

Addition of Some Marine Ostracoda and Diplostraca from Pakistan (Northern Arabian Sea) and Restudy of Ctenopod *Penilia avirostris* and Cyprinid *Cypridina dentata*

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ABSTRACT

This study was carried out in order to add in the existing fauna of the marine Ostracoda and Diplostraca of Pakistan. The paper summarizes published and unpublished species of planktonic and phytal Ostracoda and Diplostraca recorded from the Pakistan coast (northern Arabian Sea). We report hereby two halocyprid ostracods *Conchoecia* sp. and *Halocypria* sp. of the family Halocyprididae Dana, and podocopid ostracod species *Parasterope* sp. of the family Cylindroleberididae Müller; another species- *Ancohenia robusta* (Brady, 1890) of a myodocopid family Sarsiellidae and *Rutiderma* sp. of family Rutidermatidae Brady and Norman were also collected; an instar of an indeterminate myodocopid ostracod is added here. Additional descriptions of cyprinid *Cypridina dentata* (Müller, 1906), and a diplostracan *Penilia avirostris* Dana, 1849 of the order Ctenopoda in the family Sididae Baird are given here. Sample of *Penilia avirostris* is worth emphasizing as it is among the samples collected in the Northwestern Indian Ocean within the framework of the Office of Naval Research project (ONR: under Grant N00014-86-86-G-0230 1991), through partnerships with Pakistan academia and government, ONR coordinates and sponsors scientific research and technology development for the U.S. Navy and Marine Corps. All the species are described and illustrated.

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Authors' Contribution

QKB designed methodology of the study, wrote and edited the manuscript. MAK finalized the manuscript for publication.

Key words

Ostracoda, Diplostraca, Coastal, Oceanic species, Planktonic, Phytal, Taxonomy, Morphology

INTRODUCTION

This study was carried out in 1995 in order to determine Cladoceran now Diplostracan and Ostracodan fauna of the Pakistan coast, the studies were conducted in the areas very close to coast and sampling depth of the stations area changed 5 to 10m. The Ostracoda is a large class of relatively poorly known pancrustaceans. An important distinguishing feature Ostracods share with other arthropods is the bilateral symmetry of their body form. The paired body parts are enclosed in a dorsally hinged carapace. They are tiny crustaceans which inhabit virtually all aquatic environments and damp terrestrial, in shallow marine, deltaic, estuarine, lagoonal, lacustrine, fluvial and swamp environments. In tropical marine waters ostracods

also appear capable of attacking live animals, observed during night diving attacking fishes in swarms (Stephen and Brusca, 1985) or actual parasites on other marine animals (Monod, 1923; Harding, 1966; Felder, 1982; Cohen, 1983; Kretzler, 1984). The class Ostracoda is divided into 3 rescent subclasses (1) Myodocopa (2) Platycopida and (3) Podocopa; first two have representatives in marine environment (Pennak, 2001). Of the above mentioned three subclasses-two i.e., Podocopa and Mydocopa- occur in Pakistani marine waters. The samples collected from Karachi during 1995 form the basis of this study. Among the meiobenthic crustaceans, ostracods remain poorly studied that's why extant meiobenthic ostracods from this area are poorly documented and many living marine remain undescribed today. The Diplostraca is by far the most diverse and speciose superorder within the class Branchiopoda, most of which have flattened, leaf-like appendages. The superorder forms a monophyletic group of 7 orders, about 24 families, and more than 11,000 species. Many more species are undescribed. The diplostracans are important member of pelagic ecosystem and they serve as good source of food for fish and fish larvae during the warm periods. The diplostracan are represented by 8 species in marine environments (Belk, 2007), widely distributed in neritic and oceanic waters

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(Egloff *et al.*, 1997), sometimes, they produce “blooms” in marine environments. The marine cladocerans are adapted to neritic environments rather than offshore deep-sea environments (Egloff *et al.*, 1997; Onbé, 1999). Some species, however, are often observed in the open ocean over several kilometers from the coast (Della-Croce and Venugopal, 1972; Gieskes, 1971). The diplostracan are commonly used as live feed as a substitute for *Artemia* in aquaculture practices. They are major food source of many organisms like fish and other crustaceans and play an important part in the food chain, trophic levels and energy transfer in the ecosystem (Palanichamy, 1996). While going through literature we found little was known before 1990 about the deep pelagic ostracodan and diplostracan fauna of the Arabian Sea, was mainly known by collection made by the early oceanographic voyages of the German Tiefsee (1898) and the Danish Dana (1920, 1930), through a short paper on the planktonic ostracods was published by Cannon (1940) during the John Murray Expedition (1933–1934). Further data on the ostracods was published by George (1969) in a preliminary analysis of the plankton samples collected during the International Indian Ocean Expedition (IIOE, 1959–1965). Leveau (1967) also reported on a collection of halocyprids from the Arabian Sea, there have been a few follow-up studies of the halocyprids (James, 1975, unpublished thesis; George and Nair, 1980; Nair and Madhupratap, 1984; Smith and Madhupratap, 2005; Drapun and Smith, 2011) on the taxonomy and distribution of halocyprid ostracods from the Arabian Sea, based upon samples collected in the Northwestern Indian Ocean under the Netherlands Indian Ocean Program (NIOP, 1992–1993), the U.S. Joint Global Ocean Flux Study (US JGOFS, 1994–1996) and the U.S. Global Ocean Ecosystem Dynamics program (US GLOBEC, 1995). Mathew *et al.* (1996) studied planktonic distribution of Ostracoda collected from Arabian Sea; Purushothaman (2015) worked on the diversity of planktonic ostracods in the mixed layer of northeastern Arabian Sea.

Following marine planktonic and benthic diplostracan, ostracodan and ctenopodan species were reported from Pakistan (the source is given in parenthesis) *Podon* sp. planktonic (Khan, 1976), *Cylindroleberis mariae* (Baird, 1850) plankton (Khan, 1976 as *Asterope mariae* Baird), *Cypridina sinuosa* (Mueller, 1906), planktonic (Khan, 1976 as *Pyrocypris sinuosa* Muller), *Cypridina dentata* (Mueller, 1906), planktonic (Khan, 1976 as *Cypridina megalops*), *Gigantocypris mullerii* Skogsberg, 1920, planktonic, bathypelagic (Cannon, 1940), *Conchoecia* sp. 0.6 mm benthic (Shahab, 2002, unpublished project), *Euconchoecia aculeata* (Scott, 1894), planktonic (IndoOBIS), *Euconchoecia* sp.

planktonic (Khan, 1976), *Proceroecia procera* (Müller, 1894), planktonic, neritic (IndoOBIS), *Conchoecetta giesbrechti* (Müller, 1906) pelagic (IndoOBIS), *Orthoconchoecia atlantica* (Lubbock, 1856) pelagic (IndoOBIS), *Metaconchoecia rotundata* (Müller, 1890) pelagic (IndoOBIS), *Halocypris inflata* Dana, 1849 planktonic (IndoOBIS), *Paraconchoecia decipiens* (Müller, 1906) planktonic (IndoOBIS), *Mikroconchoecia curta* (Lubbock, 1860), planktonic (IndoOBIS), *Agelaiocypris pellucida* Mostafawi, 2003, littoral, 10–95m., subfossil (Mostafawi, 2003), *Argilloecia* sp. 5 benthic (Maddock, 1969), *Neonesidea phlegeri* (Mckenzie and Swain, 1967) on rocks with dense vegetation at low tide (CAS: INVERT 120542.0 Steiner, 1973), *Condonocera* sp., pelagic (Khan, 1976), *Philomedes* (*Philomedes*) *lilljeborgi* (Sars, 1928), planktonic (Khan, 1976 as *Philomedas lilljeborgi*), *Penilia avirostris* Dana, 1849 planktonic (Khan 1977; Nayeem, 1991), *Ancohenia hawaiiensis* Kornicker, 1976 benthic (Shahab, 2002, unpublished MSc project); Kazmi and Khatoon (2016), *Ancohenia robusta* (Brady, 1890) algal associated (Shazia, 2002; Kazmi and Khatoon, 2016), *Cylindroleberis bacescui* Kornicker and Caraion (1974), length, 2.5–4.0 mm, height, 0.55–1.7 mm. Bluish purple. algal associated in rocky area (Kazmi and Khatoon, 2016), *Cyprinotus inaequalis* Bronstein, 1928 brackish (Hartmann, 1964), *Neonesidea phlegeri* (Mckenzie and Swain, 1967) on rocks with dense vegetation (Maddocks, 1969). Khan *et al.* (2012) and Qureshi and Sultana (2016) merely mentioned of group ostracod without any further details. Recently Abbasi *et al.* (2018) reported, two genera of diplostracans – *Evadne* and *Penilia* from Karachi coast; Kazmi and Khatoon (2016) and Valeem *et al.* (2023) reported phytal marine ostracods namely *Cylindroleberis bacescui* and *Ancohenia robusta*, along with other symbiotic crustaceans. In spite of notable abundance of marine diplostracans, detailed information on the marine diplostracans in Pakistani waters is still lacking

MATERIALS AND METHODS

Onshore and offshore sampling was done. Offshore sampling was done in the Northwestern Indian Ocean within the framework of the Office of Naval Research project (ONR under Grant N00014-86-86-G-0230 1991), through partnerships with Pakistan academia and government, ONR coordinates and sponsors scientific research and technology development for the U.S. Navy and Marine Corps. The senior author had access to a large numbers of samples collected in the 1991. In shore algal samples were collected from June 1990 to May 1991; monthly algal collections were obtained from Manora and Buleji at low tide. The crustaceans were decanted.

Plankton net was used for collecting samples of plankton in standing bodies of waters in the tidal zone. The specimens were dissected and mounted on microscope slides. The line drawings were prepared with the aid of a drawing tube attachment. Abbreviations used in the text are cl and cb for carapace length and carapace breadth, respectively.

RESULTS

We report hereby brief descriptions of ostracodan halocyprids *Halocyprida* Dana and *Conchoecetta acuminata* Claus, 1890 in family Halocyprididae Dana; a podocopid *Xestoleberis* sp. and mydocopid ostracod *Parasterope* sp. of the family Cyllindroleberididae; *Rutiderma* sp. of family Rutidermatidae; *Ancohenia robusta* of family Sarsiellidae and an additional description of *Cypridina dentata* of Cyprinididae and *Penilia avirostris* - a Diplostracan of the order Ctenopoda in family Sididae. All the presently reported species are briefly described and illustrated.

KEY TO SUBCLASSES OF CLASS OSTRACODA

Latreille 1894 Ostracoda (after Anne et al., 2007).

Carapace bivalve elongate oblong to almost circular; with or without rostrum and incisur; valves usually not overlapping; 2nd antenna with large muscular protopod; long exopod with nine segments (rarely less) with long setae (often used for swimming); smaller (often much smaller) endopod with one to three segments, usually conspicuously dimorphic in adults; large lamellar furcae posterior to anus; with or without lateral eyes and Bellonci organ Subclass Mydocopa
-Carapace ovoid, inflated-sub triangular, oblong elongate, or compressed; no rostrum or incisur; valves overlap around free margin; 2nd antenna geniculate, pediform; with very small exopod with no more than two segments; much larger propulsive endopod with up to four segments; variable furca anterior to anus; no lateral eyes or Bellonci organ. Subclass Podocopa

Mydocopa Subclass Mueller, 1894 Order Halocyprida Dana, 1853

The Halocyprida is one of the two orders within the subclass Mydocopa. From the Arabian Sea forty-one species belonging to its family Halocyprididae have been described by [Drapun and Smith \(2012\)](#). In the present collection only 2 genera - *Conchoecetta* and *Halocyprida* are found.

Family Halocyprididae Dana, 1853

Conchoecetta acuminata Claus, 1890 (Fig. 2)

Material

Male, cl 0.89 mm.cb0.5mm.

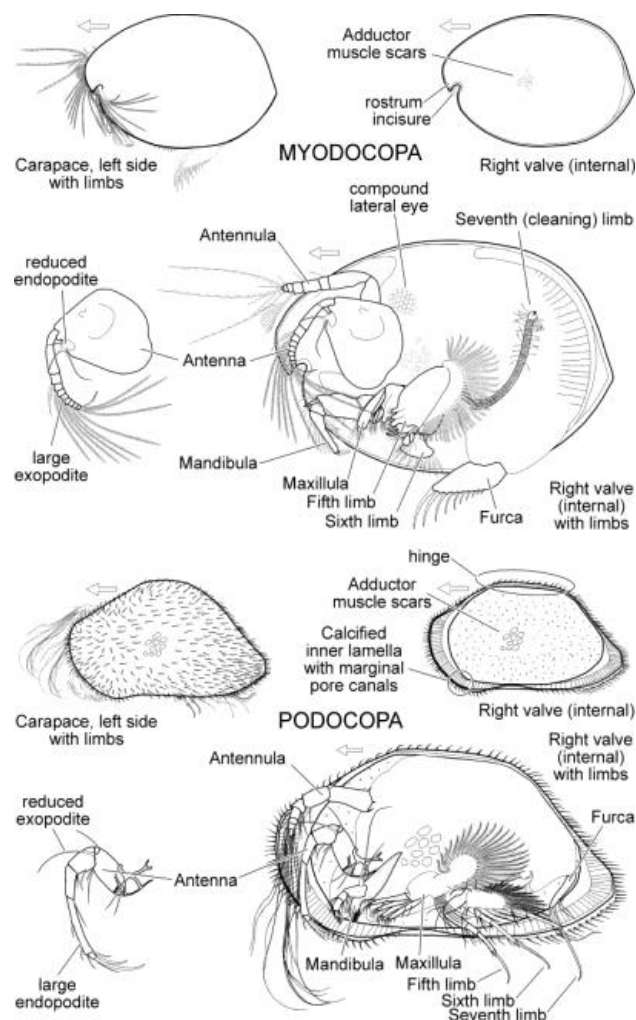


Fig. 1. Schematic diagrams of subclasses of Ostracoda (after, Rodriguez-Lazaro and Muñoz, 2011).

Description

Both the rostrum and the posterior dorsal corner of valve of the carapace are extended. The rostrum ([Fig. 2A](#)) is elongated and pointed. The front and back shoulder vaults are slightly raised. The antennule ([Fig. 2B](#)) is clearly segmented; at the distal end there are three small spines that are directed distally; just beyond the end of the armature the seta is hinged and is then flanged with very fine spinules along the edge of the flange. The protopod of antenna ([Fig. 2C](#)). is three times the length of the first exopod segment, and more than twice the combined

lengths of the remaining exopod segments that carry the swimming setae. There is a small terminal seta at the distal end of the first exopod segment that curves around the articulation with the second segment. The furca (Fig. 2D) has the typical structure for the genus with eight pairs of bare spine setae.

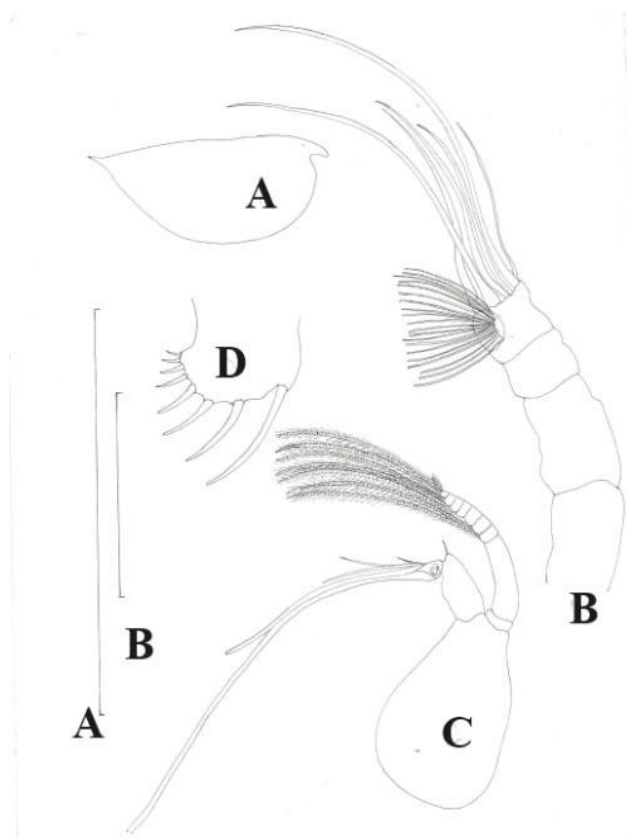


Fig. 2. *Conchoecetta acuminata*. A, carapace; B, antennule; C, antenna; D, furca.

***Halocypria globosa* Claus, 1874**
(Fig. 3)

Material

Female cl. 0.89 mm; cb. 0.5 mm

Description

The species lacks an obvious eye. Both the antennules are sexually dimorphic. In males the segments of the antennule are always clearly separated by sutures, but in the females segments are fused. In males three of the terminal setae are long, thick-walled and slender; the first exopod segment is slim composed of two segments;

the terminal segment carries five setae (Fig. 3B). In males there is a third segment, which is developed into a hook appendage. The antenna (Fig. 3C) has a bare protopod; on the endopod processus mamillaris is bluntly pointed. The mandible is with well-developed endopod (Fig. 3D), the basal segment is developed, the exopod is reduced to small pegs on the basale that carry a long plumose seta. The maxilla is as shown in Figure 3E. The fifth limb is as shown in Figure 3F and the sixth limb in Figure 3G. In males the limb is strongly developed and its three terminal setae are filamentous and subequal. In females the terminal setae are unequal. The furca (Fig. 3I) consists of two flanges which are armed with 7 pairs of hook setae, the longest first pair is off-set from the others, which progressively diminish in size posteriorly.

Remarks

Earlier identified as genus *Conchoecia* Dana.

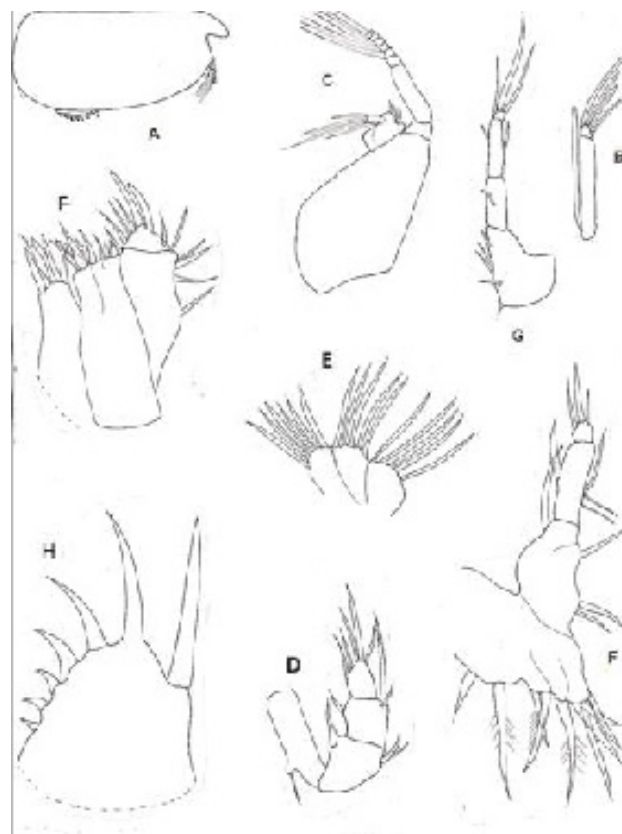


Fig. 3. A, *Halocypria globosa* carapace; B, antennule; C, antenna; D, mandibular endopod; E, endites of maxilla; F, fifth limb; G, sixth limb; H, furca.

Family Cylindroleberididae Müller, 1906

The family Cyndroleberididae is one of the largest myodocopid ostracod families with remarkable morphological diversity. The family has a worldwide marine distribution and can be found from shallow waters to depths of more than 4570 m (Kornicker, 1975). The Cyndroleberididae accounts for 225 species classified in 33 genera and the following four subfamilies: Cyndroleberidinae, Cyclasteropinae, Asteropteroinae, and Macroasteropteroinae. The Cyndroleberididae is represented in the present collection by the genus *Parasterope* Kornicker, 1975 which is the most speciose of all cyndroleberid genera of the subfamily Cyndroleberidinae with 47 species and subspecies currently listed on the World Ostracod Database. Poulsen (1965) described this genus as a new genus, but since no type species was designated, the name became only valid in 1975, when Kornicker designated a type. The genus has a global distribution.. Its species can be found in shallow waters, such as sandy mud flats near mangrove area, to abyssal depths of 4303 m.

***Parasterope* sp.**
(Fig. 4)

Material

Female, male, cl.1.5 mm. subtidal, planktonic.

Description

The male carapace (Fig. 4A) is more elongate than that of female (Fig. 4B) and with more open incisur;. Tha antennule (Fig. 4C) has a sensory seta is with robust stem and many filaments; first segment is bare second and fourth segments are without dorsal marginal spines; the margin is evenly but very weakly arched at middle; the ventral margin is straight; dorsal margin of third joint has 6 bristles; the fifth joint has sensory bristle with 2 long terminal filaments and. has 0+5 sensory bristles The antennal (Fig. 4D) endopod is prehensile and 3-jointed the exopod has 9 joints. The mandible coxale without bristle at basis of endite; a long, slender laterally placed bristle (Fig. 4E). The sixth limb (Fig. 4F) is hatchet shaped, its posteroventral margin with 29 setae with spines. The terminal part of the seventh limb is bulbous.

Remarks

Till now *Parasterope* is a genus with 49 species described so far, which makes it the most diverse representative of the subfamily Cyndroleberidinae, as well as the entire family Cyndroleberididae The cyndroleberid fauna of Pakistan is hardly known. Despite its global distribution no species of *Parasterope* have been reported from Pakistan. The present report of the genus is

the first one from Pakistan.

Order Myodocopida Sars, 1866
Family Cypridinidae Baird, 1850
***Cypridina dentata* (Müller, 1906) (Fig. 5) basionym**
***Pyrocypis dentata* Müller, 1906**

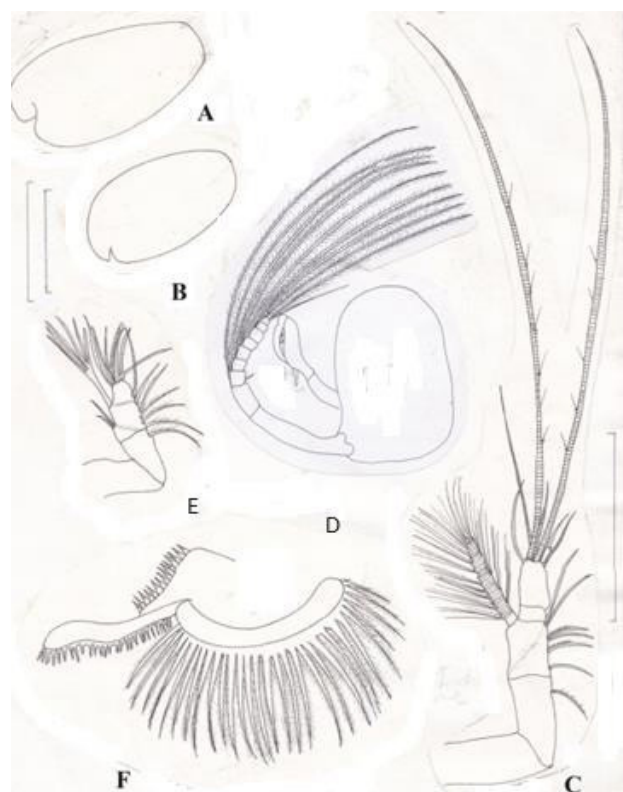


Fig. 4. *Parasterope* sp. A, B, carapaces; C, antennule; D, antenna; E, mandible; F, sixth limb.

Material

Female cl.1mm.; cb.o.7 mm

Description

Dorsal corner of rostrum is angular in lateral view (Fig. 5A), and with concave anterior margin and pointed ventral corner; caudal process is elongate with rounded tip. Outer surface of valves has 3 or 4 slender bristles along anteroventral margin near edge ventral to incisur. The rostral in fold with provided with 3 bristles forming row paralleling anterior edge of rostrum. The 1st segment of antennule (Fig. 5C) is bare. 2nd segment has no spines; 3rd segment is armed with 2 bare bristles. 4th segment is provided with 1 bare bristle. The sensory bristle of 5th segment has 2 short proximal filaments followed by 1 longer slender filament, 5 long stout filaments, 2 short

slender filaments. The 6th segment possesses a short bare medial bristle near dorsal margin. The 7th segment has a bare bristle, slightly longer and stouter than bristle of 6th segment; another bristle about half length of sensory bristle of 5th segment, with 4 short proximal filaments; one bristle about twice length of sensory bristle of 5th segment, with 8 short slender filaments, some with spines. Antennal protopod is with small distal medial bristle with few minute marginal spines (Fig. 5D); the endopod is jointed with 4 bristles. 1st segment of exopod is with few dorsal spines along concave margin; the bristle of 2nd segment reaches to about 6th segment; bristles of 3-8 segments are armed with natatory hairs but no spines; 9th segment with 3 bristles. The mandible (Fig. 5E) coxale endite is well developed, spinous, with 2 stout terminal spines, 1 on each side of small triangular process; small bristle near base of endite; basal: ventral margin with 2 small bristles; dorsal margin with 3 bristles, bare, 2 terminal; medial surface with few spines near dorsal margin; lateral surface with few proximal hairs near ventral margin. Exopod about same length as dorsal margin of 1st endopodial segment, hirsute, with terminal hirsute triangular pad and 2 sub terminal bristles. 1st endopodial segment is provided with 4 ventral bristles. 2nd endopodial segment ventral margin has few proximal spines, 2 single distal bristles, and paired terminal bristles unringed; 4 long spinous bristles, 1 shorter spinous bristle proximal to long bristles, and 1 short bristle medial to 2nd long bristle. 3rd endopodial segment with 3 equi-length claws and 4 bristles (modified from various sources).



Fig. 5. *Cypridina dentata*. A, entire; B, eggs; C, antennule; D, antenna; E, mandible; F, right furca; G, left furca; H, maxilla; I, endites of maxilla; J, fifth limb; K, seventh limb; L, seventh limb.

Instar of a myodocopid (Fig. 6)

Material

Station 132

Description

A bivalved carapace (Fig. 6A) encloses the entire soft body. one dorsodistal bristle on antennule (Fig. 6C). The seventh limb (Fig. 6B) is elongate bears bristles.

Remarks

In this order the life cycle consists of four to seven larval stages, followed by the adult. All stages are free living larval types. Instars (including nauplius): Newly hatched myodocopid ostracods have a similar morphology to that of the adults, except for their smaller size, fewer appendages, and smaller number of bristles. The free-living first larval stage, sometimes called the first instar and considered to be a nauplius, has a bivalved carapace that, when shut, encloses the entire soft body. Most useful characters are the number of bristles on the following limbs: the 4th segment of the 1st antenna, the ventral side of the 2nd segment of the endopod of the mandible, and the 6th limb; and the number and shape of bristles on the 7th limb.

The total number of larval stages in the suborder Myodocopina is four to six: The Rutidermatidae and Sarsiellidae have four larval stages; the Philomedidae has four or five; the Cypridinidae has five or six; and the Cylindroleberididae has four to six. The present larva cannot be attributed to any stage and to which family it belongs. Since in the third stage, the limb develops into the adult form and is usually furnished with many bristles as is in the present stage it is suspected that this is third stage (Atlas of Crustacean Larvae, 2014).

Family Sarsiellidae Brady and Norman, 1896

The family Sarsiellidae is divided into 2 subfamilies and 15 genera. The present genus *Ancohenia* belongs to the subfamily Sarsiellinae Brady and Norman, 1896. The genus *Ancohenia* currently has 3 taxonomic siblings. *Ancohenia hawaiiensis* Kornicker, 1976. *Ancohenia arostrata* (Kornicker, 1958) and *Ancohenia robusta* (Brady, 1890), the latter is found in study area.

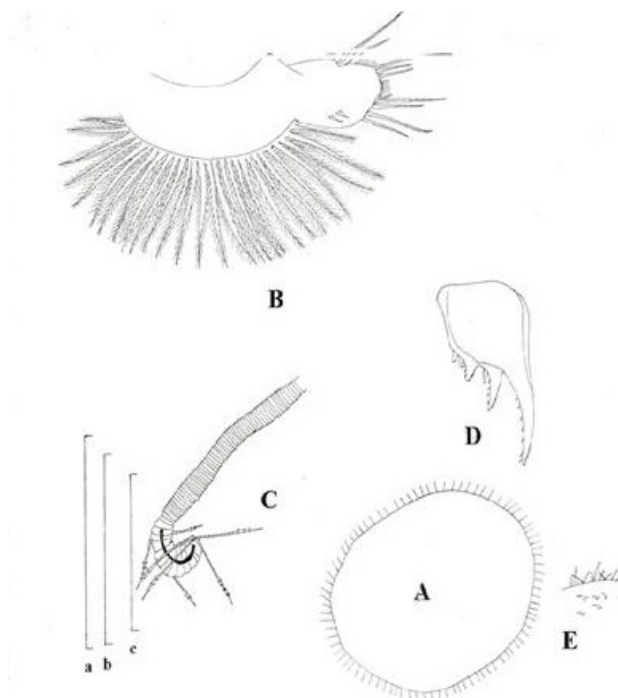


Fig. 6. Instar of a myodocopid. A, carapace; B, epipodal appendage of a limb; C, endopod of antenna, sensory tubule; D, claw; E, surface detail of carapace.

***Ancohenia robusta* (Brady, 1890)**
(Fig. 7)

Material

A large series of both sexes, cl. 1.5 mm colour golden yellow, phytal. Synonymies: *Pleoschisma robusta* Brady, 1890, *Sarstella robusta* Brady, 1897



Fig. 7. *Ancohenia robusta*. Entire.

***Eusarsiella robusta* Poulsen, 1965; Kornicker, 1981, 2002 new combination**

Material

A large series of both sexes.

Description

The carapace is with distinct but shallow sinus (Fig. 7) and truncate posterior; its dorsal margin is arched but fairly linear in posterior half, ventral margin is evenly convex. 1st segment of antennule is without any bristle. 2nd segment is with 1 distal dorsal bristle. 3rd and 4th segment are fused; third segment is short with single dorsal bristle; long 4th segment is with 2 bristles the 5th segment is small. 6th segment is long, with 1 shortmedial bristle. 7th segment has its a-bristle small; b-bristle about same length as a-bristle but with broad proximal part; c-bristle long, with 2 small proximal filaments. The 8th segment: d- and e-bristles are bare, with blunt tips; its d-bristle is shorter and narrower than e-bristle; f-bristle and g-bristle is long, clawlike proximally but bristle-like with rings distally, each bristle with short proximal filament. Antennal protopod bare. Endopod 3-jointed: 1st segment is short, with 2 proximal anterior bristles; 2nd segment is elongate with 2 long proximal bristles; 3rd segment is elongate, with broad rounded tip with transverse ridges and 2 minute bristles. Exopod 1st segment is elongate, remaining joints are short, decreasing in size distally, 9th segment is minute, with 2 bristles, 1 short, 1 fairly long with natatory hairs; 2-8 segments are provided with long natatory bristles, some with small slender ventral spines in addition to hairs. Basale: ventral margin fragmented but with 1 small proximal bristle (Modified from various sources)

Family Rutidermatidae Brady and Norman, 1896

Sparsely represented on much of the Indo-West Pacific.

***Rutiderma* sp.**
(Fig. 8).

Description

Figure 8A shows the surface of carapace is covered by circular dark dots. The incisur is deep and the dorsal margin is rather straight. 1st segment of first antenna is bare; 2nd segment is also bare; 3rd segment is fused with 4th, with 2 bristles (1 ventral, 1 dorsal). The 4th segment is elongate bearing long and short bristles (Fig. 8B).

Subclass Podocopa Mueller, 1894

The Podocopa is the only order that contains both marine and freshwater ostracods. Within Podocopa are two suborders: Metacopina and Podocopina. As will be described below a podocopin species of family Xestoleberididae Sars, 1928 in genus *Xestoleberis* Sars, 1866.

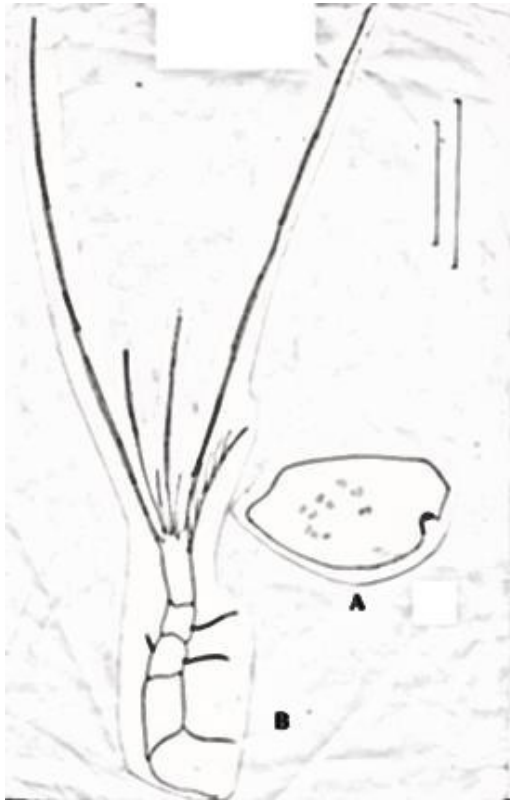


Fig. 8. *Rutiderma* sp. A, carapace; B, Antennule

Family Xestoleberididae Sars, 1928

Xestoleberis sp.

(Fig. 9).

Description

Carapace (Fig. 9A) is ovate, sub-rectangular and elongate. Ventral surface is almost straight. Maximum height is at mid-length. Maximum width is in posterior third. Dorsal margin is convex. Surface is typically smooth, margin is spiny (Fig. 9B). Eye-spot is almost inconspicuous. Antennule (Fig. 9C) consists of four articulated segments, terminal segment of the antenna with two claws; first segment with very long stout three-joined exopod; second segment trapezoidal, 1 hirsute

seta on posterior distal end; third segment shorter than first, 2 hirsute robust setae at basal anterior and posterior corners. Antenna (Fig. 9D) consisting of four segments, first segment having a very long stout two-joined exopod at anterior-distal end. Second segment trapezoidal with 1 hirsute seta on posterior distal end. Third segment not elongated, bearing 1 hirsute seta protruding from posterior edge, and 1 hirsute robust seta at apical posterior corner. Fourth segment the longest with setae on both anterior and posterior edges and 1 reduced seta on distal end and 2 stout setae on distal end. Mandible (Fig. 9E) with four segments, coxa stout. Basis carrying exopod with no setae, second segment of exopod bearing 1 apical seta at posterior distal corner, third segment of exopod with 2 simple setae and 7 setae at distal end. Vibratory plate of the mandible strong, carrying no setae.

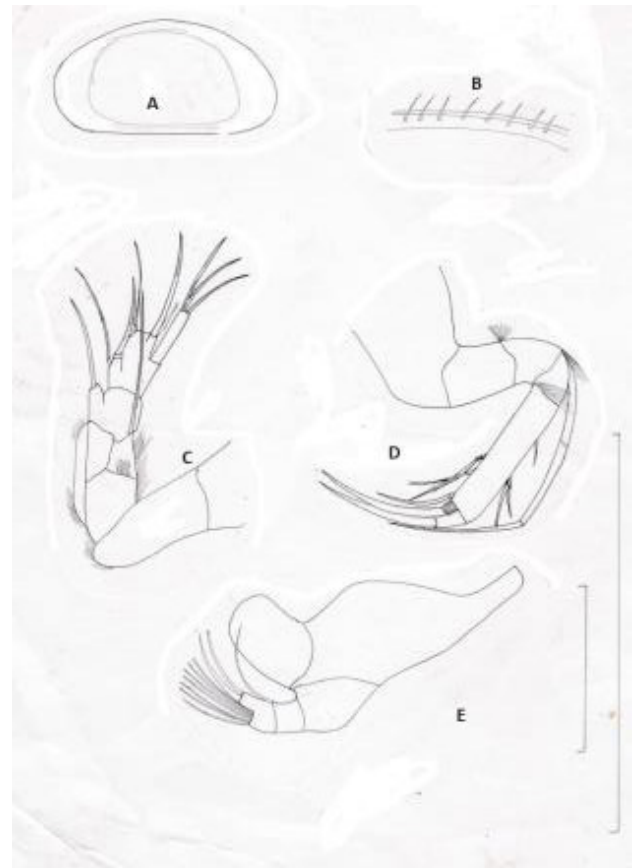


Fig. 9. *Xestoleberis* sp. A, carapace; B, carapace margin antennule; D, antenna; E, mandible.

Remarks

In order to assess the species more material is required. *Xestoleberis* Sars, 1866 is a large genus having nearly 200 species. It is one of the most common intertidal

ostracode genera in and around in certain areas of the world. The species at hand is near *Xestoleberis cornelii* Caraión, 1963 but not exactly so.

Class Branchiopoda Latreille, 1817

Order Ctenopoda G.O. Sars, 1865

Family Sididae Baird, 1850

***Penilia avirostris* Dana, 1849**

(Fig. 10A-D)

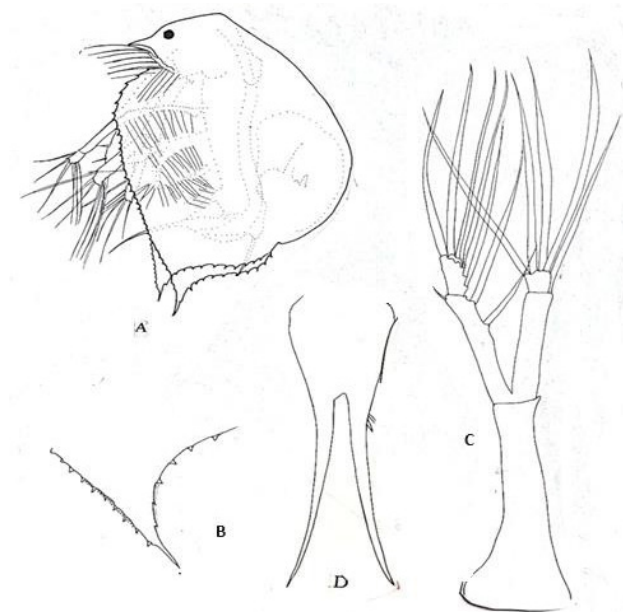


Fig. 10. *Penilia avirostris* 1.5 mm. A, entire lateral view; B, ventral shell rim; C, antenna; D, abdomen.

Synonyms: *Penilia orientalis* Dana, 1852, *Penilia pacifica* Kraemer, 1895, *Penilia schmackeri* Richard, 1895

Material

Station 25 A Female: 0.7-1.4 mm; Male: 0.6-1.3 mm.

Description

Body is transparent. The carapace is bivalve, opening ventrally, egg-shaped in lateral view; brood pouch with a large, marked spine in females (Fig. 10A), in males carapace is narrowing and strongly pointed in lateral view but without marked spine. The ventral edges of the carapace are lined with fine spines (Fig. 10B). The head is distinct, with a pointed rostrum. The abdomen bends sharply, ventrally, at the end of the carapace, and ends in two long spines (Fig. 10D). A small eye and six pairs of similar structure and feathery appendages are present. The antennule is clearly separated from the lower side of head, weakly developed in the female. The antenna (Fig.

10C) is biramous, and is as long as the carapace. Legs are short. 1st pair of legs is not elongated. Males are usually rare. The male is distinguished by its lack of a rostrum; its long antennules, which are nearly as long as the carapace; curved hook-like setae on the first pair of thoracic legs. Last segment of endopod of first pair of legs with small hook (Modified from Egloff *et al.*, 1997).

Remarks

The species is widely distributed in coastal regions throughout the world, but its true native range is still unknown. It was collected on sides of the Atlantic, the Mediterranean and Black Seas, the Indian Ocean, and the western Pacific (Ramner, 1933). It is probably the most abundant and most widely distributed of the Pakistani marine Ostracoda, also in estuaries and back waters.

DECLARATIONS

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Statement of conflict of interest

The authors have declared no conflict of interest.

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