

## RECENT BENTHIC OSTRACODA FROM THE GULF OF MANNAR, OFF TUTICORIN, SOUTHEAST COAST OF INDIA

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### ABSTRACT

A systematic study of South Indian east coast Ostracoda was made, based on 48 bottom sediment samples collected over a year from the inner shelf off Tuticorin, Tamil Nadu. A total of 43 species belonging to 34 genera were identified and described. Of these 43 species, 2 belong to Platycopina while the rest are Podocopina. Seven species are recorded for the first time from the Indian waters. Overall, the fauna shows a close similarity to other ostracod assemblages of the Indo-Pacific region. From the occurrence of a greater number of carapaces than open valves, a relatively faster rate of sedimentation is assumed for the study area.

**Key words :** Recent, Ostracoda, Systematic Palaeontology, Gulf of Mannar, Southeast Coast of India.

### INTRODUCTION

Despite the fact that the Indian Peninsula is bordered by about a 6000km long coastline, the Recent Ostracoda of this region are still inadequately known. The major papers are those of Brady (1886); Scott (1905); James (1973); Honnappa (1975); Jain (1976, 1978, 1981); Misra and Shrivastava (1979); Bhatia and Kumar (1979); Guha (1980); Khosla *et al.* (1982); Honnappa and Abrar (1983); Varma *et al.* (1993); Vaidya and Mannikeri (1994); Shyam Sunder *et al.* (1995); Hussain *et al.* (1996); Hussain and Rajeshwara Rao (1996) and Hussain *et al.* (1997). Casual references to the occurrence of certain species along the west coast of India have been made also by Gramann (1975) and Paik (1977), while some few taxa have been described from Indian waters by Maddocks (1969 a,b) and Benson (1972). Among these authors, Jain (1978) gave a comprehensive account of 56 species of Recent Ostracoda from the beach sands of Mandvi, Kutch, western India. The objective of this paper is to provide a detailed account of some South Indian east coast Ostracoda.

### STUDY AREA AND MATERIAL

The area under investigation is off the coast of Tuticorin (78°10' to 78°25'E : 8°47'N) in the Gulf of Mannar, Tamil Nadu.

The climate and water temperatures are tropical. The region is influenced by the northeast monsoon (September - November) and the southwest monsoon (June-August). The bay depressions, which generally occur during the months of October - December, frequently cross the coast near Tuticorin and during these months, there are heavy downpours. Pearl and chank beds occur in the Gulf of Mannar, roughly in a line parallel with and at a distance of 12 km from the land (Freda Chandrasekaran *et al.*, 1968). These beds are overlain by sediments formed by the consolidation of sand and dead coral *in situ*. In the shallow, surf-beaten area between high and low tides, different varieties of marine algae flourish. It is assumed that these marine algae partly provide food and a substrate for the ostracod fauna.

Sediment samples were collected from the inner shelf of the Gulf of Mannar at 12 stations in a transect off Tuticorin (fig. 1) ranging in depth from less than a metre to about 20m. Samples were collected at intervals of three months, during a period of one year, representing the four seasons. Thus, 48 samples were collected for the present study. The collections were made using a Petersen Grab from a motor launch belonging to the Fisheries Department of Tamil Nadu State. The sampling traverse ran due east, from the shore line in the harbour area. A unit of 25ml wet sediment

sample was taken on each occasion and the ostracod fauna was separated under the stereomicroscope and counted.

### SYSTEMATIC PALAEOLOGY

In the present study, the classification given in the "Treatise on Invertebrate Paleontology, Part Q, Ostracoda" (Moore and Pitrat, 1961) is followed. Specimens of all the species identified and illustrated are deposited in the Department of Geology, University of Madras, under the registration numbers Mudgoh 1 - Mudgoh 43.

*Subclass Ostracoda* Latreille, 1806

*Order Podocopida* Müller, 1894

*Suborder Platycopina* Sars, 1866

*Family Cytherellidae* Sars, 1866

*Genus Cytherelloidea* Alexander, 1929

*Cytherelloidea leroyi* Keij, 1964  
(Pl. I, fig. 1)

*Cytherelloidea leroyi* Keij, 1964, p.421, pl.2, figs.1-4.-Zhao *et al.*, 1985, p.199, pl.19, fig.1.-Whatley and Zhao, 1987, pp.334-335, pl.1, figs.15-18.-Vama *et al.*, 1993, p.554.-Vaidya and Mannikeri, 1994, p.736.-Shyam Sunder *et al.*, 1995, p.473.-Hussain *et al.*, 1996, p.79.

*Material* : 214 carapaces and 71 open valves.

*Dimensions* : Length 0.55 mm, height 0.30 mm.

*Remarks*: A species of *Cytherelloidea*, it is characterized by its numerous ridges and reticulate ornamentation. Zhao *et al.* (1985) consider this species to be an indicator of warm water conditions. In the present area also, it occurs abundantly in the temperature range of 29°C - 33.5°C, salinity 33.7-36.1 ppt. (Hussain *et al.*, 1996).

*Cytherelloidea praecipua* van den Bold, 1963  
(Pl. I, figs. 2-3)

*Cytherelloidea praecipua* van den Bold, 1963, p.75, pl.1, figs.1-7.- Swain, 1969, p.459, pl.1, figs.2a-b (not pl.1, figs. 1a-b).-Swain and Gilby, 1974, pp.277-278, pl.1, figs.5-6.

*Cytherelloidea* sp. cf. *C. praecipua* van den Bold - Khosla, 1978, p.257, pl.1, fig.7.-Khosla *et al.*, 1982, pl.1, fig.2.

*Material* : 28 carapaces and 21 open valves.

*Dimensions* : Length 0.53 mm, height 0.30 mm.

*Remarks* : *C. praecipua* is characterized by the presence of a prominent hinge pattern, and a reticulate ornamentation with the meshes arranged in concentric rows. This species was originally described by van

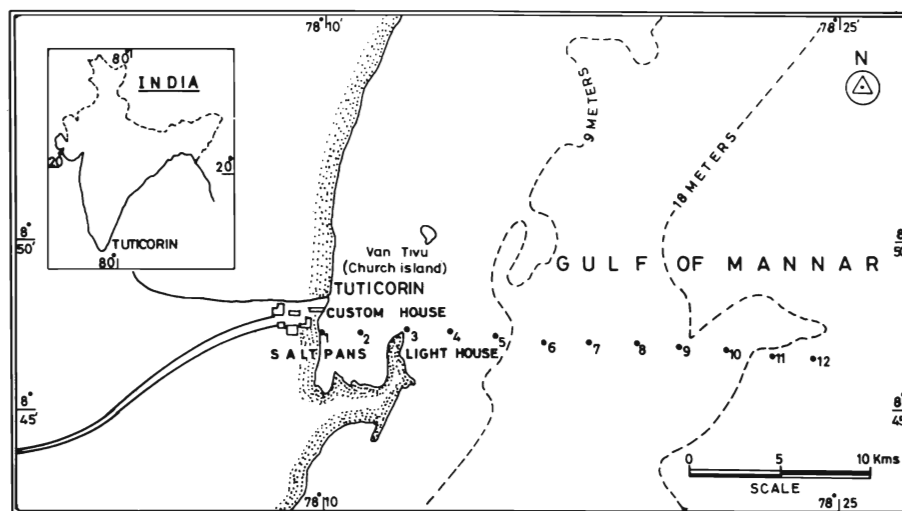


Fig. 1. Location of sampling stations in the Gulf of Mannar, off Tuticorin, Tamil Nadu.

den Bold (1963) from Recent coral sand, Tabago, West Indies. Subsequently, Swain (1969) and Swain and Gilby (1974) reported it from San Juan del Sur, Nicaragua. Malz and Jellinek (1989) and Jellinek (1993) revised *C. praecipua* Bold, 1963 and shifted it to the genus *Keijcyoidea* Malz, 1981. This is the first reported occurrence of the species from the east coast of India.

**Suborder Podocopina** Sars, 1866

**Superfamily Bairdiacea** Sars, 1866

**Family Bairdiidae** Sars, 1888

**Genus Anchistrocheles** Brady and Norman, 1889

*Anchistrocheles* sp. cf. *A. mcquadei*  
Maddocks, 1976  
(Pl. I, figs. 4-5)

*Anchistrocheles* sp. Maddocks, 1974, p.209, pl.3, figs.1-3.

*Anchistrocheles mcquadei* Maddocks, 1976, pp.206 & 208, pl.1, figs.1-6, pl.6, figs. 11-13.

**Material** : Only 3 specimens were encountered, two carapaces and one open valve.

**Dimensions** : Length 0.55mm, height 0.33mm.

**Remarks** : Maddocks (1976) originally described this species from the east and west Flower Garden Banks, northwest Gulf of Mexico. The present species slightly differs from *A. mcquadei* in having strongly arched dorsum and less concave ventral margin.

**Genus Bairdoppilata** Coryell, Sample and Fields, 1935

*Bairdoppilata (Bairdoppilata) alcyonicola*  
Maddocks, 1969  
(Pl. I, fig. 6)

*Bairdoppilata (Bairdoppilata) alcyonicola* Maddocks, 1969b, pp.71-75, figs.36-38.-Bhatia and Kumar, 1979, p.174, pl.3, fig.5.

**Material** : 87 carapaces and 18 open valves.

**Dimensions** : Length 0.95mm, height 0.58mm

**Remarks** : This is the first report of *B.(B.) alcyonicola* from the east coast of India.

**Genus Neonesidea** Maddocks, 1969

*Neonesidea* sp. aff. *N. cracenticlavula*  
Maddocks, 1969  
(Pl. I, fig. 7)

*Neonesidea cracenticlavula* Maddocks, 1969b, pp.26-28, figs.8A-N.-Honnappa and Abrar, 1983, p.588, figs.1-3.

**Material** : 89 carapaces and 17 open valves.

**Dimensions** : Length 0.85mm, height 0.48 mm.

**Remarks** : The present species resembles *N. cracenticlavula* Maddocks in its lateral outline and internal morphology but differs in the absence of fringe and denticulations in the posterior margin of right and left valves, respectively.

**Genus Paranesidea** Maddocks, 1969

*Paranesidea* sp. cf. *P. fracticorallicola*  
Maddocks, 1969  
(Pl. I, fig. 8)

*Paranesidea fracticorallicola* Maddocks, 1969b, p.43, figs.16-18, pl.1, figs.5-6.-Ahmed et al., 1991, p.188, pl.1, figs.10-12.

*Paranesidea* cf. *fracticorallicola* Maddocks - Honnappa and Abrar, 1983, pp.588-589, figs.4-6.

**Dimensions** : Length 0.85mm, height 0.43mm.

**Remarks** : But for the absence of denticles at the posteroventral and anteroventral regions of the valves, the present species is almost similar to *P. fracticorallicola* Maddocks (1969b) described from the Nosy Be', Madagascar.

**Family Macrocyprididae** G.W. Müller, 1912

**Genus Macrocyprina** Triebel, 1960

*Macrocyprina decora* (Brady, 1866)  
(Pl. III, figs. 15-16)

*Cytherideis decora* Brady, 1866, pt.5, p.366, pl.57, figs.13a-c.

*Macrocypris decora* (Brady), Brady, 1880, pt.3, p.44, pl.1, fig.3.-van den Bold, 1958, p.397, pl.1, fig.2.-Khosla, 1978, p.262, pl.2, fig.10.-Wang and Zhao, 1985, p.75, pl.6, fig.6.-Whatley and Zhao, 1987, p.336, pl.1, figs.27-28.

**Material** : 11 carapaces and 13 open valves; 9 adults and 15 juveniles.

**Diagnosis** : The large size, elongate shape, presence of large vestibula at both anterior and posterior ends, conspicuous overlap of right valve over left anterodorsally, posterodorsally and ventrally, and the occurrence of about 10 adductor scars among which the top three are somewhat separated from the rest, are some of the characteristic features of *M. decora* (Brady).

**Dimensions** : Length 1.13 mm, height 0.42 mm.

**Remarks** : *M. decora* has been recorded by many authors from various localities: East China

Sea (Wang and Zhao, 1985), Malacca Straits (Whatley and Zhao, 1987) and from the Lower Miocene beds of Gujarat, India (Khosla, 1978). *M. decora* is being reported for the first time from the Recent sediments of India.

Family **Schizocytheridae** Mandelstam, 1960

Genus ***Neomonoceratina*** Kingma, 1948

*Neomonoceratina iniqua* (Brady, 1868)  
(Pl. I, fig. 11)

*Cytherura iniqua* Brady, 1868, p.64, pl.8, figs.3-6.

*Cythere iniqua* (Brady) Brady, 1886, p.130, pl.39, figs.31-33.

*Neomonoceratina* sp.A Paik, 1977, p.42, pl.2, figs.24-28, pl.8, fig.148.

*Neomonoceratina* sp.cf. *N. delicata* Ishizaki and Kato, Jain, 1978, p.95, figs.2G1-2.-1981, p.108, pl.1, fig.10.-Bhatia and Kumar, 1979, p.173, pl.1, fig.7.

*Neomonoceratina iniqua* (Brady) - Whatley and Zhao, 1987, pp.339-340, pl.2, fig.21.-Zhao and Whatley, 1988, pp.566-567, pl.1, figs.7-12.-Varma *et al.*, 1993, p.554.-Vaidya and Mannikeri, 1994, p.736.- Shyam Sunder *et al.*, 1995, p.473.-Hussain *et al.*, 1996, p.79.

**Material** : 1755 carapaces and 279 open valves; 1124 adult specimens and 910 juveniles.

**Dimensions** : Length 0.58mm, height 0.33mm.

**Remarks** : A species of *Neomonoceratina* characterized by irregular reticulate surface ornamentation consisting of thin muri and polygonal fossae; a short and less distinct posterodorsal rib; a vertical median sulcus; a long median longitudinal rib extending from near the anterior margin to a posteromedial position; a ventrolateral rib terminating posteriorly to form a sharp and simple spine. Brady (1868) reported *Cytherura iniqua* from Batavia, Java. Later, Zhao and Whatley (1988) restudied the original material of Brady (1868) and placed his species under *Neomonoceratina*.

The genus *Neomonoceratina* was erected by Kingma (1948) from the late Neogene of Indonesia. Since then, more than 30 species have been recorded from tropical and subtropical regions of the world (Zhao and Whatley, 1988). They also stated that the western margins of the Pacific are the areas where *Neomonoceratina* is most diverse and abundant based on the fact that as much as two thirds of the species of *Neomonoceratina* have been found to occur there.

*Neomonoceratina* sp.cf. *N. delicata* Ishizaki and Kato (1976) described by Jain (1978, 1981) from Mandvi Beach and southwest Kerala coast, respectively, as well as by Bhatia and Kumar (1979) from the Recent sediments off Karwar seems conspecific with *N. iniqua*.

Whatley and Zhao (1987) found *N. iniqua* to occur rarely in the bottom sediments of the Malacca Straits between 10-100 m depth. They later also noted that it occurs abundantly in Jason Bay, off the southeastern Malay Peninsula, in depths from 0-20 m. (Zhao and Whatley, 1989a).

In the present area of study, *N. iniqua* was found in all samples and ranges in depth from 0 to 20m (Hussain *et al.*, 1996).

The zoogeographic distribution of *N. iniqua* indicates that its occurrence is almost restricted to tropical or subtropical areas including the Arabian Gulf, India, Indonesia, Vietnam, Malaysia, Southeast China, etc.

*Neomonoceratina jaini* Varma, Shyam Sunder and Naidu, 1993  
(Pl. I, fig. 12)

*Paijenborchella* sp. Jain, 1978, p.96, fig.12H.

*Neomonoceratina jaini* Varma, Shyam Sunder and Naidu, 1993, p.555, pl.1, figs.5-8.-Shyam Sunder *et al.*, 1995, p.473.

**Material** : 16 carapaces and 3 open valves.

**Dimensions** : Length 0.43mm, height 0.23mm.

**Remarks** : A species of *Neomonoceratina* characterized by its longitudinal ventral ribs and a subcentral vertical sulcus. The remaining surface is faintly punctate. *Paijenborchella* sp. recorded by Jain (1978) from the Mandvi Beach appears to be conspecific with this species.

*Neomonoceratina porocostata* Howe and McKenzie, 1989  
(Pl. III, fig. 13)

*Neomonoceratina porocostata* Howe and McKenzie, 1989, pp.12 and 14, figs. 60-61.

**Material** : 141 carapaces and 22 open valves.

**Dimensions** : Length 0.42mm, height 0.26mm.

**Remarks** : This species was originally reported by Howe and McKenzie (1989) from the Recent sediments of Darwin and northwestern Australia.

This species resembles *N. macropora* Kingma, 1948 in general outline and in the intercostal area being covered with coarse puncta, but differs in lacking a posteroventral spine which typifies the latter. It more closely resembles *N. mediterranea mediterranea* Ruggieri, 1953a and *N. mediterranea malayensis* Zhao and Whatley, 1989. However, *N. mediterranea* differs from *N. porocostata* in having numerous fine pores. According to Ruggieri (1953a, pp. 4-7), *N. mediterranea* has no appreciable sexual dimorphism, whereas the present species has marked sexual dimorphism. *N. mediterranea malayensis* Zhao and Whatley resembles it in general outline and in the arrangement of ribs but differs in having conspicuous puncta.

Howe and McKenzie (1989) expressed the view that the previous Australian records of *N. mediterranea* Ruggieri by McKenzie and Pickett (1984) are probably synonymous with *N. porocostata*.

To the authors's knowledge, this is the first record of *N. porocostata* from Indian waters.

*Neomonoceratina spinosa* Annapurna and Rama Sarma, 1987  
(Pl. I, fig. 14)

*Cytherura halyi* (Scott), Misra and Shrivastava, 1979, pp.297-298, pl.2, fig.3.

*Neomonoceratina spinosa* Annapurna and Rama Sarma, 1987, pp.179-180, pl.1, fig.E, pl.2, figs.4-5.

*Neomonoceratina spinosa* Zhao and Whatley, 1988, p.572, pl.11, figs.14-15. (not *N. spinosa* Annapurana and Rama Sarma).

**Material** : 154 carapaces and 45 open valves.

**Dimensions** : Length 0.50mm, height 0.28mm, thickness 0.22mm.

**Remarks** : A species of *Neomonoceratina* characterized by blunt spinose projections, *N. spinosa* was originally described by Annapurna and Rama Sarma (1987) from the east coast of India.

Zhao and Whatley (1988) recorded an almost identical form, *N. spinosa* as new species from the West Pacific margin. *N. spinosa* Annapurna and Rama Sarma seems conspecific with Zhao and Whatley's taxon which becomes a junior subjective homonym.

**Genus *Paijenborchellina*** Kuznetsova, 1957

*Paijenborchellina indoarabica* Jain, 1981  
(Pl. III, fig. 5)

*Paijenborchellina* sp. Bate, 1971, pl.1-3, fig.a.

*Paijenborchellina* sp. Jain, 1978, p.128, figs. 5F 1-3.

*Paijenborchellina indoarabica* Jain, 1981, pp.109-110, pl.1, figs. 5-6.-Vaidya and Mannikeri, 1994, p.737.

**Material** : 17 carapaces and 3 open valves.

**Dimensions** : Length 0.64mm, height 0.29mm, thickness, 0.17mm.

**Remarks** : A species of *Paijenborchellina* characterized by the presence of fine ribs and numerous pits on the surface, *P. indoarabica* was originally reported by Jain (1981) from Recent sediments of the southwest Kerala coast. This is the first record from the east coast of India.

*Paijenborchellina* sp. illustrated by Bate (1971) from Abu Dhabi and *Paijenborchellina* sp. reported by Jain (1978) from Mandvi Beach, are clearly conspecific.

*Paijenborchellina* sp. cf. *P. prona*  
(Lubimova and Guha, 1960)  
(Pl. I, fig. 15)

*Paijenborchella prona* Lubimova and Guha - Lubimova, Guha and Mohan, 1960, pp.43-44, pl.IV, figs.1a-b.- Guha, 1968b, p.213, pl.2, fig.4.

*Paijenborchella (Eopaijenborchella) prona* Lubimova and Guha - Khosla, 1978, p.274, pl.5, fig.8.

*Paijenborchellina prona* (Lubimova and Guha) -Khosla and Nagori, 1989, p.49, pl.12, fig.1.

**Material** : 23 carapaces.

**Dimensions** : Length 0.60mm, height 0.33mm.

**Family *Bythocytheridae*** Sars, 1866

**Genus *Bythoceratina*** Hornibrook, 1952

*Bythoceratina mandviensis* Jain, 1978  
(Pl. III, figs. 13-14)

*Bythoceratina mandviensis* Jain, 1978, pp.130-131, figs.5K 1-3.-1981, p.108, pl.2, fig.13.-Whatley and Zhao, 1987, p.341, pl.3, figs.1-2.

**Material** : 16 carapaces and 19 valves ; 24 adults and 11 juveniles.

**Dimensions** : Length 0.48mm, height 0.28mm.

**Remarks :** The diagnostic features of *B. mandviensis* are the presence of two longitudinal and three vertical ridges, and a depression in the subcentral region. The surface bears subrounded punctae. This is the first record of *B. mandviensis* from the east coast of India. Jain (1978, 1981) reported it from Mandvi Beach and the southwestern Kerala coast. Whatley and Zhao (1987) recorded it from Recent sediments of the Malacca Straits, in a fine to coarse sand substrate.

**Family Pectocytheridae Hanai, 1957**

**Genus Keijia Teeter, 1975**

*Keijia demissa* (Brady, 1868)  
(Pl. I, fig. 16)

*Cythere demissa* Brady, 1868, p.180, pl.12, figs.1-2.-1880, p.66, pl.12, fig.17.

*Keijia demissa* (Brady) -Teeter, 1975, pp.436-437, figs.7r-s and 8e.- Whatley and Zhao, 1987, p.353, pl.5, figs.27-28.-Zhao and Whatley, 1989a, p.171.- Witte, 1993, pp.26-28, pl.4, figs.10-12 and synonymy.- Jellinek, 1993, p.121, pl.8, figs.171-172.-Shyam Sunder *et al.*, 1995, pp.473, 476 & 478, pl.1, figs.7-8.

**Material :** 110 carapaces and 39 open valves.

**Dimensions :** Length 0.44mm, height 0.22mm.

**Remarks :** This species is widely distributed in almost all the localities of the Indo-Pacific and in the tropics of the Atlantic and Caribbean / Gulf of Mexico.

**Family Leptocytheridae Hanai, 1957**

**Genus Callistocythere Ruggieri, 1953**

*Callistocythere* sp. cf. *C. flavidofusca intricatoides* (Ruggieri, 1953)  
(Pl. I, fig. 17)

*Leptocythere (Callistocythere) flavidofusca intricatoides* Ruggieri, 1953, p.100, pl.3, fig.23; pl.6, fig.58.

*Leptocythere flavidofusca intricatoides* Ruggieri - Uffenerde, 1972, p.67, pl.7, fig.1 and Synonymy.

*Callistocythere* sp. cf. *C. flavidofusca intricatoides* (Ruggieri) - Paik, 1976, p.35, pl.2, figs. 32-34.-1977, p.40, pl.2, figs. 32-34.-Jain, 1978, p.96, figs. 21 1-2.-Vaidya and Mannikeri, 1994, p.736.

**Material :** 96 carapaces and 30 open valves.

**Dimensions :** Length 0.43mm, height 0.23mm.

**Remarks :** This species closely resembles *C. flavidofusca intricatoides* (Ruggieri, 1953b) as

described by Jain (1978) but slightly differs in having strong ornamentation. It is rather similar to *C. warnei* Howe and McKenzie, 1989 in general appearance but the latter has a more transversely reticulate ornamentation and also possesses a distinct anterodorsal eye tubercle. In the present species, the eye tubercle is indistinct.

**Genus Tanella Kingma, 1948**

*Tanella gracilis* Kingma, 1948  
(Pl. I, fig. 18)

*Tanella gracilis* Kingma, 1948, pp.88-89, pl.X, fig.7.-Morales, 1966, p.64, pl.7, figs.1a-c.- Guha, 1970, p.209.- Jain, 1976, p.128, pl.2, figs.G-I.- 1978, p.97, fig.2J 1-4.- 1981, p.108, pl.1, fig.9.- Hartmann, 1978, p.80, pl.4-13, text figs. 108-113. - Hartmann, 1980, p.126, pl.7, figs.11-18.- Hartman, 1981, p.103, pl.3, figs.7-14.- Keij, 1979, p.61, pl.1, figs.7-8.-Titterton and Whatley, 1988, p.770, tfg.7.- Zhao and Whatley, 1989a, p.170.- Howe and McKenzie, 1989, p.31.- Sreenivas *et al.*, 1991, p.496, pl.1, figs.7-8.-Varma *et al.*, 1993, p.554.- Witte, 1993, pp.31-32, pl.4, figs.13-15.-Jellinek, 1993, p.119, pl.7, figs.145-150.- Vaidya and Mannikeri, 1994, p.736.- Shyam Sunder *et al.*, 1995, p.473.- Hussain *et al.*, 1996, pp.79-80.

*Tanella* cf. *gracilis* Kingma -Bate, 1971, p.246, pls.1-3, fig.11.- Al-Abdul Razzaq, Shublaq and Al-Sheikh, 1982, p.62, fig.7 (figure captions interchanged).-Whatley and Zhao, 1988, p.6, pl.6, figs.5-6.

*Tanella* aff. *gracilis* Kingma - Paik, 1976, p.36, pl.2, figs.35-37, tfg.14.Paik, -1977, p.40, pl.2, figs.35-37, pl.8, fig.150.

*Tanella vasistha* Annapurna and Rama Sarma, 1979a, *Curr. Sci.*, vol.48, no.1, pp.42-43, figs.1-2.

*Tanella indica* Annapurna and Rama Sarma, 1979b, *Indian Jour. Mar. Sci.*, vol.8, no.2, pp.117-118, fig.1.

*Tanella estuarii* Annapuran and Rama Sarma, 1986, *Jour. Bombay Nat. Hist. Soc.*, vol.83, no.3, pp.620-621, pl.1, fig.C, pl.2, fig.D.

*Tanella kingmai* Annapurna and Rama Sarma, 1986, *Jour. Bombay Nat. Hist. Soc.*, vol.83, no.3, p.621, pl.1, fig.D, pl.2, figs.E & F.

**Material :** Off Tuticorin, *T. gracilis* is one of the abundantly occurring species (Hussain *et al.*, 1996). 836 carapaces and 147 open valves were recovered.

**Dimensions :** Length 0.49mm, height 0.23mm, thickness 0.20 mm.

**Remarks :** *Tanella gracilis* is widely distributed in the Indo-West Pacific and is also reported from the west Atlantic (Witte, 1993). Within the Indo-West Pacific, this species is known to exhibit a considerable variation in the intensity of its ornamentation (Hartmann, 1978, 1980; Jain, 1976,

1978; Whatley and Zhao, 1988) which sometimes leads to the description of morphotypes, as new subspecies and species as indicated in the synonymy above.

**Family Cytheromatidae** Elofson, 1939

**Genus Paracytheroma** Juday, 1907

*Paracytheroma ventrosinuosa* Zhao and Whatley, 1989  
(Pl. II, figs. 1-2)

*Paracytheroma ventrosinuosa* Zhao and Whatley, 1989a, p.178, pl.2, figs.12-14.-Vaidya and Mannikeri, 1994, p.736.

**Material** : 124 carapaces and 64 open valves.

**Dimensions** : Length 0.46mm, height 0.20mm.

**Remarks** : A species of *Paracytheroma*, it is characterized by its subreniform shape, rounded anterior margin, bluntly rounded posterior margin, deep oral concavity, very wide inner lamella and smooth surface. To the author's knowledge, this is the first reported occurrence of *P. ventrosinuosa* from the east coast of India.

**Family Cytherideidae** Sars, 1925

**Subfamily Cytherideinae** Sars, 1925

**Genus Miocyprideis** Kollmann, 1960

*Miocyprideis spinulosa* (Brady, 1868)  
(Pl. II, fig.3)

*Cytheridea spinulosa* Brady, 1868, p.132, pl.13, figs. 1-6.-Brady, 1880. p.112. pl.33, figs.6a-d.

*Clithrocytheridea atjehensis* Kingma, 1948, p.70, pl.7, figs.2a,b.

*Clithrocytheridea spinulosa* (Brady), Key, 1954, p.352, pl.1, figs.2a,b.

*Bishopina spinulosa* (Brady).-Howe and McKenzie, 1989, p.16, fig.63.

*Miocyprideis spinulosa* (Brady).-Zhao and Whatley, 1989b, p.235, pl.1, figs. 13-14.-Jellinek, 1993, p.123, pl.9, fig.207.

**Material** : 50 carapaces and 16 open valves.

**Dimensions** : Length 0.72mm, height 0.43mm.

**Remarks** : A species of *Miocyprideis*, it is characterized by its ovate shape, conspicuous anterior and posterior marginal denticulations, numerous radial pore canals, a strong ventral overlap

of the left valve over the right and densely pitted surface ornamentation.

To the author's knowledge, this is the first report of the occurrence of *M. spinulosa* from Indian waters.

**Family Loxoconchidae** Sars, 1925

**Subfamily Loxocochinae** Sars, 1925

**Genus Loxocorniculum** Benson and Coleman, 1963

*Loxocorniculum* sp. cf. *L. lilljeborgi* Brady,  
1868  
(Pl. III, figs. 1-2)

*Loxoconcha lilljeborgi* Brady, 1868, p.183, pl.13, figs.14-15.

*Loxoconcha lilljeborgi* Brady, Keij, 1954, p.358, pl.3, fig.4.-Guha, 1968a, p.61, pl.4, fig.2.-Vaidya and Mannikeri, 1994, p.736.

*Loxoconcha* cf. *lilljeborgi* Brady, Gramann, 1975, p.29, pl.5, figs.6-8.

*Loxoconcha* cf. *lilljeborgi* Brady, Jain, 1981, p.108, pl.3, fig.2.

*Loxoconcha lilljeborgi* Brady, Zhao *et al.*, 1985, p.206, pl.20, fig.12.

*Loxoconcha lilljeborgi* Brady, Whatley and Zhao, 1987, p.351, pl.5, fig.13.

*Loxoconcha lilljeborgi* (Brady), Khosla *et al.*, 1982, pp.361-371, pl.2, fig.21.

**Material** : 1206 carapaces and 234 open valves; 679 adults and 761 juveniles, including both males and females.

**Dimensions** : Length 0.66mm, height 0.25mm.

**Remarks** : This species is nearly identical to *L. lilljeborgi* in general outline and the nature of its ornamentation but slightly shorter in length. It was originally reported from the western Indian Ocean by Brady (1868), and has been recorded subsequently from the Andaman Sea, west coast of India and South China Sea. It is one of the abundantly occurring species in the study area.

**Genus Hemicytheridea** Kingma, 1948

*Hemicytheridea reticulata* Kingma, 1948  
(Pl. I, figs. 9-10)

*Hemicytheridea reticulata* Kingma, 1948, pp.71-72, pl.VII, fig.7.-Sreenivas *et al.*, 1991, pp.492-499, pl.1, figs.11.12.

*Material* : 98 carapaces and 22 open valves.

*Dimensions* : Length 0.53mm, height 0.25mm. (male carapace, Pl.I, fig.9); length 0.45 mm, height 0.30mm. (female carapace, Pl.I, fig.10).

*Remarks* : The elongate subreniform shape and heavily reticulate ornamentation are the characteristic features of *H. reticulata*. This species was originally recorded from Java and Sumatra by Kingma (1948). Subsequently, Bentley (1988) recorded it from Brisbane water, near Sydney. Zhao and Whatley (1989a) identified *H. reticulata* from the Sedili river estuary and Jason Bay, southeastern Malay Peninsula from water depths between 0 and 20 m. From India, Sreenivas *et al.* (1991) recorded this species from Pulicat Lake estuary.

*Family* **Trachyleberididae** Sylvester - Bradley, 1948

*Subfamily* **Buntoniinae** Apostolescu, 1961

*Genus* **Hemikrithe** van den Bold, 1950

*Hemikrithe peterseni* Jain, 1978  
(Pl. II, fig. 4)

*Hemikrithe* sp. Paik, 1976, p.45, pl.3, figs.48-50, tfs.18-19.- Paik, 1977, p.40, pl.3, figs.48-50, pl.8, fig.154.

*Hemikrithe peterseni* Jain, 1978, p.101 and p.104, figs.3B1-2, 6E.- Jain, 1981, p.108, pl.1, fig.16.- Whatley and Zhao, 1988, pp.24-25, pl.10, figs.8-12.- Vaidya and Mannikeri, 1994, p.736.

*Material* : 98 carapaces and 22 open valves.

*Dimensions* : Length 0.48mm, height 0.26mm.

*Remarks* : *H. peterseni* has been reported from Mandvi Beach, Kutch and the southwest Kerala coast (Jain 1978, 1981), the Persian Gulf (Paik, 1976, 1977) and also from Malacca Straits (Whatley and Zhao, 1988).

While presenting new data on Indo-Pacific *Hemikrithe*, Malz (1982) stated that the record of both fossil and Recent *Hemikrithe* in this region is very poor. van den Bold (1950) who erected the genus for a new species *H. orientalis* from off NW Kalimantan, discussed its relationship with respect to some other genera, but its systematic position remains uncertain (van Morkhoven, 1963). On the other hand, Hartmann and Puri (1974, p.34) assigned *Hemikrithe* to Krithidae, and Jain (1978,

p.101), while reporting *H. peterseni*, classified the genus under Krithidae. Recently, Whatley and Zhao (1988) described this genus under the family Trachyleberididae.

*H. javaensis* Malz, 1982 differs from *H. peterseni* in having surface reticulations and a fringing rib around the anterior end. *H. tqiwanensis* Malz, 1982 differs from the present species in its smooth valve surface with faint reticulations towards the outer margins. This is the first reported occurrence of *H. peterseni* from the east coast of India.

*Subfamily* **Trachyleberidinae** Sylvester - Bradley, 1948

*Genus* **Actinocythereis** Puri, 1953

*Actinocythereis scutigera* (Brady, 1868)  
(Pl. II, fig. 5)

*Cythere scutigera* Brady, 1868, p.70, pl.8, figs.15-16, Brady- 1880 p.109, pl.22, fig.5.

*Cythereis scutigera* (Brady).- Kingma, 1948, p.83, pl.9, fig.6.

*Trachyleberis scutigera* (Brady).- Keij, 1954, p.356, pl.3, fig.2.- Guha, 1980, pp.44-45, pl.1, figs.4,21 and 27.

*Trachyleberis (Actinocythereis) scutigera* (Brady).- Gramann, 1975, p.13, pl.5, fig.2.

*Actinocythereis* sp. cf. *A. scutigera* (Brady), Paik, 1976, p.48, pl.3, figs. 50 -52, tfs. 21.- 1977, p.40, pl.8 fig.155.- Jain, 1978, pp.105-106, fig.3E.- Zhao *et al.*, 1985, pl.19, fig.12.- Whatley and Zhao, 1988, p.7, pl.6, fig.14.- Khosla *et al.*, 1982, pp.361-371, pl.2, fig.7.- Vaidya and Mannikeri, 1994, p.736.

*Material* : 5 carapaces, all adults.

*Dimensions* : Length 0.96mm., height 0.50mm.

*Remarks* : *A. scutigera* has been widely recorded from many Indo-Pacific regions such as Indonesia (Kingma, 1948), the Persian Gulf (Paik 1976, 1977), Mandvi Beach (Jain, 1978), Juhu Beach (Guha, 1980) and Malacca Straits (Whatley and Zhao, 1988). This is the first report of this species from the east coast of India.

*Genus* **Carinocythereis** Ruggieri, 1956

*Carinocythereis (Carinocythereis) hamata*  
(Kingma, 1948)  
(Pl. II, figs. 6-7)

*Cythereis hamata* Kingma, 1948, p.80, pl.IX, fig.5.



Non *Cythereis hamata* G.W. Müller, 1894, p.373, pl.29, fig.19, pl.31, figs.14-16.

*Cythereis hamata* Kingma, Key, 1954, p.356, pl.2, figs.7-8.

*Carinocythereis* cf. *hamata* (Kingma), Bate, 1971, p.246, pls. 1,2, fig.y.- Paik, 1976, p.56, pl.3, figs.59-60, tfs. 24-25.- Paik, 1977, p.40, pl.9, fig.158.

*Carinocythereis* (*Carinocythereis*) cf. *hamata* (Kingma), Jain, 1978, p.108, fig.3H.

*Carinocythereis* (*Carinocythereis*) *hamata* (Kingma), Bhatia and Kumar, 1979, p.173, pl.2, fig.5.- Guha, 1980, p.44, pls. 1,2, fig.7.- Jain, 1981, p.108, pl.3, fig.7.- Khosla *et al.*, 1982, pp.361-371, pl.1, fig. 28.- Hussain *et al.*, 1996, p.79.

**Material** : 464 carapaces and 126 open valves.

**Dimensions** : Length 0.53mm, height 0.30mm, thickness 0.29mm.

**Remarks** : This species was first reported from the Pliocene of Sumatra by Kingma (1948). Subsequently, it has been widely recorded from the Indo-Pacific region, viz. Recent sediments of Manila (Keij, 1954); the Persian Gulf (Bate, 1971; Paik, 1976, 1977), the west coast of India at Mandvi Beach (Jain, 1978), off Karwar (Bhatia and Kumar, 1979), from Juhu Beach (Guha, 1980), from southwest Kerala coast (Jain, 1981) and from Malacca Straits (Whatley and Zhao, 1988).

Whatley and Zhao (1988) reported the occurrence of *Stigmatocythere kingmai* in the Malacca Straits. While establishing the genus *Stigmatocythere*, Siddiqui (1971) stated that it can be differentiated from *Carinocythereis* in being highly ornamented and in the presence of a subcentral tubercle. Furthermore, *Stigmatocythere* lacks a v-shaped frontal scar and small vestibules. Whatley and Zhao (1988) noticed the presence of a v-shaped frontal scar and absence of a subcentral tubercle in *S. kingmai*. Their species closely resembles *Carinocythereis hamata* (Kingma) in ornamentation, in the nature of anterior and posterior margins and in the presence of a v-shaped frontal scar. Hence, *Stigmatocythere kingmai* is possibly conspecific with *Carinocythereis hamata*.

*Carinocythereis* (*Tandonella*) *indica* Jain (1978) resembles *C. (C.) hamata* in overall shape but its dorsal and ventral ridges join posteriorly and the surface is reticulate.

## Genus *Chrysocythere* Ruggieri, 1961

### *Chrysocythere keiji* Jain, 1978 (Pl. II, fig. 8)

*Chrysocythere* sp. Paik, 1976, p.61, pl.4, figs.65-67, tfigs. 27-28.- Paik, 1977, p.40, pl.9, fig. 160.- Khosla *et al.*, 1982, pl. 2, fig. 2.

*Chrysocythere keiji* Jain, 1978, pp.113-114, figs. 3L1-2, 6k.-Jain, 1981, p.108, pl.2, fig.2.- Bhatia and Kumar, 1979, p.173, pl.3, figs.6-8.- Varma *et al.*, 1993, p.554.- Vaidya and Mannikeri, 1994, p.736.

*Bradleya ganapatii* Annapurna and Rama Sarma, 1981, *Jour. Geol. Soc. India*, Vol.22, no.1, pp.51-53, fig. 1.

**Material** : 115 carapaces and 22 open valves.

**Dimensions** : Length 0.65mm, height 0.32mm.

**Remarks** : This species is now known from the following other Indian localities : Mandvi Beach (Jain, 1978); southwest Kerala coast (Jain, 1981); and off Karwar (Bhatia and Kumar, 1979). It also occurs in the Persian Gulf (Paik, 1976, 1977).

### Subfamily *Pterygocytherinae* Puri, 1957

## Genus *Keijella* Ruggieri, 1967

### *Keijella karwarensis* (Bhatia and Kumar, 1979) (Pl. II, fig. 9)

*Bosquetina* sp. Bate, 1971, pls.1-2, figs. ee.

*Ruggieria* (*Keijella*) sp. A Paik, 1977, pl.6, figs.96-98, pl.9, fig.166.

*Jainella karwarensis* Bhatia and Kumar, 1979, p.175, pl.2, figs.6-8.- Jain, 1981, p.108, pl.2, fig.11.

*Keijella karwarensis* (Bhatia and Kumar), Whatley and Zhao, 1988, pp.12-13, pl.7, figs.17-18.- Vaidya and Mannikeri, 1994, p.736.

**Material** : 65 carapaces and 17 open valves.

**Dimensions** : Length 0.61mm, height 0.31mm.

**Remarks** : *Keijella karwarensis* in the present collection is characterized by having a smooth surface, broad anterior and posterior vestibulum and the indented nature of the line of concrescence where the marginal pore canals originate.

To the author's knowledge, *K. karwarensis* is now recorded for the first time from the east coast of India. It was previously known from the Persian Gulf, west coast of India and the Malacca Straits.

### *Keijella reticulata* Whatley and Zhao, 1988 (Pl. II, fig. 10)

*Keijella reticulata* Whatley and Zhao, 1988, p.15, pl.7, figs.19-23.- Vaidya and Mannikeri, 1994, p.736.

**Material** : 81 carapaces and 32 open valves; 87 adults and 26 juveniles.

**Dimensions** : Length 1.03mm, height 0.52mm.

**Remarks** : *Keijella reticulata* is characterized by its large size and reticulate ornamentation, with the reticulations dominated by longitudinal muri on the median and ventral areas and somewhat radial muri dorsally. This species resembles *K. papuensis* (Brady, 1980) in its reticulate ornamentation but differs in lacking the posteroventral spine. The present species also differs from *K. whatleyi* Jain (1981) in having reticulations and in the absence of longitudinal ribs.

To the author's knowledge, this is the first report of *K. reticulata* from the east coast of India.

**Genus *Lankacythere*** Bhatia and Kumar, 1979

*Lankacythere coralloides* (Brady, 1886)  
(Pl. II, figs. 11-12)

*Cythere coralloides* Brady, 1886, p.307, pl.39, figs.19-22.

*Cythereis reticulineata* Kingma, 1948, p.82, pl.9, fig.2a-b.

Indet Genus B Bate, 1971, pls.1-3, fig. p.

Indet Genus A Jain, 1978, p.119, figs.5Q1-4.

*Cythere coralloides* Brady.- Misra and Shrivastava, 1979, p.294, pl.1, fig.5.

*Lankacythere coralloides* (Brady).- Bhatia and Kumar, 1979, pp.176-177, pl.1, figs. 1-5.- Jain, 1981, p.108, pl.1, fig. 12.- Whatley and Zhao, 1988, p.17, pl.8, figs.19-22.- Zhao and Whatley, 1989b, pp.241-242, pl.2., figs. 12-15.- Jellinek, 1993, p.127, pl.17, figs.322-323.- Vaidya and Mannikeri, 1994, p.736.

**Material** : 79 carapaces and 36 open valves; 51 adults, 64 juveniles.

**Dimensions** : Length 0.72mm, height 0.31mm.

**Remarks** : This species was originally reported by Brady (1886) from near Ceylon (now Sri Lanka). The synonymy given here shows that its distribution also incorporates the west coast of India, the Malacca Straits and the Persian Gulf.

Zhao and Whatley (1989b), while revising new species described by Kingma (1948), compared the holotype of *Cythereis reticulineata* Kingma with

that of *Cythere coralloides* Brady and found them to be identical. This is the first report of this species from the east coast of India.

**Subfamily Arculacythereinae** Hartmann, 1981

**Genus *Neocytheromorpha*** Guan, 1978

*Neocytheromorpha* sp. cf. *N. indoarabica*  
(Khosla, 1989)  
(Pl. II, fig. 13).

*Arculacythereis indoarabica* Khosla, 1989, pp.329-332, fig. 2.

**Material** : 104 carapaces and 52 open valves.

**Dimensions** : Length 0.65 mm, height 0.32 mm.

**Remarks** : *N. indoarabica* was originally reported by Khosla (1989) from the creek sediments of Miani. A comparison of Tuticorin specimens with his topotype (Khosla, 1989) reveals that they are almost identical but the former has slightly denser and coarser reticules.

Whatley and Zhao (1988, p.23) remarked: "The Arculacythereinae was proposed by Hartmann in 1981 with *Arculacythereis* Hartmann, 1981 as its type genus, which the present author believed to be congeneric with *Neocytheromorpha* Guan, 1978 from the Pliocene of South China. Under ICZN rules 23 and 40 Arculacythereinae should, however, be retained". So, the author describes *Neocytheromorpha* under the subfamily Arculacythereinae. Also, it is learnt that the generic name *Arculacythereis* does not find its name in the new ostracod treatise. This is the first report of *N. indoarabica* from the east coast of India.

**Subfamily Cytherettinae** Triebel, 1972

**Genus *Cytheretta*** Müller, 1894

*Cytheretta* sp. aff. *C. trifurcata* Lubimova and Guha, 1960  
(Pl. II, fig. 17)

*Cytheretta trifurcata* Lubimova and Guha, Lubimova, Guha and Mohan, 1960, pp.45-46, pl.4, fig.3.- Guha, 1968b, pl.1, figs. 14-18.

*Cytherelloidea* sp. indet. Bhatia and Mandwal, 1960, p.283, pl.41, fig. 13.

*Cytherelloidea kathiawarensis* Tewari and Tandon, 1960, p.160, text, fig.5.

*Cytheretta (Flexus) trifurcata* Lubimova and Guha, Khosla, 1978, p.271, pl.3, figs.3-4.

*Dimensions* : Length 0.83mm, height 0.45mm.

*Material* : Only 2 carapaces.

*Genus Neocytheretta* van Morkhoven, 1963

*Neocytheretta murilineata* Zhao and  
Whatley, 1989  
(Pl. II, fig. 18)

*Neocytheretta murilineata* Zhao and Whatley, 1989a, pp.181-182, pl.3, figs.11-15.

*Material* : 285 carapaces and 60 open valves; 213 adults and 132 juveniles.

*Dimensions* : Length 0.64 mm, height 0.32 mm.

*Remarks* : The diagnostic features of this species are : longitudinal muri of reticulate ornamentation, almost smooth and polished posterior end, the occurrence of a blunt spine posteroventrally in both the valves, and the inner lamella being wide at anterior and less so ventrally and posteriorly. *N. ventrocostata* Howe and McKenzie, 1989 is almost identical to the present species in general outline, inner lamella, etc. However, in the former the reticulations are comparatively closer and the dorsal ridge overhangs at the posterodorsal margin.

To the author's knowledge, this is the first report of *N. murilineata* from Indian waters.

*Family Thaerocytheridae* Hazel, 1967

*Genus Quasibradleya* Benson, 1972

*Quasibradleya* sp. cf. *Q. plicocarinata* Benson,  
1972  
(Pl. II, fig. 14).

*Bradleya (Quasibradleya) plicocarinata* Benson, 1972, p.46, figs. 18-19.

*Material* : 99 carapaces, 18 open valves, 109 adults and 8 juveniles.

*Dimensions* : Length 0.73mm, height 0.38mm.

*Remarks* : This species was originally reported by Benson (1972) from the Great Australian Bight.

Hazel (1967) proposed the subfamily Thaerocytherinae under the family Thaerocytheridae

and placed his new genus *Thaerocythere* as well as some other genera such as *Jugosocythere*, *Verrucocythereis*, *Quadracythere*, *Aquitaniella*, *Bradleya*, etc. in that subfamily. While reporting *B.(Q) plicocarinata*, Benson (1972) erected a new subgenus *Quasibradleya* under the subfamily Bradleyinae. On *Quasibradleya*, he (1972, p.43) remarked, "this subgenus, which is comprised predominantly of shelf-dwelling species, is thought to be indigenous to the Australia-New Zealand region". Howe and McKenzie (1989) recorded one new species of *Quasibradleya* and showed that the genus extends at least to northwest Australia. The present occurrence of this species in the study area, further extends the geographical distribution of *Quasibradleya* to the east coast of India.

To the author's knowledge, this is the first report of *Quasibradleya* from Indian waters.

*Family Hemicytheridae* Puri, 1953

*Subfamily Orionininae* Puri, 1973

*Genus Caudites* Coryell and Fields, 1937

*Caudites javana* Kingma, 1948  
(Pl. II, fig. 15)

*Caudites medialis* Coryell and Fields var. *javana* Kingma, 1948, p.85, pl.X, fig.5.

*Caudites javana* Kingma - Keij, 1953, p.159, pl.1, figs. 8a-c and 9.-Kingma, 1954, p.358 pl.2, figs. 12-13.- Guha 1968a, p.64, pl.V, figs. 13 and 19.- Jain, 1978, p.122, figs. 4F1-3.- Khosla *et al.*, 1982, pp. 361-371, pl.1, fig. 18.- Vaidya and Mannikeri, 1994, p.736.

*Caudites* sp. cf. *C. javana* Kingma - Howe and McKenzie, 1989, p.39, fig. 162.

*Material* : 129 carapaces and 17 open valves.

*Dimensions* : Length 0.55mm, height 0.30mm.

*Remarks* : Kingma (1948), while establishing *C. medialis* var. *javana* from a deep boring near Bodjonegoro (East Java), observed the absence of a median ridge and the presence of a well developed central tubercle in his material. Keij (1953) re-examined *C. javana* from the *Snellius* Expedition collections and stated that the lack of a median ridge and the occurrence of a central tubercle are only true for immature specimens. He (1953) also observed that the adults show a clearly visible

median ridge interrupted at the centre by a strong central tubercle. The form illustrated here (Pl.II, fig.15) has both median ridge and a central tubercle.

The other reported occurrences of this species are from the Gulf of Mannar (Scott, 1905), Persian Gulf (Paik, 1976, 1977), the beach sands of Mandvi (Jain, 1978) and northern Australia (Howe and McKenzie, 1989).

*Caudites sublevis* Bonaduce *et al.*, 1980  
(Pl. II, fig. 16)

*Caudites rosaliensis* Swain.- Misra and Shrivastava, 1979, pp.295-296, pl.1, fig.9.

*Caudites sublevis* Bonaduce *et al.*, 1980, p.156, pl. 6, figs.1-5.- Vaidya and Mannikeri, 1994, p.736.

*Caudites* sp. indet. Jain, 1981, p.108, pl.2, fig. 9.

**Material** : 157 carapaces and 44 open valves; 139 adults and 62 juveniles.

**Dimensions** : Length 0.58mm, height 0.31mm.

**Family** *Cytheruridae* G.W. Müller, 1894

**Subfamily** *Cytherurinae* G.W. Müller, 1894

**Genus** *Hemicytherura* Elofson, 1941

*Hemicytherura subulata* Ahmad, Neale and Siddiqui, 1991  
(Pl. III, fig. 3)

*Hemicytherura subulata* Ahmad, Neale and Siddiqui, 1991, pp.250 and 252, pl.28, figs. 2-7 and 9.

**Material** : 22 carapaces and 5 open valves.

**Dimensions** : Length 0.32mm, height 0.22mm.

**Remarks** : A species of *Hemicytherura*, it is characterized by its rather small size, general outline, and by the arrangement and shape of the fossae. *H. subulata* was originally reported by Ahmad *et al.* (1991) from the Lower Miocene of the Lindi area, Tanzania.

*H. videns videns* (Müller, 1894) recorded from the Mediterranean locality resembles the present species in general outline and nature of ornamentation but differs in the size and shape of its posteroventral and central fossae. *H. santosensis* Swain and Gilby (1974) reported from the Pacific is identical to this species but varies in the arrangement of fossae and in the presence of a

median longitudinal ridge. *H. cellulosa* (Norman, 1865) which has been described from N.E. Atlantic region differs from the present species in being smaller and in the curvature of the ventral margin.

To the author's knowledge, this is the first report of *H. subulata* from Indian waters.

**Genus** *Semicytherura* Wagner, 1957

*Semicytherura contraria* Zhao and Whatley, 1989  
(Pl. III, fig. 4)

*Semicytherura contraria* Zhao and Whatley, 1989a, pp. 173-174, pl.1, figs. 10-14.

**Material** : 128 carapaces and 25 open valves; 89 adults and 64 juveniles.

**Dimensions** : Length 0.40mm, height 0.20mm.

**Remarks** : *Semicytherura contraria* is characterized by the presence of numerous longitudinal ribs, prominent intercostal puncta and a small sub-alar process posteroventrally. Also, internally the sexual dimorphism is prominent in this species and is indicated by a wide inner lamella anteriorly and posteriorly in males and a narrow inner lamella posteriorly in females. *S. contraria* was first recorded from the Recent sediments of the southeastern Malay Peninsula by Zhao and Whatley (1989a). In its ornamentation, the present species resembles *S. miurensis* Hanai, 1957 but differs in having a straight dorsal margin and in the occurrence of a small but prominent subalar process. Although this species is close to *S. peypouqueti* Bonaduce *et al.* (1980) recorded from the Red Sea, the latter has a comparatively stronger ala and denser punctae.

To the author's knowledge, this is the first report of the occurrence of *S. contraria* from Indian waters.

**Genus** *Kangarina* Coryell and Fields, 1937

*Kangarina abyssicola* (Müller, 1894)  
(Pl. III, figs. 6-7)

*Cytheropteron abyssicolum* Müller, 1894, p.302, pl.20, figs. 5, 11, pl.21, figs. 6-9.

*Hemicytherura (Kangarina) abyssicola* (Müller).- Ruggieri, 1953b, p.53, figs. 15 and 15a.

*Kangarina abyssicola* (G.W. Müller).- Van Den Bold, 1963b, p.397, pl.10, fig.1.- Guha, 1968a, p.62, pl.4, fig.12.- Bonaduce *et al.*, 1976, p.84, pl.17, fig.16.- Jain, 1978, pp.128-129, figs. 5G1-2.- Malz and Jellinek, 1984, p.150.- Witte, 1993, pp.72-73, pl.9, figs.25-26.

**Material** : 34 carapaces and 4 open valves.

**Dimensions** : Length 0.36mm., height 0.21mm.

**Remarks** : This well known cosmopolitan species has been reported from the Gulf of Naples, Trinidad, the Andaman Islands and Mandvi Beach.

**Family Xestoleberididae** Sars, 1928

**Genus Xestoleberis** Sars, 1866

*Xestoleberis variegata* Brady, 1880

(Pl. III, figs. 8-10)

*Xestoleberis variegata* Brady, 1880, p.129, pl.31, figs. 8a-g.- Guha, 1968a, p.64, pl.4, fig.19.- Kaesler and Waters, 1972, p.17, figs. 6-9.- Khosla, 1978, p.276, pl.5, fig.20.- Wang and Zhao, 1985, p.77, pl.8, fig. 15.- Zhao *et al.*, 1985, p.201, pl.20, fig.16.- Khosla *et al.*, 1982, pp.361-371, pl.2, fig. 29.

*Xestoleberis* cf. *variegata* Brady.- Kingma, 1948, p.99, pl.8, fig.9.

*Xestoleberis* sp. cf. *X. variegata* Brady.- Jain, 1978, p.129, figs. 5 H1-3.

**Material** : 504 carapaces and 133 open valves.

**Dimensions** : Length 0.49mm, height 0.33mm.

**Remarks** : *X. variegata* was originally reported from off Saint Vincent, Cape Verde Islands and off Tonga Tabu by Brady (1880). It has been recorded from various Indo-Pacific localities including : the Gulf of Mannar, Ceylon (Scott, 1905); the Andaman Islands (Guha, 1968a); beach sands of Mandvi (Jain, 1978); the South China Sea, off Guangdong Province (Zhao *et al.*, 1985); and the East China Sea (Wang and Zhao, 1985).

While reporting *X. variegata* from the South China Sea, Zhao *et al.* (1985, p.201) remarked that the species is indicative of warm waters. Off Tuticorin, it is one of the widespread and abundantly occurring forms.

**Genus Ornatoleberis** Keij, 1975

*Ornatoleberis morkhoveni* Keij, 1975

(Pl. III, fig. 11)

*Cythere bimamillata* Brady, 1886, p.309, pl.40, figs. 10-12.

*Ornatoleberis morkhoveni* nom. nov. Keij, 1975, pp.234-236, pl.1, figs.1-7.

*Ornatoleberis morkhoveni* Keij.- Misra and Shrivastava, 1979, pp.300-301, pl.2, figs.1-3.- Whatley and Zhao, 1988, p.26, pl.10, fig.20.

**Material** : Off Tuticorin, this species occurs rarely. Only 11 specimens were encountered, all carapaces.

**Dimensions** : Length 0.39mm, height 0.27mm.

**Remarks** : This species of *Ornatoleberis* is characterized by the presence of a large ear-shaped carina occupying the central and posteroventral regions.

*Ornatoleberis quilonensis* Khosla and Nagori, 1989

(Pl. III, fig. 12)

*Ornatoleberis quilonensis* Khosla and Nagori, 1989, pp.50-51, pl. 12, figs. 5-7.

**Material** : Off Tuticorin, this species occurs rarely. Only 13 specimens were encountered, all carapaces.

**Dimensions** : Length 0.50mm, height 0.29mm.

**Remarks** : A species of *Ornatoleberis* characterized by the occurrence of 3-4 feeble ribs in the ventral region and numerous pits scattered over the entire surface. The present species differs from *O. fortii* described by Bonaduce *et al.* (1980) from the Gulf of Aqaba (Red Sea) in the absence of any tubercle in the posteroventral area.

**Superfamily Cypridacea** Baird, 1845

**Family Pontocyprididae** Müller, 1894

**Genus Propontocypris** Sylvester-Bradley, 1947

*Propontocypris (Propontocypris) crocata*

Maddocks, 1969

(Pl. III, fig. 17)

*Propontocypris* sp. Maddocks, 1968, fig. 2.

*Propontocypris (Propontocypris) crocata* Maddocks, 1969a, pp.11-15, figs. 9,10, 11B, D-F, I-M.

**Material** : 26 carapaces and 7 open valves; 13 adults and 20 juveniles.

**Dimensions** : Length 0.84mm, height 0.47mm, thickness 0.23 mm.

*Remarks* : *Propontocypris* (*P.*) *crocata* was first described from Nosy Bé, Madagascar by Maddocks (1969a). *Propontocypris* (*P.*) sp. described by Jain (1978) is identical in outline to the present species but is smaller. *Propontocypris* (*P.*) *herdmanni* (Scott, 1905) somewhat resembles *P. crocata* but differs in being larger, in having a more angular shape and in the occurrence of a posteroventral spine.

To the author's knowledge, this is the first report of the occurrence of *P. (P.) crocata* from Indian waters.

*Propontocypris* (*Schedopontocypris*)  
*bengalensis* Maddocks, 1969  
(Pl. III, fig. 18)

*Propontocypris* (*Schedopontocypris*) *bengalensis* Maddocks, 1969a, pp.37-38, figs. 31A, C and F.

*Schedopontocypris* sp. A Jain 1981, p.108, pl.1, fig. 13.

*Propontocypris* (*S.*) *bengalensis* Maddocks, Sreenivas *et al.*, 1991, pp.492-499, pl.1, fig.5. - Vaidya and Mannikeri, 1994, p. 737. - Shyam Sunder *et al.*, 1995, p.473.

*Material* : 15 carapaces and 3 open valves ; 13 adults and 5 juveniles.

*Dimensions* : Length of 0.58mm, height 0.28 mm.

*Remarks* : This species appears endemic to the east and west coasts of India.

*Family* **Paracyprididae** Sars, 1923

*Genus* **Phlyctenophora** Brady, 1880

*Phlyctenophora zealandica* Brady, 1880  
(Pl. III, fig. 19)

*Phlyctenophora zealandica* Brady, 1880, p.33, pl.3, figs. 1a-m.

*Paracypris zealandica* Fyan, 1916, p.1175, fig.17.- Kingma, 1948, p.67, pl.6, figs.18a - c.- Keij, 1954, p.352, pl.1, fig.6.- Guha, 1968b, p.211, pl.1, fig.8.

*Phlyctenophora zealandica* Brady.- Jain, 1978, p.133, figs. 5 S1-2.- 1981, p.108, pl.1, fig.17.- Guha, 1980, p.43, pl.1, figs. 17 & 24.- Khosla *et al.*, 1982, pp.361-371, pl.1, fig.10.

*Material* : 63 carapaces, 36 open valves; 37 adults and 62 juveniles.

*Dimensions* : Length 0.89mm, height 0.45mm.

#### SUMMARY

48 sediment samples were collected from the Gulf of Mannar, off Tuticorin. From these, a total

of 43 species belonging to 34 genera were identified. Among these taxa, *Carinocythereis* (*C.*) *hamata*, *Cytherelloidea leroyi*, *Loxocorniculum lilljeborgi*, *Neocytheretta murilineata*, *Neomonoceratina iniqua*, *Tanella gracilis* and *Xestoleberis variegata* were abundant and widespread. Off Tuticorin, the following species are recorded for the first time from Indian waters: *Hemicytherura subulata*, *Miocyprideis spinulosa*, *Neocytheretta murilineata*, *Neomonoceratina porocostata*, *Propontocypris* (*P.*) *crocata*, *Quasibradleya* sp. cf. *plicocarinata* and *Semicytherura contraria*. The following 11 species are recorded for the first time from east coast of India : *Actinocythereis scutigera*, *Bairdoppilata* (*Bairdoppilata*) *alcyonicola*, *Bythoceratina mandviensis*, *Cytherelloidea praecipua*, *Hemikrithe peterseni*, *Keijella karwarensis*, *K. reticulata*, *Lankacythere coralloides*, *Neocytheromorpha indoarabica*, *Paijenborchellina indoarabica* and *Paracytheroma ventrosinuosa*. From the zoogeographical distribution of the present fauna, it is observed that it has close affinity to other ostracod assemblages of the Indo-Pacific region.

A total of 9,625 specimens (carapaces, open valves, adults and juveniles, all put together) of Ostracoda were recovered. These represent 91.4% Cytheracea, 3.6% Cytherellidae, 3.0% Bairdiacea and 2% to Cypridacea. Carapaces are much more common than that of open valves (81.5% and 18.5%, respectively). This is considered to indicate a relatively rapid rate of sedimentation.

#### ACKNOWLEDGEMENTS

The author is deeply indebted to his supervisor, the late Prof.V. Ragothaman and this work is dedicated to him for his encouragement and interest. Prof. S.C. Khosla, M.L. Sukhadia University, Udaipur, India and Prof. K.G. McKenzie, Charles Sturt University, Riverina, Wagga Wagga, NSW 2650, Australia are thanked for critically reading the manuscript. The author thanks the authorities of Tamil Nadu State Fisheries Department for providing motor launch and field equipment for the collection of samples. The author is indebted to Dr.V. Manivannan, Govt. Arts College,

Salem for his help in various capacities. The author expresses his sincere thanks to Dr. D. K. Guha (Former DGM) and Dr. C. N. Ravindran, Supt. Geologist, ONGC for the SEM photographs. Thanks are due to Dr. K. C. Rajasekaran, Former Head and Prof. S.P.Mohan, Head, Department of Geology, University of Madras, for the facilities and kind encouragement during the tenure of the work. The author is grateful to Prof. Robin C. Whatley, University of Wales, Aberystwyth, U.K., for his valuable comments and suggestions in improving the taxonomy. The author is also thankful to CSIR, New Delhi for financial assistance.

## REFERENCES

- Ahmad, M., Neale, J.W. and Siddiqui, Q.A. 1991. Tertiary Ostracoda from the Lindi area, Tanzania. *Bull. Br. Mus. Nat. Hist. (Geol.)* **46** (2) : 175-270.
- Al. Abdul Razzaq, S., Shublaq, W. and Al.Sheikh, Z. 1982. Ostracode distribution and ecology of the Sulaibikhat Bay, Kuwait. *Mar.Geol.* **47**: 57-75.
- Annapurna, C. and Rama Sarma, D.V. 1987. Taxonomic studies on the marine ostracoda from the east coast of India. *Jour. Bombay Nat. Hist. Soc.* **84** (1) : 177-180.
- Bate, R.H. 1971. The distribution of Recent Ostracoda in the Abu Dhabi Lagoon, Persian Gulf, p. 239-25. In : *Paleoecologic des ostracodes* (Ed. Oerli, H.J.), *colloque Pau* (1970). *Rech. Pau-SNPA*, **5** Suppl.
- Benson, R.H. 1972. The *Bradleya* problem with descriptions of two new psychrospheric ostracode genera *Agrenocythere* and *Poscidonamicus* (Ostracoda : Crustacea). *Smith. Contr. Palaeobiology*, Washington D.C. (**12**) : 1-138, pls, 1-14, figs. 1-66.
- Bentley, C. 1988. Podocopid Ostracoda of Brisbane water, near Sydney, South-eastern Australia, p. 439-448. In : *Evolutionary biology of Ostracoda, its fundamentals and applications* (Eds. Hanai, T., Ikeya, N. and Ishizaki, K.), *Development in Paleontology and Stratigraphy*, Elsevier, Kodansha, Tokyo.
- Bhatia, S.B. and Kumar, S. 1979. Recent Ostracoda from off Karwar, West Coast of India, p. 173-178. In : *Taxonomy, biostratigraphy and distribution of ostracodes* (Edited by Serbian Geological Society), Belgrade.
- Bold, W.A. van den, 1950. *Hemikriithe*, a new genus of Ostracoda from the Indo-pacific. *Ann. Mag. Nat. Hist.* **3** : 900-904.
- Bold, W.A. van den, 1963. Anomalous hinge structure in a new species of *Cytherelloidea*. *Micropal.* **9** (1) : 75-78.
- Bonaduce, G., Ciampo, G. and Masoli, M. 1976. Distribution of Ostracoda in the Adriatic Sea. *Publ. Staz. Zool. Napoli.* **40** : 1-304.
- Bonaduce, G., Masoli, M., Minichelli, G. and Pugliese, N. 1980. Some new benthic marine Ostracod species from the Gulf of Aqaba (Red Sea). *Boll. Soc. Paleont. Italiana, Modena.* **19** (1) : 143-178.
- Brady, G.S. 1868. A monograph of the Recent British Ostracoda. *Trans. Linn. Soc.* **26** (2) : 353-495.
- Brady, G.S. 1880. Report on the Ostracoda dredged by H.M.S. *Challenger* during the years 1873-76, Report voyage Zoology, **1** (3) : 1-184.
- Brady, G.S. 1886. Notes on Entomostraca collected by Mr. A. Haly in Ceylon. *Jour. Linn. Soc. London.* **19** : 293-317.
- Freda Chandrasekaran, Issac Rajendran and Malu Pillai, 1968. Salinity and temperature variations over pearl and chank beds of Tuticorin. *Madras Jour. of Fisher.* **4** : 21-27.
- Gramann, F. 1975. Ostracoda from Tertiary sediments of Burma with reference to living species. *Geologis. Jahrb. B.* **14** : 1-46.
- Guha, D.K. 1968a. On the Ostracoda from Neogene of Andaman Islands. *Jour. Geol. Soc. India*, **9** (1) : 58-66.
- Guha, D.K. 1968b. Young Cenozoic marine Ostracoda from subcroppings of South India. *Geol. Soc. India. Mem.* **2** : 208-217.
- Guha, D.K. 1980. On some Recent Ostracoda from the west coast of India. *Geosci. Jour.* **1** (2) : 41-50.
- Hanai, T. 1957. Studies on the Ostracoda from Japan. I Subfamily : Leptocytherinae n. subfamily. *Jour. Fac. Sci. Univ. Tokyo, Sec. II*, **10** (3) : 431-468.
- Hartmann, G. 1978. Die Ostracoden der Ordnung Podocopida G.W. Müller, 1894 der tropisch - subtropischen Westküste Australiens (Zwischen Derby im Norden und Perth im Süden). *Mitt. Hamburg Zool. Mus. Inst.* **75** : 63-219.
- Hartmann, G. 1980. Die Ostracoden der Ordnung Podocopida G.W. Müller, 1894 der warm temperierten und subtropisch tropischen Küstenabschnitte der Süd - und Südostküste Australiens (Zwischen Ceduna in Western und Lakes Entrance in Osten). *Mitt. Hamburg Zool. Mus. Inst.*, **77** : 111-204.
- Hartmann, G. and Puri, H.S. 1974. Summary of neontological and paleontological classification of Ostracoda. *Mitt. Hamb. Zool. Mus. Inst.*, **70** : 7-73.
- Hazel, J.E. 1967. Classification and distribution of the Recent Hemicytheridae and Trachyleberididae (Ostracoda) off Northeastern North America. *U.S. Geol. Surv. Prof. Paper* **564**: 49p. pls. 1-11.
- Honnappa, 1975. Taxonomy, morphology, ecology and statistical interpretation on *Actinocythereis tumefacientis* (Lubimova and Guha), Ostracoda from the Recent sediments of Mangalore Harbour area, West Coast of India. *Revista Esp. de Micropal.* **7** (3) : 417-449.
- Honnappa, and Syed Abrar, 1983. Bairdiidae (Ostracoda) from the Recent coastal sediments of Bhatkal area (Karnataka State), West Coast of India. *Curr. Sci.* **52** (12) : 588-591.
- Hornibrook, N. De B. 1952. Tertiary and Recent Marine Ostracoda of New Zealand. Their origin, affinities and distribution. *New Zealand Geol. Surv. Paleont. Bull.* **18** : 1-82.
- Howe, H.V. and McKenzie, K.G. 1989. Recent Marine Ostracoda (Crustacea) from Darwin and Northwestern

- Australia. *Monograph Ser. No.3. Northern Territory Museum of Arts and Sciences*, Australia. 50p.
- Hussain, Sk. Md., Ragothaman, V. and Manivannan, V.** 1996. Distribution of ostracoda in waters off Tuticorin, Southeast coast of India. *Ind. Jour. Mar.Sci.* **25** : 78-80.
- Hussain, Sk. Md. and Rajeshwara Rao, N.** 1996. Faunal affinity, zoogeographic distribution and review of Recent ostracoda from east and west coasts of India. *Bull. Pure & App. Sci.*, **15** (1) : 37-50.
- Hussain, Sk. Md., Manivannan, V. and Ragothaman, V.** 1997. Sediment - Ostracode relationship in the Gulf of Mannar, off Tuticorin, East Coast of India. *Jour. Nepal Geol. Soc.* **15** : 33-37.
- Ishizaki, K. and Kato, M.** 1976. The basin development of the Diluvium Furuya Mud Basin, Schizuoka Prefecture, Japan, based on faunal analysis of fossil Ostracodes, p. 118-143. In : *Progress in Micropaleontology*, *Micropaleontology Press*, New York.
- Jain, S.P.** 1976. Holocene Ostracoda from the Chilka Lake, Orissa. *Proc. VI Indian Colloq. Micropal. and Strat.*:126-134.
- Jain, S.P.** 1978. Recent Ostracoda from Mandvi Beach, West Coast of India. *Bull. Ind. Geol. Assoc.* **11** (2) : 89-139.
- Jain, S.P.** 1981. Recent Ostracoda from Southwest Kerala Coast, India. *Bull. Ind. Geol. Assoc.* **14** (2) : 107-120.
- James, C.M.** 1973. New distributional records of species of the subfamily Asteropinae (Ostracoda) from Indian Seas. *Jour. Mar. Biol. Assoc. India*, **15**: 604-615.
- Jellinek, T.** 1993. Zur Okologie und systematik rezenter ostracoden aus dem Bereich des Kenianischen Barriere - Riffs. *Senckenbergiana lethaca*, **73** (1): 83-225, pls.1-29.
- Keij, A.J.** 1953. Preliminary note on the Recent Ostracoda of the *Snellius* expedition. *Proc. Koninkl. Nederl. Akad. Van Westensch. Ser.B*, **56** (2): 155-168.
- Keij, A.J.** 1954. Some Recent Ostracoda of Manila (Philippines) *Proc. Koninkl. Nederl. Akad. Westensch. Ser.B*, **57** (3) : 351-363.
- Keij, A.J.** 1964. Neogene to Recent species of *Cytherelloidea* (Ostracoda) from Northwestern Borneo. *Micropal.* **10** (4): 415-430.
- Keij, A.J.** 1979. Review of the Indo-west Pacific Neogene to Holocene Ostracode genus *Atjehella*. *Proc. Koninkl. Nederl. Akad. Westensch. Ser.B*, **82** (4) : 449-464.
- Khosla, S.C.** 1978. Lower Miocene Ostracoda from Jamnagar and Porbandar districts, Gujarat, India. *Micropal.* **24** (3) : 251-290.
- Khosla, S.C.** 1989. *Arculacythereis indoarabica*, a new species of Ostracoda from the Miani creek, Saurashtra coast. *Jour. Geol. Soc. India*, **34** (3) : 329-332.
- Khosla, S.C. and Nagori, M.L.** 1989. Ostracoda from the Quilon beds (Lower Miocene) of Kerala. *Mem. 14, Geol. Soc. India*, 57p.
- Khosla, S.C., Mathur, A.K. and Pant, P.C.** 1982. Ecology and distribution of Recent ostracodes in the Miani lagoon, Saurashtra Coast, p. 361-371. In: *First Nat. Semi. Quater. Environ., Recent researches in Geology (ed. Mehr), Hindustan Publ. Corp., Delhi.*
- Kingma, J.T.** 1948. Contributions to the knowledge of the young Cenozoic Ostracoda from the Malayan region. *Kemink en. Zoon, N.V. - Utrecht*, 118p.
- Lubimova, P.S., Guha, D.K. and Mohan, M.** 1960. On Ostracoda of Jurassic and Tertiary deposits from Kutch and Rajasthan (Jaisalmer), India. *Bull. Geol. Min. Met. Soc. India*, **2** : 1-60.
- Maddocks, R.F.** 1969a. Recent Ostracodes of the family Pontocyprididae chiefly from the Indian Ocean. *Smithsonian Contr. Zoology*, **7** : 1-56.
- Maddocks, R.F.** 1969b. Revision of Recent Bairdiidae (Ostracods). *Bull. U.S. Nat. Mus.*, **295** : 1-26.
- Maddocks, R.F.** 1976. Pusselinae, are interstitial Bairdiidae (Ostracoda). *Micropal.* **2** (2) : 194-214.
- Malz, H.** 1982. New data on Indo-Pacific *Hemikrithe*, p.219-230. In : *Fossil and Recent Ostracods* (ed. Bate, R.H., Robinson, E., and Sheppard, L.M.), *Ellis Horwood Ltd.*
- Malz, H. and Jellinek, T.** 1984. Marine Plio/Pleistozan - Ostracoden von SE Lakonien (Peloponnes, Griechenland). *Senckenbergiana Biol.* **65** : 113-167.
- Malz, H. and Jellinek, T.** 1989. Cytherellide ostracoden aus dem E-afrikanischen Kustengebiet. Modell-Vorstellungen Zur Differenzierung und phylogenetischen Entwicklung. *Cour. Forsch.-Inst. Senckenberg*, **113**: 187-233.
- Misra, R.S. and Shrivastava, P.C.** 1979. Recent foraminifera and Ostracoda of Tuticorin, Gulf of Mannar. *Geol. Surv. India, Misc. Publ.* **45** : 289-309.
- Moore, R.C. and Pitrat, C.W.** (Eds.) 1961. *Treatise on Invertebrate Paleontology*, Pt. Q, Arthropoda 3, (Crustacea, Ostracoda), 442 p., 334 figs. *Geol. Soc. Amer. and University of Kansas Press.*
- Paik, K.H.** 1976. Rezent Ostracoden aus oberflachensedimenten des perischen Golfs und des Golfs von Oman. *Diss. Univ. Kiel.* (Unpublished)
- Paik, K.H.** 1977. Regionale Untersuchungen zur Verteilung der Ostracoden im persischen Golf und im Golf von Oman. *Meteor. Forschungsergeb. Reihe C*, **28** : 37-76.
- Ruggieri, G.** 1953a. Ostracodi del genere *Paijenborchella* Viveni nel Mediterraneo. *Atti della societa Italiana di Scienze naturalie del Museo civico di Storia. Naturale di Milano*, **92** : 1-7.
- Ruggieri, G.** 1953b. Eta faunadi un terrazzo marino sulla coasta ionica della calabria. *G. Gol. Bologna*, **23(2A)** : 17-168.
- Scott, A.** 1905. Report on the Ostracoda. Report to the Government of Ceylon on the pearl oyster Fisheries of the Gulf of Mannar (by W.A.Herdman). Supplementary report upon the marine biology of Ceylon, **22** : 365-384.
- Shyam Sunder, V.V., Varma, K.U. and Naidu, T.Y.** 1995. Recent ostracoda of the Goguleru creek, east coast of India. *Jour. Geol. Soc. India*, **45** (4): 471-481.






- Siddiqui, Q.A.** 1971. Early Tertiary Ostracoda of the family Trachyleberididae from west Pakistan. *Bull. Br. Mus. Nat. Hist. (Geol) Suppl.* **9** : 1-98.
- Sreenivas, K., Raju, B.N., Honnappa and Reddi, K.R.** 1991. Ostracoda in the estuarine sediments, Pulicat Lake estuary, east coast of India. *Jour. Geol. Soc. India*, **37** (5) : 492-499.
- Swain, F.M. and Gilby, J.M.** 1974. Marine Holocene Ostracoda from the Pacific coast of North and Central America. *Micropal.* **20** (3) : 257-352, pls.1-7.
- Teeter, J.W.** 1975. Distribution of Holocene marine Ostracoda from Belize, p. 400-499. In: *Belize Shelf Carbonate sediments, Clastic sediments and Ecology* (Eds. Wantland, K.F. and Pusey, W.C.). *Amer. Assoc. Petrol. Geol. Studies Geol.* **2**.
- Titterton, R. and Whatley, R.C.** 1988. The provincial distribution of shallow water Indo-Pacific marine Ostracoda : Origin, antiquity, dispersal routes and mechanisms, p. 759-786. In : *Evolutionary Biology of Ostracoda, its fundamentals and applications*(Eds. Hanai, T., Ikeya, N. and Ishizaki, K. ). *Elsevier Science Publishers B.V.*, Amsterdam.
- Vaidya, A.S. and Mannikeri, M.S.** 1994. Faunal affinity and zoogeography of Recent marine ostracoda from Karwar, west coast of India. *Curr. Sci.*, **67** (9,10 & 25) : 735-738.
- Van Morkhoven, F.P.C.M.** 1963. *Post-Palaeozoic Ostracoda*. Elsevier Publishing Company, Amsterdam.
- Varma, K.U., Shyam Sunder, V.V. and Naidu, T.Y.** 1993. Recent Ostracoda of the Tekkali creek, East coast of India. *Jour. Geol. Soc. India*, **41** (6) : 551-560, pls. 1-2.
- Whatley, R. and Zhao, Q.** 1987. Recent Ostracoda of the Malacca Straits. Part I. *Rev. Esp. de Micropal.* **19** (3): 327-366.
- Whatley, R. and Zhao, Q.** 1988. Recent Ostracoda of the Malacca Straits. Part II. *Rev. Esp. de Micropal.* **20** (1): 5-37.
- Witte, L.J.** 1993. Taxonomy and origin of modern west African shallow marine Ostracoda. Reprinted from *Verhandelingen Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Natuurkunde, Eerste Reeks deel*, **39**: 13-105, pls. 1-11.
- Zhao, Q., Wang, P. and Zhang, Q.** 1985. Ostracoda in bottom sediments of the South China sea, off Guangdong province, China : Their taxonomy and distribution, p. 196-217. In: *Marine micropalaeontology of China*.(Ed. Wang, P.).
- Zhao, Q. and Whatley, R.** 1988. The genus *Neomonoceratina* (Crustacea : Ostracoda) from the Caenozoic of the West Pacific margins. *Acta Oceanol. Sin.* **7** (4) : 562-577.
- Zhao, Q. and Whatley, R.** 1989a. Recent podocopid Ostracoda of the Sedili River and Jason Bay, Southeastern Malay Peninsula. *Micropal.* **35** (2) : 168-187.
- Zhao, Q. and Whatley, R.** 1989b. A taxonomic revision of the new species of Ostracoda described by J.T. Kingma (1948) from the late Cainozoic of Indonesia. *Acta Micropal. Sin.*, **6** (3) : 229-246.

Manuscript Accepted June 1998

## EXPLANATION OF PLATE

### Plate I

(White bar scale equals 100  $\mu$ m)

1. *Cytherelloidea leroyi* Keij, 1964  
 left valve, external view.
- 2-3. *Cytherelloidea praecipua* (van den Bold, 1963)  
 2, Right valve, external view; 3, Left valve, internal view.
- 4-5. *Anchistrocheles* sp. cf. *A. mcquadei* Maddocks, 1976  
 4, Left valve, external view; 5, Right valve, internal view.
6. *Bairdoppilata (Bairdoppilata) alcyonicola* Maddocks, 1969, juvenile right valve, external view.
7. *Neonesidea* sp. aff. *N. cracenticlavula* Maddocks, 1969  
 Right valve, external view.
8. *Paranesidea* sp. cf. *P. fracticorallicola* Maddocks, 1969  
 Right valve, external view.
- 9-10. *Hemicytheridea reticulata* Kingma, 1948  
 9,  Right valve, external; 10,  Left valve, external views.

11. *Neomonoceratina iniqua* (Brady, 1868)  
♂ Left valve, external view.
12. *Neomonoceratina jaini* Varma, Syam Sunder and Naidu, 1993, Right valve, external view.
13. *Neomonoceratina porocostata* Howe and Mckenzie, 1989 Left valve, external view.
14. *Neomonoceratina spinosa* Annapurna and Rama Sarma, 1987 Right valve, external view.
15. *Paijenborchellina* sp. cf. *P. prona* (Lubimova and Guha, 1960) Right valve, external view.
16. *Keijia demissa* (Brady, 1868)  
Right valve, external view.
17. *Callistocythere* sp. cf. *C. flavidofusca intricatoides* (Ruggieri, 1953) Left valve, external view.
18. *Tanella gracilis* Kingma, 1948  
Left valve, external view.

### Plate II

(White bar scale equals 100 µm)

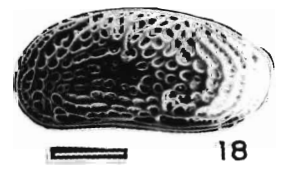
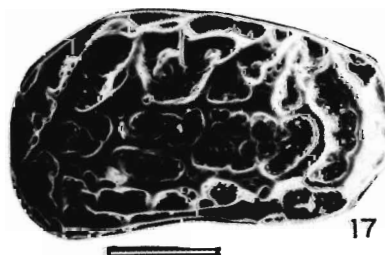
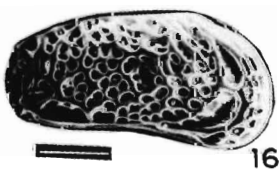
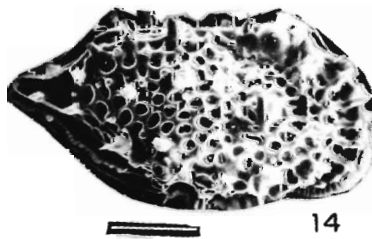
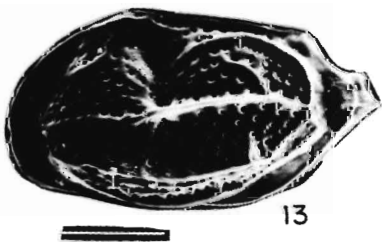
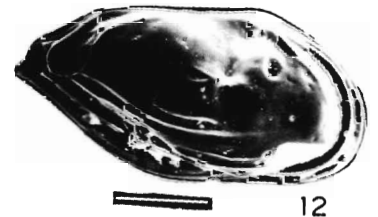
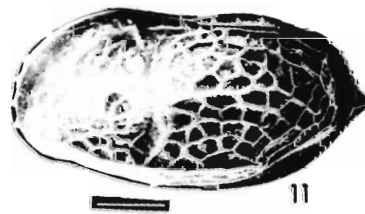
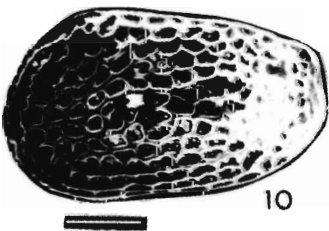
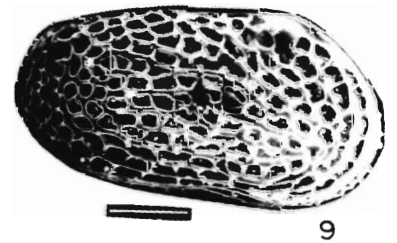
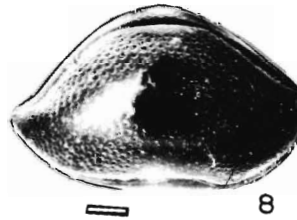
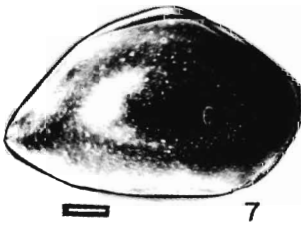
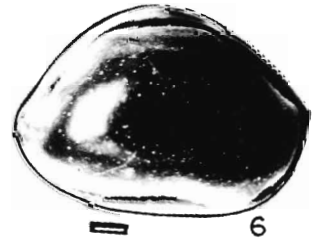
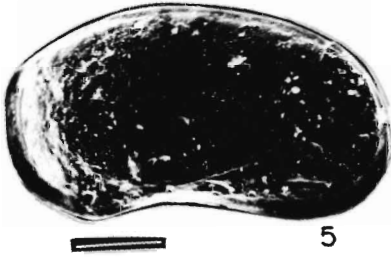
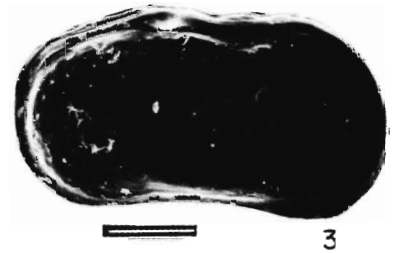
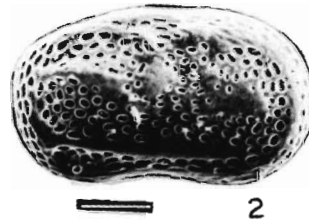
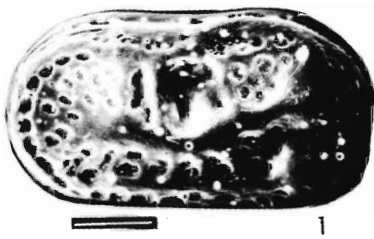
- 1-2. *Paracytheroma ventrosinuosa* Zhao and Whatley, 1989  
1, Left valve, external view; 2, Left valve, internal view.
3. *Miocyprideis spinulosa* (Brady, 1868)  
Right valve, external view.
4. *Hemikritha peterseni* Jain, 1978  
Right valve, external view.
5. *Actinocythereis scutigera* (Brady, 1868)  
Left valve, external view.
- 6-7. *Carinocythereis (Carinocythereis) hamata* (Kingma, 1948) 6, ♀ left valve, external view; 7, Dorsal view.
8. *Chrysocythere keiji* Jain, 1978  
♂ Left valve, external view.
9. *Keijella karwarensis* (Bhatia and Kumar, 1979)  
Left valve, external view.
10. *Keijella reticulata* Whatley and Zhao, 1988  
Left valve, external view.
- 11-12. *Lankacythere coralloides* (Brady, 1886)  
11, Left valve, external view; 12, Surface ornamentation.
13. *Neocytheromorpha* sp. cf. *N. indoarabica* (Khosla, 1989)  
Right valve, external view.
14. *Quasibradleya* sp. cf. *Q. plicocarinata* Benson, 1972  
Left valve, external view.
15. *Caudites javana* Kingma, 1948  
Left valve, external view.

16. *Caudites sublevis* Bonaduce *et al.*, 1980  
Right valve, external view.
17. *Cytheretta* sp. aff. *trifurcata* Lubimova and Guha, 1960  
Left valve, external view.
18. *Neocytheretta murilineata* Zhao and Whatley, 1989  
⊙ Left valve, external view.

### Plate III

(White bar scale equals 100  $\mu\text{m}$ )

- 1-2. *Loxocorniculum* sp. cf. *L. lilljorgi* Brady, 1868  
1, Right valve, external view; 2, Left valve internal view.
3. *Hemicytherura subulata* Ahmad, Neale and Siddiqui, 1991  
Right valve, external view.
4. *Semicytherura contraria* Zhao and Whatley, 1989  
Left valve, external view.
5. *Paijenborchellina indoarabica* Jain, 1978  
Right valve, external view.
- 6-7. *Kangarina abyssicola* (G.W. Müller, 1894)  
6, Right valve, external view; 7, Right valve internal view.
- 8-10. *Xestoleberis variegata* Brady, 1880  
8, Right valve, external view; 9, Left valve internal view;  
10, Dorsal view.
11. *Ornatoleberis morkhoveni* Keij, 1975  
Right valve, external view.
12. *Ornatoleberis quilonensis* Khosla and Nagori, 1989  
Left valve, external view.
- 13-14. *Bythoceratina mandviensis* Jain, 1978  
13, Left valve, external view; 14, Dorsal view.
- 15-16. *Macrocyprina decora* (Brady, 1866)  
15, Left valve, external view; 16, Left valve internal view.
17. *Propontocypris (Propontocypris) crocata* Maddocks, 1969  
Right valve, external view.
18. *Propontocypris (Schedopontocypris) bengalensis*  
Maddocks, 1969  
Left valve, external view.
19. *Phlyctenophora zealandica* Brady, 1880  
Left valve, internal view.



HUSSAIN

