-7 well developed, those of pereonites 4-7 extending beyond the posterior margins of their respective segments, lateral margins and apex of the coxal plates fringed with minute setae. Posterior margins of pereonites 4-7 studded with a single row of tubercles, thirteen on the seventh, fifteen on the sixth and seventeen on the fifth segment. Pleon consists of five segments; posterior margins of the pleonites tuberculate, pleonites 2 and 4 bear seven tubercles, third bears nine and fifth bears five; lateral margin of the pleonite 4 covers pleonite 5. Telson roughly triangular with a broad base. Apex of the telson bears eight small stout spines hidden among slender setae. On the dorsal surface of the telson are two tubercles situated submedially proximally. Posterior to these two tubercles is a double longitudinal row of four tubercles situated submedially.

Frontal lamina rounded anteriorly.
First antenna short, reaching up to the second antennal peduncle. Peduncle of first antenna 3-segmented; flagellum 10-jointed; bears setae on the distal inferior margin of each flagellar article. Peduncle of second-antenna 5-segmented; flagellum 20-21 jointed, setose apically. Superior margin of the antennae also bear bunches of long setae at the distal margin of each segment.

Mandible typical of the genus, with well developed incisor process, lacina mobilis, setal row and molar process; palp 3-segmented, the distal two segments bearing pectinate setae. First maxilla bears two stout lobes, apex of inner lobe armed with three stout plumose processes and a small spine at the base of the outermost process; outer lobe armed with twelve stout toothed spines, inner lateral margin of the outer lobe with three spinules. Second maxilla comprises of three lobes, the larger one bears eight spiny setae, outer three stouter and plumose; inner lobes bear slender, pointed spines. Maxilliped 7-segmented, endite bears two coupling hooks; apex with long plumose setae; fourth segment of maxillipetal palp produced laterally; all the segments bear sharp, slender spines; the terminal segment bears 4-5 spiked setae; the epipodite of maxillipetal rounded with plumose marginal setae.

First pereopod short and stout; ischium bears two long spines on its superior distal margin, outer one with a bifurcated tip; merus bears four marginal tubercular processes on its lower side, near the base of the more distal tubercles are two fringed sensory spines; inferior distal margin of carpus bears a fringed sensory spine; propodus with three fringed sensory spines along its inferior margin spaced equidistantly, dactylus biunguiculate, two setae distally, superior distal margin of the dactylus bears a few setae. Second and third pereopods also almost similar except for the presence of more fringed sensory spines along the inferior lateral margins of the ischium, merus and carpus; superior distal margins of these segments of pereopods 2 and 3 are also armed with stout dentate spines. Posterior pereopods more spinous than the anterior ones; inferior lateral margins of the ischium, merus, carpus and propodus armed with groups of stout fringed sensory spines; superior distal margins of these segments bear stout pectinate spines; distal margin of the carpus of pereopods 6 and 7 bear numerous stout, pectinate spines.
Exopod of pleopods 3, 4 and 5 partially two-segmented. Appendix masculina on endopod of second pleopod straight, slightly longer than the endopod; apex tapers to a narrow process. Both rami of pleopods 1-3 setigerous; endopod of pleopods 4 and 5 with no setae.

Endopod of uropod is slightly longer than telson with a rounded apex; exopod oval about 3/4 the length of endopod; apex of endopod and exopod bear ten stout, short spines amongst long, slender setae.

Penes on the seventh sternite flush with the surface, no mammiform papillae.

Yellowish brown in colour with the tubercles appearing pinkish red but this colouration disappears in formalin preserved specimens.

Female similar to the male.

**Distribution:**

South Africa, Thailand, Tale Sap, Chilka Lake (India), Kerala (India).

**Remarks:**

The very characteristic arrangement of tubercles on the pereon, pleon and telson easily distinguishes this species from all other species of *Cirolana*. The description of *C. fluviatilis* given by Pillai (1961, 1967) are too concise to permit a detailed comparative account. Pillai (1958) has described a new species *C. bicarinata* which differs from *C. fluviatilis* in having the longitudinal row of tubercles on the telson extending up to the tip, unlike in the latter where there are only four tubercles. The structure of pereopod 1 is also reportedly different in that the fifth segment is immersed in the fourth in *C. bicarinata* and not so in *C. fluviatilis*. On examination of the present material, it was observed that these two characters are not valid. Pereopod 1 exhibits an immersed fifth segment when viewed from one side and a not immersed one when viewed from the other side. Hence, it is felt that *C. bicarinata* is a synonym of *C. fluviatilis*. Bruce (pers. comm.) has also stated that these two species are synonyms.
Ecological note:

This species is very common in the estuarine region and is widespread in the Kerala backwaters. It is usually found in association with the timber-boring sphaeromatids on submerged timber along with *C. willeyi* and *Corallina nodosa*. In the Akathumuri Lake, it was found on laterite blocks in association with the above-mentioned species of isopods and in the Ashtamudi Lake it was found in association with algae.

This is also an euryhaline form (Cherian, 1978a), though its range of salinity tolerance is less than that of *C. willeyi*.

**SUBORDER - ASELLOTA**

**Diagnosis:**

Body usually small, fragile, not heavily sclerotised. Eyes present or absent. Antennae shorter or longer than body, first antenna usually shorter than body; second antenna longer, a 'squama' is sometimes present; flagellum of both antennae multi-articulate. Mouth parts normal, not exceptionally modified; mandibles well developed, palp 1-3 jointed, sometimes absent; first maxilla biramous; second maxilla with three lobes; maxillipeds with well-defined endite, bearing one to several coupling hooks, palp 5-articulated. Pereonites often free, sometimes few are fused; coxal plates, if present, small, often indistinct in dorsal view. Pereopods usually ambulatory, sometimes natatory; pereopod 1 generally subchelate, sometimes sexually dimorphic. Pleon usually free, sometimes fused with pereon, composed of pleotelson plus up to three free segments. First pair of pleopods usually modified into a thin opercular plate protecting posterior pleopods, variously modified in males. Pleopod 1 missing on female, pleopod 2 of female operculate. Uropods biramous, terminal.

**Remarks:**

The great diversity of genera coupled with different body plans make this suborder a difficult one to classify. The classification of this suborder is thus in a highly disordered state. The diverse habitats invaded by members of this suborder is also highly striking. The importance of pleopod
morphology in the classification of Asellota has been emphasised several times. However, no comprehensive revision of the families and genera has yet been attempted. Five superfamilies, viz., Aselloidea, Stenetrioidea, Janiroidea, Gnathostenetroidoidea and Protallocoxoidea are now recognised (Bowman and Abele, 1982). This suborder contains about 2000 species in 120 genera and 31 families (Schultz, 1982). This suborder is represented by a single species belonging to the family Janiridae in the present collection.

FAMILY - JANIRIDAE

Diagnosis:

Lateral parts of cephalon lamellarly expanded. Eyes when present subdorsal in position. First antenna well developed, flagellum multi-articulate, sometimes small with rudimentary flagellum. Second antenna with 6-articulated peduncle, carrying a small accessory scale outside the third joint. Mouth parts normal; mandibular molar process well developed, strong, apically truncate; maxillipedal palp with first three articles expanded, over half as wide as endite and much wider than distal two articles. Pereopod 1 may be prehensile, sometimes not differing from the following six pairs which are ambulatory, dactylus bi-ortri-unguiculate. Pleon composed of two somites, first narrow and inconspicuous, second large and shield-shaped. First pair of pleopods, in female, transformed into a single large opercular plate, undivided; second pair wanting; outer rami of pleopod 3 and 4 narrow and confluent with basal part, pleopod 5 with only a single ramus. First pair of pleopods in male coupled with the second to form a compound operculum. Second pleopod, inner rami geniculate, two-jointed; outer rami short, two-jointed and hook-shaped. Pleopods 3-5 similar to the female. Uropods subterminal or terminal with peduncle generally biramous.

Remarks:

The members of this family are exclusively marine, abundant in the intertidal, shallow sub-tidal and deep sea. This family contains at least 35 genera and over 135 species.
Genus - Bagatus Nobili, 1907


Bagatus Monod, 1933; Nierstrasz, 1941; Pillai, 1954; 1962; Menzies and Glynn, 1968; Monod, 1974.

Diagnosis:

First antenna with a multi-segmented flagellum; second antenna with a long flagellum with a small scale-like structure at the base of the third peduncular segment. Pereopod 1 with fifth segment short; sixth elongated and with teeth near proximal end; seventh long, touches against propodus to form a pincer. All pereopods biunguiculate. First pair of pleopods of males with suture at extremity.

Remarks:

The genus Bagatus closely resembles Carpias and the latter was synonymised to the former by Menzies and Glynn (1968). Carpias was accepted as a synonym of Bagatus by Monod (1974). These two genera had considerable nomenclatural problems. However, Pires (1980a) revalidated the genus Carpias and delineated the differences between the two genera concluding that the two genera are separate and valid. The main differences noted between these two genera according to Pires (1980a) is pereopod 1 of the male which has a swollen propodus in Carpias and a narrow one in Bagatus. The morphology of pleopod 1 is also distinct for each genus, the appendix masculina on pleopod 2 of the male does not reach the distal margin of the sympod in Carpias while it passes beyond the distal margin of the sympod in Bagatus.

Bagatus also resembles Janira very closely except that the former possesses two or three large spines on the sixth segment of pereopod 1. Pires (1980a) transferred the species Janira minuta Richardson, 1902 to Bagatus, probably based on this difference.

Kensley (1978b) has stated that the generic status of several South African species of the family Janiridae is doubtful and needs considerable taxonomic attention. In this regard it is felt that this statement is applicable to all Asellotan isopods of Indian waters, too.
Bagatus longimanus Pillai, 1954
Pl. XI, figs. 1 - 16


Material:

A few male and female specimens were collected from the littoral region of Kovalam (Trivandrum) and from among algae found on rafts immersed for oyster culture at Vizhinjam (Trivandrum).

Description (Male, 2.5 mm TL):

Body almost parallel-sided. Cephalon small, anterior margin slightly concave, antero-lateral sides sinuous. Eyes small, subdorsal with numerous ocelli. Pereon segments subequal to one another in length, pereonites 1-3 slightly curved forwards, pereonite 4 linear, and 5-7 slightly curved posteriorwards. Coxal plates visible on all pereonites dorsally. Pleotelson ovate, with subtruncate posterior border faintly bilobed.

First antenna short, slender, flagellum multi-segmented bearing setae. Peduncle of second antenna 6-jointed, small leaf-like exopodite on third peduncular segment; multi-articulated flagellum.

Mandible very well developed; palp 3-segmented. Outer lobe of first maxilla with eight barbed spines and a few simple spines; inner lobe with a few stout spines. Second maxilla outer and middle lobes with several apical spines; inner lobe hirsute along inner lateral margin. Maxilliped with 6-segmented palp, proximal three segments broader than distal two, endite bears two coupling hooks.

Pereopod 1 stout, subchelate; basis, ischium and merus small; carpus large with an apical and subapical spine on proximal infero-lateral margin, propodus long and narrow; dactylus biunguiculate. All other pereopods more slender; carpus not enlarged; dactylus biunguiculate.
Pleopods 1 and 2 forming an operculum over pleopods 3-5. Sympod of pleopod 1 fused in the mid-line and covering the median margin of pleopod 2; rami of pleopod bear small, sharp, spiny setae marginally. Pleopod 2 bears appendix masculina, longer than endopod, distal margin of endopod studded with small setae; pleopods 3-5 thin, membraneous.

Uropods $\frac{1}{2}$ length of pleotelson, biramous, pedunculate, endopod slightly longer than exopod.

**Description** (Female, 2.2 mm TL):

Female resembles the male in almost all respects except for the structure of pereopod 1 and pleopods 1 and 2. In pereopod 1, carpus is not enlarged as in male. Pleopod 1 large, rami of two sides fused completely with no median suture; apex slightly excavate with small marginal setae. Pleopod 2 outer ramus slender.

**Distribution:**

Cape Comorin, Kovalam, Vizhinjam and Thankasseri (South-west coast of India) and Senegal (Africa).

**Remarks:**

The material described herein agrees closely with the description of Pillai (1962).

Pillai (1954) has remarked that Bagatus longimanus closely resembles B. crosslandi (Stebbing) and B. nana (Stebbing) and has also drawn attention to the difference in the shape of the first gnathopod of this species, which is one of the main distinguishing characters. B. longimanus also resembles B. longidactylus according to Pillai (1962). The most important difference between these two species is the width of the peduncle of pleopod 1 of male, which is narrower in B. longimanus and also the rami are completely fused in this species unlike in B. longidactylus.
Ecological note:

This is a strictly marine species and has been reported from the littoral region of Kovalam, Vizhinjam, Cape Comorin and Thankasseri. It is commonly found as an algal associate.

This species has so far been reported from the South-west coast of India and Senegal (Africa). This is not surprising because very little concerted effort has been made to study the asellotan isopods. Thus, this apparently isolated distribution does not necessarily project its absence in the intervening areas.