

OCCASIONAL PAPER NO. 185

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ZOOLOGICAL SURVEY OF INDIA**

**Taxonomy, ecobiology and distribution pattern
of the Brachyuran Crabs of mangrove
ecosystem in Andaman Islands**

**M. K. DEV ROY
A. K. DAS**

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Zoological Survey of India, Calcutta

Edited by the Director, Zoological Survey of India, Calcutta



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INTRODUCTION

The brachyuran crabs constitute one of the most dominant macrobenthic faunal components in the mangrove ecosystem throughout the globe including India. Their species diversity in this ecosystem is as rich as in coral reefs (Tan and Ng, 1994) since mangroves offer diversified ecological niches for them. It is well known that several species of commercially valuable crabs like *Scylla serrata*, *Portunus pelagicus*, *Portunus sanguinolentus*, *Thalamita crenata*, *Thalamita pymna*, etc., occur in mangroves. Moreover, crabs play significant ecological roles in this ecosystem in several ways. The feeding activities of detritivore crabs particularly of the genera *Uca*, *Macrophthalmus*, *Dotilla*, *Mictyris*, *Sesarma*, *Nanosesarma*, *Neoepisesarma*, *Sesarmoides*, *Metaplex* and *Clistocoeloma* help in the degradation of plant matters to detritus particles while they themselves are preyed upon by a number of predators, such as, fishes, reptiles, birds and mammals including man, particularly in the mangrove environment.

The crabs also influence this ecosystem as burrowers since their repeated burrowing and reburrowing activities cause an increase in aeration of soil, mixing of soil and nutrient flow and even a decrease in salinity (Montague, 1980, 1982 and Bertness, 1985). At the same time such activities of these decapods create suitable microhabitats for sustenance of other animal species in the ecosystem. It has also been reported that the abundance and distribution of meiobenthos are influenced by fiddler crabs (Bell *et al.*, 1978). Furthermore, crabs create a wide variety of bioturbation structures which are very significant for trapping sediments and mangrove seeds (Chaudhury and Choudhury, 1994). Another very important role of crabs in the mangrove environment is that they produce millions of meroplanktonic larvae which serve as potential source of food for wide variety of planktophagous organisms including rich fish population and satisfy the complex food web of the ecosystem.

In spite of their abundance and significance as mentioned above brachyuran crabs of Indian mangroves are least studied. Chhapgar (1957a) is the first worker who reported the occurrence of "crabs" from mangrove habitats around 'Bombay' without mentioning any further detail regarding the taxonomic identity of those crabs. The next report on the crabs from Indian mangroves was published after a long gap when Krishnamurthy and Jeyasaleelan (1981) reported the presence of 20 species of crabs from Pichavaram mangroves without supplementing any list of the said species.

The first systematic report of crabs of Indian mangal was made by Das (1985) who recorded 8 species from Andaman mangroves. Subsequently crabs of Sundarbans mangroves were documented (Chakraborty *et al.*, 1986; Anonymous, 1987 a, Mandal and Nandi, 1989) and as many as 55 species under 30 genera are known from the region. In the course of dealing with mangrove fauna of Andaman and Nicobar islands Das and Dev Roy (1989) enlisted 31 species of crabs from Andaman mangals and dealt with briefly the zonation and annual breeding pattern of some of the crabs.

In recent years Kumar (1995) recorded two known species and some unidentified species of crabs, namely, *Uca annulipes*, *Metopograpsus messor*, *Uca sp.* and *Dotilla spp.* from the mangrove ecosystem of Cochin back waters of Kerala and Oswin (1998) also reported 5 species of crabs, *Scylla serrata*, *Portunus puber*, *Uca dussumieri*, *U. lactea* and *Sesarma fascinata* from the Muthupet mangroves, Tamil Nadu.

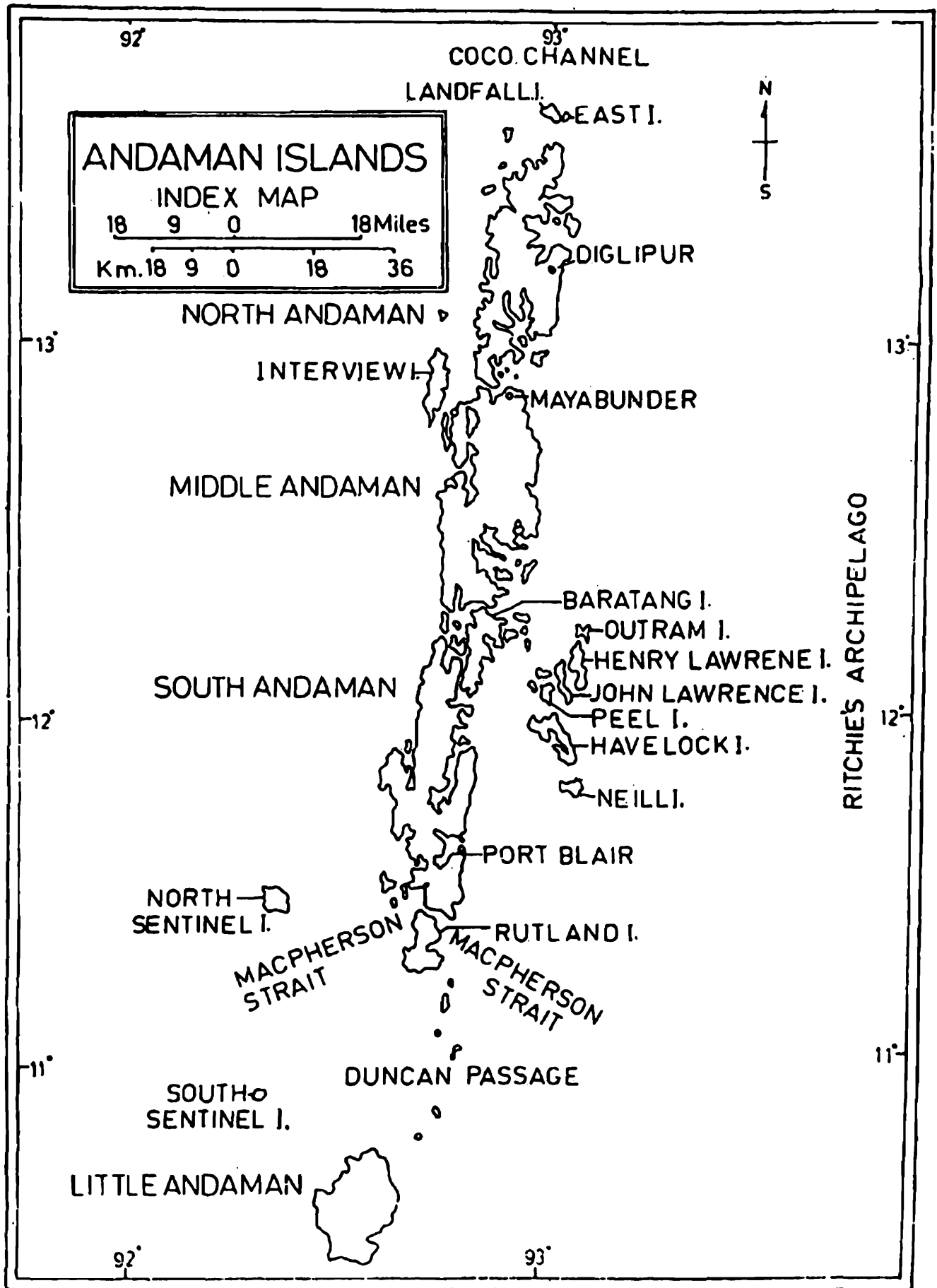
Review of above mentioned literature reveals that taxonomic treatment of these mangrove dwelling crabs of India is completely lacking and their bioecological studies are almost neglected barring some works by Das and Dev Roy (1989) and Chakraborti and Choudhury (1992). Moreover, taxonomy of brachyuran crabs as a whole is in an unsettled state and there are frequent changes in the classificatory scheme of these decapods as will be discussed elsewhere. In this context, an attempt has been made in the present communication to deal with this aspect. Each of the species present in Andaman mangal is well illustrated and user friendly key to the families, genera and species of these crabs are provided to facilitate identification of these groups occurring in the mangroves of the Bay islands as well as from other mangrove areas of India. In addition, habitat ecology and breeding pattern of some selected species of crabs as well as their distribution pattern have also been included for better understanding of these faunal groups in the mangrove ecosystem of Andaman islands.

PHYSIOGRAPHY

GENERAL

Andaman group of islands consisting of 324 islands of various sizes is located in the Bay of Bengal between 6°45' N to 13°30' N latitudes and 90°20' E to 93°56' E longitudes (Text fig. 1) with an area of 6340.4 km². They are the summits of a submarine mountain range which is connected with the Arakan Yoma of Myanmar in the north and festoons of islands in the south and west of Sumatra. The northern-most point of these islands is the Landfall Island while their southern-most boundary is Little Andaman which is separated from the rest of the Andaman group of islands by a Strait called Duncan Passage. Again, Andaman group of islands is separated from Nicobar group of islands by Ten Degree Channel. Andaman islands which stretch out in an arcuate chain in north-south direction have been divided into four main groups, viz., (1) North Andaman, (2) Middle Andaman, (3) South Andaman and (4) Little Andaman. The major part of the islands collectively called Great Andaman comprises of North, Middle and South Andamans. The total length of Andaman group of islands is about 352 km and its maximum breadth is 52 km. All the islands are separated from each other by narrow but deep creeks.

Andaman islands abound in hills while plain lands are less in extent. The hill ranges of these islands run in north-south direction. Saddle Peak with an altitude of 732 m above the sea level is the highest point of these islands. In between the hill systems, there are depressions which are encroached either by the sea forming longitudinal bay or plain lands. The coast line is broken



Text fig. 1. Map showing major islands of the Andaman group.

at several places such as south-east coast of North and Middle Andaman and west coast of North Andaman and Baratang Island. Almost the entire coast is fringed with dense curtain of mangrove forests which extend for miles together.

Substratum :

The substrata supporting mangrove vegetation in these islands are different from that of mainland of India. This is because, unlike mainland of India, there is no perennial river (excepting one or two in Middle and North Andaman). So, siltation and deposition of accretion matter is almost absent, with the result delta-like formation can not take place here. On the other hand, mangroves of these islands grow as fringe mangrove along the tidal creeks, inland channels and in shores (bays) protected by coral reefs. The substrata supporting mangrove forests of these islands are of the following two broad types.

Muddy substratum :

This type of substratum is most common. As a rule, substratum consists of soft mud of varying depths (at places more than knee deep) containing fine to coarse sand and conglomerates of shells in variable proportions with strong smell of hydrogen sulphide. They are further characterised by varying degree of salinity, high organic matter and moisture content. The consistence of the substratum varies from semi-fluid mud to hard substratum depending upon tidal exposure.

Rocky substratum :

This type of substratum occurs at places such as Chidyatapu, Rangachang, Bambooflat, Peel Island, Havelock Island, Neill Island, Rangat Bay, Stewart Island, Carlew Island, Austin IX and Aereal Bay. Generally, rocks are medium sized, small boulders and pebbles are also found. Mangrove plants developing in this type of habitat are generally dwarf in nature.

At many places, mangroves often extend upto or overlap with the coral beds. Mangroves overlapping with coral beds are usually very rich in fauna.

Climate :

During the period under study mean maximum air temperature varied from 28.7°C to 32.7°C and mean minimum temperature ranged from 20.8°C to 26.5°C.

The relative humidity ranged from 67% to 86% and maximum relative humidity was recorded during August, September and October. Mean wind velocity varied from 4.1 km/hr to 23.8 km/hr and maximum wind velocity of 23.8 km/hr was registered during August. A total rainfall ranged from 2445.6 mm to 3204 mm during the study period and highest rainfall occurred during August and September.

Hydrography :

During the study period temperature of surface water ranged from 27.5°C to 34.5°C. Throughout the present investigation, pH of water was found to vary from 5.5 to 7.8. Dissolved oxygen content fluctuated from 1.70 m1/1 to 5.4 m1/1 while the salinity values ranged from 1.8 ppt to 35.3 ppt.

Tide :

The tides are of semi-diurnal in nature. High tide usually occurs twice in 24 hours at intervals of about 12 hour and 25 minutes. Tidal height varies between 0.0 to 2.25 metres. That is why, beaches get exposed for a short duration only during low tides.

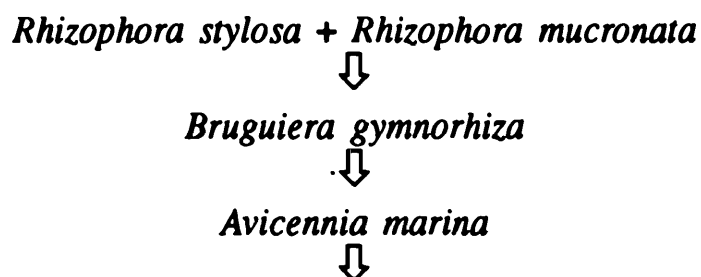
Mangroves :

The mangrove flora of these islands have been studied by Parkinson (1923), Chengappa (1944), Banerji (1958), Sahany (1957), Mall et al. (1985), Vasudeva Rao (1986) and of late by Das and Dev Roy (1989). So far, 43 species of mangroves and their associates under 30 genera and 23 families are recorded from these islands (Banerjee and Ghosh, 1998).

The total mangrove forest areas of these islands is estimated variously. According to an estimate of Blasco (1977) mangroves cover an area of 1,00,000 hectares in these islands ; but, following photointerpretation studies this has been estimated to 1,15,200 hectares (including the ecotone areas). As per Sahany's (1957) report, mangrove forests of these islands occupy about 20% of total land area of Andaman and Nicobar islands respectively. It may be mentioned in this connection that mangroves of these islands are comparatively well preserved and are supposed to be the well managed mangrove forests in India. According to a recent estimate mangrove areas of both Andaman and Nicobars are 1190 km² occupying about 18% total Indian mangals.

The mangroves of these islands are remarkable for their good shape, gregariousness, tallness, luxuriant growth and extremely dense curtain of 8-12 m height. The mangroves are of fringing type and unlike mainland India, the stretch of the forest from the shore never extends much, only a few metres in width. That is why, unlike mainland India, zonation of plant species is not very much conspicuous in most of the places of these islands. The mangrove vegetation of these islands are dominated by two plant genera namely, *Rhizophora* and *Bruguiera*. Both the genera occur in more or less pure strand although they often mix together. Pure strand of *Rhizophora* is a very common sight fringing the coasts or along the creeks in these islands followed by *Bruguiera* at the rear, while pure strands of *Avicennia* and *Sonneratia* occur at few places only.

The pioneer species in mangrove formation and the bulk of mangrove is composed of *Rhizophora* which is represented by three species in these islands. *Rhizophora* spp. with their typical arched roots form dense thickets along the coast making many places impenetrable and inaccessible and, they pave way for the settlement of other mangrove species. In the tidal swamps, *Avicennia officinalis*, *Ceriops tagal*, *Kandelia candel*, *Xylocarpus granatum*, *X. moluccensis*, *Lumnitzera racemosa*, *L. littorea*, *Excoecaria agallocha* and *Aegiceras corniculatum* are found to grow. *Acanthus ilicifolius* forms a dense thorny undergrowth near the creek, usually at the back. *Heritiera littoralis*, *Scyphiphora hydrophyllacea*, *Brownlowia lanceolata* and *Cynometra ramiflora* grow towards the landward fringe. The fern *Acrostichum* spp. and the palms *Nypa fructicans* and *Phoenix paludosa* are quite common in this zone. The arrangement of various mangrove plant species may be shown schematically as follows :



Heritiera littoralis

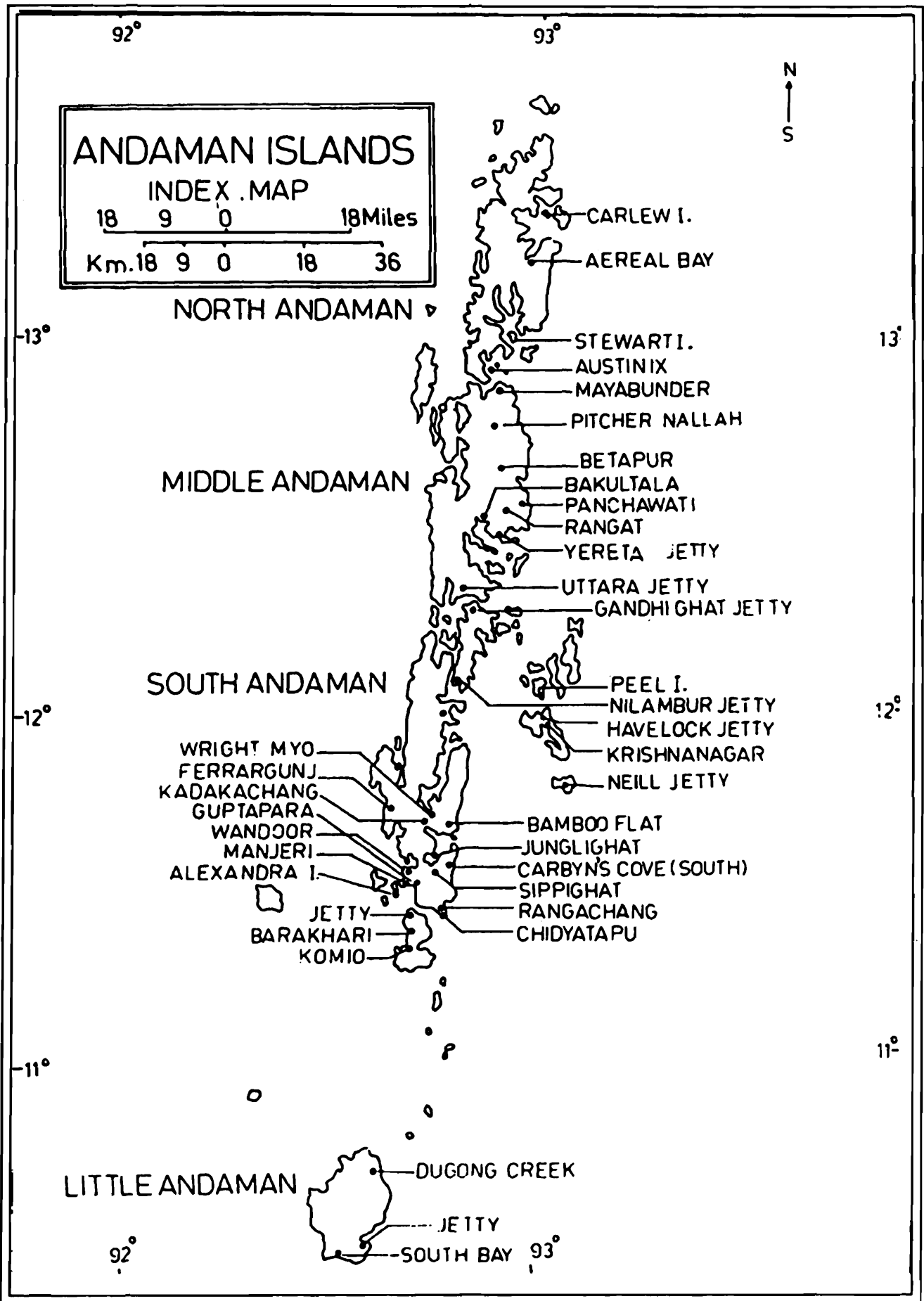


Acrostichum aureum + *Acanthus ilicifolius*

MATERIAL AND METHODS

All materials for the present investigation were collected from mangrove of various localities (Text fig. 2) of North (5 stations, namely, Carlew Island, Aereal Bay, Stewart Island, Austin IX and Mayabunder). Middle (7 stations namely, Pitcher Nallah, Betapur, Bakultala, Panchawati, Rangat Bay, Yereta Jetty and Uttara Jetty), South (22 stations, namely, Gandhi Ghat Jetty, Nilambur Jetty, Peel Island, Havelock Jetty, Krishnanagar, Neill Jetty, Bambooflat, Junglight, Carbyn's Cove, Sippighat, Rangachang, Chidyatapu, Wright Myo, Ferrargunj, Kadakachang, Guptapara, Wandoor, Manjeri, Alexandra Island, Rutland Island Jetty, Barakhari and Komio), and Little Andaman (3 stations, namely, Dugong Creek, Jetty and South Bay) during low tide when the mangrove floors got exposed. Supralittoral areas were also searched for. Some crabs were found under or among rocks and dead corals, others in burrows, whenever necessary, the rocks, pebbles or dead corals were up-turned in search of crabs, while the burrowing crabs were dug out by means of shovel, often sieving was also required for the smaller ones. Sometimes, when the crabs were out of their burrow, they were chased or their holes were plugged by throwing a lump of mud so that the crabs got confused of their burrows and were seen to turn astray when they were collected. Decaying mangrove logs which were once infested with marine borers were found to be ideal habitat for few crabs species, so logs were broken into pieces by means of choppers or sometimes by applying force. For the collection of bigger specimens living deep in burrows, an iron rod about 1.0 metre long, twisted at one end was inserted into holes and a sort of pinching was given by rotating the same. Upon pinching, crabs were found to hold the rod very firmly with claws making some sound that could be perceived. They were then pulled out very swiftly along with the rod. On rare occasions, strong formalin was poured into the holes or rock crevices and the crabs were forced to come out from their shelters.

A simple technique was devised for the collection of the ocypodid crab, *Ocyopode ceratophthalma* which are very swift runners and difficult to catch. These crabs were chased into water. As a result of driving they were seen to bury themselves under the sandy bottoms which could be felt by hand or by the sole of the feet. They could not move much and were found to sit calmly when they were hand picked by tightly holding the chelipeds against their abdomen. This method was found to be useful only in clear water and also during full moon nights. The disadvantage of this method is that not more than one crab could be collected at a time. Adopting this method, a good number of crabs belonging to the above species were collected at night from the vicinity of jetty of Neill and Havelock Islands. Following the same technique a good number of swimming crabs, namely, *Portunus pelagicus*, *Portunus sanguinolentus*, *Thalamita crenata*, *Thalamita prymna*, *Charybdis (Charybdis) helleri*, *Matuta*



Text fig. 2. Map of Andaman Islands showing the collecting stations.

banksii and *Matuta lunaris* were collected at the time when these crabs were seen to enter mangroves with high tide water.

Crabs upon collection were preserved following Tweede's (1937) method. It was noticed that if crabs were placed straight into alcohol or formalin they tended to die very slowly and in the process of struggling they used to shed their limbs damaging other crabs so that only a few perfect specimens remained out of a large collection. To overcome this difficulty, soon after the collection, crabs were placed in large vacuum flasks containing ice and water. Crabs were numbed by freezing, then taken out and preserved in 70% alcohol. Although this was the usual practice, however, in few occasions and in some remote islands this method could not be followed. On such occasion, crabs after the collection were kept in separate polythene bags or jars and killed by dipping into weak alcohol or formalin one by one. After killing, the crabs were sorted out groupwise, labelled properly and were placed in containers with 70% alcohol; small crabs were placed in glass tubes while the bigger ones were wrapped in mulmul cloth and dipped in big containers. Glass tubes were packed with cotton as otherwise they could break away at the time of transportation. The preservatives were changed in the laboratory whenever necessary.

For hydrobiological studies temperature was recorded by using Celsius thermometer and the salinity and dissolved oxygen of the samples were estimated by Mohr-Knudsen and Winkler's Iodine difference method respectively. In the field, pH was measured by pH colour comparator disc using Phenyl red screen and subsequently, in the laboratory by BIOCHEM digital pH metre. The two readings were found to be nearly concurrent. Temperature, humidity, wind speed and rainfall data were collected from the meteorological unit at Port Blair.

Measurements of crab were taken following Rathbun (1918). While the width of the carapace was measured at the widest part (in case of *Matuta* spp. spines were excluded), length was, however, measured on the median line, from anterior to posterior margin. The measurement of front was taken from the outer angle of one orbit to the outer angle of the other. Length of the segments of the chelipeds and legs were measured on the upper or anterior margin. Length of entire cheliped or leg was measured on the lower margin, from the articulation of the coxa with the sternum to the tip of the dactylus. Width of segments of chelipeds and legs was measured at the widest part. Length of immovable finger was measured from tip to the extremity of the sinus between the fingers. All measurements taken were in millimetre (mm). Camera lucida drawings have been prepared for the first male plepod structure.

For ecobiological studies fortnightly collections were made from four stations at South Andamans, one each in Carbyn's Cove, Sippighat, Chidyatapu and Bambooflat. Density of crabs (burrowing forms) were estimated by the quadrat method (0.50 cm × 0.50 cm). All the crabs enclosed within the quadrat were counted or were dug out from their burrows. Whenever necessary they were sieved through a mesh and kept in plastic bags for further studies in the laboratory. In the case of swimming crabs, the density was studied by catch per unit effort.

General observations were made for other brachyuran species also. Wherever collected, they were kept in separate packets and their habitat and zonations were recorded.

For studying the breeding pattern of crabs, at least 20-25 females were collected (often more) and examined if berried females were present. Abdomen of the berried crabs were lifted whenever necessary, to see the presence and quantity of eggs. From this, the percentage of ovigerous to non-ovigerous crabs were calculated. Data thus obtained for two years were pooled together and the results were plotted on a graph paper.

The following abbreviations have been used in the text :

W = Width ; F = Front and L = Length

TAXONOMY

Classification

Classification of brachyuran crab is still in an unsettled state. This is because there is no general agreement among various workers and, therefore, different specialists have proposed different schemes of classification. The history of decapod classification has been reviewed by Desmarest (1823), Beurlen (1928), Balss (1957), Balss *et al* (1940-61) and Glaessner (1969).

In the twelfth edition of *Systema Naturae* Linnaeus (1767) placed all crabs under the genus *Cancer* in the order Aptera alongwith insects, while Fabricius (1775) kept them under the order Agonata. Later on, Latreille (1796) placed crabs under the class Crustacea, order Decapoda (1803) and section Brachyura (1803). The foundation of crab taxonomy was, however, laid by Fabricius (1793) who had splitted the only crab genus *Cancer* known till that time into a number of genera, many of which are still recognised as valid taxa. Latreille (1806) divided Decapoda into two groups— (1) Macrura or long-tailed decapods and (2) Brachyura or short-tailed decapods. He included all crabs under two families, namely, Cancerides and Oxyrhynques. Subsequently a third group, namely, Anomura was erected by H. Milne Edwards (1834) for the hermit crabs, dividing Brachyura into four natural groups or subdivisions, namely, Oxyrhynques (Oxyrhyncha), Cyclomètopes (Cyclometopa), Catometopès (Catometopa) and Oxystomes (Oxystomata). All these groups are still retained by the succeeding authors. In his Voluminous contribution “Fauna Japonica” de Haan (1833–1850) divided Brachyura into two sections or groups— (1) Brachygnatha containing Cancroidea, Majacea, Dromiacea and Trichidea and (2) Oxystomata including the groups Dorippidea, Calappidea, Matutoidea, Leucosidea and Raninoidea. In this classification Cancroidea included not only the Cyclometopa or round-fronted crabs but also the Catometopa or Grapsoid crabs and the Corystoidea (Corystiens) of H. Milne Edwards (*op. cit.*). This system of classification was considerably improved by a number of subsequent workers among whom Dana (1851a, b) and Boas (1880) are worth mentioning.

A remarkable deviation from the general plan of classification was proposed by Boas (1880) who while studying phylogenetic relations of the Decapoda divided it into Natantia (containing prawns and shrimps) and Reptantia (including crabs and lobsters). He further splitted crabs (Brachyura) into two subtribes, namely, Brachyura vera (containing true crabs) and Dromiaceae (including Dromia-like forms) which retain most of the macrurous characters.

Later on this classification was elaborated and improved by Miers (1886), Henderson (1888), Ortmann (1896), Alcock (1896-1900), Borradaile (1907) and Bouvier (1940). Amongst these, works of Alcock (*op. cit.*) is considered a valuable contribution in the taxonomic study of brachyuran crabs of Indian subregion.

Glaessner (1969) published a scheme of classification containing only those taxonomic categories which are necessary for a coherent presentation of our present knowledge on decapod phylogeny. This classification combined with Borradaile's one (*op. cit.*) is being followed by many of the present workers on this group.

A new scheme of classification for the Decapod Brachyura has been proposed by Guinot (1977.) In this classification classical carcinological nomenclature has been rejected and instead three new sections have been erected on the basis of the position of male and female genital openings. These are : (1) Podotremata, in which both male and female genital openings are coxal, (2) Heterotremata, in which female openings are coxal or sternal and (3) Thoracotremata, in which both male and female openings are sternal. Podotremata is further subdivided into two subsections, namely, Dromiacea and Archaeobrachyura.

In 1980 Rice provided an excellent review of the classification of the Brachyura and de Saint - Laurent (1980a, b) gave some additional information in this regard. In 1982 Bowman and Abele published a "Classification of the Recent Crustacea" wherein classification of brachyuran crabs was included after a brief evaluation.

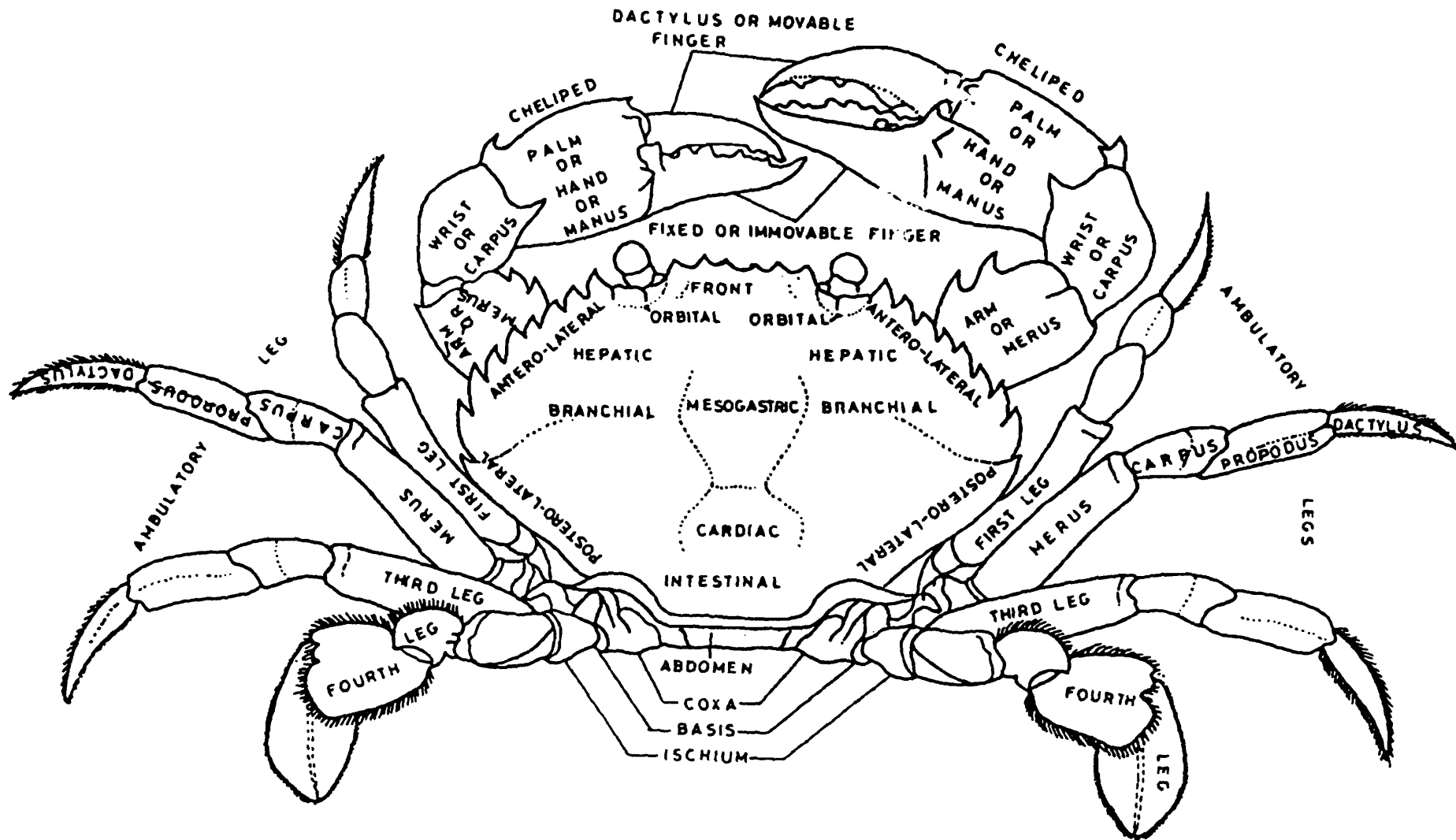
In view of above, classification adopted by Bowman and Abele (1982) has been mostly followed with some modifications in the superfamily Xanthoidea in light of taxonomic treatment made by Serène (1984). This aspect has been discussed in some detail in the proceeding taxonomic treatment of the concerned group.

MORPHOLOGY AND TERMINOLOGY

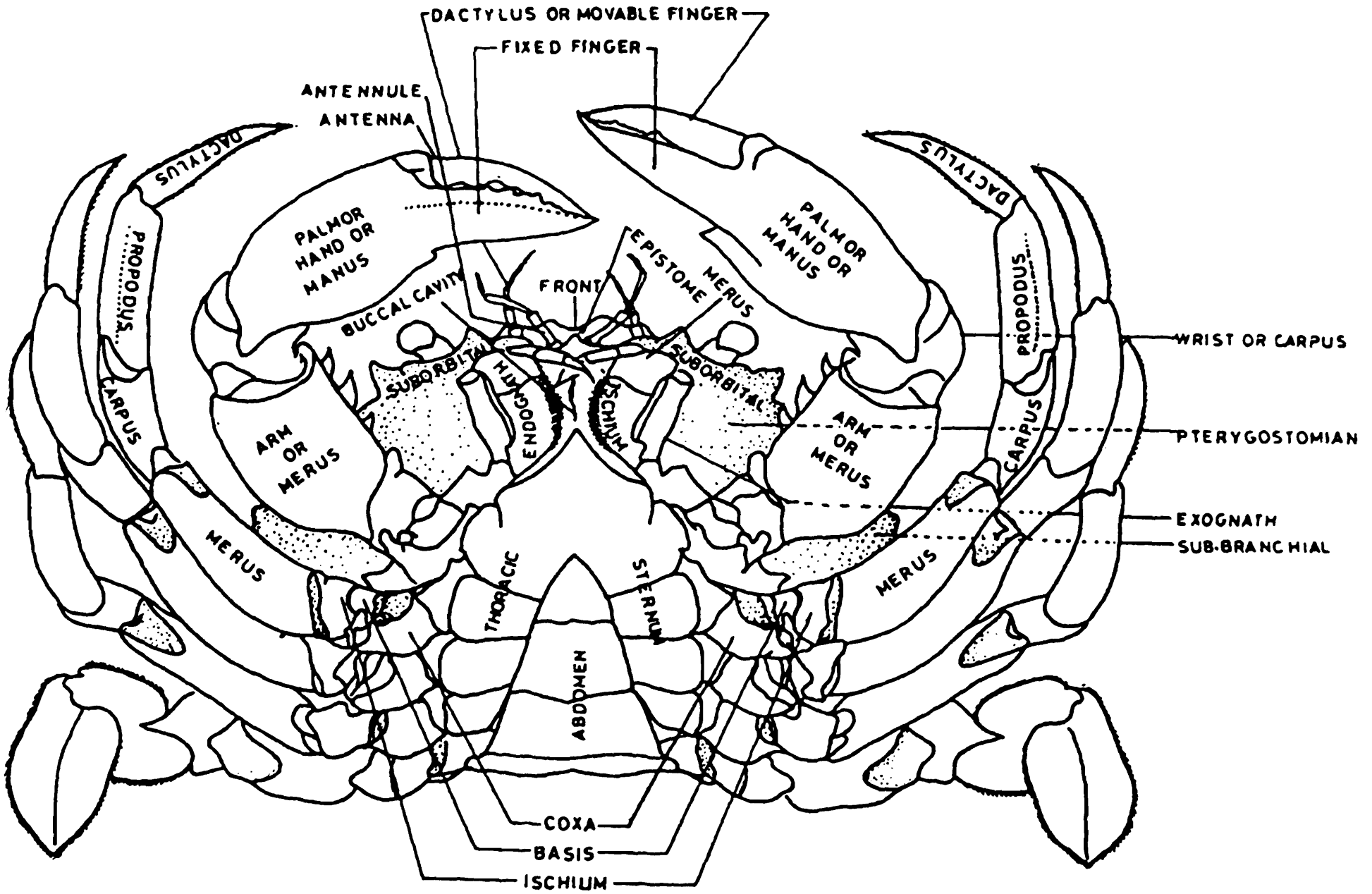
Crabs exhibit great diversity of form and structure. The body of a crab consists of an anterior rigid cephalothorax and a short abdomen which is tucked away underneath (*Figs. 3-5*).

Cephalothorax :

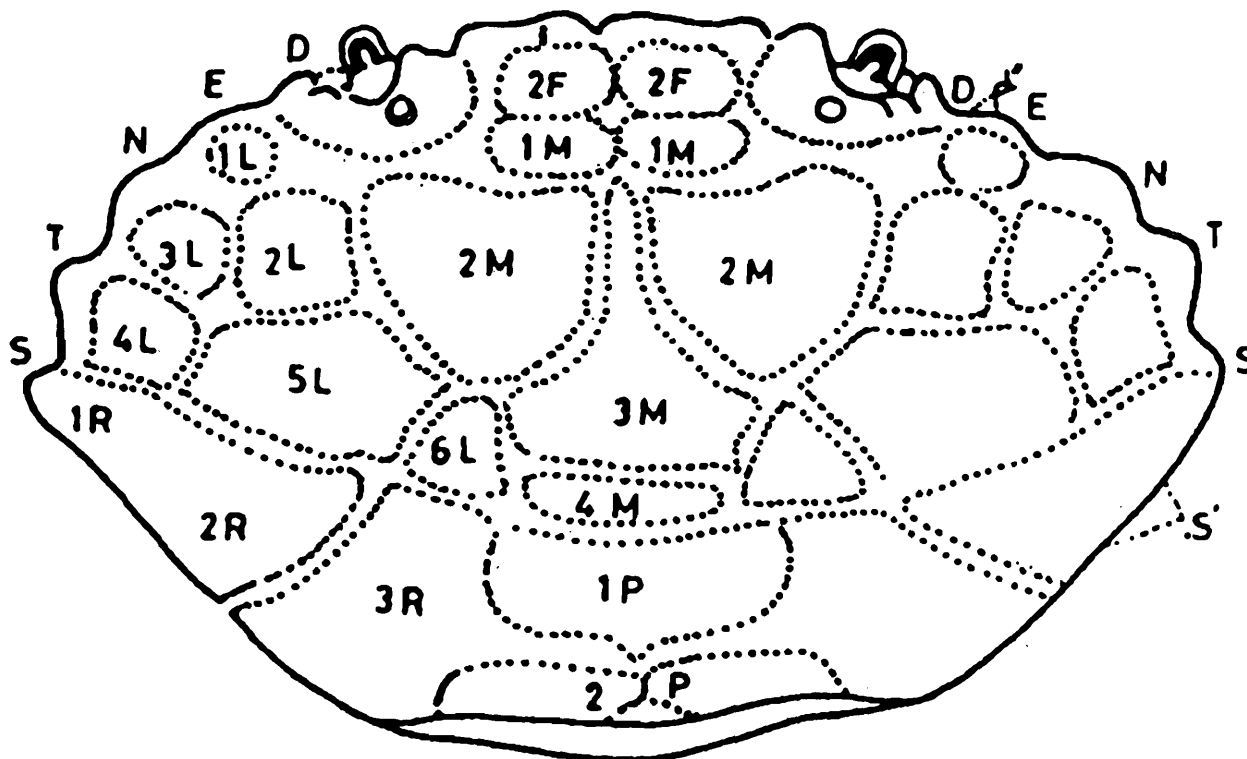
It is made up of six head segments (Warner, 1977) and eight thoracic segments, all fused together. The entire body of a crab is covered dorsally by a tough cuticle called *carapace* ; it is also called *shell* of crab. The carapace is composed of fused *tergites*. The anterior portion of carapace in between the orbits is known as *front*. Lateral sides of carapace are often



Text fig. 3. Diagrammatic dorsal view of the portunid crab, *Scylla serrata* showing the terms used in the description.



Text fig. 4. Diagrammatic ventral view of the portunid crab, *Scylla serrata* showing the terms used in the description.



Text fig. 5. Diagrammatic dorsal view of a xanthid crab showing principal areolations (D, E, N, T, S = antero-lateral teeth; d, s = smaller, occasional teeth; F = frontal; L = antero-lateral; M = medial; P = postero-lateral).
(After Dana, 1852)

Differentiated into *antero* and *postero-lateral borders*. The margins of the antero-laterals may be smooth, denticulate or spiniform. The carapace is usually divisible into several regions such as gastric, cardiac, intestinal and branchial.

Cephalothorax is covered ventrally by sternites, its lines of fusion are very prominent. Sternites extend into the body as folds called *apodemes*. The exoskeleton that covers the lateral sides of carapace is called *pleuron*. The margin of the carapace extending on either side is known as *pleural fold* which is separated into an anterior *pterygostomial region* (also called *jugal region*) and a posterior *branchiostegite*. The former is immovable and separated from the carapace by a pleural suture whereas the later is continuous with the carapace forming the external covering of the gill chamber.

Appendages :

They are of three types, namely, cephalic appendages, thoracic appendages and abdomen.

Cephalic appendages : Starting anteriorly, it includes (i) *antennule or first antenna* : they are small, biramous, paired, retractile appendages usually remain folded sidewise and placed within sockets, (ii) *Second antenna* : they are small, erect and paired appendages without lateral branches or exopod, (iii) *mandible* : in this paired appendage, exopod is lost and endopod is

reduced to a stout palp, the base of the mandibles are enlarged bearing a strong biting edge, (iv) *first maxilla* : in this paired appendage, exopods are lost and each is made up of a group of endites which bear *setae*, (v) *second maxilla* : in this paired appendage, exopods are developed into a lateral flap-like structure called *scaphognathite* which pump water through the branchial chamber and are important in respiration.

Thoracic appendages : (i) *maxillipeds* : These are 3 pairs and all are biramous bearing *epipods* which extend backward into the branchial chamber. The *epipods* serve to clean the gills. The third maxillipeds (also called *external* or *outer maxilliped*) become flattened and assume the shape of an operculum to cover the mouth or buccal cavity. The maxillipeds alongwith other mouth parts, such as, mandibles and maxillae are used for manipulating food, (ii) *Chelipeds* : These are also called *first leg*. They are uniramous, paired appendages and consist of *coxa*, *basis*, *ischium*, *arm* or *merus*, *wrist* or *carpus* and the *chela* which is made up of *palm* (also called *hand* or *manus*) and *fingers* of which the upper finger is known as *dactylus* or *movable finger* and lower one as *fixed finger* (also called *thumb* or *immovable finger* or *pollex*. Chela are used for food capture, defence and grasping, (iii) *Walking legs* : These are 4 pairs and all are long, pointed, uniramous and jointed structure. Each leg is made up of seven segments, viz., *coxa*, *basis*, *ischium*, *merus*, *carpus*, *propodus* and *dactylus*. Unlike chelipeds, *dactylus* of walking legs are clawed and not chelated. The bases of walking legs on each side in a crab are set apart. They are meant for sidewise walking.

Abdomen : The abdomen of a crab is a flap-like structure and usually made up of six segments. However, according to Alcock (1896—1900) and Rathbun (1918) abdomen consists of 7 segments, including the telson. This system has been followed in the present work in most of the cases. The abdomen is articulated ventrally to the cephalothorax with a groove formed by the somites. It is much broader in female than in male ; in the latter, some of the segments may be fused together. The abdominal appendages and pleopods are rudimentary and in both sexes six pairs of pleopods are absent, while only two pairs of copulatory stylets formed by first and second pleopods are found in males. In females, however, four pairs of biramous pleopods form an egg-bearing basket. Male pleopods are uniform and form intromittent structures. During copulation, second pleopods work as pistons inside channels in the first pair to pump sperm into the female. Anus is located at the terminal end of the last abdominal segment, at the junction with telson.

SYSTEMATIC LIST OF BRACHYURAN CRABS

(After Bowman and Abele, 1982)

Phylum, Subphylum or Superclass *CRUSTACEA* Pennant, 1777

Class *MALACOSTRACA* Latreille, 1806

Subclass *EUMALACOSTRACA* Grobben, 1892

Superorder *EUCARIDA* Calman, 1904

Order *DECAPODA* Latreille, 1803

Suborder *PLEOCYEMATA* Burkenroad, 1963

Infraorder *BRACHYURA* Latreille, 1803

Section *OXYSTOMATA* H. Milne Edwards, 1834

Superfamily *LEUCOSIOIDEA* Samouelle, 1819

Family *CALAPPIDAE* de Haan, 1833

1. *Matuta banksii* Leach, 1817
2. *Matuta lunaris* (Forskål, 1775)

Section *BRACHYRHYNCHA* Borradaile, 1903

Superfamily *PORTUNOIDEA* Rafinesque, 1815

Family *PORTUNIDAE* Rafinesque, 1815

3. *Scylla serrata* (Forskål, 1775)
4. *Portunus pelagicus* (Linnaeus, 1758)
5. *Portunus sanguinolentus* (Herbst, 1796)
6. *Charybdis (Charybdis) helleri* (A. Milne Edwards, 1867)
7. *Charybdis (Charybdis) orientalis* Dana, 1852
8. *Thalamita crenata* (Latreille, 1829)
9. *Thalamita prymna* (Herbst, 1803)
10. *Thalamita admete* (Herbst, 1803)

Superfamily *XANTHOIDEA* MacLeay, 1838

Family *XANTHIDAE* MacLeay, 1838

11. *Actaeodes tomentosus* (H. Milne Edwards, 1834)
12. *Atergatis floridus* (Linnaeus, 1767)
13. *Atergatis integerrimus* (Lamarck, 1801)
14. *Platypodia cristata* (A. Milne Edwards, 1865)
15. *Leptodius exaratus* (H. Milne Edwards, 1834)
16. *Leptodius sanguineus* (H. Milne Edwards, 1834)
17. *Pilodius nigrocrinitus* Stimpson, 1858

Family *PILUMNIDAE* Samouelle, 1819

18. *Pilumnus vespertilio* (Fabricius, 1793)

Family *CARPILIDAE* Ortmann, 1893

19. *Carpilius convexus* (Forskål, 1775)
20. *Carpilius maculatus* (Linnaeus, 1758)

Family *MENIPPIDAE* Ortmann, 1893

21. *Baptozius vinosus* (H. Milne Edwards, 1834)

22. *Epixanthus dentatus* (White, 1847)
23. *Epixanthus frontalis* (H. Milne Edwards, 1834)
24. *Lydia annulipes* (H. Milne Edwards, 1834)
25. *Eriphia sebana* (Shaw and Nodder, 1803)

Superfamily GRAPSIDOIDEA MacLeay, 1838

Family GECARCINIDAE MacLeay, 1838

26. *Cardisoma carnifex* (Herbst, 1794)

Family GRAPSIDAE Macleay 1838

27. *Grapsus albolineatus* Lamarck, 1818
28. *Metopograpsus frontalis* Miers, 1880
29. *Metopograpsus oceanicus* Jacquinot, 1842-1853
30. *Sesarma (Chiromantes) bidens* (de Haan, 1835)
31. *Sesarma (Parasesarma) plicatum* (Latreille, 1803)
32. *Nanosesarma (Beanium) andersoni* (de Man, 1888)
33. *Neopisesarma (Neopisesarma) taeniolata* White, 1847
34. *Neopisesarma (Muradium) tetragonum* (Fabricius, 1798)
35. *Sesarmops intermedium* (de Haan, 1835)
36. *Sesarmoides longipes* (Krauss, 1843)
37. *Metaplax crenulata* (Gerstaecker, 1856)
38. *Metaplax distincta* H. Milne Edwards, 1852
39. *Metaplax elegans* de Man, 1888
40. *Metasesarma rousseauxii* (H. Milne Edwards, 1853)
41. *Clistocoeloma merguense* de Man, 1888

Family MICTYRIDAE Dana, 1851

42. *Mictyris longicarpus* Latreille, 1806

Superfamily OCYPODOIDEA Rafinesque, 1815

Family OCYPODIDAE Rafinesque, 1815

43. *Ocypode ceratophthalma* (Pallas, 1772)
44. *Uca dussumieri* (H. Milne Edwards, 1852)
45. *Uca tetragonon* (Herbst, 1790)
46. *Uea vocans* (Linnaeus, 1758)
47. *Uca lactea* (de Haan, 1835)
48. *Dotilla myctiroides* (H. Milne Edwards, 1852)
49. *Macrophthalmus (Macrophthalmus) convexus* Stimpson, 1858
50. *Macrophthalmus (Mareotis) depressus* Rüppell, 1830
51. *Leipocten sordidulum* Kemp, 1915

SYSTEMATIC ACCOUNT

Nomenclature adopted in this work is that of Alcock (1896–1900), Rathbun (1897) and Crane (1975). Family keys have been arranged mostly following Sakai (1976) and Serène (1984) with some modifications. Family and generic descriptions are based mostly after Alcock (*op. cit.*), Barnard (1950) and Crane (1975) to some extent. Recent relevant literature has been consulted for critical taxonomic assessment. Important *opinions* published by International Commission on Zoological Nomenclature as well as by eminent experts on the group such as Guinot (personal communication, 1989, 1990, 1991) and Holthuis (personal communication, 1990, 1991) have also been consulted for the purpose. Species description has been made following Alcock (*op. cit.*) but the style adopted in this work is that of Stephenson and Hudson (1957) and George and Jones (1982) with some modifications. An attempt has been made to maintain uniformity in descriptions as much as possible excepting in few cases. This is done due to differential emphasis placed on characters by specialists in different groups. Telegraphic language has been used for the most part. In the present work, taxonomic account of each species of crab is supported with illustrations. Relevant important synonymies (necessarily not all synonymies) have been cited chronologically including the Indian works. In order to avoid repetition, collector's name has been omitted in the material column as all the materials cited in this work has been collected by the authors. Distribution of all the species dealt with here has also been included. All material reported in this work is at present deposited with Sundarban Field Research Station, Zoological Survey of India, Canning Town but will be sent to Andaman and Nicobar Regional Station, Zoological Survey of India, Port Blair in due course.

Infraorder BRACHYURA Latreille, 1803

Cancris brachyuri Lamarck, 1801 : 148.

Brachyures brachyuri Latreille, 1803 : 347.

Brachyuri brachyures Latreille, 1806 : 24.

Decapodes brachyures Latreille, 1829 : 28.

Brachyures Lamarck, 1818 : 226.

Diagnosis : Carapace fused with the epistome at the sides and almost always in the middle ; last thoracic sternites fused with the anterior sternites. Abdomen brachyurous (i.e., short, flattened, straight), symmetrical and tucked under the cephalothorax. Third maxillipeds broad. Basis and ischium of cheliped and leg immovably articulated. First pereopods invariably chelate, third pereopods never chelate.

Remarks : Infraorder Brachyura is divided into six sections, namely, (i) Dromiacea de Haan, 1833, (ii) Archaeobrachyura Guinot, 1977, (iii) Oxystomata H. Milne Edwards, 1834, (iv) Oxyrhyncha Latreille, 1803, (v) Cancridea Latreille, 1803 and (vi) Brachyrhyncha Borradaile, 1907 (Bowman and Abele, 1982). Among these, the representatives of two sections, namely,

Oxystomata and Brachyrhyncha have been found to occur in the mangroves of Andaman Islands.

Section OXYSTOMATA H. Milne Edwards, 1834

Oxystomata H. Milne Edwards, 1834 : 265 ; de Haan, 1841 : 111 ; Dana, 1852b : 389 ; Miers, 1886 : 337 ; Alcock, 1896 : 135 ; Rathbun, 1937 : 75 ; Barnard, 1950 : 345 ; Sakai, 1965 : 18 ; Glaessner, 1969 : R491 ; Sakai, 1976 : 59.

Diagnosis : Carapace oval, subcircular or polygonal in shape. Epistome rudimentary or absent. Buccal frame elongate, triangular. Gills 6–9 on each side. Last pair of legs normal or subdorsal, no epipodite on pereopods. First abdominal somite of female without any appendage.

Remarks : The section Oxystomata is represented by a single superfamily, namely Leucosioidea Samouelle, 1819 in Andaman mangroves.

Superfamily LEUCOSIOIDEA Samouelle, 1819

Leucosiadae Samouelle, 1819 : 91.

Leucosioidea Bowman and Abele, 1982 : 24.

Diagnosis : Carapace round, oval or polygonal in shape. Abdomen not reduced but fully turned under the sternum. All pereopods well developed.

Remarks : This superfamily includes two families, namely, Calappidae de Haan, 1837 and Leucosiidae Samouelle, 1819 (Bowman and Abele, *op. cit.*) ; but representatives only one family, Calappidae has been found to occur in the mangroves of Andaman Islands.

Family CALAPPIDAE de Haan, 1833

Calappidea de Haan, 1833 : IX (corrected to Calappidae by White, 1847, name no. 371 on Official List) ; Manning and Holthius, 1981 : 49.

Matutoidea de Haan, 1835 : 36 ; 1941 : 119, 126.

Orithyinae Dana, 1952b ; 391.

Type genus *Calappa* Weber, 1795

Diagnosis : Carapace oval or subcircular in outline. Front almost as broad as the orbit. Lateral borders either with (1) a small tooth or a strong spine at the junction of the antero-lateral and postero-lateral borders or (2) a postero-lateral vault-like expansion over the walking legs. Antenna small. Antennules folding obliquely. External maxillipeds may or may not close the buccal cavity fully ; their palps remaining either concealed in repose or always exposed. Efferent branchial openings together forming a deep channel in the endostome, afferent branchial openings near the bases of chelipeds. Chelipeds massive, greatly enlarged, almost symmetrical in size (asymmetrical in the size of fingers). Palm enormous, often very prominent. Abdomen

of adult male consisting of five segments (3rd-5th terga fused together) and of 7 distinct segments in female and young male respectively. Gills nine on each side. Male genital opening coxal.

Remarks : These are intertidal crabs living on sandy shores. The family is represented by a single subfamily, namely, Matutinae de Haan, 1835 in Andaman mangroves.

Subfamily MATUTINAE de Haan, 1835

Matutinae de Haan, 1835 : 36 ; Alcock, 1896 : 138, 139 ; Stebbing, 1905 : 53 ; Ihle, 1918 : 178 ; Rathbun, 1937 : 234 ; Sakai, 1965 : 59 ; Glaessner, 1969 : R495 ; Sakai, 1976 : 127, 139.

Diagnosis : Carapace circular with a stout spine at the junction of the antero- and postero-lateral borders. Merus of external maxillipeds elongate with acute tip, concealing the flagellum entirely in repose. Legs adapted for swimming.

Genus *Matuta* Weber, 1795

Matuta Weber, 1795 : 92 ; Fabricius, 1798 : 369 ; H. Milne Edwards, 1837 : 113 ; Miers, 1886 : 294 ; Alcock, 1896 : 153 ; Stebbing 1910 : 335 ; Chopra, 1933 : 31 ; Barnard, 1950 : 357 ; Monod, 1956 : 98 ; Glaessner, 1969 : R495 ; Sakai, 1976 : 139 ; Manning and Holthuis, 1981 : 56.

Matutinus MacLeay, 1838 : 70.

Type species : *Cancer victor* Fabricius, 1786, a subjective junior synonym of *Cancer lunaris* Forskål, 1775 ; by subsequent designation by Latreille, 1810 ; gender : feminine.

Diagnosis : Carapace more or less flat, subcircular. Front almost as broad as orbit, trilobed, middle one more prominent than the others. Postero-lateral borders strongly convergent, generally with a strong spine at the junction of the antero-lateral and postero-lateral borders. Antenna extremely small, inconspicuous. Antennules folded almost longitudinally. Orbits large, oval with a deep groove in the lower border near the external orbital angle and a narrow gap at the inner angle. Eyestalks stout, usually elongate. External maxillipeds elongate, covering the buccal cavity entirely ; endostomial septum not separating the efferent canals. Chelipeds massive, equal. Stridulatory organ consisting of two elevated obliquely striated areas—one linear (proximal) and the other oval or subcircular (distal) on the inner surface of upper margin of palm of cheliped along with a double series of transversely elongate tubercles on the pterygostomial region. Palm compressed, its upper border cristate and outer surface sculptured. Legs adapted for swimming and burrowing, propodus and dactylus of ambulatory legs broadened enormously in the first and last pair. Abdomen of adult male consisting of 5 segments with 3rd-5th segments fused and of 7 separate segments in female and young males ; first tergum in both sexes completely concealed under the carapace.

Distribution : East coast of Atlantic Ocean and the Indo-Pacific.

Key to the species of the genus *Matuta* from Andaman Mangroves.

- Longitudinal ridge of dactylus of chelipeds smooth, postero-lateral border of carapace with a prominent tubercle..... *M. banksii*
- Longitudinal ridge of dactylus of chelipeds strongly milled, postero-lateral border of carapace with an obscurely defined tubercle..... *M. lunaris*

1. *Matuta banksii* Leach, 1817

(Pl. 1, Fig. 1, Pl. 8, Figs. 1, 4)

Matuta banksii Leach, 1817 : 14 ; Miers, 1880 : 315, 1886 : 295 ; Walker, 1890 : 111 ; Alcock, 1896 : 158 ; Lanchester, 1900 : 762 ; Borradaile, 1903 : 436 ; Nobili, 1906a : 149 ; Ihle, 1918 : 185 ; Balss, 1922 : 125 ; Buitendijk, 1939 : 231 ; Barnard, 1950 : 359, figs. 67 h-k ; Sankarankutty, 1962b : 153, fig. 3 ; Sakai, 1976 : 141, pl. 44, fig. 3 and pl. 45, fig. 1.

Material examined : North Andaman : 1 ♂ Aereal Bay, 6.3.1987 ; 2 ♂ ♂, 2 ♀ ♀, Mayabunder, 8.3.1987.

Measurement : W = 32.0 mm, F = 6.0 mm, L = 32.0 mm.

Diagnosis : Carapace with six distinct tubercles both in young and adult specimens. Postero-lateral border with a well defined tubercle near the epibranchial spine on each side. Longitudinal ridge of dactylus of chelipeds smooth.

Description :

Carapace : Subcircular, slightly convex from front to back with six distinct tubercles both in adult and young specimens ; epibranchial, post-gastric and cardiac regions thickly covered with coarse granules.

Front : Almost equal in width to the orbit, rostrum faintly bilobed in the middle.

Lateral borders : Antero-lateral borders crenulate, last three crenulations forming blunt but conspicuous teeth. A prominent tubercle on the postero-lateral border located considerably in rear of the lateral epibranchial spine.

Orbits : Orbital margin with 2 short sutures, lower border crenulated. Eye-stalks short, stout.

Chelipeds : Outer surface of arm smooth, that of the wrist roughened with three blunt but strong tubercles. Upper border of palm or crest trilobed — proximal lobe broad, rest acute and tooth-shaped ; lower border dentate, the denticles extending upto the base of the fixed finger. Below the crest, upper surface of palm adorned with two obliquely-longitudinal rows of tubercles, of which the lower row somewhat broken and irregular. Little beneath this, palm traversed longitudinally from its proximal end to the tip of the fixed finger by a row of 5 teeth of which second tooth longest and acute, 4th tooth also somewhat enlarged and acute but much shorter than the second. Below this, surface of palm roughened by a longitudinal row of tubercles

from the angle at the meeting point of palm and arm formed to the tip of the fixed finger. Outer surface of dactylus traversed by a sharp, smooth ridge. Fixed fringer grooved from its base to its tip, cutting edges of both the fingers strongly dentate.

Legs : Propodus and dactylus of first and last pair of legs very much broadened, carpus of the last pair of legs showing traces of a second dorsal longitudinal carina obscurely. Both sides of merus and lower border of carpus, propodus and dactylus of first and last pair thickly fringed with hairs. Lower border of merus of all the legs tuberculate excepting the last pair.

Abdomen : Consisting of 5 segments in male and 7 segments in female, 3rd-5th terga fused in male.

Male pleopod : Nearly straight and stout appendage, more or less rounded at the tip, inner border crenulated sub-apically.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Andaman and Nicobar Islands ; West coast : Gulf of Kachchh (Gujarat) ; Kolak, Mumbai (Maharashtra) ; Karwar (Karnataka) ; Kavaratii Island (Lakshadweep). Elsewhere : Coasts of East and South Africa, Red Sea, Mauritius, Japan to Polynesia and Australia.

Remarks : The specimens in general agree with the descriptions of Alcock (1896), Barnard (1950) and Sakai (1976), differing from Alcock (*op. cit.*) by the ridge on outer surface of dactylus of chelipeds which is not milled at the distal end and from Barnard (*op. cit.*) in size. The present specimens are smaller than those reported by Barnard (*op. cit.*) and Sakai (*op. cit.*) but bigger than those of Sankarankutty (1962b).

2. *Matuta lunaris* (Forskål, 1775)

(Pl. 1, Fig. 2 ; Pl. 8, Figs. 2, 5)

Cancer lunaris Forskål, 1775 : 91.

Matuta victor Fabricius, 1798 : 369 ; de Haan, 1850 : 127 ; Alcock, 1896 : 160 ; Kemp, 1915 : 209 ; Kohli, 1921-1922 : 83 ; Gravely, 1927 : 142.

Matuta victrix Miers, 1880 : 315 ; Haswell, 1882 : 133 ; Walker, 1890 : 111 ; Henderson, 1893 : 396 ; Lanchester, 1900 : 762.

Matuta lunaris Herbst, 1799 : 43, pl. 48, fig. 6 ; Hilgendorf, 1878 : 810 ; Henderson, 1893 : 396 ; Stebbing, 1905 : 54 ; Laurie, 1906 : 356 ; Stebbing, 1910 : 335 ; Ihle, 1918 : 185 ; Balss, 1922 : 124 ; Chopra, 1933 : 31 ; Chopra and Das, 1937 : 383, fig. 1a ; Buitendijk, 1939 : 231 ; Barnard, 1950 : 358, fig. 671 ; Pillai, 1951 : 9 ; Chhapgar, 1957a : 405, pl. 2, figs. a-c ; Holthuis, 1959 : 104 ; Sankarankutty, 1962b : 153, fig. 2 ; Sakai, 1965 : 59, pl. 24, fig. 1 ; 1976 : 140, pl. 44, fig. 1.

Material examined : North Andaman : 2♂♂, Mayabunder, 9.3.1987.

Measurement : W = 40·0 mm, F = 8·0, L = 38·0 mm.

Diagnosis : The tubercles on carapace rather indistinct, especially the anterior two. Front wider than orbit. Longitudinal ridge of dactylus strongly milled. A distinct spine-like tooth at the base of the lower outer angle of palm at its juncture with the wrist.

Description :

Carapace : Subcircular, slightly convex from front to back, finely granular in the epibranchial, post-gastric and cardiac regions. Anterior two tubercles faint and almost invisible, only the mesogastric and cardiac tubercles somewhat prominent, rest two again indistinct. Surface of carapace covered with numerous minute, simple, red dots.

Front : Wider than orbit, rostrum distinctly bilobed.

Lateral borders : Antero-lateral borders crenulate, at least two of the tubercles become somewhat enlarged forming blunt teeth. Posterior and postero-lateral borders forming a continuous finely beaded slightly raised ridge, the tubercle of the posterolateral borders almost obsolete.

Orbits : Same as in *Matuta banksii*.

Chelipeds : Outer surface of arm smooth and that of wrist roughened with 2-3 strong, blunt tubercles. Upper border of palm or crest trilobed—proximal lobe broad, rest acute and tooth-shaped ; lower border bluntly crenulate, the crenulations extending upto the base of the fixed finger. Below the crest, palm adorned with two obliquely longitudinal rows of tubercles of which, the lower one somewhat broken and irregular. Beneath this, palm traversed longitudinally by a ridge extending up to the tip of the fixed finger bearing a tubercle at its proximal end followed by a large, stout spine ; surface of palm smooth below the above ridge ; a strong tooth like spine at the angle between palm and arm. Outer surface of dactylus traversed by a very prominent striated ridge from its base to tip. Cutting edges of both the fingers strongly dentate.

Legs : Same as in *Matuta banksii*.

Abdomen : Same as in *Matuta banksii*.

Male pleopod : Similar to the preceding species but the distal end of the appendage broadly truncated.

Type locality : Red Sea (Forskål).

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Mahanadi Delta (Orissa) ; Channai, Palk Bay, Gulf of Mannar (Tamil Nadu) ; Nancowry Island (Nicobar). West coast : Gulf of Kachchh (Gujarat) ; Umarsadi, Kolak, Mumbai (Maharashtra) ; Karwar (Karnataka) ; Travancore coast (Kerala). Elsewhere : East coast of Africa, South Africa, Red Sea, Madagascar, Seychelles, Mauritius, Pakistan, Sri Lanka, Myanmar, Malay Peninsula, Java, Celebes, Philippines, South China Sea, Japan, New Guinea, Australia and Samoa.

Remarks : Original description of the species by Forskål (1775) is inadequate. The specimens in general agree with Haswell (1882), Alcock (1896) and Barnard (1950), differing from Barnard (*op. cit.*) in size. They differ from Chhapgar (1957a) in the shape of the male pleopods which are not arrow-headed at the tip. In the course of study, thick fringe of black hairs have been noticed along the upper border of palm and dactylus of both the chelipeds.

Section BRACHYRHYNCHA Borradaile, 1903

Brachyrhyncha Borradaile, 1903 : 425, 1907 : 481 ; Stebbing, 1910 : 293 ; Rathbun, 1918 : 14, 1930 : 8 ; Sakai, 1939 : 365 ; Barnard, 1950 : 75 ; Monod, 1956 : 163 ; Sakai, 1976 : 321.

Diagnosis : Carapace not narrowed in front and more or less oval, round or square in outline, generally broader than long. Rostrum reduced or absent. Epistome well developed. Buccal frame more or less square-cut. Orbits almost complete. Last pair of legs normal, often reduced.

Remarks : This is represented by four superfamilies, namely, Portunoidea Rafinesque, 1815, Xanthoidea MacLeay, 1838, Grapsidoidea MacLeay, 1838 and Ocypodoidea Rafinesque, 1815 in Andaman mangroves.

Key to families of the section BRACHYRHYNCHA from Andaman Mangroves

1. Carapace circular or transversely oval, carpus of external maxillipeds articulating at or near the inner angle of the merus 2
- Carapace square or squarish, carpus of external maxillipeds not articulating at or near the inner angle of the merus 6
2. Inner angle of endopodite of first maxillipeds with a small lobe, leg joints of last pair broadened and adapted for swimming Portunidae
- Endopodite of first maxillipeds without any inner lobe, legs not adapted for swimming 3
3. Male abdomen five segmented, segments 3–5 fused together Xanthidae
- Male abdomen made up of six or seven segments, segments 5–6 fused together 4
4. Male abdomen consisting of seven segments, antero-lateral margins dentate, lobate or spiniform 5
- Male abdomen six segmented, antero-lateral margins entire Carpilidae
5. Carapace and its appendages covered with thick coat of hairs Pilumnidae
- Carapace and its appendages devoid of such dense hair Menippidae

6. External maxillipeds almost or quite close to the mouth, front conspicuously narrow 7
 7
- A rhomboidal gap left between the external maxillipeds, front moderately or extensively broad 8
7. Carapace quadrilateral, subglobose or almost square, buccal cavity of usual size, orbits usually very long and oblique, occupying almost the anterior portion of carapace Ocypodidae
- Carapace globose, buccal cavity extremely large, no orbits.....Mictyridae
8. Flattish carapace, square or squarish in outline, lateral borders straight or slightly curvedGrapsidae
- Tumid carapace, subcircular or slightly transverse, lateral bodies strongly curved and convergent Gecarcinidae

Superfamily PORTUNOIDEA Rafinesque, 1815

Portunidia Rafinesque, 1815 : 93.

Portunoidea Glaessner, 1969 : R 510 ; Bowman and Abele 1982 : 24.

Diagnosis : Carapace flat, squarish or oval in outline, usually broader than long ; surface mostly with transverse ridges. Front narrow or broad, dentate or lobed. Last two joints of the fifth pereopods usually broadened, flattened and paddle like.

Remarks : The superfamily Portunoidea contains two families namely Geryonidae Colosi, 1923 and Portunidae Rafinesque, 1815 (Bowman and Abele, *op. cit.*) of which representatives of the family Portunidae has been found to occur in the mangroves of Andaman Islands.

Family PORTUNIDAE Rafinesque, 1815

Portunidia Rafinesque, 1815 : 97 (corrected to Portunidae by Samouelle, 1819 : 93, name no. 69 on Official List) ; Manning and Holthuis, 1981 : 72.

Megalopidae Haworth, 1825 : 184.

Portuniens H. Milne Edwards, 1834 : 432

Carcinidae MacLeay, 1838 : 59.

Lupinae Dana, 1851a : 129

Arenaeinae Dana, 1851a : 129.

Platyonychidae Dana, 1851a : 130.

Podophthalmidae Dana 1851a : 130.

Neptuniden Nauck, 1880 : 65.

Thalamitinae Miers, 1886 : 170, 193.

Caphyrinae Miers, 1886 : 170.

Portuninea Ortmann, 1893 : 65.

Polybiidae Ortmann, 1893 : 66, 68.

Carupidae Ortmann, 1893 : 66, 68.

Lissocarcinidae Ortmann, 1893 : 67, 87.

Lupocycloida Alcock, 1899 : 22.

Portumninae Ortmann, 1899 : 117.

Goniocaphyrinae Borradaile, 1900 : 577.

Xaividae Berg, 1900 : 224.

Catoptrinae Borradaile, 1902 : 200.

Liocarcininae Rathbun, 1930 : 18.

Macropipinae Stephenson and Campbell, 1960 : 75, 76, 88.

Type genus *Portunus* Weber, 1795

Diagnosis : Carapace depressed, slightly convex, hexagonal subquadrate, elongate-ovate or sub-circular, usually broader than long and rarely areolated, regions generally not well outlined. Front broad, horizontal and cut into 2-6 teeth or lobes. Antero-lateral borders cut into 4-9 teeth. Antennal flagella usually long and slender, antennules folding obliquely or transversely. Epistome of fair length antero-posteriorly or linear and sunken, palate well defined anteriorly. Buccal cavity quadrate, usually broader than long, merus of the external maxillipeds never remarkably long. Chelipeds massive. Male genital openings coxal. Last pair of legs usually modified for swimming, with at least the last two joints flattened, broadened and paddle-like.

Remarks : These are intertidal crabs living in burrows in mud flats, among coral reefs and rocks. They also inhabit mangrove swamps, estuaries or rivers.

The family is represented by a single subfamily, namely, Portuninae Rafinesque, 1815 in Andaman mangroves.

Subfamily PORTUNINAE Rafinesque, 1815

Portuninae Rafinesque, 1815 : 97 ; Stephenson and Campbell, 1960 : 76, 100 ; Crosnier 1962 : 10, 34 ; Sakai, 1965 : 115, 1976 : 335.

Diagnosis : Carapace conspicuously broad and of typical Portunid shape. Antero-lateral borders cut into 4-9 teeth. Basal antenna-joint broad, antero-external angle often lobulate, flagellum sometimes included in the orbit. Legs shorter than chelipeds, fifth pair shaped like a paddle.

Key to the genera of the subfamily PORTUNINAE from Andaman mangroves

1. Carapace oval, antero-lateral borders cut into nine teeth 2
 — Carapace hexagonal, antero-lateral borders never cut into nine teeth..... 3
2. Carapace smooth, regions ill-defined, propodus of chelipeds smooth and inflated.....
 *Scylla*
 — Carapace not smooth, regions well outlined, propodus of chelipeds prismatic and costate
 *Portunus*
3. Antero-lateral border of carapace cut into six teeth
 *Charybdis*
 — Antero-lateral border of carapace cut into five teeth, fourth tooth often small or rudimentary
 *Thalamita*

Genus *Scylla*. de Haan, 1833

Scylla de Haan, 1833 : 11 ; A. Milne Edwards, 1861 : 347 ; Miers, 1886 : 184 ; Alcock, 1899 : 27 ; Shen, 1937 : 99 ; Sakai, 1939 : 382, 384 ; Barnard, 1950 : 160 ; Stephenson and Campbell, 1960 : 111 ; Crosnier, 1962 : 71 ; Sakai, 1976 : 335.

Type species : *Cancer serratus* Forskål, 1775, by subsequent designation by the International Commission of Zoological Nomenclature, 1956, in opinion 73, Smithsonian Miscellaneous 1922 ; gender : feminine : name no. 833 on Official List.

Diagnosis : Carapace broad, transverse, somewhat convex with an almost even surface. Front cut into four teeth. Antero-lateral borders arched, oblique and cut into nine subequal teeth (including the outer orbital tooth), postero-lateral margin shorter than the antero-lateral. Basal joint of antenna short, broad, its antero-external angle produced forming a lobule lying in the orbit, flagellum quite long and lodged in the orbital hiatus. Antennules folding transversely. Upper edge of orbit with two fissures. Epistome not produced ; buccal cavity more or less square cut, broader than long. Chelipeds massive ; wrist and palm smooth, without ridges, palm inflated. Legs stout, moderately compressed ; merus and carpus of the last pair shortened and broadened, propodus and dactylus typically foliaceous for swimming. Male abdomen triangular, five segmented, 3rd-5th terga fused, first tergum much concealed below the carapace.

Distribution : Indo-West Pacific.

3. *Scylla serrata* (Forskål, 1775)
 (Pl. 1, Fig. 3 ; Pl. 8, Figs. 3, 6)

Cancer serratus Forskål, 1775 : 90.

Scylla serrata de Haan, 1833 : 40 ; Krauss, 1843 : 25 ; A. Milne Edwards, 1861 : 349 ; Heller, 1865 : 27 ; Miers, 1876 : 27 ; Haswell, 1882 : 79 ; Miers, 1886 : 185 ; Henderson, 1893 : 372 ; Alcock, 1899 :

27 ; Lanchester, 1900 : 748 ; de Man, 1903 : 472 ; Nobili, 1906a : 189 ; Stimpson, 1907 : 75 ; Klunzinger, 1913 : 345 ; Kemp, 1915 : 248, 1918 : 250 ; Gravely, 1927 : 142 ; Gordon, 1931 : 527 ; Shen, 1937 : 99 ; Chopra and Das 1937 : 391 ; Estampador, 1937 : 521 ; Leene, 1938 : 14 ; Sakai, 1939 : 384, fig. 4 ; Gravely, 1941 : 104 ; Estampador, 1949a : 99, pl. 1, figs. 1a, b ; Barnard, 1950 : 160 ; Serène, 1952 : 134-137 ; Edmondson, 1954 : 234, figs. 10b, 11a-c ; Chhappgar, 1957a : 416, pl. 5, figs. a-c ; Stephenson and Campbell, 1960 : 111, fig. 2N, pl. 4, fig. 4, pls. 5N, 6C ; Sankarankutty, 1961a : 104 ; Crosnier, 1962 : 71 ; Sakai, 1965 : 115, pl. 52 ; Chandy, 1970 : 402 ; Sakai, 1976 : 335, pl. 115 ; Mustaquim and Rabbani, 1976 : 163 ; Holthuis, 1978 : 15 ; Chakraborty, Choudhury and Deb, 1986 : 64 ; Soemodihardjo, 1987 : 103 ; Ansari, 1987 : 160 ; Aksornkoae, 1987 : 240 ; Jayewardene, 1987 : 224.

Cancer olivaceus Herbst, 1796 : pl. 38, fig. 3

Portunus tranquebaricus Fabricius, 1798 : 366 ; Bosc, 1802 : 219 ; Latreille, 1828 : 191.

Portunus serratus Rüppell, 1830 : 10.

Lupa tranquebarica H. Milne Edwards, 1834 : 448.

Scylla tranquebarica var. *oceanica* Dana, 1852b : 270, pl. 16, fig. 2 ; Estampador, 1949a : 103, pl. 3, fig. 1.

Scylla oceanica Estampador, 1949a : 101, pl. 1, fig. 2.

Scylla serrata var. *paramamosain* Estampador, 1949a : 104, pl.3, fig. 2.

Material examined : North Andaman : 1♂, Mayabunder, 24.7.1979. Middle Andaman : 2♂♂, 1♀, Yerata Jetty, 10.11.1979 ; 1♂, 1♀, Rangat, 24.3.1987. South Andaman : 1♀, Sippighat, 2.8.1981 ; 1♂, Carbyn's Cove, 24.3.1985 ; 1♂, 1♀, Ferrargunj, 18.8.1985.

Measurement : W = 112.0 mm, F = 22.0 mm, L = 80.0 mm.

Diagnosis : Antero-lateral border of carapace cut into 9 sharp acuminate teeth of nearly equal size. Arm of the larger cheliped adorned with 3 spines on the anterior border and two on the posterior border. Leg joints unarmed.

Description :

Carapace : Transverse, broad, moderately convex in both the directions ; regions almost indistinct ; surface smooth excepting a faint granular ridge.

Front : Broad, cut into four blunt teeth of almost equal size and about 1/5th of the greatest breadth of carapace.

Lateral borders : Antero-lateral border of carapace cut into nine, sharp teeth of equal size (including the outer orbital angle). Postero-lateral sides convergent, greater part of it finely crenulated. Posterior border of the carapace forming a curve with the postero-lateral borders and the point of junction slightly thickened.

Orbits : Orbital edge lodged with two dorsal sutures and one ventral suture just below the outer orbital angle, lower orbital angle tooth-shaped and prominent. Both margins of the orbit also crenated. Eyes large ; eye-stalk thick, short.

Chelipeds : Stout, massive and unequal in both sexes ; arm, wrist and palm smooth. Anterior and posterior border of the arm adorned with three and two claw-like spines respectively. Inner corner of the wrist drawn into a strong spine ; its outer angle adorned with a spinule. Upper border of palm armed with three spines—one near the apex of the wrist-joint, remaining two placed side by side just behind the finger-joint. Fingers stout, tips pointed and crossed. Outer surface of both the fingers grooved longitudinally. Cutting edge of dactylus adorned with a large molariform tooth at its proximal corner ; both edges of fingers bearing several large teeth.

Legs : Joints moderately compressed, unarmed. Third pair of legs largest. In the last pair, merus and carpus become shortened and broadened ; propodus and dactylus become foliaceous and paddle like for swimming.

Abdomen : Male abdomen broadly triangular, made up of 5 segments, 3rd-5th joints fused.

Male pleopod : Elegantly bent bearing short, stout spinules, the tip looking like a scalpel.

Type locality : unknown.

Distribution : Indo West Pacific. India : East coast : Sundarbans (West Bengal) ; Chilka Lake (Orissa) ; Kakinada Bay (Andhra Pradesh) ; Chennai, Pulicat Lake, Palk Bay (Tamil Nadu) ; North Bay, Ross Island (Andamans). West Coast : Gulf of Kachchh (Gujarat) ; Kolak, Mumbai (Maharashtra) ; Zuari Estuary (Goa) ; Karwar (Karnataka). Elsewhere : East and South coasts of Africa, Red Sea, Pakistan, Sri Lanka, Thailand, Japan, China, Philippines, Indonesia, Australia, New Zealand, Tahiti and Hawaiian Islands.

Remarks : The specimens examined agree well with Alcock (1899) although variations with regard to size of specimens have been observed. Further, longitudinal costae on the upper surface of the palm of chelipeds and transverse granular line across the gastric region of carapace as reported by Alcock (*op. cit.*) was not observed in young specimens. As these crabs exhibit a good deal of variation with regard to colouration, size, spination, habitat especially with references to depth, nature of bottom and number of burrow openings several forms, varieties and species have been described by various workers leading to much confusion. Many carcinologists, still consider these crabs to belong to a single species, namely, *Scylla serrata* (Forskål, 1775).

However, based upon his studies of comparative external morphology and gametogenesis of the various forms of the genus *Scylla* de Haan Estampador (1949a, b) recognised three species, *Scylla serrata* (Forskål), *Scylla oceanica* (Dana), *Scylla tranquebarica* (Fabricius) and a variety *Scylla serrata paramamosain* Estampador from Philippines. Serène (1952) reported the four forms of Estampador from Vietnam dividing them broadly into two groups of "marked

Scylla oceanica (Dana)" and its variety *scylla oceanica tranquebarica* (Fabricius) and the "unmarked kind *Scylla serrata* (Forskål)" with its variety *Scylla serrata paramamosain* Estampador. Ong (1964) also recorded all the four forms from Malaya. All carcinologists working on Indian crabs have recognised only one species, namely, *Scylla serrata* (Forskål) except Joel and Raj (1980) who reported two forms, *Scylla serrata* and *Scylla tranquebarica* from Pulicat Lake.

All the forms reported above are recognised based on colour. Since colour disappears on preservation this character is of little help with the preserved materials. Several morphological characters cited by Estampador (1949a), such as, relative length of chelipeds, H-groove on carapace and protrusion of the frontal lobes as reported by above workers appear to be insufficient for distinguishing these forms. Even other characters enlisted by Serène (1952), such as, length of external spine on upper surface of palm of cheliped near the finger, length of spine on antero-inferior border of the carpus, shape of frontal lobe and antero-lateral teeth, relative length of posterior border of carapace and orbital space for this purpose are also highly variable and not easy to interpret. Based upon these studies, Stephenson and Campbell (1959) opined that they disagree upon the features other than the colour which could be used to effect a separation.

Hólthuis (1978) while criticizing the works of Estampador (*op. cit.*) and Serène (*op. cit.*) pointed out that none of them had attributed their reasons for using the epithets *serrata*, *tranquebarica* and *oceanica* for the various forms they dealt with ; original descriptions of those species were inadequate, types of those species had not been examined by any of them, so, validity of these names appear uncertain.

All live specimens examined by Stephenson and Campbell (*op. cit.*) in different parts of Australia were unmarked forms belonging to either *Scylla serrata* or its variety *paramamosain*. Notable difference between these two forms is spination upon palm and wrist of chelipeds which they attributed due to different degrees of wear and tear and would be related to different intervals since the last moult. They opined not to recognise the variety *paramamosain* unless this possibility is ruled out.

From the above discussion, it is clear that a good deal of work is still required before splitting the old species *Scylla serrata* (Forskål) into the four forms. Already workers like Serène (1952), Ong (1964) and Stephenson and Campbell (1959) have argued for more work before Estampador's classification can be regarded as justified. More information is needed on the effect of wear and tear, on spination of the chelae, shape of antero-lateral teeth, morphology of male pleopod, effect of environment upon colouration and marking pattern of individuals, habitat ecology and migratory behaviour. Because of the above discontinuations, it is preferable to keep all the four forms under a single species, *Scylla serrata* (Forskål) till the required information is gathered.

In this connection, it is worth mentioning that in 1988, Oshiro recognised three "species" of *Scylla* from Japan, namely, *S. serrata*, *S. tranquebarica* and *S. oceanica*. Subsequently,

Sugimoto (1990 ; cited from Fuseya and Watanabe, 1996) and Fuseya and Watanabe (1996) justified this taxonomic work by allozyme analysis and electrophoretic analysis of the allozymes. However, further study and analysis are required to establish this classification of *Scylla*.

Genus *Portunus* Weber, 1795

Portunus Weber, 1795 : 93 ; Latreille, 1806 : 26 ; Rathbun, 1897 : 155 ; Hale, 1927 : 149 ; Rathbun, 1930 : 33 ; Edmondson, 1954 : 235 ; Stephenson and Campbell, 1959 : 85 ; Crosnier, 1962 : 41 ; Glaessner, 1969 : R510 ; Sakai, 1976 : 336 ; Manning and Holthuis, 1981 : 87.

Non *Portunus* Fabricius, 1798 (part) : 363 ; A. Milne Edwards, 1861 : 392 ; Miers, 1886 : 199 ; Sakai, 1939 : 377.

Lupa Leach, 1814 : 390 ; H. Milne Edwards, 1834 : 445 ; Dana, 1852b : 268 ; Barnard, 1950 : 152.

Lima Leach, 1814 : 429.

Lupania Rafinesque, 1818 : 272.

Neptunus de Haan, 1833 : 7 ; A. Milne Edwards, 1861 : 314 ; Miers, 1886 : 171 ; Alcock, 1899 : 28 ; Shen, 1937 : 99 ; Sakai, 1939 : 385.

Achelous de Haan, 1833 : 3, 8.

Amphitrite de Haan, 1833 : 3, 8.

Pontus de Haan, 1833 : 3, 9.

Lupea H. Milne Edwards, 1834 : 445.

Monomia Gistel, 1848 : viii.

Posidon Herklots, 1851 : 3.

Xiphonectes A. Milne Edwards, 1873b : 157.

Hellenus A. Milne Edwards, 1874, in 1873-1881 : 210, 221.

Lupocycloporus Alcock 1899 : 31, 32, 44.

Cycloachelous Ward, 1942 : 79.

Type species : *Cancer pelagicus*, 1758, by selection by Rathbun, 1926 ; in opinion 394, International Commission on Zoological Nomenclature, 1965 ; gender : masculine ; name no. 986 on Official List.

Diagnosis : Carapace transversely broad, depressed or slightly convex. Front wide, cut into 3-6 teeth. Antero-lateral borders oblique, curved, longer than the postero-laterals and cut into 9 regular teeth (including the external orbital angle), the last tooth often enlarged. Basal antenna-joint short, its antero-external angle produced to form a lobule or spine extending into the orbit, flagellum quite long and lodged in the orbital hiatus. Antennules folding transversely. Orbit with two fissures or sutures on the upper border ; lower border also with a suture or fissure near the

outer angle, inner angle tooth-like and usually very distinct. Epistome short or linear, often prolonged in the middle forming a spine beneath the inter-antennular septum. Buccal cavity more or less square-cut, broader than long. Chelipeds long, massive and armed with spines, both inner and outer corners of wrist spine-like, palm prismatic with longitudinal ridges and spines, fingers almost as long as palm and strongly toothed. Legs compressed, in the last pair merus and carpus broadened and shortened, propodus and dactylus typically foliaceous and paddle-like for swimming. Male abdomen five-jointed, 3rd-5th segments fused; first tergum in both sexes concealed almost completely under the carapace.

Remarks : It is well known to the carcinologists that lot of problems arise to assign subgeneric status of crabs under the genus *Portunus* as elucidated by Stephenson and Campbell (1959). In view of this, subgenera of the crabs under this genus are not considered in the present communication.

Distribution : Tropical and Temperate Seas.

Key to the species of the genus *Portunus* from Andaman Mangroves

- Carapace marked with three large blood-red spots, posterior border of merus of chelipeds without any spine..... *P. sanguinolentus*
- Carapace devoid of such spots but its surface studded with miliary granules, posterior border of merus of chelipeds with a spine at its distal end *P. pelagicus*

4. *Portunus pelagicus* (Linnaeus, 1758)

(Pl. 1, Fig. 4 ; Pl. 9, Figs. 3, 4)

Cancer pelagicus Linnaeus, 1758 : 626 ; Forskål, 1775 : 89.

Cancer cedo-nulli Herbst, 1796 : 157, pl. 39.

Cancer reticulatus Herbst, 1799 : 65, pl. 50.

Portunus pelagicus Fabricius, 1798 : 367 ; Latreille, 1806 : 26, 1828 : 187 ; Hale, 1927 : 149, fig. 150 ; Montgomery, 1931 : 427 ; Stephenson and Campbell, 1959 : 96, figs. 2A, 3A, pl. 1, fig. 1, pl. 4A, 5A ; Crosnier, 1962 : 43, figs. 58, 61, 67 ; Sankarankutty, 1961a : 103 ; Sakai, 1965 : 117, pls. 55, 56 ; Chakraborty, Choudhury and Deb, 1986 : 65.

Portunus cedo-nulli Bosc, 1802 : 221.

Lupa pelagica Desmarest, 1823 : 223, 1825 : 98, pl. 6, fig. 2 ; H. Milne Edwards, 1834 : 450 ; Barnard, 1950 : 153, fig. 27.

Neptunus pelagicus de Haan, 1835 : 37, pls. 9, 10 ; Krauss, 1843 : 23 ; Heller, 1865 : 27 ; A. Milne Edwards, 1861 : 320, 1873b : 156 ; Haswell, 1882 : 77 ; Kossmann, 1877 : 46 ; Hilgendorf, 1878 : 799 ; de Man, 1887 : 69 ; Walker, 1890 : 110 ; Henderson, 1893 : 367 ; Alcock, 1899 : 34 ; Calman, 1900 : 21 ; Kemp, 1915 : 248 ; Kohli, 1921-1922 : 85 ; Delsman and de Man, 1925 : 309 ; Gravely, 1927 : 141, 1941 : 104 ; Pillai, 1951 : 21 ; Chandy, 1970 : 402.

Neptunus (Neptunus) pelagicus Miers, 1886 : 173 ; Ortmann, 1893 : 74 ; de Man, 1895 : 556 ; Lanchester, 1900 : 745 ; Laurie, 1906 : 412 ; Chopra, 1935 : 476 ; Sakai, 1939 : 387, pl. 49 ; Stephensen, 1945 : 124, fig. 26E ; Chhappgar, 1957a : 418, pl. A, fig. 6, figs. a-c.

Portunus mauricianus Ward, 1842 : 79, pl. 5, fig. 4.

Portunus (Portunus) pelagicus Rathbun, 1923 : 130 ; Shen, 1934 : 37, fig. 1 ; Sakai, 1976 : 339, pl. 118.

Material examined : North Andaman : 2♂♂, 1♀, Mayabunder, 8.3.1987 ; 1♂, Austin IX, 10.3.1987.

Measurement : W = 74.0 mm, F = 8.0 mm, L = 39.0 mm.

Diagnosis : Carapace covered with miliary granules dorsally. Posterior border of the arm of cheliped adorned with a spine. Two spines on palm present side by side just behind the finger-joint.

Description

Carapace : Very broad, slightly convex, its length (excluding the lateral spines) a little more than half of the greatest breadth of carapace; surface studded with miliary granules, crossed by two granular lines on the gastric and one on each side of the branchial region ; branchial area tumid, hepatic part depressed.

Front : Cut into four acute teeth, middle pair extremely small and inconspicuous, lateral teeth sharp and very prominent.

Lateral borders : Antero-lateral borders very long, curved and cut into nine acute teeth, including the outer orbital angle, last tooth remarkably long and spiniform, tips of spines whitish. Posterior border forming a curve with the postero-lateral sides.

Orbits : Upper border of the orbit cut by two fissures into three lobes ; outer corner of the middle lobe very distinct and tooth-like. Lower orbital edge notched near the outer angle, inner angle very prominent and dentiform. Margins of both the edges crenated. Eyes large ; eye-stalk thick, short.

Chelipeds : Massive and unequal. Arm with three large acute spines on the anterior border and a sharp spine on the posterior border ; all of its three edges granular. Inner and outer corner of wrist armed with two large, sharp spines. Palm also bearing three spines dorsally — two just behind the finger-joint side by side and one near the apex of the wrist-joint, inner surface of palm smooth with a longitudinal ridge in the middle. Both wrist and palm costate, costae granular. Both fingers strongly dentate ; dactylus of large chela with a large molariform tooth at its proximal end. Finger tips pointed, crossing ; distal 1/3rd of it brick-red in colour.

Legs : Joints smooth, compressed. In the last pair, merus and carpus shortened and broadened, propodus and dactylus become foliaceous and paddle-like for swimming. Upper

border of carpus, propodus and dactylus crest-like ; anterior margin of carpus of 2nd-4th pair of legs armed with a sub-terminal spine towards the distal end ; lower border of propodus and dactylus of 2nd-4th pair fringed with hairs ; all sides of merus, carpus, propodus and dactylus of the last pair also fringed with hairs.

Abdomen Sixth segment of male abdomen almost as long as broad, seventh segment about half of the sixth.

Male pleopod : Long, slender, curved, gradually tapering towards the tip ; the apical part bearing backwardly directed stout spinules.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East Coast : Sundarbans (West Bengal) ; Chilka Lake (Orissa) ; Palk Bay and Gulf of Mannar (Tamil Nadu) ; North Bay (Andaman Island). West coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra) ; Karwar (Karnataka) ; Travancore (Kerala). Elsewhere : East and South coasts of Africa, the Mediterranean, Red Sea, Persian Gulf, Sri Lanka, Mergui Archipelago, Singapore, Philippines, Hong Kong, Japan, Australia, New Caledonia, New Zealand and Tahiti.

Remarks : Original description of the species by Linnaeus (1758) is very brief. The specimens studied agree in general with Alcock (1899), Haswell (1882) and Stephenson and Campbell (1959). These, however, differ from Haswell (*op. cit.*) in the number of spines on the anterior margin of the arm of the larger cheliped. The present materials are smaller in size than those of Rathbun (1923), Shen (1937), Chhapgar (1957a), Stephenson and Campbell (*op. cit.*), Sankarankutty (1961a) and Sakai (1976).

5. *Portunus sanguinolentus* (Herbst, 1796)

(Pl. 1, Fig. 5 ; Pl. 9, Figs. 1, 2)

Cancer sanguinolentus Herbst, 1796 : 161, pl. 8, figs. 56, 57.

Lupa sanguinolenta H. Milne Edwards, 1834 : 451 ; Dana, 1852b : 271 ; Stimpson, 1907 : 76, Barnard, 1950 : 152, 154.

Neptunus sanguinolentus de Haan, 1835 : 38 ; A. Milne Edwards, 1861 : 319 ; Heller, 1865 : 26 ; Haswell, 1882 : 77 ; Streets, 1877 : 106 ; Henderson, 1893 : 368 ; Alcock, 1899 : 32 ; Kohli, 1921-1922 : 84 ; Delsman and de Man, 1925 : 310 ; Estampador, 1937 : 520 ; Gravely, 1941 : 104 ; Pillai, 1951 : 21.

Neptunus (Neptunus) sanguinolentus Miers, 1886 : 174 ; Ortmann, 1893 : 75 ; de Man, 1895 : 556 ; Lanchester, 1900 : 745 ; de Man, 1902 : 472, 642 ; Laurie, 1906 : 412 ; Gordon, 1931 : 527 ; Chopra, 1935 : 474, fig. 2 ; Chopra and Das, 1937 : 391 ; Shen, 1937 : 100 ; Estampador, 1937 : 520 ; Sakai, 1939 : 387, pl. 47, fig. 1 ; Chhapgar, 1957a : 417, pl. A, fig. 3, pl. 4, figs. m-o ; Stephensen, 1945 : 123, fig. 26D.

Portunus sanguinolentus Fabricius 1798 : 367 ; Bosc, 1802 : 220 ; Latreille, 1828 : 190 ; Rathbun, 1906b : 870 ; Hale, 1927 : 150, fig. 151 ; Edmondson, 1954 : 236, figs. 12, 13 ; Stephenson and Campbell, 1959 : 98, figs. 2B, 3B, pl. 1, fig. 2, pls. 4B, 5B ; Sankarankutty, 1966a : 103 ; Crosnier, 1962 : 45, figs. 59, 62, 63, 68 ; Sakai, 1965: 116, pl, 53.

Portunus (Portunus) sanguinolentus Rathbun, 1923 : 130 ; Sakai, 1976 : 338, pl. 117.

Material examined : South Andaman : 2♂♂, 2♀♀, Carbyn's Cove, 16.11.1980.

Measurement : W = 58.0 mm, F = 7.0 mm, L = 28.0 mm.

Diagnosis : Dorsal surface of carapace conspicuously marked with three large blood-red spots. Posterior border of arm of the chelipeds without any spine. A single spine on palm just behind the finger-joint.

Description

Carapace : Very broad, about twice its length (excluding the lateral spines) rather convex in the middle and finely granular in the anterior half ; surface crossed transversely by slightly elevated granular lines — two on the gastric and one on either side of the branchial region. Three large, prominent blood red spots present posteriorly on carapace — two laterally on either side near the postero-lateral border, almost circular in shape ; the middle one largest, longer than broad and located beneath the cardiac region.

Front : Same as in *Portunus pelagicus*.

Lateral borders : Antero-lateral borders very long, arched and cut into nine short, low teeth (excluding the outer orbital angle) ; last tooth, the largest. Posterior border granular, forming a curve with the postero-lateral angle.

Orbits : Same as in *Portunus pelagicus*.

Chelipeds : Stout and unequal. Outer surface of arm, wrist and palm smooth. Anterior border of the arm adorned with three large spines but none on the posterior border ; all the three edges of arm granular. Inner and outer corners of wrist bearing strong acute spines, palm adorned with two spines dorsally—one near the apex of the wrist-joint and the other little behind the finger-joint. Outer and inner surfaces of palm and only outer surface of wrist costate, costae smooth. Both the fingers strongly dentate and grooved. A longitudinal channel running from middle of the fixed finger extending up to its distal end. Finger tips pointed and crossing:

Legs Same as in *Portunus pelagicus*.

Abdomen Same as in *Portunus pelagicus*.

Male pleopod : Almost similar to the preceding species, the apical part abruptly narrowed, dropper-like bearing shorter spinules.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Kakinada Bay (Andhra Pradesh) ; Chennai, Palk Bay (Tamil Nadu) ; Andaman and Nicobar Islands. West coast : Mumbai (Maharashtra) ; Karwar (Karnataka) ; Travancore (Kerala). Elsewhere : East Africa, Red Sea, Persian Gulf, Sri Lanka, Malay Peninsula, Philippines, Hong Kong, Formosa, Japan, Australia, New Zealand and as far as Hawaii.

Remarks The specimens examined during the present study correspond well with the description of Alcock (1899) although palm of larger chela has been found to be slightly smaller than fingers. The present specimens are, however, much smaller than that of Rathbun (1923), Barnard (1950) and Stephenson and Campbell (1959). Further the blood red spots of carapace have been observed to disappear on long preservation.

Genus *Charybdis* de Haan, 1833

Charybdis de Haan, 1833 : 9, 10 ; Rathbun, 1897 : 161 ; Alcock, 1899 : 47 ; Leene, 1938 : 15-24 ; Sakai, 1939 : 398, 400 ; Shen, 1937 : 116 ; Barnard, 1950 : 165 ; Stephenson, Hudson and Campbell, 1957 : 491, 492, 493 ; Crosnier, 1962 : 73 ; Glaessner, 1969 : R510 ; Sakai, 1976 : 353 ; Manning and Holthuis, 1981 : 73.

Oceanus de Haan, 1833 : 9, 10.

Goniosoma A. Milne Edwards, 1861 : 367 ; Miers 1886 : 189.

Type species : *Cancer sexdentatus* Herbst, 1783, a subjective junior synonym of *Cancer ferriatus* Linnaeus, 1758, by subsequent designation by Glaessner, 1929 : 113 ; gender : feminine ; name no. 1616 on Official List.

Diagnosis : Carapace hexagonal, moderately broad, depressed or slightly convex with more or less distinct transverse granular ridges in the anterior half. Front cut into six lobes or teeth (excluding the supra-orbital angles). Antero-lateral teeth usually six (including outer orbital tooth), sometimes 5 or 7. Basal joint of antenna short, broad ; outer angle of it lobule-like, filling the orbital hiatus, meeting the front and excluding the flagellum from the hiatus. Antennules transversely folded. Upper orbital border with two notches or fissures, inner angle of the lower border tooth-like. Epistome considerably long, buccal cavity squarish, broader than long. Chelipeds massive. Legs compressed ; merus and carpus of the last pair shortened and broadened, propodus and dactylus typically foliaceous for swimming. Male abdomen consisting of 5 segments, 3rd-5th terga fused.

Distribution : Indo-West Pacific.

Remarks : The genus *Charybdis* de Haan, 1833 is divided into five subgenera (Stephenson *et. al.*, 1957). It is represented by a single subgenus, namely, *Charybdis* de Haan, 1833 in Andaman mangroves.

Subgenus *Charybdis* de Haan, 1833

Charybdis de Haan, 1833 : 9, 10 ; Rathbun, 1897 : 161 ; Leene, 1938 : 18 ; Crosnier, 1962 : 73.

Oceanus de Haan, 1833 : 9, 10.

Goniosoma A. Milne Edwards, 1861 : 367 ; Miers, 1886 : 189 ; Alcock, 1899 : 48, 49.

Diagnosis : Four median teeth of the front almost of same size of the lateral frontal teeth. Antero-lateral borders of carapace cut into six spines (often seven). Lobule at the outer angle of the basal antenna-joint extended up to the front excluding the flagellum entirely from the orbital hiatus. Posterior border of the arm of the cheliped devoid of spine.

Key to the species of the subgenus *Charybdis* from Andaman Mangroves

- Six spines of the antero-lateral border almost equal in size *C. (C.) helleri*
- Six spines of the antero-lateral border unequal in size, second spine rudimentary
..... *C. (C.) orientalis*

6. *Charybdis (Charybdis) helleri* (A. Milne Edwards, 1867)

(Pl. 2, Fig. 1 ; Pl. 9, Figs. 7, 8)

Goniosoma helleri A. Milne Edwards, 1867 : 282 ; Henderson, 1893 : 375.

Goniosoma merguensis de Man, 1887 : 82, pl. 5, figs. 3, 4 ; 1895 : 560.

Charybdis (Goniosoma) merguensis Alcock, 1899 : 55 ; Gordon, 1931 : 527 ; Chopra, 1935 : 484, fig. 8 ;
Shen, 1937 : 121, figs. 12 a-d ; Chopra and Das, 1937 : 394.

Charybdis merguensis Barnard, 1950 : 168, figs. 27d, 32 b.

Charybdis hellerii Edmondson, 1954 : 247, figs. 32a, f.

Charybdis (Charybdis) helleri Leene, 1938 : 44, figs. 15-17 ; Buitendijk, 1947 : 281 ; Stephenson, Hudson and Campbell, 1957 : 497, figs. 1A, 2I, 3J, pl. 1, fig. 4, pls. 4C, 5B ; Mustaquim and Rabbani, 1976 : 162.

Material examined : Middle Andaman : 1♂, Rangat, 24.3.1987.

Measurement : W = 74.0 mm, F = 20.0 mm, L = 48.0 mm.

Diagnosis : First spine of the antero-lateral border convex on the outer margin. Carpus of the last pair of leg with a distinct, acute spine on its lower border.

Description

Carapace : Broad, slightly convex in both the directions with transverse granular ridges on the anterior half. Lateral ridge joining the last antero-lateral spine almost unbroken excepting an interruption by cervical groove; ridge above this almost straight and unbroken ; further anteriorly, two convex ridges widely apart ; in front of these two ridges and just behind the

median pair of frontal teeth, a pair of short, post-frontal ridge also present. Carapace and appendages covered with short hairs.

Front : Broad, less than 1/3rd of the greatest breadth of carapace and cut into six teeth ; apices of the middle two teeth rounded, laterals triangular and widely separated from the outermost teeth.

Lateral borders : First five teeth of the antero-lateral border pointed anteriorly, sixth one directed antero-laterally ; tips of the antero-lateral teeth chocolate brown in colour. Posterior border of carapace forming a curve with the postero-lateral borders.

Orbits : Upper orbital edge sharp with two dorsal sutures ; inner angle of the lower border bluntly tooth-shaped, lobule of the outer end prominent but not dentiform.

Chelipeds : Massive, unequal. Outer surface of arm smooth, its upper surface granular, anterior edge of which armed with three strong spines; first two spines much larger than the third. Outer surface of wrist and palm smooth. Inner angle of wrist beset with a large, pointed spine ; three spinules also present on its lower outer side. Upper border of palm armed with five spines, two side by side just behind the finger-joint, other two almost medially and the last one near the apex of the wrist-joint. Outer surface of palm costate, costae smooth. Both outer and inner surfaces of dactylus and fixed finger grooved, their cutting edges strongly toothed. Fingers inflated, tips chocolate brown in colour.

Legs : Joints long, compressed. Dactylus grooved and claw-shaped except for the last pair. In the fifth pair, merus and carpus shortened and broadened ; merus twice as long as broad with the usual spine on the lower distal corner ; lower border of carpus also armed with an acute spine at its distal corner ; propodus and dactylus typically foliaceous ; lower edge of propodus serrated. Upper border of merus and both the edges of carpus, propodus and dactylus of the last pair fringed with hairs ; in others, lower surfaces of propodus and dactylus hairy.

Abdomen : Male abdomen consisting of 5 segments. Sixth segment of male as long as broad with the sides parallel at the basal two-thirds and convergent distally.

Male pleopod : Long, slender with a blunt tip and curved at the apex ; its outer margin bearing two stout, blunt spines sub-apically, both the borders of the appendage carrying long spines.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Andaman Islands. Elsewhere : Mediterranean Sea, Persian Gulf, Pakistan, China, Hong Kong, Mergui Archipelago, Malay Peninsula, Singapore, Australia and as far as Hawaii.

Remarks : Shen (1937) reported 3-4 spines and a spinule at the distal end of the anterior border of the arm of the larger cheloped but the present specimen has been found to contain 3

spines only. Further, lower border of the arm of the larger cheliped has been found to be infested with oysters. Cirriped settlement has also been observed on right antennary flagellum of the specimen.

7. *Charybdis (Charybdis) orientalis* Dana, 1852

(Pl. 2, Fig. 2 ; Pl. 9, Figs. 5, 6)

Charybdis orientalis Dana, 1852a : 85, 1852b : 285, pl. 17, fig. 10.

Goniosoma orientale A. Milne Edwards, 1861 : 383; Henderson, 1893 : 375 ; Klunzinger, 1913 : 365, pl. 7, fig. 21.

Charybdis (Goniosoma) orientalis Alcock, 1899 : 63 ; Laurie, 1906 : 418; Chhapgar, 1957a : 422, pl. 7, figs. d-g ; Chandu, 1970 : 402.

Charybdis orientalis Sakai, 1939 : 407, pl. 83, fig. 2 ; Barnard, 1950 : 170, figs. 32d-g.

Non *Charybdis orientalis* Rathbun, 1906b : 872, pl. 13, fig. 1.

Charybdis (Charybdis) orientalis Leene, 1938 : 68, figs. 32-34 ; Stephenson, Hudson and Campbell, 1957 : 502, figs. 2B, 3B, pl. 3, fig. 1, pl. 4G ; Crosnier, 1962 : 80 ; Sakai, 1976 : 362, pl. 128, fig. 2.

Material examined : North Andaman : 1♂, 1♀, Aereal Bay, 8.3.1987.

Measurement : W = 42.0 mm, F = 11.0 mm, L = 26.0 mm.

Diagnosis : Second spine of antero-lateral border rudimentary. Carpus of the last pair of leg devoid of any spine on its posterior border.

Description

Carapace : Moderately broad and slightly convex with the usual number of transverse granular lines.

Front : Broad, about $\frac{1}{4}$ th of the greatest breadth of carapace and cut into six teeth ; apices of middle two pairs rounded, outer pair slightly conical and narrower.

Lateral borders : Antero-lateral borders of carapace diagonal, cut into six spines of which the second spine rudimentary, the last four almost equal to the first. Posterior border of dorsal surface of carapace with a conspicuous ridge forming a distinct curve with the postero-lateral borders.

Orbits : Same as in *Charybdis (Charybdis) helleri*.

Chelipeds : Unequal, short. Anterior edge of the arm adorned with 3 spines, outer side of it roughened with granules. Wrist with a strong spine on its inner corner and 3 spinules on the lower outer side. Palm not much swollen ; upper surface of it armed with five spines — two of which stand side by side just behind the finger-joint, other two almost median and the fifth spine

in front of the apex of the wrist-joint ; lower outer side of palm with three distinct costae. Fingers long, pointed and crossing, their outer surfaces grooved with longitudinal channels. Cutting edges of both fingers furnished with several big teeth, dactylus with a strong molariform tooth at its proximal end.

Legs : Joints long, narrow and unarmed. In the last pair, merus twice as long as broad with usual spine on lower distal corner ; posterior border of propodus serrated with 5-8 spinules ; dactylus claw-shaped excepting the last pair. Upper border of merus, both the edges of carpus, propodus and dactylus of last pair fringed with hairs.

Abdomen : Male abdomen five-segmented with 3rd-5th segments being fused ; female with 7 distinct segments. Sixth segment of male abdomen almost as long as broad with the sides slightly convergent distally.

Male pleopod : Long, slender with a blunt tip ; inner margin with long spines sub-apically, outer margin bearing few.

Type locality : Island of Mindanao, Philippines (Dana).

Distribution : Indo-West Pacific. India : East coast : Chennai, Gulf of Mannar (Tamil Nadu) ; Andaman Islands (present record). West coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra). Elsewhere : East coast of Africa, Madagascar, Red Sea, Sri Lanka, Arakan coast, Philippines, Japan and Australia.

Remarks : The specimens in general agree with Alcock (1899) and Chhapgar (1957a). However, these are slightly smaller than Chhapgar's (*op. cit.*) specimens. This species is reported for the first time from Andaman Islands.

Genus *Thalamita* Latreille, 1829

Thalamita Latreille, 1829 : 33 (foot note) ; A. Milne Edwards, 1861 : 354 ; Miers, 1886 : 193 ; Alcock, 1899 : 11, 72 ; Shen, 1937 : 128 ; Sakai, 1939 : 413 ; Barnard, 1950 : 171 ; Stephenson and Hudson, 1957 : 314 ; Crosnier, 1962 : 93 ; Sakai, 1976 : 367 ; Manning and Holthuis, 1981 : 107.

Type species : *Cancer admete* Herbst, 1803 ; by monotypy ; gender : feminine ; name no. 195 on Official List.

Diagnosis : Carapace more or less hexagonal, broad, depressed or slightly convex and usually marked with prominent transverse ridges. Front cut into 2-6 rounded or subquadrate teeth or lobes. Antero-lateral borders cut into five teeth ; fourth tooth often rudimentary or absent. Basal antenna-joint broad, apical lobe long, lying in contact for its entire length with the inner orbital tooth, antenna excluded from the orbit. Antennules transversely folded. Upper orbital edge with two sutures. Epistome long, buccal cavity squarish, slightly broader than long ; efferent branchial channels distinct. Chelipeds strong. Legs compressed ; merus and carpus of the last pair broadened, propodus and dactylus typically foliaceous and paddle-like for swimming. Male abdomen

five-jointed, 3rd-5th segments fused ; first segment concealed below the carapace almost completely.

Distribution : Indo-West Pacific, West Africa (introduced into East Mediterranean).

Key to the species of the genus *Thalamita* from Andaman Mangroves

1. Front cut into six lobes 2
- Front cut into two lobes *T. admete*
2. Antero-lateral border of carapace cut into five subequal teeth, crest of basal antennal segment with some granules *T. crenata*
- Antero-lateral border of carapace cut into five teeth, fourth tooth rudimentary, crest of basal antennal segment with few spines *T. prymna* :

8. *Thalamita crenata* (Latreille, 1829)

(Pl. 2, Fig. 3 ; Pl. 10, Figs. 1, 2)

Portunus crenatus Latreille, 1829 : 33.

Thalamita crenata H. Milne Edwards, 1834 : 461 ; A. Milne Edwards, 1861 : 365, 1868 : 70, 1873b : 166 ; Hilgendorf, 1878 : 800 ; Lenz and Richters, 1881 : 422 ; Miers, 1886 : 199 ; de Man, 1887 : 79, 1895 : 569 ; Ortmann, 1893 : 86 ; Alcock, 1899 : 76 ; Lanchester, 1900 : 748 ; de Man, 1903 : 472 ; Lenz, 1905 : 361 ; Nobili, 1906a : 202 ; Stimpson, 1907 : 84, pl. 10, fig. 6 ; Stebbing, 1910 : 365 ; Rathbun, 1911 : 207 ; Klunzinger, 1913 : 351, pl. 7, fig. 19 ; Kemp, 1915 : 249 ; Kohli, 1921-1922 : 85 ; Delsman and de Man, 1925 : 313, pl. 14a ; Urita, 1926 : 7 ; Gravely, 1927 : 141 ; Gordon, 1931 : 527 ; Shen, 1937 : 129, figs. 16a-d ; Estampador, 1937 : 519 ; Sakai, 1939 : 414, pl. 84, fig. 3 ; Gravely, 1941 : 104 ; Barnard, 1950 : 172, figs. 27e, 33a ; Edmondson, 1954 : 267, figs. 39b, 40a-f ; Chhappgar, 1957a : 423, pl. 7, figs. 1-n ; Stephenson and Hudson, 1957 : 332, figs. 2Q, 3Q, pl. 2, fig. 3, pls. 7E, 9C ; Sankarankutty, 1961a : 106 ; Sakai, 1976 : 369, pl. 132, fig. 1 ; Mustaquim and Rabbani, 1976 : 163.

Thalamita prymna var. *crenata* Laurie, 1906 : 418.

Material examined : North Andaman : 1 ♂, Mayabunder, 9.3.1987 ; Middle Andaman : 1 ♂, Rangat, 24.3.1987 ; 2 ♂♂, Gandhi Ghat Jetty, 27.6.1985 ; South Andaman : 2 ♂♂, Chidyatapu, 25.10.1980 ; 4 ♂♂, 3 ♀♀, Chidyatapu, 3.12.1980 ; 1 ♀, Havelock Island 18.6.1980 ; 1 ♀, Bambooflat, 27.2.1987 ; 1 ♂, Carbyn's Cove, 18.11.1980.

Measurement : W = 63.0 mm, F = 21.0 mm, L = 40.0 mm.

Diagnosis : Antero-lateral margins of carapace cut into five subequal teeth. Crest of basal antennal segment traversed by a row of granules. Outer surface of palm of the larger cheliped smooth. Posterior border of propodus of last pair of legs with 1-5 denticles. Sixth segment of male abdomen slightly broader than long.

Description

Carapace : Moderately convex, smooth, nearly hexagonal, much broader than long, about $\frac{2}{3}$ rd of the greatest breadth of carapace. Surface crossed by fine transverse granular ridges of which the first pair small, straight, not much prominent, separated by a small gap ; second pair crescent shaped and widely separated from each other ; third pair large, straight, restricted only at the middle of the gastric region ; fourth pair running between the last spines of the antero-lateral borders broken by cervical grooves.

Front : Horizontal and cut into six subequal, broad, low lobes. Inner supra-orbital angles distinctly arched, nearly as broad as the combined width of submedian and lateral lobes.

Lateral borders : Antero-lateral borders cut into five claw-shaped teeth (including the outer orbital angle) of which the first tooth stout and the largest, second and third broader at the base and subequal, fourth and fifth little smaller than the preceding ones, fifth tooth slightly bigger than the fourth. Antero-lateral teeth increasing in size from back to front. Posterior border of dorsal surface of carapace forming a prominent curve with the postero-lateral borders, its length measuring more than $\frac{1}{3}$ rd of the greatest breadth of carapace.

Antenna : Crest of basal antenna-joint traversed by a granular ridge, flagellum enormously elongated, extending much beyond the orbital edge.

Orbits : Orbital edge sharp. Upper margin with two sutures. Supra-orbital corner prominent, rounded and slanting outwards ; infra-orbital border with an inner spine-like tooth. Eye-stalk thick, short ; eyes large.

Chelipeds : Massive, unequal with an almost smooth surface. Anterior border of the arm adorned with 3-4 enlarged spines, the distal two spines much larger than the rest ; posterior border of the arm granular and its upper outer surface roughened with granules. Inner angle of the wrist with a sharp, strong spine ; its outer surface bearing three spinules, united faintly by costae. Palm armed with four spines arranged in two rows on the upper surface and one near the apex of the wrist-joint. Fingers grooved and smooth, tips pointed and crossing, cutting edge of dactylus with an enlarged tooth ; colour of distal $\frac{1}{3}$ rd of the finger faint brown, tips white.

Legs : Joints slender, smooth, unarmed excepting the last pair. Upper border of merus, carpus and sides of propodus and dactylus fringed with hairs. Last pair of leg broadened and flattened for swimming ; posterior border of merus of the fifth pair adorned with a subterminal spine.

Abdomen : Sixth segment of the male abdomen slightly broader than long and gently convergent towards the distal borders. In both sexes, abdomen segments fringed with hairs.

Male pleopod : Long, thin, gradually tapering and curving inwards ; apical opening wide ; inner border with few short laterally directed spinules.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Chilka Lake (Orissa) ; Palk Bay, Gulf of Mannar (Tamil Nadu) ; Aberdeen Bay (Andaman Island). West coast : Mumbai (Maharashtra). Elsewhere : East coast of Africa, Red Sea, Pakistan, Sri Lanka, Mergui Archipelago, Singapore, Indonesia, Philippines, Japan, Australia, New Zealand, Samoa, Hawaii and Society Islands.

Remarks : The specimens in general correspond well with the description of Alcock (1899) but with the following variations. Transverse ridges of carapace are not faint, rather these are conspicuous. Fine hairs have been found to occur along the ridges of the carapace. Median and submedian lobes of the front are often fused, which may affect either on one side or on both the sides. Number of spines of the posterior border of propodus of last pair of legs has been found to vary from 1 to 5. Sixth segment of male abdomen is only slightly broader than long. However, in the present material it is not twice as broad as long as reported by Shen (1937). Stephenson and Hudson (1957) reported right cheliped to be more massive than left. But, left cheliped has been found to be more massive than right in the specimens examined. In a few specimens, some prominent granules have been observed behind the second pair of spines on palm of the larger chelipeds.

9. *Thalamita prymna* (Herbst, 1803)

(Pl. 2, Fig. 4 ; Pl. 10, Figs. 3, 4)

Cancer prymna Herbst, 1803 : 41, pl. 57, fig. 2.

Thalamita prymna H. Milne Edwards, 1834 : 461 ; Krauss, 1843 : 25 ; de Haan, 1835 : 43, pl. 12, fig. 2 ; A. Milne Edwards, 1861 : 360 ; Hess, 1865 : 140, 171 ; A. Milne Edwards, 1873b : 163 ; Kossman, 1877 : 47 ; Streets, 1877 : 108 ; Haswell, 1882 : 80 ; de Man, 1887 : 75, pl. 4, figs. 5, 6 ; 1892 : 269, 285 ; Henderson, 1893 : 372 ; Ortmann, 1893 : 85 ; de Man, 1895 : 567 ; Alcock, 1899 : 78 ; Calman, 1900 : 22 ; Nobili, 1906a : 201 ; Stebbing, 1910 : 309 ; Rathbun, 1911 : 208 ; Klunzinger, 1913 : 354, pl. 7, fig. 20 ; Parisi, 1916 : 176 ; Gravely, 1927 : 144 ; Yokoya, 1933 : 178 ; Boone, 1934 : 73, pls. 31-34 ; Chopra and Das, 1937 : 395 ; Shen, 1937 : 133, figs. 18a-d ; Sakai, 1939 : 416, pl. 51, fig. 1 ; Ward, 1942 : 81 ; Barnard, 1950 : 174 ; Chhapgar, 1957a : 424 pl. 7, figs. o-q ; Stephenson and Hudson, 1957 : 346, figs. 2R, 3R, pl. 4, fig. 3, pls. 8L, 9E ; Sankarankutty, 1961a : 107 ; Crosnier, 1962 : 136-138, figs. 234.-236 ; Sakai, 1965 : 125, pl. 64, fig. 2 ; Sakai, 1976 : 372, pl. 131, fig. 1 ; Mustaquim and Rabbani, 1976 : 163.

Material examined : North Andaman : 2♂♂, Stewart Island, 11.3.1987. Middle Andaman : 1♀, Rangat, 24.3.1987. South Andaman : 1♂, Chidyatapu, 17.10.1978 ; 3♂♂, 5♀♀, Bambooflat, 27.2.1980 ; 1♂, Peel Island, 12.6.1980 ; 3♂♂, 3♀♀, Chidyatapu, 25.10.1980 ; 1♂, 1♂, Chidyatapu, 4.6.1981 ; 1, Chidyatapu, 9.10.1984 ; 1♂, Bambooflat, 27.2.1987 ; 2♂♂, Chidyatapu, 6.10.1991.

Measurement : W = 57.0 mm, F = 22.0 mm, L = 38.0 mm.

Diagnosis : Fourth tooth of the antero-lateral border of carapace rudimentary. Crest of basal segment of the antenna traversed by 2-3 spines. Outer surface of palm granular. Sixth segment of the male abdomen nearly as long as broad.

Description

Carapace : Hexagonal, glabrous or hairy, slightly convex medially. Surface crossed by transverse granular ridges of which first pair small, straight, crest-like, smooth, truncated anteriorly and separated by a small gap ; second pair curved, widely separated from each other ; third pair very prominent and continued up to the edge of carapace ; ridge joining the last antero-lateral spine broken by cervical groove.

Front : Horizontal, broad, well separated from the supra-orbital angles and cut into six subequal lobes, usually squarish but often rounded, especially the laterals.

Lateral borders : Antero-lateral border of carapace armed with five claw-shaped spines ; first three spines stout and larger than the rest ; fourth spine extremely small, rudimentary, often absent. Tips of the spines dark brown in colour. Posterior border of carapace with a prominent straight ridge forming a curve with the postero-lateral sides.

Antenna : Crest of basal antenna-joint traversed by a row of spines, the number varying from 2-3 besides some tubercles.

Orbits : Same as in *Thalamita crenata*.

Chelipeds : Stout, unequal. Upper part of arm, wrist and palm granular. Inner edge of arm bearing 3-4 stout spines and a spinule near articulation of the wrist ; ventral surface granular. Wrist also carrying four spines, spine of the inner corner very sharp ; granular lines or ridges connecting the spines of the outer surface of the wrist very prominent. Inner and outer surface of palm granular. Outer surface of palm adorned with four strong spines arranged in two rows ; one additional spine present near articulation of the wrist, tips of the spines chocolate brown. Outer surface of palm with two prominent carinae towards the middle and lower surfaces, upper one of these represented by a row of rounded granules ; the second one more or less smooth and continued upto the distal end of the fixed finger. Inner surface of palm granular almost up to the middle along with a granular ridge, remaining portion smooth. Under surface of palm granular. Fingers long, sharp, slightly shorter than the palm, grooved and smooth ; tips pointed and crossed. Cutting edges of the fingers dentate, dactylus with a strong molariform teeth at its proximal end.

Legs : Joints long, slender and smooth excepting the last pair. In the last pair merus, carpus, propodus and dactylus broadened and flattened for swimming. Posterior border of merus of the last pair adorned with a subterminal spine ; posterior border of propodus of last leg bearing 5-14 spines. Upper border of merus, carpus and the edges of propodus and dactylus fringed with hairs.

Abdomen : Sixth abdominal tergum of male as long as broad with gently curved sides.

Male pleopod : Long, narrowed anteriorly, sharply curved at the apex, apically and sub-apically granular bearing bristles along the inner borders.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East Coast : Chennai, Palk Bay, Gulf of Mannar (Tamil Nadu) ; Aberdeen Bay (Andamans) ; Nicobars. West Coast : Gulf of Kachchh (Gujarat). Elsewhere : South Africa, Red Sea, Mergui Archipelago, Pakistan, Malay Peninsula, Indonesia, Liu-Kiu Island, Japan, Australia, New Caledonia, Tonga Island, Samoa and Marshall Island.

Remarks : The specimens agree well with the description of Alcock (1899) and Stephenson and Hudson (1957). In few specimens, however, surface of carapace has been found to be clothed with hair especially near the granular ridges.

Spination of the basal antennal joint varies in different geographical locations as reported by different authors. A. Milne Edwards (1861) reported 2-3 spines, Sakai (1939) 3-4, Barnard (1950) 1-3 and Stephenson and Hudson (1957) 3-5 spines ; the present study, however, agrees with the report of A. Milne Edwards.

Chhapgar (1957a) reported six spines on palm and four on the arm (including a spinule distally) in the females of this species ; Stephenson and Hudson (*op. cit.*) also recorded variation of spination on the upper surface of the palm, but no such variation has been observed in the present materials. In some specimens, infestation of sessile cirripede crustacean on eye-stalks have been noticed.

10. *Thalamita admete* (Herbst, 1803)

(Pl. 2, Fig. 5 ; Pl. 10, Figs. 5, 6)

Cancer admete Herbst, 1803 : 40, pl. 57, fig. 1.

Thalamita admete Latreille, 1829 : 33 ; Guérin-Méneville, 1829-1944 : 6, pl. 1, fig. 4 ; H. Milne Edwards, 1834 : 459 ; Krauss, 1843 : 24 ; Dana, 1852b : 281, pl. 17, figs. 5a-c ; Stimpson, 1858b : 39 ; A. Milne Edwards, 1861 : 356, 367 ; Heller, 1861 : 355, 1865 : 28 ; Streets, 1877 : 105 ; Hilgendorf, 1878 : 799 ; Miers, 1886 : 194 ; de Man, 1892 : 269, 285 ; Henderson, 1893 : 372 ; Ortmann, 1893 : 84 ; Alcock, 1899 : 82 ; Rathbun, 1906b : 874 ; Stimpson, 1907 : 83 ; Rathbun, 1911 : 208 ; Klunzinger, 1913 : 356, pl. 4, figs. 11a-b ; Urita, 1926 : 6 ; Sakai, 1939 : 421, pl. 85, fig. 1 ; Gravel, 1941 : 104 ; Edmondson, 1954 : 255, figs. 30a-b, 31a-c ; Stephenson and Hudson, 1957 : 320, figs. 21, 31, pl. 1, fig. 1, pls. 7A, 10A ; Forest et Guinot, 1961 : 30, figs. 19a-b ; Crosnier, 1962 : 96, figs. 154, 157, 162, 163, 164, 168 ; Sakai, 1976 : 377, pl. 130, fig. 2.

Thalamita savignyi A. Milne Edwards, 1861 : 357, 367 ; 1873b : 163 ; Kossmann, 1877 : 49 ; de Man, 1887 : 73, 1895 : 564 ; Henderson, 1893 : 372.

Thalamita admeta var. *edwardsi* Borradaile, 1900 : 579 ; Rathbun, 1906b : 874 ; Edmondson, 1954 : 254.

Thalamita admeta var. *A. admeta* Borradaile, 1902 : 202.

Thalamita admeta var. *B. edwardsi* Borradaile, 1902 : 202.

Thalamita admeta var. *C. savignyi* Borradaile, 1902 : 202.

Material examined : Middle Andaman : 1♂, 1♀, Rangat, 24.3.1987. South Andaman : 1♂, Havelock Island, 17.6.1980 ; 1♂, 1♀, Neill Island, 21.6.1980 ; 1♂, Chidyatapu, 27.10.1980; 1♂, 3♀, Chidyatapu, 3.12.1980 ; 4♂♂, 1♀, Chidyatapu, 4.6.1981 ; 1♂♂, Bambooflat, 27.3.1987.

Measurement : W = 25.0 mm, F = 8.0 mm, L = 15.0 mm.

Diagnosis : Front bilobed. Fourth tooth of the antero-lateral border extremely small.

Description

Carapace : Flat, tomentose and crossed by fine transverse granular ridges, first pair of these small and straight ; second pair crescent shaped, widely separated from each other ; third pair biggest, separated by a short gap ; ridges joining the last antero-lateral spine interrupted by cervical groove. An additional ridge beneath cardiac region extending to the branchial region with small interruptions.

Front : Bilobed, broad, squarish, grooved in the middle, about 1/3rd of the greatest breadth of carapace. Frontal margin beaded, its surface granular, inner orbital lobes broad and slightly arched.

Lateral borders : Antero-lateral borders cut into five claw-shaped teeth of which fourth tooth rudimentary, others very acute and stout ; tips of antero-lateral teeth whitish. Posterior border slightly smaller than the antero-laterals, forming a curve with postero-lateral borders.

Antenna : Basal joint of the antenna about 1/3rd of the greatest breadth of carapace. Crest of basal antenna joint tooth-like, antenna not extending beyond the eye.

Orbits : Edges of the orbits sharp, beaded. Upper orbital border cut into two sutures ; inner angle of the lower border bluntly tooth-shaped. Eye-stalk thick, short ; eyes large.

Chelipeds : Stumpy, dissimilar in male. Inner corner of the arm adorned with four spines, of which distal two teeth much enlarged than the others ; posterior border of the arm granular. Outer surface of wrist with three granular costae and three spines ; inner corner of wrist adorned with a strong, sharp spine. Upper and outer surfaces of palm with five costae; outer surface bearing six spines ; inner surface of palm smooth near the middle with a line of granules on the lower border. Fingers very much shorter than the palm, both dactylus and fixed finger grooved with longitudinal channels ; dentary edge of the dactylus adorned with a strong molariform tooth near the proximal end ; fingers brownish, their tips whitish, pointed and crossed.

Legs Joints slender, smooth. Lower border of the merus produced into a sharp spine ; propodus armed with 5-10 large spines and 1 or 2 spinules on the lower border. All leg segments of the last pair fringed with hairs along the edges. Upper border of merus beaded with granules.

Abdomen : Consisting of 7 segments in both sexes. In male, 3rd-5th segments fused, sixth segment almost as long as broad with gently curved sides.

Male pleoped : Short, narrowed anteriorly, apical part widely bifid.

Type locality : Eastern India (Herbst).

Distribution : Indo-West Pacific. India : East coast : Palk Strait, Gulf of Mannar (Tamil Nadu); Aberdeen Bay (Andamans) ; Car Nicobar (Nicobars); West coast : Minicoy Island (Lakshadweep). Elsewhere : East Africa, Red Sea, Pakistan, Sri Lanka, Gulf of Martaban, Gulf of Thailand, Japan, Australia, Fiji and Hawaiian Islands.

Remarks : The specimens in general agree with Alcock (1899), Sakai (1939) and Stephenson and Hudson (1957). These, however, differ from Sakai (1939) in size, in the number of spines on the arm of the larger chela and number of spinules on the posterior border of propodus of the last pair of legs. In the present study, fourth antero-lateral tooth has been found to be absent in most of the specimens.

Superfamily XANTHOIDEA MacLeay 1838

Xanthidae MacLeay, 1838 : 59.

Xanthoidea Glaessner, 1969 : R 515 ; Bowman and Abele, 1982 : 24.

Diagnosis : Carapace transversely oval or squarish in outline. Front broad. Orbits well developed, margins commonly dentate. Antennules infolded obliquely or transversely, antennal flagella short. 2nd-5th pereopods ambulatory. Male genital openings on coxa or sternum.

Remarks : Several earlier workers on this group of crabs had attempted to divide this large family into a number of subfamilies. Notable among them is Balss (1957) who placed in them several fossil genera following Beurlen (1930). But such definition of the subfamilies is considered unsatisfactory by other carcinologists especially for accommodating the extinct genera (Glaessner, 1969).

However, of late, the family Xanthidae Macleay, 1838 has been thoroughly revised. This revision *vis-a-vis* taxonomic arrangement in this family was improved mainly by Guinot (1977, 1978) and Serene (1984). This has been followed by many workers including the present authors. This family is presently splitted into five families, viz., Xanthidae MacLeay, 1838 *sensu stricto*, Trapeziidae Miers, 1886, Pilumnidae Samouelle, 1819, Carpilidae Ortmann, 1893 and Menippidae Ortmann, 1893, all of which are placed under the Superfamily Xanthoidea. Among these, the representatives of the families Xanthidae, Pilumnidae, Carpilidae and Menippidae have been collected from the mangrove ecosystem of Andaman Islands.

Key to the families of the superfamily XANTHOIDEA from Andaman mangroves

1. Male abdomen five segmented, segments 3-5 fused togetherXanthidae
- Male abdomen consisting of six or seven segments, segments 5-6 fused together2

2. Male abdomen made up of seven segments, antero-lateral margins dentate, lobate or spiniform3
 — Male abdomen six segmented, antero-lateral margins entire with a small epibranchial tubercleCarpilidae
3. Carapace and its appendages covered with thick coat of hairs.....Pilumnidae
 — Carapace and its appendages devoid of such dense hair.....Menippidae

Family XANTHIDEA MacLeay, 1838

Xanthidae MacLeay, 1838 : 59 (Name No. 73 on Official List) ; Alcock, 1898 : 67, 69 ; Rathbun, 1930 ; 233 ; Sakai, 1939 : 440 ; Barnard, 1950 : 198 ; Guinot, 1968a : 695-727 ; Serène, 1968 : 71-89 ; Glaessner, 1969 : R515 ; Guinot, 1971 : 1063-1090 ; Manning and Holthuis, 1981 : 118 ; Serène, 1984 : 18, 19.

Type genus *Xantho* Leach, 1814

Diagnosis : Carapace transversely oval, hexagonal or subquadrate, often subcircular, usually broader than long. front broad or little broad but never rostrum-like or acute, Antero-lateral borders of carapace usually arched with lobes, teeth or spines. Antennules folding transversely or obliquely, antennary flagella short, slender, Anterior margin of buccal cavity very distinct, not covered by the external maxillipeds. Chelipeds symmetrical or asymmetrical. Leg joints adapted for walking. Male abdomen five-jointed.

Remarks : Members of crabs belonging to this family are usually marine, intertidal living among burrows in mudflats, coral reefs and rocks. They also inhabit mangrove swamps, estuaries or rivers. The family is represented by four subfamilies, namely, Actaeinae Alcock, 1898, Zosiminae Alcock, 1898, Chlorodiinae Alcock, 1898 and Xanthinae MacLeay, 1838 in Andaman mangroves.

Key to the subfamilies of the family XANTHIDAE from Andaman Mangroves

1. Carapace profusely and profoundly lobulated with numerous vesiculous granules Actaeinae
 — Lobulations of the carapace without such granules 2
2. Antero-lateral border of carapace sharply cristate, thin and entire (often fissured only) .. Zosiminae
 — Antero-lateral border of carapace lobate or dentate 3
3. Outer margin of the front with two lateral lobules Chlorodiinae
 — Outer margin of the front without any lateral lobule Xanthinae

Subfamily ACTAEINAE Alcock, 1898

Actaeinae Alcock, 1898 : 78, 137 ; Serène, 1984 : 16, 92.

Diagnosis : Carapace much broader than long, very profusely and profoundly lobulated. Front divided into two conspicuous lobes. Antero-lateral borders cut into four blunt lobes or crenated.

Genus *Actaeodes* Dana, 1851

Actaeodes Dana, 1851a : 126, 1852b : 149 ; Miers, 1886 : 135 ; Guinot, 1971 : 1072 ; Sakai, 1976 : 447 ; Serène, 1968 : 79, 1984 : 133.

Type species : *Zozymus tomentosus* H. Milne Edwards, 1834 ; gender : masculine.

Diagnosis : Carapace convex from front to back and from side to side, transversely oval, regions well demarcated by deep grooves, usually subdivided into convex granular lobes or lobules. Front deflexed, bilobed with a distinct median notch. Antero-lateral borders cut into four shallow lobes, postero-lateral borders short, concave, not strongly convergent. Basal antenna-joint short, broad and jointed to the inner supra-orbital angle, flagellum almost as long as the orbit and lodged in the orbital gap. Antennules folding obliquely or nearly transversely. Upper orbital edge tumid, generally with two fissures or sutures ; a third fissure below the external orbital angle ; eye-stalk thick, short. Anterior border of merus of external maxillipeds slightly oblique. Chelipeds equal in both sexes, finger tips blunt or pointed, often hollowed out at tip. Legs broad and laterally compressed. Male abdomen five-jointed, 3rd-5th segments fused.

Distribution : Indo-West Pacific.

11. *Actaeodes tomentosus* (H. Milne Edwards, 1834)

(Pl. 2, Fig. 6 ; Pl. 10, Figs. 7, 8)

Zozymus tomentosus H. Milne Edwards, 1834 : 358.

Actaea tomentosa A. Milne Edwards, 1865 : 262 ; 1873b : 191 ; Hilgendorf, 1878 : 788 ; Richters, 1880 : 145 ; Haswell, 1882 : 44 ; Ortmann, 1893 : 453 ; Alcock, 1898 : 140 ; Borradaile, 1903 : 254 ; Lenz, 1905 : 352 ; Nobili, 1906a : 252 ; Rathbun, 1906b : 852 ; Lenz, 1910 : 549 ; Rathbun, 1911 : 217 ; Klunzinger, 1913 : 188, pl. 6, figs. 6a-c ; Laurie, 1915 : 446 ; Odhner, 1925 : 70 ; Urita, 1926 : 11 ; Gordon, 1934 : 31 ; Estampador, 1937 : 526 ; Sakai, 1939 : 487, pl. 93, fig. 8 ; Barnard, 1950 : 233, figs. 43e-f ; Edmondson, 1962 : 259, fig. 11c ; Sankarankutty, 1962a : 131, figs. 18, 19.

Actaeodes tomentosus Dana, 1852b : 197 ; Stimpson, 1858a : 32 ; Heller, 1861 : 328, 1865 : 17 ; Miers, 1877 : 134, 1886 : 135 ; de Man, 1895 : 499 ; Stimpson, 1907 : 44 ; Guinot, 1971 : 1072 ; Sakai, 1976 : 447, fig. 239 ; Serène, 1984 : 134, pl. 18A, fig. 78.

Material examined : South Andaman : 1♂, Neill Island, 28.3.1987.

Measurement : W = 25.0 mm, F = 7.0 mm, L = 16.0 mm.

Diagnosis : Lobulations of the carapace studded with large vesiculous granules. Carapace, chelipeds and legs covered with blackish felt.

Description

Carapace : Broad, transversely oval, its length about 2/3rd the greatest breadth of carapace, strongly lobulated ; lobules covered with large vesiculous granules and separated by deep groove. Carapace, chelipeds and legs covered with dense, short, blackish felt almost concealing the granules but not the areolations.

Front : Deflexed, little prominent, about 1/3rd of the greatest breadth of carapace and cleaved medially into two lobules.

Lateral borders : Antero-lateral borders long, granular, cut into four unequal and inconspicuous lobes by narrow notches ; postero-lateral borders short, concave.

Orbits : Upper orbital border furrowed into lobules by two fissures, a third fissure at the outer angle of the orbit.

Chelipeds : Stout, equal. Inner surface of palm granular. Cutting edges of fingers strongly dentate, fingers hollowed at tips, finger tips light brown.

Legs : Joints short, broad ; edges of leg joints especially the anterior margins fringed with coarse hair.

Abdomen : Male abdomen five-joint, 3rd-5th segments fused, last segment of male abdomen almost triangular.

Male pleopod : Long, gradually tapering with a sharp curve at the apex, tip bearing long hairs.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Palk Strait (Tamil Nadu) ; Andaman and Nicobar Islands. West coast : Lakshadweep. Elsewhere : East coast of Africa, South Africa, Red Sea, Mauritius, Maldives, Hong Kong, Philippines, Formosa, Japan, Australia, Polynesia and Hawaii.

Remarks : Original description of the species by H. Milne Edwards (1834) is very brief. The specimens in general agree with the descriptions of Haswell (1882), Alcock (1898), Sakai (1939), Barnard (1950) and Edmondson (1962) but differs from Ward (1932), Barnard (*op. cit.*) and Edmondson (*op. cit.*) in size.

Subfamily ZOSIMINAE Stimpson 1907

Zosiminae Stimpson, 1907 : 57 ; Serene, 1984 : 16, 137.

Diagnosis : Carapace broad, transversely oval. Front weakly bilobed, with or without a marginal crest. Antero-lateral borders sharp, crest-like and thin, entire (often fissured only) or

divided into four large teeth. Chelipeds subequal, similar, anterior border of the palm more or less carinated. Upper border of the leg-joints especially that of merus, carpus and propodus sharply cristate.

Key to the genus of the subfamily ZOSIMINAE from Andaman Mangroves

- Carapace smooth with the regions either not at all or very poorly indicated *Atergatis*.
- Carapace granular with the regions and subregions well delimited *Platypodia*.

Genus *Atergatis* de Haan, 1833

Atergatis de Haan, 1833 : 4, 17 ; Dana, 1851a : 124, 1852b : 157 ; A Milne Edwards, 1865 : 234, 1873b : 183 ; Miers, 1886 : 111 ; Ortmann, 1893 : 460 ; Alcock, 1898 : 94 ; Klunzinger, 1913 : 147 ; Balss, 1922 : 123 ; Sakai, 1939 : 441, 446 ; Barnard, 1950 : 205 ; Guinot, 1967 : 261 ; Glaessner, 1969 : R517 ; Sakai, 1976 : 408 ; Manning and Holthuis, 1981 : 118 ; Serène, 1948 : 144.

Type species : *Cancer integerrimus* Lamarck, 1818, by subsequent designation by the International Commission on Zoological Nomenclature, 1956, in Opinion 73 ; gender : masculine ; name no. 124 on Official List.

Diagnosis : Carapace very broad and convex, surface smooth or pitted, regional boundaries absent or very faintly indicated, lower surface of carapace wings hollowed containing the wrists and palm in flexion. Front narrow, somewhat deflexed, its free edge shaped like a Cupid's bow. Antero-lateral margins curved with keel-like edge, postero-laterals strongly convergent and straight. Basal antenna-joint short, meeting the front only at their antero-external angle, flagellum shorter than the major diameter of the orbit. Antennules transversely folded, small, three suture lines near the outer angle of the orbit distinct. Eye stalks thick, short ; eyes small. Anterior margin of merus of external maxillipeds nearly transverse. Chelipeds subequal. Legs with upper margins of merus, carpus and propodus and lower margins of merus and propodus sharply carinate or cristate. Male abdomen five-jointed, 3rd-5th segments fused.

Distribution : Indo-Pacific.

Key to the species of the genus *Atergatis* from Andaman Mangroves

- Surface of carapace smooth, lateral epibranchial angle of carapace forming a mere ridge *A. integerrimus*.
- Surface of carapace somewhat lumpy, not smooth, lateral epibranchial angle of carapace forming a blunt tooth *A. floridus*.

12. *Atergatis floridus* (Linnaeus, 1767)

(Pl. 2, Fig. 7 ; Pl. 11, Figs. 1, 2)

Cancer floridus Rumphius, 1705 : 16, pl. 8, fig. 5 ; 1711 : pl. 8, fig. 5 ; Linnaeus, 1767 : 1041.

Cancer ocyroe Herbst, 1801 : 20, pl. 54, fig. 2 ; H. Milne Edwards, 1834 : 375, Rathbun, 1906b : 845 ; Parisi, 1916 : 179 ; Urita, 1926 : 12.

Atergatis floridus de Haan, 1835 : 46 ; Krauss, 1843 : 27 ; Dana, 1852b : 159 ; Stimpson, 1858a : 32 ; A Milne Edwards, 1865 : 243 ; Heller, 1865 : 8 ; A Milne Edwards, 1873b : 186 ; Haswell, 1882 : 41 ; Miers, 1886 : 112 ; de Man, 1887 : 24 ; Walker, 1890 : 109 ; de Man, 1892 : 268, 277 ; Henderson, 1893 : 352 ; Ortmann, 1893 : 460 ; de Man, 1895 : 498 ; Alcock, 1898 : 98 ; Calman, 1900 : 5 ; Lanchester, 1900 : 730 ; Borradile, 1903 : 258 ; Balss, 1922 : 123 ; Estampador, 1937 : 524 ; Sakai, 1939 : 447, pl. 58, fig. 1 ; Barnard, 1950 : 207, figs. 38b-c ; Holthius, 1953 : 12 ; Chhappgar, 1957a : 426, pl. 8, figs. d-f ; Forest et Guinot, 1961 : 44 ; Sankarankutty, 1926a : 123 ; Edmondson, 1962 : 224, fig. 1c ; Sakai, 1965 : 131, pl. 66, fig. 4 ; 1976 : 409, pl. 148, fig. 2 ; Khan, 1977 : 180, pl. 1B ; Serène, 1984 : 148, pl. 21D, fig. 87.

Material examined : South Andaman : 7♂♂, 5♀♀, Chidyatapu, 24.10.1980 ; 1♂, 2♀♀, Chidyatapu, 21.1.1987 ; 1♂, Neill Island, 28.3.1987.

Measurement : W = 48.0 mm, F = 16.0 mm, L = 34.0 mm.

Diagnosis : Carapace lumpy with broad, shallow depressions. No hair on the surface of the external maxillipeds.

Description

Carapace : Broad, deep and convex in both the directions ; surface smooth, lumpy ; regional boundaries faintly defined by broad, shallow depressions.

Front : Broad, Slightly deflexed, about $\frac{1}{3}$ rd of the greatest breadth of carapace, forming a semi-circle with the anterolateral margins ; its free edge smooth, crest like.

Lateral borders : Antero-lateral borders strongly arched, crest-like and cut into four shallow lobes by fine fissures, culminating posteriorly at a very prominent tubercle at the lateral epibranchial angle.

Orbits : Very small, circular with smooth edges. Eyes small ; eye-stalk thick, short.

External maxillipeds : Without hair on the surface, sternum smooth.

Chelipeds : Massive and equal in both the sexes. Upper margin of arm and palm crest-like. Outer surface of arm and wrist smooth. Fingers broad, stout ; outer surface of both the fingers grooved with a longitudinal channel, the dentary edges of the fingers armed with inter-locking teeth ; both fingers cross each other in males but meet at tips in females ; tips of fingers chocolate brown in colour ; fingers leave no gap when closed.

Legs : Joints broad, compressed. Outer surface of leg joints pitted, their upper and lower edges carinated. Lower border of propodus hairy, both the edges of dactylus thickly fringed with tufts of hairs.

Abdomen : Male abdomen five-jointed, abdominal segments densely pitted.

Male pleopod : Elegantly bent bearing very long hairs and spinules ; a stout spine-like projection at the apex.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Palk Bay, Gulf of Mannar (Tamil Nadu) ; Andaman Islands. West coast : Mumbai (Maharashtra) ; LakshawEEP. Elsewhere : East coast of Africa, Red Sea, Pakistan, Maldives, Sri Lanka, Myanmar, Thailand, Philippines, Japan, Australia and as far as Hawaii.

Remarks : The specimens agree with the description of Haswell (1882), Alcock (1898) and Edmondson (1962) but with following variations : (1) outer surface of palm of the larger cheliped of both the sexes are usually smooth, but in some specimens, these are found to be roughened by wrinkles and reticulations and (2) width of orbit is less than 1/4th of the breadth of the front.

13. *Atergatis integerrimus* (Lamarck, 1801)

(Pl. 2, Fig. 8 ; Pl. 11, Figs. 3, 4)

Cancer integerrimus Lamarck, 1801 : 272 ; H. Milne Edwards, 1834 : 374.

Cancer (Atergatis) integerrimus de Haan, 1835 : 45, pl. 14, fig. 1.

Atergatis integerrimus Dana, 1852b : 158 ; Stimpson, 1858a : 32 ; A. Milne Edwards, 1865 : 235 ; de Man, 1887 : 24 ; Walker, 1890 : 109 ; Henderson, 1893 : 352 ; Ortmann, 1893 : 462 ; de Man, 1895 : 496 ; Alcock, 1898 : 95 ; Lanchester, 1900 : 730 ; Laurie, 1906 : 394 ; Parisi, 1916 : 187 ; Balss, 1922 : 124 ; Urita, 1926 : 12 ; Gravely, 1927 : 144 ; Chopra and Das, 1937 : 397 ; Sakai, 1939 : 448, pl. 56, fig. 2 ; Chhapgar, 1957a : 425, pl. 8, figs. a-c ; Sakai, 1965 : 132, pl. 67, fig. 3 ; 1976 : 410, pl. 147, fig. 2 ; Serène, 1984 : 151, pl. 21F.

Atergatis subdivisus Adams and White, 1848 : 38, pl. 8, fig. 3 ; White, 1848 : 284.

Atergatis subdentatus de Haan, 1835 : 46, pl. 3, fig. 1 ; A. Milne Edwards, 1865 : 236.

Material examined : South Andaman : 1♂, Chidyatapu, 25.3.1984.

Measurement : W = 37.0 mm, F = 6.5 mm, L = 23.0 mm.

Diagnosis Carapace smooth. External maxillipeds bearing few short hairs on its surface.

Description

Carapace : Broader than long and convex in both the directions. Anterior 1/3rd surface of carapace irregularly and distantly pitted especially near the front and the antero-lateral margins. No indication of regional boundaries.

Front : Moderately broad, about 1/6th of the greatest breadth of carapace ; its free edge smooth, cristate, forming a semicircle with the antero-lateral margins.

Lateral borders : Antero-lateral borders strongly arched, the crest-like edges of it turning in at the lateral epibranchial angle forming a strong ridge.

Orbits : Same as in *Atergatis floridus*.

External maxillipeds : With short, scanty hair on the surface, sternum not smooth but pitted.

Chelipeds : Same as in *Atergatis floridus*.

Legs : Same as in *Atergatis floridus*.

Abdomen : Same as in *Atergatis floridus*.

Male pleopod : Almost similar to the preceding species but with a sharp curve at the apex and bearing much shorter hairs.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East Coast : Gulf of Mannar (Tamil Nadu) ; Andaman Islands. West Coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra) ; Karwar (Karnataka). Elsewhere : East coast of Africa, Mauritius, Mergui Archipelago, Singapore, Hong Kong, Philippines and Japan.

Remarks : Lateral epibranchial ridge of this species often shows traces of 2-3 fissures as mentioned by Alcock (1898) but, the specimen under present investigation is without any such fissure. Inner border of the wrist of the larger cheliped has been found to be armed with a small tooth. The present specimen is smaller in size than specimens reported by Sakai (1976).

Genus *Platypodia* Bell, 1835

Platypodia Bell, 1835 : 336 ; Rathbun, 1897 : 158, 1930 : 246 ; Ward, 1942 : 88 ; Sakai, 1939 : 452 ; Buitendijk, 1941 : 297 ; Barnard, 1950 : 208 ; Guinot, 1964b : 16 ; Sakai, 1976 : 404 ; Serène, 1984 : 154.

Lophactaea A. Milne Edwards, 1865 : 245 ; Alcock, 1898 : 99.

Paraplatypodia Ward, 1942 : 42.

Type species : *Xantho granulosa* Rüppell, 1830.

Diagnosis : Carapace moderately broad, convex ; surface granular, regions well defined. Front slightly deflexed, grooved, slightly sinuous at the middle. Antero-lateral borders crest-like, thin, sharp and divided into blunt lobes by narrow fissure, postero-lateral margins rather concave. Basal antenna-joint short, meeting the front only at their antero-external angle, flagellum short, lodged in the orbital hiatus. Antennules transversely folded. Orbits large, thick, short, more or less circular with three prominent suture lines near the outer angle ; eye-stalks thick, short. Anterior border of merus of external maxillipeds slightly curved. Chelipeds equal in both sexes,

fingers pointed, not hollowed at tips. Upper margin of leg joints sharp and crest-like. Male abdomen five jointed, 3rd-5th segments fused.

Distribution : Atlantic America and the Indo-Pacific.

14. *Platypodia cristata* (A. Milne Edwards, 1865)

(Pl. 3, Fig. 1 ; Pl. 11, Figs. 5, 6)

Lophactaea cristata A. Milne Edwards, 1865 : 246, pl. 16, fig. 4 ; Ortmann, 1893 : 50 ; Alcock, 1898 : 100 ; Borradaile, 1903 : 258 ; Nobili, 1906a : 230 ; Lenz, 1910 : 546 ; Klunzinger, 1913 : 159 ; Bouvier, 1915 : 290.

Platypodia cristata Rathbun, 1911 : 214 ; Buitendijk, 1941 : 302, fig. 1c ; Ward, 1942 : 88 ; Barnard, 1950 : 208 ; Chhappgar, 1957a : 427, pl. 8, figs. i-k ; Guinot, 1964a : 11, 1964b : 16, 1967 : 268 ; Serène, 1968 : 73, 1984 : 161, pl. 22C, fig. 93.

Material examined : South Andaman : 3♂♂, Peel Island, 12.6.1980 ; 1♀, Chidyatapu, 25.10.1980.

Measurement : W = 35.0 mm, F = 9.0 mm, L = 24.0 mm.

Diagnosis : Surface of carapace and outer surface of carpus and propodus of walking legs covered with pearl-like granules. Upper border of palm of chelipeds sharply crested.

Description

Carapace : Transversely oval, convex in both the directions ; anterior two-thirds of it divided into regional and subregional lobules by deep, wide furrows ; surface studded with pearl-like granules at the anterior two-thirds, posterior one-third of carapace almost smooth.

Front : Deflexed, about 1/4th of the greatest breadth of carapace, faintly grooved in the middle and slightly emerginate.

Lateral borders : Antero-lateral border of carapace thin, sharp and divided into four broad lobes by three fine fissures, postero-lateral borders convergent.

Orbits : Large, supra-orbital margin swollen and studded with pearly granules, lower border almost straight. Eye-stalk thick, short.

Chelipeds Stout, equal. Upper edge of arm, palm and dactylus strongly and sharply cristate. Outer surface of arm roughened with microscopic granules, that of palm and wrist strongly granular, arranged in linear series. Fingers short, stout and brown in colour, their tips pointed and hollowed. Both the fingers strongly grooved, their cutting edges strongly dentate.

Legs : Joints broad, compressed. Upper border of merus, carpus and propodus and lower border of merus strongly crested. Upper surface of leg joints covered with pearl-like granules. Dactylus claw-shaped. Scattered bristles occurring on most of the leg joints.

Abdomen : Male abdomen five-jointed, 3rd to 5th segments fused.

Male pleopod : Elegantly bent with a spine-like projection at the tip bearing very few hairs.

Type locality : Cochinchine (= Vietnam) and Zanzibar.

Distribution : Indian Ocean. India : East coast : Chennai (Tamil Nadu) ; Andaman Islands (present record). West coast : Gulf of Kachchh (Maharashtra). Elsewhere : East Africa, Mauritius to South China Sea ; Malay Peninsula.

Remarks : The specimens in general agree with the description of Alcock (1898), Buitendijk (1941) and Chhapgar (1957a). The present specimens are, however, slightly smaller than those reported by Chhapgar (*op. cit.*). This species is reported for the first time from Andaman Islands.

Subfamily XANTHINAE MACLEAY, 1838

Xanthidae MacLeay, 1838 : 59.

Xanthini Dana, 1851a : 124, 1852b : 157 ; Guinot, 1978 : 272.

Xanthoida (Part) Alcock, 1898 : 77, 112 ; Serène, 1968 : 75 ; Sakai, 1976 : 418 ; Serène, 1984 : 17, 172.

Diagnosis : Carapace transversely oval or hexagonal, usually broader than long. Front almost linear or cut into two lobes, without a marginal crest and fissured at the middle. Antero-lateral teeth usually four, often more.

Genus *Leptodius* A. Milne Edwards, 1863

Leptodius A. Milne Edwards, 1863 : 284, 1873b : 221 ; Miers, 1886 : 136 ; Rathbun, 1930 : 296 ; Forest et Guinot, 1961 : 63 ; Guinot, 1968a : 704, 1971 : 1068 ; Sakai, 1976 : 422 ; Serène, 1984 : 181.

Xantho (*Leptodius*) Alcock, 1898 : 117 ; Sakai, 1939 : 463.

Type species : *Chlorodius exaratus* H. Milne Edwards, 1834, by monotypy ; gender : masculine, name no. 874 on Official List.

Diagnosis : Carapace broad, suboval, moderately convex in the anterior half, flat in the posterior half, regions distinct and fairly well lobulated in anterior two-thirds, but not in the posterior one third. Front slightly deflexed, sublaminar, notched in the middle line, separated from supra-orbital margin by a notch or groove. Antero-laterals borders curved, usually cut into four teeth or lobes, often more ; postero-lateral borders as long as the chord of antero-laterals and convergent moderately. Basal antennal joint short ; flagellum almost as long as orbit, touching the front at inner angle and lodged in the orbital hiatus. Antennules folding transversely. Orbits suboval, their margins with two suture lines above and one just beneath the outer angle, lower edge of the orbit with a prominent tooth at the inner angle. Anterior border of merus of external maxillipeds almost transverse and usually with a small tooth near the antero-lateral angle. Chelipeds unequal in both sexes, fingers pointed. Legs thick, subcylindrical, their upper margins often sharp. Male abdomen five-jointed, 3rd-5th segments fused.

Distribution : Atlantic Ocean and the Indo-Pacific.

Key to the species of the genus *Leptodius* from Andaman Mangroves

- Antero-lateral border of carapace with four teeth (excluding the outer orbital angle) *L. exaratus*
- Antero-lateral border of carapace with five teeth (excluding the outer orbital angle).....*L. sanguineus*

15. *Leptodius exaratus* (H. Milne Edwards, 1834)

(Pl. 3, Fig. 2 ; Pl. 11, Figs. 7, 8).

Chlorodius exaratus H. Milne Edwards, 1834 : 402 ; Dana, 1852b : 208 ; Stimpson, 1858a : 34.

Chlorodius (Leptodius) exaratus Kossmann, 1877 : 32, pl. 2.

Leptodius exaratus A. Milne Edwards, 1868 : 71, 1873b : 222 ; Hilgendorf, 1878 : 790 ; Richters, 1880 : 148 ; Haswell, 1882 : 60 ; Miers, 1886 : 138 ; de Man 1887 : 33, 1892 : 268, 278 ; Henderson, 1893 : 362 ; de Man, 1895 : 521 ; Lanchester, 1900 : 738 ; Nobili, 1906a : 121 ; Klunzinger, 1913 : 209, pl. 3, fig. 6, pl. 5, fig. 16 ; Bouvier, 1915 : 284 ; Yokoya, 1933 : 189 ; Chopra and Das, 1937 : 398 ; Chhapgar, 1957a : 428, pl. 8, figs. o-q ; Forest et Guinot, 1961 : 63, fig. 54 ; Sankarankutty, 1962a : 129 ; Edmondson, 1962 : 242, fig. 7b ; Guinot, 1964a : 11 ; Sakai, 1965 : 140, pl. 70, fig. 6 ; Guinot, 1967 : 265 ; Serène, 1968 : 75 ; Kim, 1970 : 14 ; Chandy, 1970 : 402 ; Kim, 1973 : 380, fig. 144, pl. 82, fig. 109 ; Sakai, 1976 : 423, pl. 153, fig. 1 ; Takeda and Nunomura, 1976 : 70 ; Takeda and Miyake, 1976 : 109 ; Khan, 1977 : 181, pl. 1D ; Takeda, 1978 : 39 ; Kensley, 1981 : 44 ; Serène, 1984 : 183, pl. 26A, fig. 106.

Xantho exaratus Ortmann, 1893 : 445 ; Holthuis, 1953 : 27 ; Buitendijk, 1960 : 331, figs. 9k-m.

Xantho (Leptodius) exaratus Alcock, 1889 : 118 ; Calman, 1900 : 6 ; Laurie, 1906 : 402 ; Balss, 1922 : 127 ; Urita, 1926 : 10 ; Gravely, 1927 : 146 ; Gordon, 1931 : 528, 543, figs. 20, 22b ; Estampador, 1937 : 525 ; Sakai, 1939 : 464 ; Stephensen, 1945 : 149, fig. 37c.

Xantho hydrophilus Laurie, 1915 : 444, pl. 43, fig. 1.

Xantho (Leptodius) hydrophilus Barnard, 1950 : 223, figs. 41c, 42c-e.

Material examined : North Andaman : 8♂♂, Carlew Island, 10.3.1987. Middle Andaman : 4♂♂, Rangat, 24.3.1987. South Andaman : 1♂, Chidyatapu, 3.12.1980 ; 4♀♀, 2♀♀, Chidyatapu, 6.5.1981 ; 2♂♂, 2♀♀, Bambooflat, 27.2.1987, 3♂♂, 3♀♀, Neill Island, 28.3.1987..

Measurement : W = 25.0 mm, F = 6.0 mm, L = 16.0 mm.

Diagnosis : Antero-lateral margin of carapace cut into four teeth (excluding the outer orbital angle). Postero-lateral border equal in length to the chord of antero-lateral border.

Description

Carapace : Transversely oval, moderately convex in anterior two-thirds, nearly flat in the

posterior one-third. Regional and subregional lobules well outlined by deep grooves, the lobules being more convex anteriorly. Surface of carapace smooth except in young crabs.

Front : Narrow, bilaminar ; lobes square-cut, their free edges slightly concave, granular and non prominent.

Lateral borders : Antero-lateral borders equal in length to the chord of postero-lateral and cut into four acuminate teeth (excluding the outer orbital angle) — first tooth small, second tooth broad, low, acuminate and the last two teeth sharply acuminate anteriorly. Postero-lateral sides equal in length to the chord of antero-lateral sides and converging.

Orbits : Upper border of the orbit with two sutures, lower border with a conspicuous tooth at the inner angle. Eye-stalk thick, short.

Chelipeds : Massive, unequal. Outer surface of arm smooth. Upper and outer surface of wrist somewhat dimpled and wrinkled, inner corner of it adorned with a blunt conical tooth. Palm smooth, its upper surface roughened with reticulating wrinkles. Fingers broad, stout, dark brown, their tips hollowed.

Legs : Joints compressed, smooth and sparsely hairy along the anterior and posterior edges. Dactylus granular and coated with a good deal of hair along both the edges as far as the claw.

Abdomen : Male abdomen narrow, five-jointed, 3rd-5th somites fused ; sixth segment diverging posteriorly, longer than broad. Female abdomen consisting of seven distinct segments.

Male pleopod : Very much narrowed at the apex, tip plough-shaped and distally serrated bearing a row of hammer-shaped setae ; inner border carrying a few curved spinule at the base of the curved distal end of the appendage, outer border with a few spinules subapically

Type locality : Indian Ocean (H. Milne Edwards).

Distribution : Indo-West Pacific. India : East coast : Palk Bay, Gulf of Mannar (Tamil Nadu) ; Mayabunder (Andaman Islands). West coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra). Elsewhere : East Africa, Red Sea, Persian Gulf, Sri Lanka, Arakan coast, Mergui Archipelago, Malay Peninsula, Indonesia, Philippines, Japan, Polynesia, Australia and Hawaii.

Remarks : The specimens agree well with the descriptions of Haswell (1882) and Alcock (1898). They differ from those reported by Sakai (1993) in size. The species closely resembles *Leptodius sanguineus* in shape, convexity, areolation, lobulation of carapace and with regard to the character of front and chelipeds.

16. *Leptodius sanguineus* (H. Milne Edwards, 1834)

(Pl. 3, Fig. 3 ; Pl. 11, Figs. 9, 10)

Chlorodius sanguineus H. Milne Edwards, 1843 : 402 ; Dana, 1852b : 207, 1855 : pl. 11, figs. 11a-d ; Heller, 1865 : 18.

Chlorodius edwardsi Heller, 1861 : 336.

Leptodius sanguineus A. Milne Edwards, 1868 : 71, 1873b : 224 ; Richters, 1880 : 147 ; Haswell, 1882 : 60 ; de Man, 1895 : 521, 1903 : 602 ; Borradaile, 1903 : 258 ; Lenz, 1905 : 342, 1910 : 548 ; Grant and McCulloch, 1906 : 10 ; Rathbun, 1906b : 847 ; Nobili, 1907 : 389 ; Klunzinger, 1913 : 213 ; Bouvier, 1915 : 284 ; Parisi, 1916 : 181 ; Balss, 1922 : 127 ; Boone, 1934 : 116, pl. 60, 61 ; Ward, 1932 : 244 ; Forest et Guinot, 1961 : 63, figs. 50a, b ; Sankarankutty, 1961b : 129, 1962a : 128, figs. 10, 11 ; Edmondson, 1962 : 240, fig. 6e ; Guinot, 1967 : 265 ; Sakai, 1965 : 141, pl. 70, fig. 4 ; Serène, 1968 : 75 ; Sakai, 1976 : 422, fig. 222 ; Takeda and Miyake, 1976 : 109 ; Takeda and Nunomura, 1976 : 71 ; Chen and Lan, 1978 : 263 ; Serène, 1984 : 185, pl. 26B, fig. 108.

Xantho exaratus var. *sanguineus* Ortmann, 1893 : 447 Stimpson, 1907 : 53.

Xantho (Leptodius) sanguineus de Man, 1895 : 525 ; Alcock, 1898 : 119 ; Balss, 1922 : 127 ; Urita, 1926 : 10 ; Sakai, 1939 : 464, pl. 90, fig. 3 ; Miyake, 1939 : 180, fig. 7, pl. 14, fig. 5 ; Stephensen, 1945 : 150 ; Chang, 1963 : 98.

Leptodius nodosus Ward, 1939 : 7.

Material examined : South Andaman : 1♂, 4♀♀, Chidyatapu, 27.2.1980 ; 5♂♂, 4♀♀, Chidyatapu, 3.12.1980 ; 3♂♂, 2♀♀, Chidyatapu, 6.5.1981 ; 2♂♂, 4♀♀, Bambooflat, 27.2.1987 ; 3♂♂, 1♀, Havelock Island, 26.3.1987.

Measurement : W = 30.0 mm, F = 7.0 mm, L = 20.0 mm.

Diagnosis : Antero-lateral border of carapace cut into 5 teeth (excluding the outer orbital angle). Poster-lateral border shorter than the antero-lateral border.

Description :

Carapace : Broadly oval, slightly convex antero-posteriorly, regional and sub-regional lobules prominent and well demarcated.

Front : Same as in *Leptodius exaratus*.

Lateral borders : Antero-lateral border of carapace longer than the postero-lateral and cut into five teeth (excluding the outer orbital angle)—first tooth small, second tooth broad, third and fourth very acute and distinct, fifth tooth rudimentary. Another small tooth lying in between and slightly below the outer orbital angle and the first antero-lateral tooth.

Orbits : Same as in *Leptodius exaratus*.

Chelipeds : Massive and unequal in both sexes. Outer surface of arm smooth. Outer surface of wrist and upper border of palm roughened with reticulating wrinkles. Inner corner of wrist armed with a blunt, conical tooth. Fingers broad, dark brown, hollowed at tips ; base of fixed finger armed with two and dactylus with three denticles.

Legs : Same as in *Leptodius exaratus*.

Abdomen : Same as in *Leptodius exaratus*.

Male pleopod : Long, slender appendage, gradually tapering towards the tip and bearing stout spines subapically.

Type locality : Mauritius (H. Milne Edwards).

Distribution : Indo-Pacific. India : East coast : Andaman and Nicobar Islands. West coast : Mumbai (Maharashtra) ; Minicoy (Lakshadweep). Elsewhere : West coast of South America, East Africa, South Africa, Red Sea, Persian Gulf, Pakistan, Maldives, Sri Lanka, Arakan coast, Malay Peninsula, South China Sea, Japan, Australia and Polynesia to as far as Hawaii.

Remarks : The specimens examined correspond well with descriptions of Alcock (1898), Rathbun (1906b) and Edmondson (1962). However, a good deal of variation with regard to shape and acuteness of lateral lobes and teeth have been observed even among population of the same habitat. In young crabs, the lobes and teeth are generally less distinct. Similar observations were made by Chhapgar (1957a) in *Leptodius exaratus* from West coast of India.

In the present collection, many crabs were found with a vertically long brick red band on either side near 2F, 2M and 3M regions of carapace ; an almost circular band of the same colour was also noticed near region 1P of carapace. These bands, however, have been found to disappear on long preservation.

Subfamily CHLORODIINAE Alcock, 1898

Chlorodiinae Alcock, 1898 : 78, 156 ; Sakai, 1976 : 385, 454 ; Serène, 1984 : 17, 232.

Diagnosis : Carapace transversely oval, hexagonal, circular or subcircular. Front rather broad, extending from one-third to half of the maximum breadth of carapace ; frontal margin with two large sub-median lobes and two small lateral lobules, separated from the supra-orbital angles by a weak concavity. Antero-lateral teeth varying from 2-4.

Genus *Pilodius* Dana, 1852

Pilodius Dana, 1852b : 216 ; Stimpson, 1907 : 57 ; Forest et Guinot, 1961 : 89 ; Glaessner, 1969 : R520 ; Sakai, 1976 : 459 ; Serène, 1984 : 233.

Chlorodopsis A. Milne Edwards, 1873b : 227 ; Alcock, 1898 : 165 ; Sakai, 1939 : 502 ; Barnard, 1950 : 214.

Type species : *Chlorodius pilumnoides* White, 1847, by subsequent selection by Forest et Guinot, 1961 ; gender : masculine.

Diagnosis : Carapace flat, roughly hexagonal, regional boundaries distinct, areolations prominent, areolae covered with granules or hair, sometimes both. Front bilobed, their outer angles well defined forming a distinct lobule. Antero-lateral borders shorter than the postero-laterals and divided into four lobes. Basal antenna-joint large ; flagellum long, exceeding the

orbits. Orbits with three distinct grooves or notches. Anterior border of merus of external maxillipeds nearly transverse. Chelipeds unequal or subequal, about twice the length of carapace ; arms short, fingers strong, arched, broadened and hollowed at tip. Legs usually hairy, spiny. Male abdomen five-jointed.

Distribution : Indo-Pacific.

17. *Pilodius nigrocrinitus* Stimpson, 1858

(Pl. 3, Fig. 4 ; Pl. 12, Figs. 1, 2)

Pilodius nigrocrinitus Stimpson, 1858a : 34, 1907 : 58, pl. 7, fig. 1 ; Sakai, 1965 : 148, pl. 73, fig. 5 ; 1976 : 461, pl. 164, figs. 2, 248a-b.

Chlorodopsis melanochirus A. Milne Edwards, 1873b : 228, pl. 8, fig. 5 ; Haswell, 1882 : 55 ; de Man, 1892 : 268, 278 ; Ortmann, 1893 : 471 ; Alcock, 1898 : 168.

Chlorodopsis nigrocrinitus de Man, 1895, 520 ; Alcock, 1898 : 168 ; Urita, 1926 : 11 ; Sakai, 1939 : 504, pl. 62, fig. 2, pl. 97, fig. 2.

Material examined : Middle Andaman : 1 ♂, Yereta Jetty, 24.3.1987. South Andaman : 2 ♂ ♂, Peel Island, 12.6.1980 ; 3 ♀ ♀, Havelock Island, 26.3.1987.

Measurement : W = 13.0 mm, F = 4.0 mm, L = 9.0 mm.

Diagnosis : Antero-lateral margin divided into four spinuliferous lobes. Upper edge of the arm spinulate distally.

Description :

Carapace : Entire surface of carapace, chelipeds and legs granular, covered with short, black setae interspersed with numerous long, yellowish or brownish hairs. Carapace flat, transversely oval and well areolated ; anterior two-thirds of it divided into regional and sub-regional lobules by more or less broad, shallow furrows ; posterior third slightly concave between two elevated transverse beaded lines.

Front : Broad, about 1/3rd of the greatest breadth of carapace, notched in the middle forming two rounded granular lobes, outer angle of each of these further forming a lobule ; free edge of the front finely crenulate.

Lateral borders : Antero-lateral border of carapace cut into 4 blunt lobes (including the outer orbital angle), each lobe bearing 3-4 spinules.

Orbits : Upper orbital edge with three distinct grooves, both upper and lower margins granular. Eye-stalk thick, short.

Chelipeds : Unequal in male, subequal in female. Upper surface of arm spinulate only at the distal end. Outer surface of wrist bearing several spines, but the two spines near the inner angle

much larger than the rest. Anterior border of palm tuberculate, its upper outer surface covered with rows of vesiculous granules ; inner surface of palm with somewhat larger granules along the upper part and smaller granules towards the lower part. Fingers strongly fluted, the ridges being sharply spinate dorsally ; fingers hollowed at tips, their dentary edges adorned with 3-4 large teeth. Fingers dark, leaving a wide gap when closed.

Legs : In all legs, margins of merus somewhat spinous. Outer surface of leg joints and upper borders of merus, carpus and propodus granulated.

Abdomen : Male abdomen five-jointed, sixth abdominal segment slightly diverging posteriorly ; female abdomen consisting of 7 distinct segments.

Male pleopod : Short and slender, tip of the appendage circular.

Type locality : Izu Shimoda (Stimpson).

Distribution : Indo-West Pacific. India : East coast : Andaman Islands. Elsewhere : Malay Peninsula, Indonesia, Thailand, Philippines, Japan, New Guinea, Australia, New Caledonia, New Zealand, Fiji and Kermadec Island.

Remarks : The specimens examined agree with the description of Alcock (1898) and Sakai (1939). The present specimens, however, are smaller than those reported by Sakai (1976). They further differ from Sakai's report (*op. cit.*) in the shape of the male pleopod which is not beak-like at the apex. Further, it has been noticed that anterior border of dactylus of chelipeds is adorned with 2-6 blunt and stout tubercles. Cutting edge of dactylus of larger cheliped has also been found to be adorned with a strong, molariform tooth.

Family PILUMNIDAE Samouelle, 1819

Pilumnidae Samouelle, 1819 : 86 (Name No. 74 on Official List) ; Serene, 1984 : 17.

Type genus *Pilumnus* Leach, 1815

Diagnosis : Carapace and its appendages covered with both long and short hairs or setae. Front bilobed, outer angle of each forming an independent tooth or spine-like lobule, separated from the supra-orbital angle by a groove or notch. Antero-lateral borders often shorter than the postero-laterals and cut into four sharp teeth (including the outer orbital angle). Basal joint of antenna short, may or may not be touching the front. Antennules folding transversely. Anterior border of merus of external maxillipeds almost transverse and without any notch. Chelipeds stout, unequal. Legs stout. Male abdomen 7 - segmented.

Remarks : These are intertidal crabs living in coral reef or rocky beach. However, the present materials have been collected from the mangrove areas.

The family is represented by a single subfamily namely, Pilumninae Ortmann, 1893 in Andaman mangroves.

Subfamily PILUMNINAE Ortmann, 1893

Pilumninae Ortmann, 1893 : 429-432 (*partim*) ; Alcock, 1898 : 176 ; Sakai, 1976 : 385, 483 ; Serène, 1984 : 17.

Diagnosis : Carapace and its appendages covered with dense coat of hairs surface granular or spinose, regions prominent. The four antero-lateral teeth (including the outer orbital angle) sharp and prominent. Chelipeds asymmetrical, strongly granular or spinose or at least partly setose.

Genus *Pilumnus* Leach, 1815

Pilumnus Leach, 1815 : 321 ; Desmarest, 1825 : 111 ; de Haan, 1833 : 19 ; H. Milne Edwards, 1834 : 415 ; Dana, 1851a : 127, 1852b : 229 ; A. Milne Edwards, 1863 : 285 ; Kossmann, 1877 : 37 ; Miers, 1886 : 145 ; Ortmann, 1893 : 445 ; Alcock, 1898 : 190 ; Rathbun, 1930 : 481 ; Sakai, 1939 : 531 ; Barnard, 1950 : 262 ; Glaessner, 1969 : R520 ; Sakai, 1976 : 483 ; Manning and Holthuis, 1981 : 152.

Type species : *Cancer hirtellus*, 1761, by monotypy ; gender : masculine ; name no. 384 on Official List.

Diagnosis : Carapace transversely oval or sub-quadrilateral, anteriorly declivous, flattened posteriorly and not much broader than long ; regions well marked and areolated. Front bilobed, outer angle of each of which forming a tooth or spine-like lobule, separated from the supra-orbital angle by a groove or notch. Antero-lateral borders shorter than the postero-laterals and cut into spiny teeth. Basal joint of antenna may or may not be reaching up to the front ; flagellum long, exceeding the major diameter of the orbit. Antennules folded transversely. Orbits with one or two gaps or notches on the upper border ; lower border also with a gap or fissure, inner lower orbital angle generally sharp, distinct ; eye-stalks moderately long, slender. Endostomial ridges plain, not very high ; merus of external maxillipeds with its anterior border almost transverse and without any notch. Chelipeds stout, subequal, fingers rough and short, tips pointed. Legs stout. Male abdomen consisting of 7 distinct segments. Carapace, chelipeds and legs usually thickly covered with shaggy coat of hairs.

Distribution : Atlantic Ocean and the Indo-Pacific.

18. *Pilumnus vespertilio* (Fabricius, 1793)

(Pl. 3, Fig. 5 ; Pl. 12, Figs. 3, 4)

Cancer vespertilio Fabricius, 1793 : 463, 1798 : 338.

Pilumnus vespertilio Desmarest, 1825 : 112 ; Latreille, 1828 : 125 ; H. Milne Edwards, 1834 : 418 ; Dana, 1852b : 236 ; Heller, 1861 : 343 ; A. Milne Edwards, 1873b : 242 ; Miers, 1876 : 19 ; Hilgerdort, 1878 : 793 ; Miers, 1880 : 234 ; Richters, 1880 : 148 ; Haswell, 1882 : 65 ; de Man 1887 : 58 ; Walker, 1890 : 110 ; de Man, 1892 : 268, 283 ; Henderson, 1893 : 365 ; Ortmann, 1893 : 436, 438 ;

de Man, 1895 : 537 ; Alcock, 1898 : 192 ; Lanchester, 1900 : 743 ; Laurie, 1906 : 408 ; Urita, 1926 : 15 ; Gravely, 1927 : 144 ; Yokoya, 1933 : 184 ; Estampador, 1937 : 529 ; Sakai, 1939 : 532, pl. 100, figs. 1, 2 ; Barnard, 1950 : 263 ; Chhapgar, 1957a : 434, pl. 10, figs. j-1 ; Edmondson, 1962 : 291, fig. 28b ; Sankarankutty, 1962a : 144 ; Guinot, 1964b : 97 ; Sakai, 1965 : 157, pl. 78, fig. 1 ; 1976 : 484, fig. 258 ; Khan, 1977 : 185.

Pilumnus ursulus Adams and White, 1848 : 45, pl. 9, fig. 6 ; Hess, 1865 : 137, 171, pl. 6, fig. 2 ; Kossmann, 1877 : 39 ; Klunzinger, 1913 : 263, pl. 2, fig. 7, pl. 7, fig. 3.

Material examined : North Andaman : 1 ♀, Aereal Bay, 6.3.1987. Middle Andaman : 1 ♂, Rangat, 24.3.1987. South Andaman : 2 ♂ ♂, 2 ♀ ♀, Havelock Island, 26.3.1987 ; 2 ♀ ♀, Neill Island, 28.3.1987.

Measurement : W = 27.0 mm, F = 7.0 mm, L = 20.0 mm.

Diagnosis : Entire carapace, legs and major part of chelipeds concealed by a thick, dark and shaggy coat of coarse, tufted hair. Upper margin of the orbit with two distinct notches. A sub-hepatic tooth present just below the outer orbital angle.

Description :

Carapace : Entire carapace, legs and chelipeds covered with thick, dark coat of long, coarse matted hairs comprising of two types — longer and shorter ; longer hairs more on the sides of carapace and on legs. Carapace transversely oval, moderately convex before backwards, less so from side to side and about 3/4th as long as broad, regions distinctly outlined and areolated, surface covered with small scattered granules and clusters of granules.

Front : Obliquely deflexed, bilobed, about 1/4th of the greatest width of carapace ; each lobe made up of a large, convex inner division and a small tooth-like outer angle.

Lateral borders : Antero-lateral border little shorter than the postero-lateral and cut into three stout teeth (excluding the sharp outer orbital angle). A sub-hepatic tooth present behind and beneath the outer orbital angle.

Orbits : Orbital margins smooth or crenated. Outer angle of the orbit sharp but not spine-like. Eyes small ; eye-stalk stout, moderately long.

Chelipeds : Massive and unequal in both sexes. Outer surface of arm smooth, its edges granular. Upper and outer surfaces of wrist and palm bearing granules or clusters of granules and long hairs. Inner corner of the wrist adorned with a short, sharp tooth. Inner surface of palm smooth, lower border with a row of granules. Fingers broad, stout, smooth and chocolate brown ; their cutting edges adorned with interlocking teeth.

Legs : Joints granular on their outer surface, upper and lower margins also granular.

Abdomen : Male abdomen consisting of seven separate joints.

Male pleopod : Hook-like, bent apically bearing spines.

Type locality India (Fabricius).

Distribution : Indo-West Pacific. India : East coast : Palk Straits, Gulf of Mannar (Tamil Nadu) ; Neill Island (Andamans). West coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra). Elsewhere : East Africa, Red-Sea, Mauritius, Pakistan, Sri Lanka, Tenasserim coast, Mergui Archipelago, Indonesia, Philippines, Japan, Polynesia, Australia and Hawaii.

Remarks Crenulations of the orbital margins are not obscure ; rather these are very much distinct. Anterior border of the arm of larger cheliped bears a very prominent acuminate spine. Extent of frontal breadth varies from 1/4th to 1/3rd of the greatest width of carapace. In old mature male specimens, the lower distal part of the larger chelae may be bare.

Family CARPILIDAE Ortmann 1893

Carpilidae Ortmann, 1893 : 429 ; Serène, 1984 : 17, 302.

Type genus *Carpilius* Desmarest, 1823

Diagnosis Carapace broad, transversely oval and strongly convex dorsally. Front moderately broad. Antero-lateral borders strongly curved, thick, entire with a prominent epibranchial tubercle. Basal joint of antenna long, flat ; antennary flagellum exceedingly small, less than half the diameter of the orbit. Antennules folding obliquely, nearly transversely. Anterior border of merus of external maxillipeds very oblique. Chelipeds stout, unequal, smooth. Legs thin, smooth, sub-cylindrical. Male abdomen made up of six segments.

Remarks : These are inter-tidal crabs usually inhabiting coral reef or rocky beach. However, the present materials have been collected from the mangrove areas.

Genus *Carpilius* Desmarest, 1823

Carpilius Desmarest, 1823 : 228 ; Rüppell, 1830 : 13 ; H. Milne Edwards, 1834 : 380 ; de Haan, 1833 : 16 ; Dana, 1852b : 159 ; A. Milne Edwards, 1865 : 212 ; Miers, 1886 : 110 ; Alcock, 1898 : 78 ; Rathbun, 1930 : 239 ; Sakai, 1939 : 445 ; Barnard, 1950 : 203 ; Guinot, 1968b : 321 ; Glaessner, 1969 : R517 ; Sakai, 1976 : 388 ; Serène, 1984 : 302.

Type species : *Cancer maculatus* Linnaeus 1758, by subsequent designation by International Commission on Zoological Nomenclature, 1956 ; gender : masculine ; name no. 777 on Official List.

Diagnosis : Carapace broadly oval, convex in both directions, smooth excepting some rough pittings inside the frontal and antero-lateral borders and without any indication of regions. Front moderately broad, deflexed, 3-lobed, middle lobe conspicuous and bilobulate. Antero-lateral borders strongly curved, thick, entire with a small but prominent tubercle at the junction of the antero- and postero- lateral borders. Basal antennal joint long, flat, reaching the cleft between front and infra-orbital plate ; flagellum exceedingly small, less than half the diameter of the

orbit and lodged in the cleft. Antennules folding obliquely transversely. Orbits circular with entire margins ; upper edge of the orbit thickened, forming a distinct blunt tooth at its junction with the antero-lateral margin. Eyes on short, thick stalks. Anterior border of merus of external maxillipeds very oblique. Chelipeds massive, smooth, unequal ; fingers bluntly pointed, larger cheliped with one or two molariform teeth, smaller cheliped with a blunt cutting edge. Leg joints smooth, sub-cylindrical. Male abdomen six-jointed, 3rd and 4th segments fused with obliteration of sutures, 5th segment immovably adherent to the 4th.

Distribution Atlantic coast of Middle America and the Indo-Pacific.

Key to the species of the genus *Carpilius* from Andaman Mangroves

- Carapace with symmetrically arranged 11 large prominent red spots
.....*C. maculatus*
- Carapace irregularly marbled with dark red and white blotches*C. convexus*

19. *Carpilius convexus* (Forskål, 1775)

(Pl. 3, Fig. 6 ; Pl. 12, Figs. 7, 8)

Cancer convexus Forskål, 1775 : 88.

Cancer adpersus Herbst, 1790 : 264, pl. 21, fig. 1.

Cancer marmarinus Herbst, 1804 : 7, pl. 60, fig. 1.

Carpilius convexus Rüppell, 1830 : 13, pl. 3, fig. 2, pl. 6, fig. 6 ; H. Milne Edwards, 1834 : 382, pl. 16, figs. 9, 10 ; Dana 1852b : 159, pl. 7, fig. 5 ; Stimpson, 1858a : 32 ; Heller, 1861 : 319 ; A. Milne Edwards, 1865 : 215, 1873b : 176 ; Hilgendorf, 1869 : 73 ; Miers, 1877 : 133 ; Richters, 1880 : 145 ; Haswell, 1882 : 41 ; Ortmann, 1893 : 469 ; de Man, 1895 : 496 ; Alcock, 1898 : 80 ; Borradaile, 1903 : 261 ; Rathbun, 1906b : 842 ; Stimpson, 1907 : 37 ; Rathbun, 1911 : 211 ; Klunzinger, 1913 : 125, pl. 5, fig. 1 ; Balss, 1922 : 130 ; Ward, 1932 : 239 ; Sakai, 1939 : 445, pl. 55, fig. 1 ; Barnard, 1950 : 205 ; Holthuis, 1953 : 12 ; Forest et Guinot, 1961 : 37 ; Sankarankutty, 1961b : 126, fig. 1c ; Edmondson, 1962 : 223, fig. 1b ; Sakai, 1976 : 389, pl. 136, fig. 3, Serène, 1984 : 302, pl. 44F, figs. 210, 211.

Material examined : Middle Andaman : 1♂, 1♀, Rangat, 24.3.1987.

Measurement : W = 65.0 mm, F = 20.0 mm, L = 51.0 mm.

Diagnosis : Carapace mottled with dark red and white patches.

Description :

Carapace : Very thick, convex from front to back and from side to side, surface smooth excepting some rough pittings near the lateral margins and the front, regions indistinct. Surface mottled with dark red and white patches fading away on long preservation.

Front : Broad, vertically deflexed, median lobe prominent but very faintly bilobed and separated from each lateral lobe by a shallow emargination; free edge of the front smooth, thick.

Lateral borders : Antero-lateral borders strongly curved, thick, entire : a thick, blunt, prominent tooth at the posterior extremity ; postero-lateral borders converging strongly, straight.

Orbits : Both the margins of the orbit smooth. Upper orbital edge thick, entire, forming a distinct blunt tooth at its junction with the antero-lateral borders. Eyes small ; eye-stalk thick, short.

Chelipeds : Massive, unequal. All sides of arm, outer surface of wrist and palm smooth. Inner corner of the wrist produced into an inconspicuous blunt tooth. Fingers broad, very strong, unequal ; dactylus strongly curved, much shorter than the upper border of the palm ; cutting edges of both fingers of the larger cheliped adorned with one molariform tooth, those of the smaller cheliped smooth.

Legs : Joints smooth, sub-cylindrical, glabrous ; dactylus claw-shaped, grooved, tips chocolate brown.

Abdomen : Male abdomen six-jointed, 3rd and 4th segments fused with obliteration of sutures, fifth segment immovably articulated to the fourth.

Male pleopod : Nearly straight and stout process ; tip rounded, spoon-like ; both the borders of the appendage bearing stout spinules subapically.

Type locality : Red Sea. (Forskål).

Distribution : Indo-West Pacific. India : East coast : Andaman and Nicobar Islands. West coast : Minicoy (Lakshadweep). Elsewhere : South Africa, East Africa, Red Sea, Madagascar, Mauritius, Japan, Australia and Hawaii.

Remarks : Forskål's (1775) original description of the species is inadequate. The specimens examined agree well with the descriptions of Alcock (1898), Barnard (1950) and Edmondson (1962). They differ from Ward (1932), Barnard (*op. cit.*) and Edmondson (*op. cit.*) only in size.

20. *Carpilius maculatus* (Linnaeus, 1758)

(Pl. 3, Fig. 7 ; Pl. 12, Figs. 5, 6)

Cancer ruber Rumphius, 1705 : 18, pl. 10, fig. 1 ; 1711 : pl. 10, fig. 1.

Cancer maculatus Linnaeus, 1758 : 626, 1767 : 1042 : Fabricius, 1793 : 447, 1798 : 338 ; Herbst, 1790 : 135, pl. 6, fig. 41 ; 1804 : 8, pl. 60, fig. 2 ; Desmarest, 1825 : 104.

Carpilius maculatus H. Milne Edwards, 1834 : 382 ; Dana, 1852b : 160 ; Stimpson, 1858a : 32 ; A Milne Edwards, 1865 : 214, 1873b : 175 ; Heller, 1865 : 9 ; Hess, 1865 : 133, 171 ; Richters, 1880 : 145 ; Miers, 1886 : 111 ; Henderson, 1893 : 353 ; Ortmann, 1893 : 469 ; de Man, 1895 : 496 ; Alcock, 1898 : 79 ; Borradaile, 1903 : 261 ; Rathbun, 1906b : 842 ; Stimpson, 1907 : 30 ; Ward,

1932 : 239 ; Sakai, 1939 : 445, pl. 55, fig. 1 ; Barnard, 1950 : 203, figs. 37e, 38a-b ; Holthuis, 1953 : 12 ; Forest et Guinot, 1961 : 37 ; Sankarankutty, 1961b : 126 ; Edmondson, 1962 : 223, fig. 1a ; Sakai, 1976 : 388, pl. 137, fig. 4 ; Serène, 1984 : 302, pl. 44E, figs. 208, 209.

Material examined Middle Andaman : 2♂♂, Rangat, 24.3.1987.

Measurement : W = 94.0 mm, F = 25.0 mm, L = 73.0 mm.

Diagnosis : Carapace marked with 11 symmetrically arranged large, round dark red prominent spots.

Description :

Carapace : Very thick, convex in both directions ; surface smooth excepting some rough pittings around antero-lateral borders and the front, regions indistinct. Surface marked with 11 round, large dark red conspicuous spots—two on each side of the antero-lateral borders, three at the middle followed by four spots in transverse row near the posterior margin of the carapace.

Front : Broad, obliquely deflexed ; middle lobe prominent, bilobed, separated from each lobe by a deep notch. Free edge of the front smooth, thick.

Lateral borders : Same as in *Carpilius convexus*.

Orbits : Same as in *Carpilius convexus*.

Chelipeds : Same as in *Carpilius convexus*.

Legs : Same as in *Carpilius convexus*.

Abdomen : Same as in *Carpilius convexus*.

Male pleopod : Similar to the preceding species but with a triangular tip.

Type locality : Asia (Linnaeus).

Distribution : Indo-West Pacific. India : East coast : Palk Strait, Gulf of Mannar (Tamil Nadu) ; Andaman and Nicobar Islands. West coast : Minicoy (Lakshadweep). Elsewhere : East Africa, Red Sea, Madagascar, Maldives, Japan, Australia and Hawaii.

Remarks : The specimens agree well with the descriptions of Haswell (1882), Alcock (1898), Barnard (1950) and Edmondson (1962). But in the course of study, some additional spots (one spot on right antero-lateral margin, one each on both the wrists and one on the outer surface of palm of the larger cheliped) have been noticed in addition to the existing eleven ; these spots are light brown in colour. Besides, one additional pair of dark red spots have been observed little above the transverse row of three spots near the middle of the carapace. The present specimens are bigger than those reported by Ward (1932) but smaller than those of Sakai (1976). Unlike Sankarankutty (1961b), no further pair of blotches behind the three transverse row of spots in the middle of carapace have been observed in the present specimens.

Family MENIPPIDAE Ortmann, 1893

Menippidae Ortmann, 1893 : 428 ; Serène, 1894 : 302.

Type Genus : *Menippe* de Haan, 1833

Diagnosis : Carapace broad, transversely oval. Front broad or moderately broad. Antero-lateral borders cut into lobes, teeth, spine or spinules, rarely entire. Basal antennal joint may or may not be meeting the front. Antennules folded nearly transversely. Anterior border of merus of external maxillipeds also may or may not be notched. Chelipeds massive, unequal. Legs stout. Male abdomen consisting of 7 distinct segments.

Remarks : This family is represented by two subfamilies, namely, Oziinae Alcock, 1898 and Eriphiinae Alcock, 1898 in Andaman mangroves. These are inter-tidal crabs inhabiting coral reef or rocky shore. However, the present materials have been collected from the mangrove areas.

Key to subfamilies of the family MENIPPIDAE from Andaman Mangroves

- Antero-lateral borders of carapace lobate or dentate, fingers of smaller cheliped conspicuously elongated..... Oziinae
- Antero-lateral borders spinose, fingers of smaller cheliped not noticeably elongated Eriphiinae

Subfamily OZIINAE Alcock, 1898

Oziinae Alcock, 1898 : 176 ; Serène, 1984 : 302.

Diagnosis : Carapace very broad, flattened dorsally, less so medially. Antero-lateral borders cut into lobes or teeth. Chelipeds massive, unequal. Fingers of smaller chelipeds conspicuously elongated.

Key to genera of the subfamily OZIINAE from Andaman Mangroves

1. Dactylus of smaller cheliped as long as the entire lower border of the palm 2
- Dactylus of smaller cheliped shorter than the lower border of the palm *Lydia*
2. Antero-lateral borders much shorter than the postero-laterals *Baptozius*
- Antero-laterals as long as or little shorter than the postero-laterals *Epixanthus*

Genus *Baptozius* Alcock, 1898

Rüppellia (part) H. Milne Edwards, 1834 : 420 ; Haswell, 1882 : 73.

Baptozius Alcock, 1898 : 188 ; Sakai, 1939 : 521, 1976 : 476.

Type species : *Rüppellia vinosa* H. Milne Edwards, 1834.

Diagnosis : Carapace broadly oval, moderately convex from front to back, regions not defined. Front almost straight, broad, thin, deflexed, Antero-lateral sides short, thin and cut into

four, sharp teeth. Basal antennal segment massive, flagella excluded from the orbit. Antennules transversely folded, inter-antennular septum very broad. Orbits large with a sharp, conspicuous, entire orbital edge. Endostomial ridges strong, anterior border of merus of external maxillipeds not notched but entire. Chelipeds stout, unequal in both sexes, fingers pointed. Legs thick, stout. Male abdomen seven-segmented.

Distribution : Indo-Pacific.

21. *Baptozius vinosus* (H. Milne Edwards, 1834)

(Pl. 3, Fig. 8 ; Pl. 13, Figs. 5, 6)

Rüppellia vinosa H. Milne Edwards, 1834 : 422.

Eurüppellia vinosa de Man, 1892 : 268, 278, pl. 1, fig. 1.

Rüppellia lata A. Milne Edwards, 1873a : 81.

Baptozius vinosus Alcock, 1898 : 189 ; Sandler, 1923 : 38, pl. 6, fig. 8 ; Estampador, 1937 : 529 ; Sakai, 1939 : 521, 1976 : 476, pl. 170.

Material examined : South Andaman : 1 ♂, Guptapara, 22.12.1978 ; 1 ♀, Guptapara, 7.6.1980 ; 1 ♀, Carbyn's Cove, 15.11.1980 ; 1 ♂, Baratang Island, 19.3.1987.

Measurement : W = 65.0 mm, F = 23.0 mm, L = 45.0 mm.

Diagnosis : Fourth antero-lateral tooth elegantly procurved. Foliaceous process of the first maxillipeds with its notched anterior margin prominent beyond the anterior margin of the external maxillipeds.

Description :

Carapace : Thick, transversely oval, convex from front to back and from side to side ; regions not defined. Surface covered with fine granules ; granules near frontal, orbital and lateral margins larger in size and visible even with the naked eye. Carapace unbroken excepting a short, sinuous, granular ridge passing inwards from the gap between third and fourth antero-lateral margins.

Front : Very broad, double edged, thin, deflexed ; both margins of the front crenated.

Lateral borders : Antero-lateral borders cut into four thin, granular, sharp teeth, of which the first three teeth broad, and slightly angular ; last tooth elegantly procurved. Antero-lateral borders much shorter than the postero-laterals.

Orbits : Large, deep, almost sub-tubular and without any suture. Upper orbital margin elegantly beaded, lower one coarsely crenated ; inner corner of the lower border bluntly prominent and tooth-like. Inner border of the orbit with a good number of eye-lashes.

External maxillipeds : Anterior border of the merus of external maxillipeds not notched but

entire. Endostomial ridges very strong, a permanent orifice formed by a deep emargination of the prolonged foliaceous opercular process of the first maxillipeds.

Chelipeds : Massive and unequal in both sexes. Outer surface of arm smooth ; outer and upper surface of wrist and palm frosted. Inner corner of wrist armed with a sharp, spine-like tooth. Fingers broad, massive and crossing each other. Fingers chocolate brown, tips white. Cutting edges of both the fingers adorned with several big teeth, dactylus armed with one large molariform tooth at its proximal end.

Legs : Joints broad, compressed. Third pair of leg largest. Merus, carpus and dactylus thickly covered with hairs especially on their upper surfaces, dactylus claw-shaped.

Abdomen Consisting of 7 distinct segments in both sexes and fringed with hairs. Sixth segment in male slightly converging posteriorly.

Male pleopod : Long, slender, ending with an acute tip, bearing spinules sub-apically.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Andamans. Elsewhere : Celebes, Philippines, Japan, Solomon Island and Buka.

Remarks : The present specimens agree with the descriptions of Alcock (1898) and Haswell (1882). These differ from Alcock (*op. cit.*) in the extent of frontal length which is about 1/3rd of the greatest breadth of carapace and not 1/5th as reported. These also differ from Sakai (1976) in size. In the course of study, it has been observed that (1) upper rim of the front is almost straight while the lower one is slightly sinuous at the middle, (2) granules on the outer surface of palm are larger at the anterior half and smaller at the posterior half and (3) dactylus of larger cheliped is slightly larger than the upper border of the palm. This species is reported for the first time from Andaman Islands.

Genus *Epixanthus* Heller, 1861

Epixanthus Heller 1861 : 323 ; A. Milne Edwards, 1863 : 290, 1873b : 240 ; de Man, 1887 : 45 ; Alcock, 1898 : 184 ; Stebbing, 1910 : 301 ; Sakai, 1939 : 511, 518 ; Barnard, 1950 : 259 ; Monod, 1956 : 235 ; Sakai, 1976 : 474 ; Manning and Holthuis, 1981 : 123 ; Serène, 1984 : 307.

Type species : *Epixanthus kotschii* Heller, 1861, a subjective junior synonym of *Ozius frontalis* H. Milne Edwards, 1834 ; by monotypy ; gender : masculine ; name no. 199 on Official List.

Diagnosis : Carapace broad, transversely oval, more or less flat or moderately convex, regional boundaries indistinct. Front broad, little deflexed, 4-lobed, separated from the supra-orbital margin by a notch. Antero-lateral margins long, strongly curved, crest-like and either fissured or dentate ; postero-lateral margins converging strongly. Basal segment of antenna very

broad, short, lying in contact with the front ; flagellum very short and lodged in the orbital gap. Antennules transversely folded. A suture or a gap below the external angle of the orbit. Endostomial ridges strong, anterior border of merus of external maxillipeds with or without any notch. Chelipeds strong, unequal, fingers of smaller cheliped markedly long and slender. Male abdomen consisting of seven distinct segments.

Distribution : Atlantic Ocean and the Indo-Pacific.

Key to the species of the genus *Epixanthus* from Andaman Mangroves

- Carapace depressed, smooth, antero-lateral borders cut into four shallow lobes by very short narrow fissures *E. frontalis*
- Carapace very thick, rough, antero-lateral borders deeply cut into five lobes
..... *E. dentatus*

22. *Epixanthus dentatus* (White, 1847)

(Pl. 4, Fig. 1 ; Pl. 13, Figs. 1, 2)

Panopeus dentatus White, 1847a : 226, 1848 : 286 ; Adams and White, 1848 : 41, pl. 11, figs. 1a-b.

Heteropanope dentatus Stimpson, 1858a : 35 ; A. Milne Edwards, 1868 : 71.

Epixanthus dilatatus de Man, 1879 : 58.

Panopeus acutidens Haswell, 1882 : 51, pl. 1, fig. 2.

Epixanthus dentatus Miers, 1880 : 233 ; de Man, 1887 : 46 ; Henderson, 1893 : 364 ; Ortmann, 1893 : 478 ; Alcock, 1898 : 185 ; Sakai, 1939 : 520 ; Sankarankutty, 1962a : 142 ; Sakai, 1976 : 476, pl. 169, fig. 3 ; Serène, 1984 : 307, pl. 45E, figs. 220, 221.

Material examined : South Andaman : 1 ♀, Guptapara 24.5.1980 ; 1 ♂, Havelock Island, 19.6.1980 ; 1 ♂, Rutland Island, 23.1.1982 ; 1 ♀, Bambooflat, 27.2.1987 ; 2 ♂ ♂, Baratang Island, 19.3.1987.

Measurement : W = 54.0 mm, F = 14.0 mm, L = 32.0 mm.

Diagnosis : Carapace very thick, scabrous. Antero-lateral sides of carapace deeply cut into five broad lobes. A gap present on the orbital margin below the outer angle of the orbit. Outer surface of arm, wrist and palm not smooth.

Description :

Carapace : Carapace broadly oval, moderately convex from front to back, less so from side to side. Surface roughened with fine granules and tubercles towards the anterior one-third ; short, soft hairs also present in that area ; posterior two-third smooth and covered with soft hairs. Regional lobules faintly outlined ; branchial regions distinct ; a transverse fine granular ridge extending inwards towards the protogastric regions of carapace from the notch between third and fourth antero-lateral teeth.

Front : Broad, about 1/4th of the greatest breadth of carapace, double edged and divided into four lobes ; inner lobes broader and more rounded than the outer pair.

Lateral borders : Antero-lateral borders cut into five, very broad, low teeth including the outer orbital angle ; first three teeth truncated ; fourth, fifth acute and acuminate, last one smallest.

Orbits Small, rounded. A distinct gap in the orbital margin just below the outer orbital angle. Eye-stalk short, thick.

Chelipeds : Stout, markedly unequal in both the sexes. Upper and outer surfaces of arm, wrist and palm roughened with reticulating rugae and wrinkles. Fingers long, pointed ; those of the smaller cheliped slenderer and longer, movable finger of the larger cheliped armed with one large molariform tooth at its proximal end. Cutting edge of both the fingers adorned with 3-4 broad interlocking teeth. Fingers chocolate brown leaving no gap when closed.

Legs Joints broad, compressed and hairy.

Abdomen : Consisting of 7 segments in both sexes.

Male pleopod : Long, gradually tapering towards the tip ; apical opening broad, funnel-like ; both the borders of the appendage bearing spines.

Type locality : Philippines (White).

Distribution : Indo-West Pacific. India : East coast : Palk Bay, Gulf of Mannar (Tamil Nadu) ; Bimblitan (Andaman Islands). Elsewhere : East coast of Africa, Madagascar, Seychelles, Mergui Archipelago, Malay Peninsula, Java, Philippines, Formosa, Japan, Australia and Fiji.

Remarks : The specimens in general agree with the descriptions of White (1847a) and Alcock (1898). They differ from White (*op. cit.*) in the dentary arrangement of the larger cheliped and from Alcock (*op. cit.*) in the dimension of size and extent of frontal width. The present specimens are, however, bigger than those reported by Sakai (1976). Further, inner corner of wrist of larger cheliped has been found to be armed with two very distinct, stout, blunt teeth in the specimens examined.

23. *Epixanthus frontalis* (H. Milne Edwards, 1834)

(Pl. 4, Fig. 2 ; Pl. 12, Figs. 9, 10)

Ozius frontalis H. Milne Edwards, 1834 : 406 ; Krauss, 1843 : 31 ; Stimpson, 1858a : 34 ; Hilgendorf, 1869 : 75.

Epixanthus frontalis Heller, 1865 : 20 ; A. Milne Edwards, 1873b : 241 ; Kossmann, 1877 : 36 ; Richters, 1880 : 148, pl. 16, fig. 16 ; Lenz and Richters, 1881 : 421 ; de Man, 1887 : 46 ; Henderson, 1893 : 364 ; Ortmann, 1893 : 477 ; de Man, 1895 : 525 ; Alcock, 1898 : 185 ; Laurie, 1906 : 408 ;

Stimpson, 1907 : 60, pl. 7, fig. 4 ; Balss, 1922 : 132 ; Urita, 1926 : 14 ; Chopra and Das, 1937 : 405 ; Sakai, 1939 : 519, pl. 98, fig. 4 ; Stephensen, 1945 : 139 ; Barnard, 1950 : 259, figs. 48a-b ; Chhappgar, 1957a : 434, pl. 10, figs. g-i ; Sankarankutty, 1962a : 142, figs. 46, 47 ; Sakai, 1976 : 474, pl. 169, figs. 2, 254 ; Serène, 1984 : 307, pl. 45F, figs. 222, 223.

Epixanthus kotschii Heller, 1861 : 325, pl. 1, fig. 14.

Material examined : North Andaman : 6♂♂, Carlew Island, 10.3.1987 ; 3♀♀, Stewart Island, 11.3.1987. Middle Andaman : 1♂, Uttara Jetty, 17.3.1987 ; 1♂, Rangat, 24.3.1987. South Andaman : 2♂♂, 2♀♀, Chidyatapu, 17.10.1978 ; 3♂♂, 4♀♀, Chidyatapu, 3.12.1980 ; 6♂♂, 2♀♀, Chidyatapu, 6.5.1981 ; 1♂, Baratang Island, 19.3.1987.

Measurement : W = 30.0 mm, F = 7.0 mm, L = 18.0 mm.

Diagnosis : Carpace very much depressed and smooth to the naked eye. Antero-lateral borders divided into four broad, shallow lobes by very short narrow fissures. A suture, not a gap present below the outer angle of the orbit. Outer surface of arm, wrist and palm of larger cheliped smooth.

Description :

Carapace : More or less flat and transversely oval; its anterior half roughened with short rugae and granules ; regions not defined, only the gastric region faintly demarcated.

Front : Broad, deflexed, double-edged, about one-fourth of the greatest breadth of carapace and cut into four subequal teeth.

Lateral borders : Antero-lateral borders sharp, crest-like, divided into four shallow lobes (including the outer orbital angle) by extremely short narrow fissures. An oblique fine granular line extending towards the gastric region of the carapace from the last antero-lateral tooth.

Orbits : Circular, both upper and lower orbital borders crenated. A suture below the outer angle of the orbit. Eye-stalk very short, thick.

Chelipeds : Stout, smooth, markedly unequal in male, less so in female. Outer surface of arm, wrist and palm smooth. Inner corner of the wrist bidentate. Fingers of the larger chela strongly curved, meeting at tips only and those of the smaller chela very long, narrow, not curved, meeting throughout their length ; distal 2/3rd of the fingers brown in colour.

Legs : Joints narrow, smooth ; propodus and dactylus of all legs tomentose.

Abdomen : Same as in *Epixanthus dentatus*.

Male pleopod : Strong, stout, tubular process with a broad tip, more or less resembling a spoon ; apical and subapical parts of the appendage bearing spines.

Type locality Tranquebar (H. Milne Edwards).

Distribution : Indo-West Pacific. India : East coast : Orissa ; North Bay (Andamans) ; Nicobars. West coast : Mumbai (Maharashtra). Elsewhere : East coast of Africa, Red Sea, Persian Gulf, Comoro Island, Madagascar, Mauritius, Seychelles, Sri Lanka, Arakan coast, Mergui Archipelago, Gulf of Thailand, Malay Peninsula, Philippines, Japan, Australia, Tasmania, New Caledonia and Funafuti.

Remarks : The specimens examined correspond with the description of H. Milne Edwards (1834) and Alcock (1898) although three gastric subregions as reported by the latter are not distinct in the present materials. Fourth lobe of the antero-lateral border was reported to be subdivided by a narrow fissure by Chhapgar (1957a) ; but, this has not been observed in the present specimens.

Genus *Lydia* Gistel, 1848

Lydia Gistel, 1848 : IX ; Rathbun, 1906b : 862 ; Sakai, 1939 : 511, 520 ; 1976 : 477 ; Serène, 1984 : 309.
EurüPELLIA Miers, 1884 : 534 ; Alcock, 1898 : 186.

Type species : *Cancer renax* Rüppell, 1830, by selection by Holthuis, 1990, gender : feminine.

Diagnosis : Carapace broad, transversely oval, moderately convex from front to back, less so from side to side, only the gastric region well outlined, other regions less distinct ; surface smooth or granular. Front broad, deflexed and cut into four subequal teeth or lobules separated from the orbit by a notch. Antero-lateral borders strongly curved and cut into lobes, postero-lateral borders converging almost as long as the antero-lateral. Basal antenna joint extended between the sides of the front and the orbital plate, flagellum extremely small and lodged in the orbital hiatus. Antennules folding transversely. Orbits small, deep ; its upper and lower margins meeting each other closing the orbit and excluding the antennary flagellum entirely. Eye-stalk thick, short. Endostomial ridges very strong. Opposed margin of the merus of external maxillipeds notched deeply. Chelipeds massive and unequal in both sexes. Legs stout. Male abdomen consisting of 7 segments.

Distribution : Indo-Pacific.

24. *Lydia annulipes* (H. Milne Edwards, 1834)

(Pl. 4, Fig. 3 ; Pl. 13, Figs. 3, 4)

RüPELLIA annulipes H. Milne Edwards, 1834 : 422 ; Dana, 1852b : 246, 1855 : pl. 14, figs. 4a-c ; Stimpson, 1858a : 37 ; Haswell, 1882 : 73 ; Ortmann, 1893 : 479.

EurüPELLIA annulipes Miers, 1884 : 523 ; Odhner, 1925 : 85.

OZIUS (EurüPELLIA) annulipes Alcock, 1898 : 188 ; Borradaile, 1900 : 589 ; Lenz, 1910 : 552 ; Balss, 1922 : 132.

Lydia annulipes Rathbun, 1906b : 862 ; Urita, 1926 : 14 ; Miyake, 1936 : 509 ; Sakai, 1939 : 524, pl. 64, fig. 3 ; Holthuis, 1953 : 23 ; Forest et Guinot, 1961 : 133, figs. 109a-b, 110 ; Edmondson, 1962 : 288, fig. 25e ; Sakai, 1976 : 477, pl. 171, fig. 2 ; Serène, 1984 : 309, pl. 45F, figs. 230, 231.

Material examined : South Andaman : 1 ♂, Peel Island, 12.6.1980 ; 1 ♀, Neill Island, 18.6.1980 ; 1 ♂, Chidyatapu, 3.12.1980.

Measurement : W = 34.0 mm, F = 10.0 mm, L = 21.0 mm.

Diagnosis : Front cut into four broad, shallow, equal and equidistant teeth. Antero-lateral border cut into five teeth of which the first four teeth sharp and fifth tooth tubercle-like. Lower orbital margin separated from the upper orbital by a shallow groove.

Description

Carapace : Thick, broad, transversely oval, moderately convex in both the directions. Anterior 1/3rd of the carapace distinctly divided into regional and subregional lobules by wide grooves.

Front : Broad, deflexed, less than one third of the greatest breadth of carapace. Free frontal edge followed by a parallel edge, divided into four equal and equidistant teeth. Front separated from the orbital edge by a notch.

Lateral borders : Antero-lateral border of the carapace divided into five tooth-shaped lobules ; first three lobes low, broad ; fourth acuminate, fifth shaped like a tubercle; margins of the first three sharp and crest-like.

Orbits : Deep, oval ; upper margin of the orbit entire, separated from the lower margin by a shallow groove.

Chelipeds : Stout, unequal. Outer surface of arm smooth. Upper and outer surface of wrists finely granular, inner corner of wrist broadly bidentate. Upper and outer surface of palm roughened with large pustulose granules and granular ridges, the granules concentrated almost upto the middle of the palm. Fingers pointed at tips, those of the smaller cheliped long and rather narrower while those on the larger cheliped very much stout. Movable finger adorned with a large, molariform tooth.

Legs : Joints stout, nearly smooth ; upper and lower edges of dactylus covered with velvet up to the claw.

Abdomen : Male abdomen seven-segmented.

Male pleopod : Long, tubular process ; apical opening broad, funnel-like ; sub-apical part of the appendage spinose.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Andaman Islands (present record). Elsewhere : East coast of Africa, Seychelles, Indonesia, Japan, Fiji, Samoa, Tahiti and Hawaiian Islands.

Remarks : This species is reported for the first time from India. The specimens in general agree with the descriptions of Alcock (1898) and Edmondson (1962) although some variations

have been observed. These are : (1) entire surface of carapace has been found to be studded with small granules which are visible under the lens ; often, in some specimens 1 or 2 tubercles are observed behind the antero-lateral tooth, (2) cutting edge of fixed finger of larger cheliped is adorned with 3 large teeth and (3) upper border of meri of legs are roughened with granules.

Subfamily ERIPHIINAE Alcock, 1898

Eriphunnae Alcock, 1898 : 177 ; Serène, 1984 : 18, 309.

Diagnosis Carapace of Xanthoid-shape, narrow and dorsally convex. Antero-lateral borders spinose. Chelipeds unequal, slightly dissimilar, smaller chelipeds without any noticeably elongated finger.

Genus *Eriphia* Latreille, 1817

Eriphia Latreille, 1817a : 404 ; Desmarest, 1825 : 125 ; de Haan, 1833 : 22 ; H. Milne Edwards, 1834 : 425 ; Dana, 1851a : 128, 1852b : 126 ; Miers, 1886 : 162 ; Alcock, 1898 : 213 ; Stebbing, 1910 : 302 ; Rathbun, 1930 : 545 ; Sakai, 1939 : 522 ; Garth, 1946 : 482 ; Barnard, 1950 : 273 ; Glaessner, 1969 : R517 ; Sakai, 1976 : 477 ; Manning and Holthuis, 1981 : 124 ; Serène, 1984 : 309.

Type species : *Cancer spinifrons* Herbst, 1785, a subjective junior synonym of *Cancer verrucosus* Forskål, 1775, by selection by H. Milne Edwards, 1842, in 1836-1844, gender : feminine ; name no. 1621 on Official List.

Diagnosis : Carapace thick, deep, sub-quadrilateral slightly convex or nearly flat and broader than long ; only the gastric region well demarcated. Front broad, strongly deflexed, almost straight and cut into two broad lobes. Antero-lateral margins slightly curved, spinate, much shorter than the postero-laterals meeting the latter at a very open and imperceptible angle. Basal joint of antenna extremely small, short and broad ; flagellum long, exceeding the major diameter of the orbit. Antennules folding transversely. Orbits deep, oval. Endostomial ridges strong ; anterior margin of merus of external maxillipeds not notched. Chelipeds massive, unequal ; fingers strong, tips pointed, not hollowed. Legs strong. Male abdomen consisting of 7 distinct segments.

Distribution : Atlantic Ocean and the Indo-Pacific.

25. *Eriphia sebana* (Shaw and Nodder, 1803)

(Pl. 4, Fig. 4 ; Pl. 13, Figs. 7, 8)

Cancer sebana Shaw and Nodder, 1803 : pl. 591.

Eriphia laevimana Guérin-Méneville, 1829-1844 : 6, pl. 3, fig. 1 ; H. Milne Edwards, 1834 : 427 ; Dana, 1852b : 249, pl. 14, figs. 7a-c ; Stimpson, 1858a : 37 ; Heller, 1865 : 24 ; A. Milne Edwards, 1868 : 71, 1873b : 255 ; Hilgendorf, 1869 : 75, 1878 : 797 ; Miers, 1877 : 135, 1884 : 517, 534 ; 1886 : 162 ; Richters, 1880 : 151 ; Haswell, 1882 : 75 ; de Man, 1887 : 68, 1895 : 555 ; Henderson, 1893 : 367 ; Ortmann, 1893 : 480 ; Alcock, 1898 : 214 ; Klunzinger, 1913 : 300 ; Gravely, 1927 : 145 ; Estampador, 1937 : 530 ; Sakai, 1939 : 522, pl. 90, fig. 1 ; Edmondson, 1962 : 289, fig. 26a ; Sankarankutty, 1962a : 146.

Eriphia sebana Rathbun, 1906b : 865 ; Holthuis, 1953 : 20 ; Forest et Guinot, 1961 : 122, figs. 111a-b, 112 ; Sakai, 1976 : 478, pl. 172, fig. 1 ; Serène, 1984 : 311, pl. 47b, figs. 234, 235.

Material examined : North Andaman : 1 ♀, Carlew Island, 10.3.1987. South Andaman : 1 ♂, Neill Island, 23.6.1980 ; 1 ♂, Neill Island, 28.3.1987.

Measurement : W = 50.0 mm, F = 13.0 mm, L = 39.0 mm.

Diagnosis : No hair on carapace. Gastric region prominent and divided into three large areas. Frontal lobes bluntly spinate.

Description

Carapace : Carapace thick, slightly broader than long and moderately convex in both the directions. Surface roughened with small pearl-like granules and tubercles towards the anterior half of the carapace and by minute vesiculous granules at posterior half. Gastric region large, well outlined and divided into three large areas.

Front : Broad, about one-fourth of the greatest breadth of carapace, bilobed ; frontal margin with blunt spines, well separated from the orbital edge by a groove.

Lateral borders : Antero-lateral borders oblique producing on either side 5-6 tubercles, diminishing in size from front to back ; postero-lateral borders slightly convergent, longer than the antero-laterals.

Orbits : Deep, oval, upper and lower orbital edges finely crenulated. Postero-orbital crest distinct, tubercular ; a narrow fossa behind the orbit. Eyes large ; eye-stalk thick, short.

Chelipeds : Massive, markedly unequal in both the sexes. Upper border of the arm denticulate at its far end. Inner corner of the wrist armed with three spines towards its proximal end, of which the middle spine longest. Fingers stout, pointed at tips and crossing each other. Both dactylus and base of fixed finger of larger cheliped armed with at least one large molariform tooth in addition to denticles.

Legs : Joints stout, compressed, smooth. Upper border of meral joints denticulate.

Abdomen : Male abdomen made up of 7 distinct segments, sixth segment biggest.

Male pleopod : Narrowed anteriorly, sharply tipped, dagger like ; inner margin carrying spinules, outer margin with long, stout spines.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Palk Bay and Gulf of Mannar (Tamil Nadu) ; Port Blair : South Point (Andaman Island). West coast : Minicoy (Lakshadweep). Elsewhere : South Africa, Red Sea, Mauritius, Sri Lanka, Arakan coast, Mergui Archipelago, Philippines, Japan, Palao Islands, Australia, Fiji, Samoa and Hawaiian Islands.

Remarks : The specimens examined agree well with descriptions of Alcock (1898) and Edmondson (1962) ; however, several minor variations have been noted during the present study. These are : (1) number of teeth of the frontal lobe has been found to vary from 4-6, (2) outer surface of arm, wrist and palm of chelipeds are smooth with the naked eye, although they are closely covered with small granules when observed under the lens and (3) both upper and lower margins of meri of legs are covered with tufts of stiff hairs ; similar tufts of hair occur on the upper surface of the carpus and on all the edges of the propodus ; major part of the dactylus of legs are also covered with stiff hairs and long bristles.

Superfamily GRAPSIDOIDEA MacLeay, 1838

Grapsidea MacLeay 1838 : 63, 65.

Grapsidoidea Glaessner, 1969 : R528 ; Bowman and Abele, 1982 : 25.

Diagnosis : Carapace thick, transversely oval, globose or quadrangular ; lateral borders straight or convex. Front narrow or broad. Orbits at or very near to the antero-lateral angles. Buccal cavity square cut. Male gonoducts opening sternally.

Remarks : This superfamily contains three families, namely, Gecarcinidae MacLeay, 1838, Grapsidae MacLeay, 1838 and Mictyridae Dana, 1851, the representatives of all the families have been found to occur in the mangroves of Andaman Islands.

Family GECARCINIDAE MacLeay, 1838

Gecarciniens H. Milne Edwards, 1837 : 7, 16-20.

Gecarcinidae H. Milne Edwards, 1853 : 200

Gecarcinidae MacLeay, 1838 : 63

Cardisomaceen Nauck, 1880 : 27, 65.

Geocarcinidae Miers, 1886 : XVI, 216, 346.

Diagnosis : Carapace thick, transversely oval. Front broad, strongly deflexed, its width much less than the greatest width of carapace. Antero-lateral margins strongly arcuate anteriorly. Inter-antennular septum very broad, inter-antennular fossae narrow. Orbits large. Palp of external maxillipeds articulating either at the antero-external angle or at the middle of the anterior margin of the merus ; exognath slender, indistinct, often concealed and without any flagellum. Chelipeds massive. Legs strong, dactylus long, usually throny. Male genital openings sternal.

Type genus *Gecarcinus* Leach, 1814

Remarks : Members belonging to this family are usually terrestrial, burrowing in mud banks, mangroves, under stones or fallen logs, usually at a considerable distance away from water, migrating towards water only during spawning. The family is represented by a single genus, namely, *Cardisoma* Latreille, 1828 in Andaman mangroves.

Genus *Cardisoma* Latreille, 1828

Cardisoma Latreille, 1828 : 685 ; de Haan, 1835 : 27 ; H. Milne Edwards, 1837 : 22 ; 1853 : 203 ; Smith, 1870 : 142 ; Miers, 1886 : 219 ; Ortmann, 1984 : 732 ; Sakai, 1976 : 678 ; Manning and Holthuis, 1981 : 249.

Cardisoma Smith, 1869 : 16, 36 ; Alcock, 1900 : 441 ; Tesch, 1918 : 136 ; Rathbun, 1918 : 340 ; Sakai, 1939 : 704 ; Türkay, 1974 : 224.

Discoplax A. Milne Edwards, 1867 : 284 ; 1873b : 293.

Perigrapsus Heller, 1862 : 522.

Type species : *Cardisoma guanhumi* Latreille, 1828, selected by H. Milne Edwards, 1838, in 1836-1844, pl. 20 ; gender : neuter.

Diagnosis : Carapace thick, transversely oval and convex from front to back. Fronto-orbital width much more than half of the greatest breadth of carapace ; front almost straight, deflexed. Lateral borders tumid and strongly curved, due to vault-like expansion of gill chambers, pterygostomial regions thickly coated with short hairs. Basal antenna-joint broad, touching the front, antennae lodged in the orbital hiatus, antennal flagellum very short. Antennules folded below the front obliquely, inter-antennular septum very broad. Orbits deep, its outer angle defined by a denticle, inner angle also with a well developed tooth. Epistome short, prominent and well demarcated, buccal cavity squarish longer than wide. Chelipeds massive, equal or considerably unequal. Legs stout, dactyli spinose. Abdomen consisting of 7 distinct segments in both sexes, its base covered by the entire breadth of sternum between the last pair of legs in male.

Distribution : Coasts of East Pacific, Atlantic and the Indo-West Pacific.

26. *Cardisoma carnifex* (Herbst, 1794)

(Pl. 7, Fig. 8 ; Pl. 21, Figs. 1, 2)

Cancer carnifex Herbst, 1794 : 163, pl. 41, fig. 1.

Cardisoma carnifex Latreille, 1828 : 685 ; H. Milne Edwards, 1837 : 23 ; Dana, 1852b : 377 ; H. Milne Edwards, 1853 : 204 ; Heller, 1865 : 35 ; A. Milne Edwards, 1873b : 264 ; Brocchi, 1875 : 85, pl. 17, figs. 117, 118 ; Miers, 1877 : 137 ; Hilgendorf, 1878 : 801 ; Lenz and Richters, 1881 : 422 ; Henderson, 1893 : 380 ; de Man, 1903 : 546 ; Tesch, 1918 : 137 ; Maki and Tsuchiya, 1923a : 194, pl. 23, fig. 1 ; Estampador, 1937 : 541 ; Sakai, 1939 : 705, pl. 111, fig. 2 ; Holthuis, 1953 : 34 ; Forest et Guinot, 1961 : 165 ; Türkay, 1973 : 108, pls. 7, 8 ; Sakai, 1976 : 680, pl. 233, fig. 374 ; Soemodihardjo, 1987 : 103 ; Aksornkoe, 1987 : 240.

Cardisoma obesum Dana, 1852b : 375, pl. 24, fig. 1 ; H. Milne Edwards, 1853 : 205 ; Stimpson, 1858b : 100 ; Streets, 1877 : 114.

Perigrapsus excelsus Heller, 1865 : 50, fig. 1.

Cardisoma guanhumi var. *carnifex* Ortmann, 1894 : 735.

Cardiosoma carnifex Alcock, 1900 : 455 ; Borradaiale, 1903 : 97.

Material examined North Andaman : 1♂, Mayabunder, 8.3.1987. South Andaman : 1♂, Carbyn's Cove, 30.4.1980.

Measurement : W = 68.0 mm, F = 16.0 mm, L = 56.0 mm.

Diagnosis : An extremely small tooth just behind the outer orbital angle. A fine raised line on the antero-lateral border of carapace.

Description

Carapace : Deep, transversely oval, strongly convex from front to back. Surface smooth. Gastric and branchial regions indicated by their unequal levels ; postero-gastric, cardiac and intestinal regions demarcated by grooves ; posterior areola of the gastric region outlined as small swollen area.

Front : Thick, broad and deflexed ; free edge of it almost horizontal and smooth, sides very oblique.

Lateral borders : Antero-lateral borders of carapace defined by a fine ridge, becoming fainter on ageing.

Orbits : Upper orbital edge crest-like and curved like ω , lower edge crenated ; greatest breadth of orbit not more than half of its length. Eyes large, very loose in the orbits ; eye-stalk long, slender.

Chelipeds : Very stout and unequal in both sexes. Outer surface of chelipeds smooth excepting the edges of arm and palm. Inner angle of wrist with a small tooth. Palm much higher than long. Fingers stout, very long meeting at tips. Cutting edges of fingers of the larger cheliped strongly denate with one molariform tooth at the middle ; finger tips hollow, dark brown in colour.

Legs : Joints broad, stout and fringed with thickly set of stiff bristles particularly on the upper borders of carpus and propodus ; merus also bearing bristles but only at its far end ; dactylus spiny.

Abdomen : Male abdomen 7-jointed, abdominal segments convergent distally ; sixth segment longest, almost as long as broad, seventh segment half the length of sixth segment. Abdominal segments fringed with bristles in both sexes.

Male pleopod : Very strong, stout and grooved process ; apex broad, blunt and slightly notched bearing dense setae.

Type locality : Tranquebar (Herbst).

Distribution : Indo-West Pacific. India : East coast : Coromandel coast ; Andamans. Elsewhere :

South Africa, East coast of Africa, Madagascar, Mauritius, Thailand, Formosa, Japan, Indonesia, East Indies, Tahiti and Tuamotu.

Remarks : The specimens in general corroborate well with the description of Alcock (1900) although some variations have been noticed during the present study. These are (1) convexity of carapace is more pronounced in young specimens, (2) ridge of the antero-lateral border is continued beyond the level of the cervical groove, (3) outer surface of the arm of larger cheliped is scabrous and its lower edge denticulate, (4) dactylus of larger cheliped is more than double the length of the upper border of the palm, (5) upper border of merus of legs is granular with a spine at the distal end and (6) in the larger cheliped, upper border of dactylus (near the distal end) and lower border of fixed finger are granular.

Family GRAPSIDAE MacLeay, 1838

Grapsidae MacLeay, 1838 : 63, 65 ; Manning and Holthuis, 1981 : 225.

Sesarminae Dana, 1851b : 288.

Plagusinae Dana, 1851b : 288 (corrected to Plagusiinae by Miers, 1878 : 147).

Varunacea H. Milne Edwards, 1853 : 175 (corrected to Varuninae by Alcock, 1900 : 288, 400).

Cyclograpsacea H. Milne Edwards, 1853 : 191.

Type genus *Grapsus* Lamarck, 1801

Diagnosis : Carapace thick or depressed, quadrilateral with lateral margins either straight or little convex. Front very broad. Orbits at or very close to the antero-lateral angles. Buccal cavity square cut ; a gap, often wide and rhomboidal in shape, between the external maxillipeds. Chelipeds massive. Legs strong. Male genital openings sternal.

Remarks : These are essentially inter-tidal crabs living among rocks or pelagic on drift timber and weeds ; they inhabit mangrove swamps, estuaries, rivers, fresh water and even land. The family is represented by two subfamilies, namely, Grapsinae MacLeay, 1838 and Sesarminae Dana, 1852 in Andaman mangroves.

Key to subfamilies of the family GRAPSIDAE from Andaman Mangroves

- An oblique hairy ridge on the exposed surface of the external maxillipeds, exognath concealed either partly or almost entirely Sesarminae
- No oblique hairy ridge on the exposed surface of the external maxillipeds, exognath remaining exposed throughout..... Grapsinae

Subfamily GRAPSINAE MacLeay, 1838

Grapsinae MacLeay, 1838 : 63 ; Dana, 1851b : 287, 1852b : 331 ; Alcock, 1900 : 288, 295 ; Rathbun, 1918 : 226 ; Tesch, 1918 : 107 ; Sakai, 1939 : 647, 679 ; Barnard, 1950 : 112 ; Edmondson, 1959 : 156 ; Crosiner, 1965 : 9 ; Glaessner, 1969 : R529 ; Sakai, 1976 : 628.

Diagnosis : Carapace flat. Front broad, strongly deflexed. Lower border of the orbit extending downwards towards the buccal cavity. Antennal flagellum very short. External maxillipeds without any hairy ridge, their palp articulating at the antero-external angle of the merus ; the exognath very slender and exposed throughout. Male abdomen filling entire space between the last pair of ambulatory legs.

Key to the genera of the subfamily GRAPSINAE from Andaman Mangroves

- Carapace subcircular, merus of external maxillipeds longer than broad *Grapsus*
- Carapace quadrate, merus of external maxillipeds broader than long *Metopograpsus*

Genus *Grapsus* Lamarck, 1801

Grapsus Lamarck, 1801 : 150 ; Alcock, 1900 : 390 ; Stebbing, 1910 : 317 ; Rathbun, 1918 : 226 ; Tesch, 1918 : 70 ; Sakai, 1939 : 646, 649 ; Barnard, 1950 : 112 ; Monod, 1956 : 407 ; Edmondson, 1959 : 158 ; Banerjee, 1960 : 133 ; Crosnier, 1965 : 10 ; Glaessner, 1969 : R529 ; Sakai, 1976 : 629 ; Manning and Holthuis, 1981 : 232.

Type species : *Cancer grapsus* Linnaeus, 1758, by tautonymy ; gender : masculine.

Diagnosis : Carapace flat, slightly broader than long, regions faintly indicated, branchial grooves distinct, branchial regions with parallel, oblique ridges ; gastric region marked with a transverse squamiform sculpture. Front broad and strongly deflexed. Lateral borders curved and armed with a tooth just behind the outer orbital angle. Basal antenna-joint short, broad; flagellum exceedingly short. Antennules transversely folded, inter-antennular septum very broad. Orbits, deep, divided into 2 fossae. Epistome well defined and of good length from front to back; buccal cavity squarely cut with the antero-lateral corners rounded off, the external maxillipedes leaving between them a large rhombidal gap exposing mandibles. Chelipeds subequal in both the sexes, finger tips broad and hollowed. Legs broad and compressed, especially the 4th joints, dactyls throny. Abdomen made up of 7 segments in both sexes ; in male, its base almost as broad as sternum between the last pair of legs.

Distribution : Cosmopolitan in warm waters of tropical and subtropical seas.

27. *Grapsus albolineatus* Lamarck, 1818

(Pl. 5, Fig. 7 ; Pl. 17, Figs. 1, 2)

Cancer strigosus Herbst, 1799 : 55, pl. 47, fig. 7.

Grapsus albolineatus Lamarck, 1818 : 249 ; Banerjee, 1960 : 147, figs. 1c, 2o, p, 3a-f ; Sankarankutty, 1961a : 108 ; Crosnier, 1965 : 17, pl. 1, fig. 2 ; Sakai, 1976 : 630, pl. 215.

Grapsus (Goniopsus) strigosa de Haan, 1833 : 33, pl. D.

Grapsus (Goniopsus) flavipes MacLeay, 1838 : 66.

Grapsus peroni H. Milne Edwards, 1853 : 169.

Grapsus granulosus H. Milne Edwards, 1853 : 169.

Grapsus longipes Stimpson, 1858b : 102, 1907 : 119.

Grapsus strigosus Bosc, 1802 : 203 ; Alcock, 1900 : 393 ; Lanchester, 1900 : 755 ; Rathbun, 1906b : 838 ; Tesch, 1918 : 71, pl. 4, fig. 1 ; Kemp, 1918 : 228 ; Urita, 1926 : 22 ; Tweedie, 1936 : 45 ; Chopra and Das, 1937 : 425 ; Sakai, 1939 : 650, pl. 106, fig. 3 ; Barnard, 1950 : 115, figs. 22e, 24a ; Pillai, 1951 : 34 ; Chhapgar, 1957b : 515, pl. 15, figs. k-m ; Sakai, 1965 : 193, pl. 92.

Material examined : North Andaman : 3 ♂♂, 1 ♀, Aereal Bay, 8.3.1987 ; 1 ♀, Stewart Island, 11.3.1987. Middle Andaman : 2 ♀♀, Rangat, 24.3.1987. South Andaman : 1 ♀, Chidyatapu, 26.10.1980 ; 2 ♀♀, Neill Island, 21.11.1980 ; 1 ♀, Chidyatapu, 27.12.1980 ; 1 ♂, Carbyn's Cove, 8.5.1984 ; 2 ♂♂, Havelock Island, 27.3.1987 ; 3 ♂♂, Neill Island, 28.3.1987. Little Andaman : 1 ♂, 1 ♀, South Bay, 4.3.1982.

Measurement : W = 52.0 mm, F = 18.0 mm, L = 56.0 mm.

Diagnosis : Carapace subcircular. Tooth at the inner orbital angle subacute and keeled. First pair of legs almost as long as the last pair. Lower border of meri of legs dentate distally.

Description

Carapace : Subcircular, depressed, slightly longer than broad, regions well defined, branchial grooves not well cut, branchial region marked with some low, smooth transverse and oblique ridges, gastric area not smooth but traversed by short transverse ridges, cardiac and intestinal regions almost smooth.

Front : Deep, vertically deflexed, about 1/3rd of the greatest breadth of carapace, its free edge straight and finely crenulated : post frontal lobes four, inner pair broader than the outer pair, their surfaces roughened with transverse reidges.

Lateral borders : Smooth, crest like, strongly arched and cut into a small blunt tooth in addition to the outer orbital angle.

Orbits : Upper border of the orbit smooth, lower edge microscopically crenulate and deeply notched near the outer angle. Eye-stalk thick, short ; eyes large.

Chelipeds : Unequal, stout. Inner border of the arm strongly spinate followed by 1-3 less acute spine at the distal end ; outer edge of the lower distal corner of the arm with three spines, at least one of these very strong ; outer surface of the arm roughened with squamiform sculpture. Outer surface of the wrist strongly tuberculate bearing transverse ridges ; inner corner armed with a strong, straight, long and acute tooth. Upper border of palm coarsely granular, the granulations extending upto the middle of the dactylus ; upper distal corner of the palm ending in a blunt but strong tooth ; outer surface of the palm traversed by two distinct longitudinal ridges, one medially continued up to the base of the fixed finger, the other just beneath it extending upto the tip of the fixed finger ; lower edge of the palm roughened with squamiform

sculpture. Fingers stout ; their cutting edges irregular, denticulate, leaving a narrow gap when closed. Tips of fingers broad, rounded, hoof-like and brown in colour.

Legs : Joints broad, compressed, especially the merus. First pair shortest, third pair longest, height of merus almost half of its length ; upper border of merus crest-like and finely crenulated culminating in a strong spine, its outer surface roughened with squamiform sculpture, lower distal border strongly spinate distally. Dactylus thorny; propodus also with thorns and bristles and with a terminal spine on its posterior border.

Abdomen : Male abdomen consisting of 7 distinct segments, sixth segment much shorter than the fifth, last segment having a three lobed appearance.

Male pleopod : Very thick, stout ; apex bifid ; inner lobe broad, rounded with a projection on its tip bearing dark brown hairs ; outer lobe much smaller with pale yellow hairs.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Palk Bay, Gulf of Manner (Tamil Nadu) ; Andaman Islands ; Car Nicobar (Nicobars). West coast : Gulf of Kachchh (Gujarat) ; Mumbai (Maharashtra) ; Travancore (Kerala). Elsewhere : East Africa, Red Sea, Baluchistan, Sind coast, Sri Lanka, Arakan and Tenasserim coasts, Mergui Archipelago, Philippines, Japan, Polynesian Islands, Australia and Hawaii.

Remarks : The specimens examined agree well with the descriptions of Haswell (1882), Alcock (1900), Sakai (1939), Barnard (1950) and Banerjee (1960). This species was earlier reported from Andaman mangroves as *Grapsus strigosus* (Das and Dev Roy, 1989) following Alcock (1900).

Genus *Metopograpsus* H. Milne Edwards, 1853

Metopograpsus H. Milne Edwards, 1853 : 164 ; Kingsley, 1880 : 188, 190 ; Miers, 1886 : 257 ; Alcock, 1900 : 389, 396 ; Tesch, 1918 : 78 ; Sakai, 1939 : 646, 653 ; Banerjee, 1960 : 172 ; Crosnier, 1965 : 21 ; Sakai, 1976 : 633.

Type species : *Grapsus thukuhar* Owen, 1839, by selection by Holthuis, 1977 ; gender : masculine.

Diagnosis : Carapace more or less flat, quadrangular, little broader than long ; regions inconspicuous, branchial groove distinct, branchial region bearing distinct oblique ridges, urogastric grooves distinct, cardiac and intestinal regions smooth and without any ridge or tubercle. Front very broad, more than half of the greatest breadth of carapace, deflexed with a rugose surface and crenulated free margin, four depressed post-frontal lobes along the line of flexion of the front. Lateral borders with or without any tooth. Antenna excluded from the orbit by the inner sub-orbital tooth and may or may not be touching the front. Antennules transversely folded in the fossa. Orbits of moderate size, placed at the antero-lateral corner of the carapace ; eye-stalk

thick, short. Epistome well outlined ; not very deeply excavated, rather short and broad ; buccal cavity more or less square cut with the antero-lateral corners rounded off, a large rhomboidal gap left between the external maxillipeds exposing the mandibles. Chelipeds subequal or unequal ; fingers short, stout with spooned tip. Legs broad, compressed specially the merus, edges of last three joints bearing bristles, dactylus thorny. Abdomen consisting of seven distinct segments in both sexes, its base as broad as sternum between the last pair of leg in male.

Distribution : Indo-Pacific.

Key to the species of the genus *Metopograpsus* from Andaman Mangroves

- Lateral border of carapace entire, propodus of the first three walking legs without any hair on the dorsal surface *M. frontalis*
- Lateral border of carapace toothed behind the outer orbital angle, propodus of the first three walking legs with a linear row of fine hairs on the dorsal surface *M. oceanicus*

28. *Metopograpsus frontalis* Miers, 1880

(Pl. 6, Fig. 1 ; Pl. 18, Figs. 1, 2)

Metopograpsus messor frontalis Miers, 1880 : 311.

Metopograpsus messor gracilipes de Man, 1891 : 49, pl. 4, fig. 14.

Metopograpsus gracilipes Tweedie, 1949 : 470, fig. 1g.

Metopograpsus frontalis Banerjée, 1960 : 174, 182, figs. 5e, 6b-e ; Sankarankutty, 1961a : 108, figs. 2A-B.

Material examined : North Andaman : 1♂, Mayabunder 9.3.1987 ; 2♂♂, 2♀♀, Carlew Island, 10.3.1987. Middle Andaman : 1♂, Panchawati, 15.3.1987. South Andaman : 1♀, Peel Island, 12.6.1980 ; 1♀, Peel Island, 15.6.1980 ; 1♂, 1♀, Havelock Island, 18.6.1980 ; 1♀, Neill Island, 25.6.1980 ; 2♂♂, 2♀♀, Chidyatapu, 24.11.1980 ; 1♂, Chidyatapu, 4.6.1981 ; 1♂, 1♀, Bambooflat, 7.2.1987 ; 1♀, Junglighat, 1.3.1987 ; 2♂♂, 1♀, Havelock Island, 26.3.1987. Little Andaman : 2♂♂, South Bay, 4.3.1982.

Measurement : W = 19.0 mm, F = 12.0 mm, L = 14.0 mm.

Diagnosis : Lateral border of carapace not toothed behind the outer orbital angle. With a narrow pubescent area on the anterior side of the lower border of propodus in first pair of walking legs.

Description

Carapace : Almost quadrangular, broader than long, regions indistinct, surface smooth excepting few transverse markings on the post-frontal and along the lateral borders. Cervical and urogastric grooves distinct, hepatic region bearing a single transverse ridge just before the cervical groove. The cardiac and intestinal regions smooth but without any demarcation between them.

Front : Broad, deflexed downwards ; its free margin thin, slightly sinuous at the middle and crenated (excepting the median). Post-frontal lobes four, very distinct, outer pair broader than the inner pair. Dorsal surface of the lobes bearing distinct transverse ridges.

Lateral borders : Entire, distinctly convergent backwards.

Orbits : Rather transverse or little oblique. Upper orbital edge smooth, sub-orbital tooth acute, strongly keeled. Eyes on short, thick stalks.

Chelipeds : Short, stout, unequal. Upper surface of arm and palm and outer surface of wrist roughened with wrinkles and tubercles. Inner corner of the arm spinate and expanded distally forming a lacinate lobe. Inner angle of the wrist spinate. Outer surface of palm smooth for the most part excepting a long ridge near its lower margin extending over its entire length, inner surface granular ; lower border of the palm with several oblique ridges. Both upper border of dactylus and lower border of fixed finger coarsely granular. Fingers blunt with hoofed tips, their cutting edges adorned with 3-4 big teeth, finger tips brown in colour.

Legs : Joints stout, compressed ; third pair longest, first pair smallest. Merus broad, its height about half of its greatest breadth ; outer surface of meri scabrous, their upper borders cristiform, culminating in a sharp spine ; lower border also spinate distally. Lower border of propodus of the first pair of walking legs with a narrow pubescent area on the anterior side; similar fringe of hair occurring also on the upper border of propodus of the last leg besides another linear hairy fringe at its lower margin on the posterior surface. Carpus, propodus and dactylus adorned with long bristles and thorns, dactyli slightly smaller than the upper border of propodus.

Abdomen : Consisting of 7 separate segments in both sexes, fifth segment of male abdomen distinctly longer than the sixth.

Male pleopod : Broad, thick and densely setose sub-apically ; chitinous projection of the pleopod with a concavity at its top, upper margin of this projection not serrated but smooth.

Type locality : Makasar, Celebes (Miers).

Distribution : Indo-West Pacific. India : East coast : Car Nicobar (Nicobars). Elsewhere : Sri Lanka, Malay Peninsula, Singapore, Indonesia, East Indies, Torres Strait, Thursday Island and Australia.

Remarks : This species was earlier reported from Andaman mangroves under the name *Metopograpsus messor* (Forskål) (Das and Dev Roy, (1989). However, careful reexamination of these material in the light of discussion made by Banerjee (1960) reveals that all of them belong to *Metopograpsus frontalis* Miers.

29. *Metopograpsus oceanicus* Jacquinot, 1842-1853

(Pl. 6, Fig. 2 ; Pl. 17, Figs. 3, 4)

Grapsus oceanicus Jacquinot, 1842-1853 : pl. 6, fig. 9.

Metopograpsus oceanicus H Milne Edwards, 1853 : 166 ; Heller, 1865 : 44 ; Lanchester, 1900 : 755 ; de Man, 1903 : 503 ; Tesch, 1918 : 81 ; Banerjee, 1960 : 174, 189, figs. 5f. 6h.

Grapsus (Grapsus) sulcifer Herklot, 1861 : 129.

Material examined : South Andaman : 1 ♀, Peel Island, 12.6.1980 ; 1 ♂, Hevelock Island, 18.6.1980 ; 3 ♂ ♂, 4 ♀ ♀, Chidyatapu, 24.10.1980 ; 1 ♀, Chidyatapu, 20.5.1981 ; 1 ♂, Bambooflat, 7.2.1987 ; 4 ♂ ♂, 5 ♀ ♀, Havelock Island, 26.3.1987.

Measurement : W = 31.0 mm, F = 21.0 mm, L = 28.5 mm.

Diagnosis : Lateral border of the carapace with a distinct tooth behind the outer orbital angle. Propodi of the first three walking legs with a linear row of fine soft hairs on their posterior surfaces.

Description

Carapace : More or less quadrate, broader than long, regions indistinct, cervical groove very prominent, deep and continuous ; hepatic region bearing a single transverse ridge just before the cervical groove, mesogastric region almost smooth and without any ridge or marking, branchial region with the usual oblique ridges.

Front : Same as in *Metopograpsus frontalis*.

Lateral borders : Antero-lateral borders cut into a small but distinct tooth just behind the external orbital angle. Lateral borders convergent posteriorly.

Orbits : Same as in *Metopograpsus frontalis*.

Chelipeds : Same as in *Metopograpsus frontalis*.

Legs : Almost same as in *Metopograpsus frontalis*. Propodi of first three walking legs bearing a linear row of soft fine hairs on their posterior surfaces. The anterior border of propodus of the last walking leg also with a linearly arranged row of hairs. Upper border of dactylus of first three legs possessing a linear row of hairs on the ventral side; but, no such row of hairs on the last pair.

Abdomen : Same as in *Metopograpsus frontalis*.

Male pleopod : Broad, thick and densely setose sub-apically. Chitinous projection of the male pleopod curved at its distal margin, very finely serrated, inner lateral margin bearing a concavity at its top.

Type locality : Poulo-Han (Jacquinot).

Distribution : Indo-West Pacific. India : East coast : Andaman Islands (present record) ; Nicobars. Elsewhere : East Africa, Malay Peninsula, Singapore, Indonesia and the East Indies.

Remarks : The specimens examined correspond well with the description of Banerjee (1960). This is the first record of the species from Andaman group of islands.

Subfamily SESARMINAE Dana, 1852

Sesarminae Dana, 1852b : 333 ; Alcock, 1900 : 289, 409 ; Tesch, 1918 : 107 ; Rathbun, 1918 : 225 ; Sakai, 1939 : 647, 679 ; Crosnier, 1965 : 45 ; Sakai, 1976 : 654 ; Manning and Holthuis, 1981 : 239.

Diagnosis : Carapace thick. Front very broad, strongly deflexed. Antennal flagella variable. External maxillipeds traversed by an oblique hairy crest across ischium and merus, their palp articulating either at the summit or near the antero-external angle of merus ; the exognath slender and partly or almost completely hidden. Male abdomen may or may not be filling the entire space between the last pair of ambulatory legs.

Key to genera of the subfamily SESARMINAE from Andaman Mangroves

1. Carapace almost as broad as long, the pterygostomian region and the side-walls with a sieve-like reticulation, lower orbital border not prominent beyond the front.....2
 - Carapace much broader than long, the pterygostomian region and side walls not reticulated, lower orbital border prominent beyond the front..... *Metaplax*
2. Antenna lodged in the orbital hiatus.....3
 - Antenna not lodged in orbital hiatus7
3. Postero-lateral border of merus of last two pairs of legs denticulate *Nanosesarma*
 - Postero-lateral borders of merus of last two pairs of legs without any denticulation.....4
4. Carapace flat or nearly flat, lateral border strongly divergent backwards..... *Sesarmoides*
 - Carapace deep, lateral border not markedly divergent posteriorly5
5. Carapace as long as broad, no pectinated crest on upper part of palm *Sesarmops*
 - Carapace slightly broader than long, upper part of palm of chelipeds with a pectinated crest6
6. Palm with a longitudinal pectinated crest on its upper part..... *Neoepisesarma*
 - Palm with 2-3 transverse pectinated crest of its upper part *Sesarma*
7. Carapace smooth and nude, lateral borders entire ,..... *Metasesarma*
 - Carapace verrucose dorsally and tomentose densely, lateral borders dentate *Clistocoeloma*

Genus *Sesarma* Say, 1817

Sesarma Say, 1817 : 76 ; H. Milne Edwards, 1837 : 71, 1853 : 181 ; A. Milne Edwards, 1873b : 301 ; Kingsley, 1880 : 213 ; Miers, 1886 : 269 ; Bürger, 1894 : 613 ; Alcock, 1900 : 409 ; Tesch, 1917 : 127-211, 235-237 ; Rathbun, 1918 : 284 ; Sakai, 1939 : 679 ; Crosnier, 1965 : 46 ; Serène and Soh, 1970 : 387-407 ; Sakai, 1976 : 654 ; Manning and Holthuis, 1918 : 241.

Type species : *Ocypode reticulatus* Say, 1817, by monotypy ; gender ; neuter.

Diagnosis : Carapace square or squarish, usually deep, often depressed, gastric region well outlined, usually divided into five subregions, the four antero-lateral subregions projecting as four prominent post-frontal lobes. Front broad, about half or more of the anterior border of carapace, deflexed obliquely or vertically. Lateral borders almost straight and parallel, with or without tooth behind the outer orbital angle, postero-lateral regions generally crossed by oblique parallel lines. Pterygostomial region and vertical walls of carapace reticulated with fine hairs. Basal antenna-joint broad ; flagellum slender, short, lying in the orbital hiatus. Antennules transverse, inter-antennular septum broad. Epistome well defined, distinct and rather short from front to back. Buccal cavity square cut ; the external maxillipeds leaving between them a large rhomboidal gap , major part of this gap filled by fringe of hairs. Chelipeds massive and unequal in male, less so and subequal in female ; palm high, short ; fingers subacute, hollowed at tip. Legs differing little in length, third pair longest, first and fourth pairs shortest ; merus thin, broad. Abdomen made up of 7 distinct segments in both sexes, occupying in the male the entire breadth of the last pair of legs ; in female, last segment small and deeply embedded in sixth segment.

Distribution : Cosmopolitan in warm waters of tropical and subtropical seas.

Remarks : The taxonomy and nomenclature of the genus *Sesarma sensu lato* are still in a state of confusion and quite unsatisfactory. The genus *Sesarma sensu largo* includes more than 100 species from the Indo-Pacific, of which more than 60 species are predominantly associated with the mangals (Jones, 1984). All these Indo-Pacific species of crabs have been accommodated under 13 genera by Serène and Soh (1970) and five new subgenera have also been erected by them. According to these workers, *Geosesarma* de Man, 1892 emmended with a new definition is a valid taxon ; *Chiromantes* Gistel, 1848, *Holometopus* H. Milne Edwards, 1853 and *Parasesarma* de Man, 1895 have been shifted at the generic level. According to them the genus *Sesarma* Say, 1817 *sensu stricto* with reference to its type species *Sesarma reticulatum* (Say, 1817) is not represented in the Indo-West Pacific region but confined to the Atlantic America. Their work, however, suffers from several lacunae containing some inconsistencies and inaccuracies and the status of some species is still uncertain. Because of these discrepancies, following Sakai (1976) and, Manning and Hothuis (1981) all the present materials belonging to the genus *Sesarma* have been included under two subgenera, namely, *Chiromantes* Gistel and *Parasesarma* de Man ; the remaining part has been dealt with following Serène and Soh (1970).

Subgenus *Chiromantes* Gistel, 1848

Chiromantes Gistel, 1848 : X ; Sakai, 1976 : 658 ; Manning and Holthuis, 1981 : 241.

Perisesarma de Man, 1895 : 208.

Diagnosis : Lateral borders of carapace toothed behind the outer orbital angle.

30. *Sesarma (Chiromantes) bidens* (de Haan, 1835)

(Pl. 6, Fig. 3 ; Pl. 18, Figs. 3, 4)

Grapsus (Pachysoma) bidens de Haan, 1835 : 60, pl. 11, fig. 4, pl. 16, fig. 4.

Sesarma bidens Dana, 1852b : 353 ; H. Milne Edwards, 1853 : 185 ; Stimpson, 1858b : 105 ; Heller, 1865 : 64 ; Kingsley, 1880 : 214 ; Lenz and Richters, 1881 : 425 ; Bürger, 1894 : 628 ; Ortmann, 1894 : 726 ; Alcock, 1900 : 415 ; Estampador, 1937 : 536 Soemodihardjo, 1987 : 103.

Sesarma dussumieri Kingsley 1880 : 215 ; de Man, 1888.: 177, pl. 12, figs. 8-12 ; Ortmann, 1894 : 426.

Sesarma lividum A. Milne Edwards, 1873b : 303, pl. 16, fig. 2 ; Brocchi, 1875 : 83 ; de Man, 1888 : 180.

Sesarma haswelli de Man, 1888 : 175.

Sesarma (Chiromantes) bidens Tesch 1917 : 132, 1918 : 115 ; Urita, 1926 : 20 ; Chopra and Das, 1937 : 431 ; Sakai, 1939 : 688, pl. 79, fig. 1 ; Sankarankutty, 1961a : 110 ; Sakai, 1965 : 203, pl. 98, fig. 1 ; 1976 : 658, pl. 225, fig. 1 ; Chakraborty, Choudhury and Deb, 1986 : 62.

Material examined : North Andaman : 6♂♂, 6♀♀, Mayabunder, 9.3.1987, 2♂♂, 2♀♀, Stewart Island, 11.3.1987. Middle Andaman : 2♀♀, Rangat, 24.3.1987 ; 6♂♂, 5♀♀, Yereta Jetty, 13.3.1987 ; 7♂♂, 7♀♀, Bakultala, 14.3.1987 ; 3♂♂, 2♀♀, Panchawati, 15.3.1987 ; 2♂♂, 2♀♀, Uttara Jetty, 17.3.1887. South Andaman : 2♂♂, 3♀♀, Jungalighat, 1.3.1987. Little Andaman : 1♂, 1♀, Hut Bay Jetty, 24.2.1982 ; 2♂♂, South Bay, 4.3.1982.

Measurement : W = 26.0 mm, F = 14.0 mm, L = 21.0 mm.

Diagnosis : Lateral border of carapace with a prominent tooth just behind the outer orbital angle.

Description

Carapace : Deep, very little convex, broader than long, its length about 4/5th of the greatest breadth of carapace. Regions well outlined, gastric region much more prominent than cardiac and intestinal, some oblique straitions on the epibranchial region.

Front : Deflexed, little more than half of the greatest breadth of carapace ; post frontal lobes four, inner lobes broader than the outer pair and rugulose to some extent transversely with sparsely distributed tufts of hair on the rugae ; free margin of front smooth and slightly concave medially.

Lateral borders : Lateral borders almost parallel, slightly divergent anteriorly and cut into a short sharp tooth just behind the outer orbital angle.

Orbits : Upper orbital border smooth, gently curved outwards ; lower border crenated. Eye-stalk thick, short.

Chelipeds : Massive in male, less so in female but almost equal in the same sex. Outer surface of arm and wrist granular with squamiform sculpture. Upper border of the arm crest-like

and beaded, lower and inner borders crenated ; inner corner of it adorned with an acute, large spine at the distal end, upper border also bearing a shorter and lesser acute spine. Inner corner of the wrist blunt. Upper surface of the palm in male with two oblique pectinated crests. Upper border of the dactylus of male elegantly milled with 15-20 coarse, transverse lamellae. Fingers stout, hollowed at tips. Cutting edges of both the fingers armed with several big teeth.

Legs : Joints broad, compressed. Meropodites foliaceous, their upper borders cristiform, serrated, culminating in an acute, distal, subterminal spine ; lower edges also crest-like. Height of merus of second and third pairs exceeding more than half of their lengths, outer surface of meropodites rugulose. Anterior and posterior border of propodus and dactylus fringed with tufts of hairs and bristles, dactylus claw-shaped.

Abdomen : Consisting of 7 distinct segments in both sexes. Length of sixth abdominal segment of male about half of its breadth.

Male pleopod : Long, stout process, strongly curved apically ; inner border and apical projection of the pleopod covered with dense setae.

Type locality : Japan (de Haan).

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Bimblitan, Port Blair (Andaman Islands) ; Nicobars. Elsewhere : East Coast of Africa, Madagascar, Sri Lanka, Mergui Archipelago, Malay Peninsula, Hong Kong, Indonesia, Philippines, Korea, New Guinea and Australia.

Remarks : The specimens examined correspond well with the description of Alcock (1900) but with following variations : (1) third pair of leg is almost twice the length of carapace and (2) propodus longer than dactylus of all legs excepting the fifth pair. During the present study, it has been noticed that the pectinated crest of palm and transverse lamellae on dactylus of chelipeds are less conspicuous in females. Tip of the first male pleopod was reported to be bilobed (Sankarankutty, 1961a) but the specimens under present report have been found to consist of a single lobe. This species was earlier reported from Andaman mangroves as *Sesarma bidens* (Das and Dev Roy, 1989) following Alcock (1900).

Subgenus *Parasesarma* de Man, 1895

Parasesarma de Man, 1895 : 181 ; Sakai, 1976 : 655.

Diagnosis : Lateral borders of of carapace entire, not toothed behind the outer orbital angle.

31. *Sesarma* (*Parasesarma*) *plicatum* (Latreille, 1803)

(Pl. 6, Fig. 4 ; Pl. 18, Figs. 5, 6)

Ocypode plicata Latreille, 1803 : 47.

Grapsus (*Pachysoma*) *affinis* de Haan, 1837 : 66, pl. 18, fig. 5.

Sesarma quadrata H. Milne Edwards, 1837 : 75 ; Henderson, 1893 : 392 ; Alcock, 1900 : 413 ; Gravely, 1927 : 147.

Sesarma (Sesarma) quadrata Chhapgar, 1957b : 520, pl. 16, figs. a-c.

Sesarma (Parasesarma) plicata, Tesch 1917 : 187 ; Sakai, 1939 : 683, pl. 110, fig. 2 ; Barnard, 1950 : 127 ; Crosnier, 1965 : 65, figs. 83, 88, 93, 105 ; Sakai, 1976 : 656, pl. 226, fig. 1.

Material examined : Middle Andaman : 3 ♂♂, 2 ♀♀, Yereta Jetty, 13.3.1987 ; 1 ♂, Panchawati, 15.3.1987. South Andaman : 1 ♂, Rangachang, 3.12.1981 ; 3 ♂♂, 4 ♀♀, Carbyn's Cove, 8.5.1984.

Measurement : W = 20.0 mm, F = 11.0 mm, L = 16.0 mm.

Diagnosis : Lateral border entire, not toothed behind the outer orbital angle. Upper border of the dactylus of male cheliped milled with 10-20 blunt, transverse lamellae.

Description

Carapace : Deep, convex from front to back in male, nearly flat in female, broader than long, its length about 4/5th of the greatest breadth of carapace at the antero-lateral angle. Surface slightly coarse anteriorly, otherwise smooth. Gastric region prominent, cardiac and intestinal areas faint, epibranchial region marked with some oblique striations.

Front : Deflexed, extending more than half of the greatest breadth of carapace, free edge smooth, slightly sinuous at the middle ; post-frontal lobes four, middle pair broader than the outer ones.

Lateral borders : Parallel, slightly diverging anteriorly. Antero-lateral borders without any tooth behind the outer orbital angle.

Orbits : Same as in *Sesarma (Chiromantes) bidens*.

Chelipeds : Stout and unequal in both sexes. Outer surface of arm and wrist rugulose. All the edges of arm crenated ; upper border of the arm crest-like bearing a short spine distally, lower border with a large subterminal spine. Both outer and inner surfaces of the palm granular, upper edge of the palm bearing two pectinated oblique crests in male and, tuberculate and less developed in female. Anterior border of dactylus in male elegantly milled with 10-20 blunt, coarse transverse lamellae ; in female specimens milling incomplete and much less prominent. Dactylus twice the length of palm at its upper border. Cutting edge of both the fingers with an enlarged tooth at the middle, other teeth tubercular and irregular. In both sexes, fingers leaving a narrow gap when closed, finger tips hollow.

Legs : Same as in *Sesarma (Chiromantes) bidens*.

Abdomen : Same as in *Sesarma (Chiromantes) bidens*.

Male pleopod : Long, stout process with a horn-like projection on the inner border ; tip of the pleopod and the inner border covered with dense, long setae.

Type locality : East India (Latreille).

Distribution : Indo-West Pacific. India : East coast : Andaman and Nicobar Islands. West coast : Gulf of Kachchh (Gujarat) ; Umarsadi, Kolak (Maharashtra) ; Karwar (Karnataka). Elsewhere : East coast of Africa, Madagascar, Sri Lanka, Malay Archipelago, China, Korea and Japan.

Remarks : Original description of the species by Latreille (1803) is inadequate. The specimens agree well with Alcock (1900) although dactylus and propodus of leg joints in the present specimens are almost of equal length. Further, it has been observed that surface of carapace of this species is much less coarse than *Sesarma (Chiromantes) bidens*. This is to be mentioned here that this species has earlier been reported from Andaman mangroves under the name *Sesarma quadrata* by Das and Dev Roy (1989) following Alcock (1900).

Genus *Nanosesarma* Tweedie, 1950

Nanosesarma Tweedie, 1950a : 310 ; Sakai, 1965 : 203 ; Crosnier, 1965 : 70 ; Serène and Soh, 1970 : 388, 393 ; Sakai, 1976 : 663 ; Manning and Holthuis, 1981 : 242.

Type species : *Sesarma andersoni* de Man, 1988, by original designation ; gender : neuter.

Diagnosis : Small crab, outer surface of chela adorned with one or more fine, raised granular lines.

Distribution : Indo-West Pacific.

Remarks : The status of this genus is not satisfactory as pointed out by Tan and Ng (1994).

Subgenus *Beanium* Serène and Soh, 1970

Beanium Serène and Soh, 1970 : 389, 394 ; Sakai, 1976 : 659 ; Manning and Holthuis, 1981 : 242.

Diagnosis : Antero-lateral tooth not prominent, often feebly indicated. On male cheliped : upper border of palm with at least one oblique pectinated crest ; outer surface of palm smooth and bare, often partly covered by a patch of hairs around cutting edges of fingers ; upper border of dactylus ornamented with a row of 15-20 transverse tubercles. Postero-lateral border of merus of legs armed with 2-3 spinules distally.

32. *Nanosesarma (Beanium) andersoni* (de Man, 1888)

(Pl. 6, Fig. 5 ; Pl. 18, Figs. 7, 8)

Sesarma andersoni, de Man, 1888 : 172, pl. 12, figs. 1-4 ; Alcock, 1900 : 418 ; Tesch, 1917 : 129 ; Kemp, 1918 : 234 ; Tweedie, 1950b : 346.

Nanosesarma andersoni Tweedie, 1950a : 312, figs. 1d

Nanosesurma (Beanium) andersoni Serène and Soh, 1970 : 394, 405.

Material examined : Middle Andaman : 2♂♂, 2♀♀, Yereta Jetty 24.3.1987.

Measurement : W = 8.0 mm, F = 4.0 mm, L = 6.0 mm.

Diagnosis : One of the striations of the epibranchial region extending beyond the lateral margin as a tooth behind the orbital angle. A very fine distinct, raised line on the outer surface of the fixed finger. Lower border of merus of legs denticulate.

Description

Carapace : Moderately deep, slightly convex and broader than long. Surface covered with small microscopic granules. Regions faintly indicated. Striations of the epibranchial region sharp, distinct and granular ; one of these, extending beyond the lateral margin as a tooth behind the orbital angle.

Front : Half of the greatest breadth of carapace and faintly divided into four lobes, middle pair more prominent than the laterals, outer lobes broader than the inner pair. Free edge of the front smooth and nearly straight.

Lateral borders : Entire and convergent posteriorly.

Orbits : Upper orbital border smooth and curved outwardly ; lower edge finely crenated. Eye-stalk short, thick.

Chelipeds : Larger in male than the female but equal in the same sex. Inner border of the arm ending right angularly and its upper edges denticulate. Outer surface of arm and wrist scabrous, that of palm smooth. Upper border of the palm with two oblique parallel striae, at least one of these prominent; pectinated ridges less distinct and fewer in females. Anterior border of dactylus milled in males ; lamellae decreasing in size from front to rear and so also the coarseness, number of lamellae varying from 15-20. Outer surface of fixed finger traversed by a fine raised line. Fingers hooked, hollowed at tips, cutting edges strongly dentate.

Legs : Merus broad, compressed. Upper border of merus crest-like, lower margin denticulate, number of teeth varying from 3 to 5 followed by some spinules ; the denticles decreasing in size from behind forwards, outer surface of merus granular. Dactylus claw-shaped, shorter than propodus. Carpus, propodus and dactylus fringed with both short and long bristles.

Abdomen : Consisting of 7 distinct segments in both, sexes, male abdomen broad.

Male pleopod : Short, stout process, apex with two horn-like projections.

Type locality : Mergui Archipelago (de Man).

Distribution : Indian Ocean. India : East coast : Andaman Islands (present record). Elsewhere : Mergui Archipelago and Malay Peninsula.

Remarks : This species is reported for the first time from Andaman Islands. The specimens in general agree with the original description of the species by de Man (1888). These also corroborate well with Alcock (1900) but differ by the following points : (1) size and (2) upper

border of meri of walking legs with a distinct subterminal tooth. The number of tooth on the postero-lateral border of meri of walking legs have also been found to vary ; Alcock (1900) reported 3-4 while Tweedie (1950a) recorded 2-3 teeth ; in the present specimens, however, 3-5 teeth have been noticed. Number of dactylar tubercle of chelipeds was reported to be 13-14 in Sarawak specimens by Tweedie (1950 b) but in the present study this has been found to vary from 15-20 tubercles.

Genus *Neopisesarma* Serène and Soh, 1970

Neopisesarma Serène and Soh, 1970 : 389, 395 ; Sakai, 1976 : 661 ; Manning and Holthuis, 1981 : 242.

Type species : *Sesarma mederi* H. Milne Edwards, 1853, by original designation ; neuter.

Diagnosis : Differing from the genus *Sesarma* Say by its relatively narrower carapace and front. Antero-lateral tooth behind the outer orbital angle strongly marked instead of just indicated as in *Sesarma*. Anterior border of arm of male cheliped with a sub-distal triangular dentate process instead of a granular subdistal convexity as found in *Sesarma*. A longitudinal pectinated crest on upper part of palm of male cheliped running parallel to the margin instead of a granulated line not distinct from the margin as in *Sesarma*. Dactylar tubercle on male cheliped conspicuously shaped instead of 7-9 depressed spinules as in *Sesarma*.

Distribution : Indo-Pacific.

Remarks : The genus *Neopisesarma* Serène and Soh, 1970 has been found to be represented by two sub-genera, namely, *Neopisesarma* Serène and Soh, 1970 and *Muradium* Serène and Soh, 1970 in mangroves of Andaman Islands.

Subgenus *Neopisesarma* Serène and Soh, 1970

Neopisesarma Serène and Soh, 1970 : 396 ; Sakai, 1976 : 659, 661.

Diagnosis : Carapace almost quadrate and flattened dorsally. Pectinated crest of palm on male chelipeds low, extending from its proximal to distal margin. Transverse dactylar tubercles swollen, closely arranged together in a continuous rim.

33. *Neopisesarma (Neopisesarma) taeniolata* White, 1847

(Pl. 6, Fig. 6 ; Pl. 19, Figs. 1, 2)

Sesarma taeniolatum White, 1847a : 38 ; Miers, 1880 : 313 ; Kingsley, 1880 : 218 ; de Man, 1888 : 181 ; Bürger, 1894 : 615 ; Ortmann, 1894 : 720 ; Alcock, 1900 : 419 ; Chakraborty, Choudhury and Deb, 1986 : 62.

Sesarma mederi H. Milne Edwards, 1853 : 185.

Sesarma taeniolata, Lanchester, 1900 : 756 ; Estampador, 1937 : 536 ; Chopra and Das, 1937 : 426 ; Soemodihardjo, 1987 : 103.

Sesarma (Sesarma) taeniolata Tesch. 1917 201 Tweedie. 1936 53 Chhappgar. 1957b : 521. pl. 16.
figs h-j

Neopisesarma (Neopisesarma) taeniolata Serène and Soh, 1970 : 395, 405.

Material examined : South Andaman : 1♂, Wright Myo, 20.7.1978 ; 2♂♂, Carbyn's Cove, 7.12.1979 ; 1♂, Carbyn's Cove, 15.11.1980 ; 1♂, Carbyn's Cove, 30.4.1981 ; 1♂, Carbyn's Cove, 10.9.1981.

Measurement : W = 31.0 mm, F = 16.0 mm, L = 28.0 mm.

Diagnosis : Carapace flattened dorsally. Pectinated crest of palm of chelipeds extending from its proximal to distal margin. Upper border of dactylus of chelipeds elegantly milled with 40-60 fine lamellae.

Description

Carapace : Flat, squarish. Only the gastric region well defined. Surface covered with tufts of hair, hairs of the anterior half longer than the posterior half.

Front : Deflexed, about half of the greatest breadth of carapace, its free edge strongly sinuous ; post-frontal lobes four, middle pair slightly broader than the outer ones.

Lateral borders : Almost parallel. Antero-lateral borders cut into two teeth including the outer orbital angle ; first tooth large, acute, pointed anteriorly and separated from the second one by a deep groove ; second tooth much smaller than the preceding one but quite sharp and acute.

Orbits : Upper orbital border smooth and markedly curved outwards, lower edge evenly denticulate. Eye-stalk thick, short.

Chelipeds : Unequal but almost equal in the same sex, massive in male, slenderer in female. Outer surface of arm and wrist granular-rugulose ; upper border of the arm crest-like culminating in a sharp tooth, lower and inner borders crenulated ; inner surface with a good deal of hair. Inner corner of the wrist tooth-like. Upper border of palm about half the length of dactylus, its outer surface granular, inner surface with transverse granular ridges ; upper border of palm in male with a pectinated crest ; outer surface of dactylus and fixed finger smooth, upper border of dactylus of male elegantly milled with a crest of 40-60 fine lamellae. Fingers hollowed, meeting at tips ; cutting edges of both the fingers adorned with 2-3 large teeth in addition to denticles.

Legs : Joints broad, compressed. Meropodites foliaceous, rugulose with their upper borders serrated, culminating in a sharp subterminal spine. Third pair of legs longest, slightly more than twice the length of carapace. Dactylus claw-shaped. Propodus and dactylus covered with velvety hairs especially on their upper and lower surfaces.

Abdomen : Consisting of 7 separate segments in both sexes, width of sixth segment about half of its length in male.

Male pleopod : Long, broad and stout process ; apically lobed, central lobe broader and longer than the laterals. Tips and the borders covered with setae.

Type locality : Philippine Islands (White).

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Andaman Islands. West coast : Ratnagiri (Maharashtra). Elsewhere : Mergui Archipelago, Malay peninsula, Singapore, Indonesia, Thailand, China and Philippines.

Remarks : The specimens examined agree with the original description of White (1847a). These also corroborate well with Alcock (1900) differing only in size. This species was earlier reported from Andaman mangroves under the name *Sesarma taeniolata* (Das and Dev Roy, 1989) following Alcock (1900).

Subgenus *Muradium* Serène and Soh, 1970

Muradium Serène and Soh, 1970 : 390, 396; Sakai, 1976 : 659 ; Manning and Holthuis, 1981 : 242.

Diagnosis : Pectinated crest of palm of male chelipeds high but restricted to the median part being continued proximally and distally by a smooth rim. The dactylar tubercles neither swollen nor transverse but longitudinal, triangular and distinctly separated from one another.

34. *Neopisesarma (Muradium) tetragonum* (Fabricius, 1798)

(Pl. 6, Fig. 7 ; Pl. 19, Figs. 3, 4)

Cancer tetragonus Fabricius, 1798 : 341.

Cancer fascicularis Herbst, 1799 : 49, pl. 47, fig. 5.

Sasarma tetragonum Alcock, 1900 : 420 ; Kemp, 1915 : 238.

Neopisesarma (Muradium) tetragonum Serène and Soh, 1970 : 397, 405.

Material examined : South Andaman : 1♂, Carbyn's cove, 7.12.1979 ; 1♀, Carbyn's Cove, 30.4.1981.

Measurement : W = 34.0 mm, F = 18.0 mm, L = 33.0 mm.

Diagnosis : Carapace thick. Pectinated crest along the upper border of the palm of male cheliped shortened. Upper border of dactylus of chelipeds coarsely crenated.

Description

Carapace : Square, deep and slightly convex; its length little less than its breadth between the antero-lateral angles. Gastric region well marked with deep groove. Entire dorsal surface covered with thick tufts of hairs ; hairs larger and longer anteriorly, shorter posteriorly. Epibranchial region marked with some striations.

Front Deflexed, little more than half of the greatest breadth of carapace ; post-frontal lobes four, middle pair broader than the outer ones; free margin of the front markedly sinuous and beaded.

Lateral borders : Same as in *Neoepisesarma (Neoepisesarma) taeniolata*.

Orbits : Same as in *Neoepisesarma (Neoepisesarma) taeniolata*.

Chelipeds : Massive and unequal in both sexes. Outer surface of arm and wrist granular-rugulose; that of palm granular only. All sides of the arm crenulated. Inner angle of the wrist sharp and dentiform. Inner surface of the palm marked with transverse granular ridge. Fingers stout, hollowed, meeting at tips. Upper border of the dactylus evenly denticulate, cutting edge of both the fingers adorned with 2-3 larger teeth in addition to denticles; fingers leaving long gap when closed.

Legs : Same as in *Neoepisesarma (Neoepisesarma) taeniolata*.

Abdomen : Consisting of 7 distinct segments both in male and female. Sixth segment slightly broader than long in male. Anterior sternal segments bearing sparsely distributed long bristles.

Male pleopod : Long, stout process, narrowed distally, densely setose at the apex and along the borders.

Type locality : India (Fabricius).

Distribution : Indian Ocean. India : East coast : Sundarbans (West Bengal) ; Chilka Lake, Mahanadi Delta (Orissa) ; Chennai (Tamil Nadu) ; Andaman Islands. Elsewhere : Sri Lanka.

Remarks : Original description of the species by Fabricius (1798) is very brief. The specimens agree in general with Alcock (1900) differing only in size. This species was earlier reported from Andaman mangroves under the name *Sesarma tetragonum* (Das and Dev Roy, 1989) following Alcock (1900).

Genus *Sesarmops* Serène and Soh, 1970

Sesarmops Serene and Soh, 1970 : 391, 400 ; Sakai, 1976 : 659 ; Manning and Holthuis, 1981 : 242.

Type species : *Sesarma impressa* H. Milne Edwards, 1837, by original designation ; gender : masculine.

Diagnosis : Differing from *Sesarma* Say by the following : Carapace as long as or longer than broad between the outer orbital angles. Gastric and cardiac regions well defined. Frontal margin with a deep median concavity ; post-frontal lobes very prominent. Antero-lateral tooth acute, separated from the outer orbital angle by a distinct sulcus.

Distribution : Indo-Pacific.

35. *Sesarmops intermedium* (de Haan, 1835)

(Pl. 7, Fig. 1 ; Pl. 19, Figs. 5, 6)

Grapsus (Pachysoma) intermedius de Haan, 1835 : 61, pl. 16, fig. 5.*Sesarma intermedia* H. Milne Edwards, 1853 : 186 ; Stimpson, 1858b : 105 ; Heller, 1865 : 64 ; Kingsley, 1880 : 216 ; Miers, 1880 : 314 ; de Man, 1888 : 182 ; Ortmann, 1894 : 721.*Sesarma intermedium*, Alcock, 1900 : 416.*Sesarma (Sesarma) intermedia* Tesch, 1917 : 162 ; Balss, 1922 : 155 ; Gordon, 1931 : 528 ; Sakai, 1939 : 684, pl. 78, fig. 3; 1965 : 202, pl. 97, fig. 3.*Sesarmops intermedium* Serène and Soh, 1970 : 401, 406 ; Sakai, 1976 : 659, pl. 224, fig. 3.**Material examined** : South Andaman : 1♂, Carbyn's Cove, 30.4.1980; 1♀, Havelock Island, 27.3.1987.**Measurement** : W = 33.0 mm, F = 17.0 mm, L = 32.0 mm.**Diagnosis** : Lateral border of carapace cut into two teeth. No pectinated crest on the upper border of the palm but a conspicuous transverse granular crest present on its inner surface.**Description****Carapace** : Deep, squarish, moderately convex in both directions; surface of carapace especially the anterior 1/3rd thickly covered with tufts of long hairs, posterior 2/3rd with short hairs. Gastric region well outlined, cardiac and intestinal regions also prominent.**Front** : Slightly more than half of the greatest breadth of carapace ; post frontal lobes four, medians broader and more prominent than the outer pair ; free margin little sinuous.**Lateral borders** : Almost parallel and cut into two teeth (excluding the outer orbital angle) ; first tooth very prominent, arched anteriorly, separated from the external orbital angle by a deep groove; second tooth almost obscure.**Orbits** : Deep, oval. Upper border smooth, lower margin crenated.**Chelipeds** : Stout, unequal or subequal. Outer surface of arm, wrist and palm roughened with granules. Inner border of the arm smooth, all of its corners serrated. Wrist tumid, inner corner of it blunt, without any spine. Palm high. No pectinated crest on the upper surface of the palm. Inner surface of the palm with a conspicuous transverse granular crest. Upper border of dactylus adorned with short but thick blunt granules in its proximal half; lower margin coarsely granular. Fingers acute, hollowed at tips and without much gaping even in full grown male. Cutting edge of dactylus adorned with three large blunt teeth, fixed finger with two large teeth. Finger tips chocolate brown in colour.**Legs** : Meri of all legs very broad and compressed ; their upper edges crest like, crenulate, ending with an acute subterminal spine ; lower border smooth, with long, scattered bristles.

Upper border of carpus, propodus and dactylus covered with thick coat of black hairs and bristles. Dactylus claw-shaped.

Abdomen : Sixth segment of male abdomen longer than broad. Abdominal segments in both sexes fringed with bristles.

Male pleopod : Very long, broad and stout process, apical projection also very long and broad. Tip and both the borders of the pleopod densely setose.

Type locality : Japan (de Haan).

Distribution : Indo-West Pacific. India : East coast : Andaman Islands (present record). Elsewhere : Mergui Archipelago, Java, Hong Kong, Formosa, Korea and Japan.

Remarks : The specimens examined agree well with the descriptions of Alcock (1900) and Sakai (1939). However, the following variations have been noted during the present study : (1) number of granules on the upper surface of dactylus of chelipeds has been found to vary from 12- 15, (2) granules of the outer surface of arm and wrist displaying a squamiform arrangement, (3) outer surface of meri of leg joints (excepting the last pair) tuberculate and (4) all sides of arm, outer surface of wrist and proximal part of external surface of palm of male chela are cherry red in colour ; rest part of the palm yellowish. This species was earlier reported from Andaman mangroves as *Sesarma intermedium* (Das and Dev Roy, 1989) following Alcock (1900).

Genus *Sesarmoides* Serène and Soh, 1970

Sesarmoides Serène and Soh, 1970 : 392; Manning and Holthuis, 1981 : 242.

Type species : *Sesarma kraussi* de Man, 1887, by original designation; gender : masculine.

Diagnosis : Differing from *Sesarma* by the following characters : Carapace flattened with lateral borders strongly divergent backward. Frontal breadth less than posterior border of carapace. A strong transverse rim with a deep median notch on epistome. Basal antennular segment tumid, globular; antennal peduncle almost longitudinal. Leg joints slender, elongated ; fourth pair of legs usually twice the carapace length, merus at least as long as carapace length.

Distribution : Indo-Pacific.

36. *Sesarmoides longipes* (Krauss, 1843)

(Pl. 7, Fig. 2 ; Pl. 19, Figs. 7, 8)

Sesarma longipes Krauss, 1843 : 44, pl. 3, fig. 2 ; H. Milne Edwards, 1853 : 199; Kingsley, 1880 : 216; de Man, 1887 : 651 ; Alcock, 1900 : 424; Soegiarto, 1984 : 74 ; Chakraborty, Choudhury and Deb, 1986 : 63 ; Soemodihardjo, 1987 : 103.

Sesarma (*Sesarma*) *longipes* Guinot and Crosnier, 1964 : 215, figs. 5, 7-10 ; Crosnier, 1965 : 139, figs. 258-260.

Sesarmoides longipes. Serène and Soh, 1970 : 403.

Material examined : North Andaman : 1♂, Stewart Island, 11.3.1987. South Andaman : 5♂♂, 1♀, Rutland Island, 21.1.1982; 1♂, Peel Island, 25.6.1987.

Measurement : W = 16.0 mm, F = 7.0 mm, L = 16.0 mm.

Diagnosis : Length of carapace equal to its breadth between the antero-lateral angles. Dactylus of third pair of leg long, almost equal to its propodus.

Description

Carapace : Slightly deep, square, moderately convex in both the directions antero-posteriorly and from side to side. Length of carapace equal to its breadth but greatest breadth attained near the second pair of legs. Excepting mesogastric, other regions of carapace indistinct, surface rough near the front, epibranchial regions rugulose.

Front : Deflexed, about half of the greatest breadth of carapace, free edge of it finely beaded with granules and strongly concave medially; post-frontal ridges prominent, divided into four lobes, inner lobes broader than the outer ones.

Lateral borders : Diverging posteriorly. Antero-lateral border adorned with a small tooth behind the outer orbital angle.

Orbits : Upper border of orbit smooth, lower border finely crenated. Eye-stalk thick, short; eyes large.

Chelipeds : Stout and equal in both sexes, often unequal in male. Outer surface of arm and wrist rugulose, all the edges of the arm crenated. Inner corner of the wrist denticulate; at least, one of the teeth very stout and large. Outer surface of palm almost smooth, inner surface with a few sharp granules. Upper border of dactylus and lower border of fixed finger adorned with few sharp granules. Fingers little bent, cutting edges unevenly dentate.

Legs : Joints long, slightly compressed. Upper border of merus crenulated ending with a subterminal spine ; outer surfaces of meri of leg joints granular-rugulose. Dactylus long, narrow and almost as long as its propodus in the third pair. Upper border of carpus and both edges of propodus and dactylus thorny.

Abdomen : Consisting of 7 segments in both sexes.

Male pleopod : Long, stout process, strongly curved apically with a very long projection; tip and the inner border covered with dense setae.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Andaman Islands. Elsewhere : Madagascar, Indonesia and Philippines.

Remarks : The specimens examined agree with the description of Krauss (1843). These corroborate well with Alcock (1900) although differing by the following points : (1) the present

specimens are slightly smaller in size than Alcock's (1900) and (2) third pair of leg is only about 2.2 times the length of carapace and not 2.5 times as reported.

In the course of study, following points have also been noted : (1) upper border of the palm spinulate, (2) outer surface of palm strongly granulated and (3) upper border of dactylus and lower border of fixed finger strongly tuberculate (at least 10-12 tubercles on the upper border). This species was earlier reported from Andaman mangroves as *Sesarma longipes* (Das and Dev Roy, 1989) following Alcock (1900).

Genus *Metaplax* H. Milne Edwards, 1852

Metaplax H. Milne Edwards, 1852 : 161; de Man, 1888 : 153 ; Alcock, 1900 : 430; Tesch, 1918 : 115; Sakai, 1939 648, 698 1976 673.

Rhaconotus Gerstaecker, 1856 : 140 ; Kingsley, 1880 : 213.

Type species *Metaplax indicus* H. Milne Edwards, 1852 or *M. distinctus* H. Milne Edwards, 1852; gender : feminine.

Diagnosis : Carapace quadrilateral, more or less flat, much broader than long ; regions fairly or well outlined, cervical and branchial grooves distinct. Front deflexed. Lateral borders of carapace straight or slightly curved anteriorly, almost parallel and divided into 4 or 5 teeth; last one or two teeth very indistinct. Basal joint of antenna very short, flagellum fairly long, antenna lodged in the orbital hiatus. Antennules folded almost transversely, inter-antennular septum broad. Outer wall of orbit incomplete, lower border crenulate; eyes not filling the orbits, eye-stalks not much extended. Epistome short, distinct and prominent, buccal cavity squarish, a rhomboidal gap left between the external maxillipeds exposing the mandibles. Chelipeds differing markedly in the sexes ; chelipeds shorter and slenderer than the legs in females but longer and much more massive than the legs in males. Males always with a short oblique horny crest either on or close to and parallel with the inner border of the arm used for scraping against the lower border of the orbit for producing a musical sound. Legs slender, second and third pairs longer than the first and last pairs, third pair being the longest. Abdomen consisting of 7 distinct segments in both sexes ; in males third to fifth segments often fused together; in females, seventh segment small and deeply impacted in the sixth.

Distribution : Indo-West Pacific.

Key to the species of the genus *Metaplax* from Andaman Mangroves

1. Anterior border of carpus and propodus of legs spiny, male chelipeds 3 times the length of carapace *M. crenulata*
- Anterior border of carpus and propodus of legs smooth, male chelipeds less than 3 times the length of carapace 2

2. Dactylus of male chelae with a prominent lobe on its dentary edge, antero-lateral border cut into five teeth, male chelipeds unequal *M. elegans*
- Dactylus of male chelae without any lobe on its dentary edge, antero-lateral border cut into four teeth, male chelipeds distinctly equal *M. distincta*

37. *Mataplax crenulata* (Gerstaecker, 1856)

(Pl. 7, Fig. 3 ; Pl. 20, Figs. 1, 2)

Rhaconotus crenulatus Gerstaecker, 1856 : 142, pl. 5, fig. 5 ; Kingsley, 1880 : 213.

Mataplax crenulatus de Man, 1888 : 156.

Mataplax crenulata Alcock, 1900 : 435 ; Chakraborty, Choudhury and Deb, 1986 : 63; Aksornkoae, 1987 : 240.

Material examined : Middle Andaman : 2♂♂, Yereta Jetty, 24.3.1987 ; South Andaman : 4♂♂, 1♀, Baratang Island, 13.7.1979 ; 9♂♂, 8♀♀ Baratang Island, 19.3.1987.

Measurement : W = 35.0 mm, F = 7.0 mm, L = 25.0 mm.

Diagnosis : Regional areas of carapace very distinct and strongly curved. No prominent lobe on the dentary edge of chelipeds. Legs spiny.

Description

Carapace : Quadrilateral, broader than long, more or less flat with pitted surface ; regions, subregions, cervical and epibranchial areas well outlined by deep grooves.

Front : Deflexed, 1/5th of the greatest breadth of carapace, free margin slightly convex and crenulated.

Lateral borders : Divided into five teeth, margins of which thin, sharp and serrated; first four teeth very prominent; first tooth broadest, separated from the second by a deep sulcus; fifth inconspicuous. Anterior half of the lateral sides distinctly curved.

Orbits : Upper border of the orbit crenated and sharp with a ω-shaped curve; in male lower border of the orbit extending beyond the first antero-lateral tooth, inner corner of the orbit sharp, sinuous and entire, rest part elegantly beaded; lower border elegantly pectinate in female. Eye-stalk thick, long.

Chelipeds : Remarkably unequal, but equal in the same sex ; very long and massive in male, much shorter and slenderer in female. Arm long, slender and little dilated at its proximal end; muscular crest present near the proximal end of the anterior margin of the upper surface of the arm; three edges of the arm tubercular. Upper margin of wrist and both upper and lower border of palm granular; inner corner of wrist with few teeth; palm long, compressed, its greatest height about half of its length; inner surface of palm with a row of granules at the middle.

Fingers slender, incurved and compressed, their upper and lower borders granular; cutting edges dentate and without any prominent lobe finger tips acute.

Legs : Joints stout, long. Both upper and lower borders of merus and only the upper borders of carpus and propodus spinulate. Third pair of legs longest, almost as long as male chelipeds. Dactylus long, slender ; its margins fringed with hairs.

Abdomen : Consisting of 7 distinct segments in both sexes, sixth segment of male squarish.

Male pleopod : Nearly straight and stout process. Tip of the pleopod rounded bearing a squarish projection at the inner border, apical and subapical parts covered with dense setae.

Type locality : 'Der Fundort ist unbekannt' (Type locality unknown) (Gerstaecker).

Distribution : Indian Ocean. India : East coast : Sundarbans (West Bengal) ; Andaman Islands. Elsewhere : Mergui Archipelago, Malay Peninsula and Thailand.

Remarks : The specimens examined agree well with the descriptions of de Man (1888) and Alcock (1900). They differ from de Man (*op. cit.*) in the length of cheliped which was reported to be 2.5 times the breadth of carapace. In the present specimens, however, cheliped has been found to be slightly longer than the breadth of carapace. They differ from Alcock (1900) in the extent of frontal width. During the present study it has also been observed that lower border of propodus of the middle two legs of this species possesses longer and more dense hairs than those of the first and last legs.

38. *Metaplex distincta* H. Milne Edwards, 1852

(Pl. 7, Fig. 4 ; Pl. 20, Figs. 3, 4)

Metaplex distinctus H. Milne Edwards, 1852 : 162, pl. 4, fig. 27 ; de Man, 1888 : 158, pl. 10, figs. 7-9; Henderson, 1893 : 391; Aksornkoe, 1987 : 240.

Metaplex distincta Alcock, 1900 : 432; Tesch, 1918 : 117 ; Chhapgar, 1957b : 523, pl. 16, fig. q; Sankarankutty, 1961a : 110, fig. 1E.

Material examined : North Andaman : 1 ♀, Stewart Island, 11.3.1987. Middle Andaman : 1 ♂, Bakultala, 12.2.1979 ; 7 ♂♂, 10 ♀♀, Yereta Jetty, 24.3.1987 ; South Andaman : 7 ♂♂, 4 ♀♀ Baratang Island, 19.3.1987.

Measurement : W = 19.0 mm, F = 5.0 mm, L = 14.0 mm.

Diagnosis : Lower orbital border of male extended to the level of second notch of the antero-lateral border of carapace and its orbital portion cut into 9-11 small, obscurely-bilobulate, blunt teeth diminishing in size very regularly from within outwards. Only the fixed finger with a lobe on its dentary edge. Anterior border of merus of last pair of leg armed with a subterminal spine.

Description

Carapace : Quadrilateral, deep, surface finely granular at the anterior half. Gastric region well outlined, cervical and branchial grooves very prominent.

Front : Deflexed, about 1/4th of the greatest breadth of carapace, its free edge smooth.

Lateral borders : Nearly straight and cut into 4 teeth ; first tooth very prominent, sharp and curved inwards, second tooth larger than the first, third very small and the fourth almost obscure.

Orbits : Lower orbital border in male extended upto the level of the 2nd notch in the lateral border of carapace, its orbital portion cut into 9-11 small, blunt, obscurely-bilobulate teeth progressively decreasing in size from within outwards. Eye-stalk thick, long.

Chelipeds : Markedly unequal but equal in the same sex ; broad and massive in male, slenderer in female. Outer and inner surface of arm roughened with granules, margins denticulate ; inner border of the arm slightly dilated distally ; the muscular crest running obliquely away from the inner border and nearer to the middle of that border. Outer surface of wrist and palm smooth ; both upper and lower borders of palm granular. Fingers obliquely-truncated and channelled at tip, fixed finger with a small but distinct lobe on its dentary edge ; movable finger long, slender and curved like a strong hook ; tips of fingers broad, hoofed.

Legs : Joints slender, long. Anterior border of meropodites of first and last pair of leg adorned with a subterminal spine, 2nd and 3rd pairs with several spines.

Abdomen : Consisting of 7 distinct segments in both sexes, all segments fringed with hairs.

Male pleopod : Straight, stout and broad process with numerous setae at the tip.

Type locality : 'Bombay' (H. Milne Edwards).

Distribution : Indian Ocean. India : East coast : Sundarbans (West Bengal) ; Chennai (Tamil Nadu) ; Mayabunder (Andaman Islands) ; Nicobars. West coast : Mumbai (Maharashtra) ; Karwar (Karnataka). Elsewhere : Mergui Archipelago and Thailand.

Remarks : The specimens examined correspond well with the description of Alcock, (1900) although they differ by the following points : (1) the specimens are slightly smaller than Alcock's (*op. cit.*), (2) height of palm slightly exceeds its length, (3) only the anterior border of meropodite of last pair of leg is armed with a subterminal spine and (4) posterior border of propodites of middle two pair of legs are thickly tomentose. They also differ from Chhapparg (1957b) in size and in the absence of 5th tooth on the lateral margin of carapace ; from Sankarankutty (1961a) : in the absence of tri-lobed teeth on infra-orbital ridge, length of dactylus of the major chela which does not exceed the upper border of propodus and in the absence of blunt projection at the tip of the male pleopod.

In bigger specimens, both upper and lower border of fingers of larger cheliped has been

found to be coarsely granular. Number of spines on the anterior border of meropodites of 2nd and 3rd pair of legs has been found to vary from 3-6.

This species was reported to be as one of the rare species of brachyuran crustacea by de Man (1888) but it was noticed to be quite abundant in muddy substratum of mangroves in Andaman Islands among the small puddles. de Man reported the occurrence of this species from 'Bombay' in 1888. Later on Tesch (1918) also reported its occurrence from the same locality. Therefore, Chhapgar's claim to record this species first from the west coast of India does not stand at all.

39. *Metaplax elegans* de Man, 1888

(Pl. 7, Fig. 5 ; Pl. 20, Figs. 5, 6)

Metaplax elegans de Man, 1888 164, pl. 11, figs. 4-6; 1895 : 596; Alcock, 1900 : 434; Gordon, 1931 : 528; Soemodihardjo, 1987 : 103 ; Aksornkoae, 1987 : 240.

Metaplax crassipes de Man, 1892 : 325, pl. 19, fig. 12.

Material examined : Middle Andaman : 3♂♂, Bakultala, 13.2.1979; 4♂♂, 5♀♀, 24.3.1987.

Measurement : W = 16.0 mm, F = 4.0 mm, L = 10.0 mm.

Diagnosis : Regional areas of carapace ill-defined. Lower orbital border very finely and regularly pectinated instead of being irregularly cut into tooth-like lobules.

Description

Carapace : Quadrilateral, broader than long with smooth surface, slightly convex in both the directions. Regional areas faintly outlined.

Front : Declivous, 1/4th of the greatest breadth of carapace, its free margin crenulated.

Lateral borders : Almost straight and cut into five teeth; first tooth prominent and broad; second tooth larger than the first, third tooth very small, last two teeth almost obscure.

Orbits : Upper border of the orbit crenated and sharp with ω-shaped curve; lower border very finely and regularly pectinated instead of being irregularly cut into tooth-like lobules.

Chelipeds : Markedly unequal in male. Arm not much long, outer surface and its all margins roughened with granules; muscular crest very fine, lying at the middle of inner border of the arm and running obliquely parallel with that border. Outer surface of wrist and palm smooth; inner surface and the upper border of palm granular. Fingers obliquely truncate, strongly channelled and both of them with a lobe near the middle of their dentary edge; dactylus strongly curved in the larger chela, its upper border granular. Finger tips broad and hoofed.

Legs : Joints slender, long. Anterior border of meropodites armed with a single sub-terminal spine in first pair of legs, 3-6 spines on second pair and from 7-10 on the third and fourth pair; posterior border of meropodites of second and third pair of legs adorned with 2-3 spinules at their distal ends.

Abdomen Male abdomen broad, consisting of 7 distinct segments. All the abdomen joints fringed with hairs.

Male pleopod Almost similar to the preceding species but with a slight curve at the middle with the tip pointing outwards.

Type locality Mergui Archipelago (de Man).

Distribution Indian Ocean. India East coast Godavari Delta (Andhra Pradesh), Andaman Islands (present record). Elsewhere Mergui Archipelago, Malay Peninsula, Thailand and Indonesia.

Remarks The specimens examined agree well with the original description of de Man (1888) but differing from it by the height of palm which is slightly more in the present specimens. They also correspond well with Alcock (1900) although slight variation in cheliped length which is just little more than twice its carapace length (not 2.5 times) has been noticed. This species is reported for the first time from Andaman Islands.

Genus *Metasesarma* H. Milne Edwards, 1853

Metasesarma H. Milne Edwards, 1853 : 188 ; Kingsley, 1880 : 211 ; Alcock, 1900 : 427 ; Tesch, 1917 : 211, 257 ; 1918 : 109 ; Rathbun, 1918 : 319 ; Sakai, 1939 : 648, 699 ; Crosnier, 1965 : 73 ; Sakai, 1976 : 674.

Type species *Metasesarma rousseauxii* H. Milne Edwards, 1853, by monotypy, gender feminine, name no. 884 on Official List.

Diagnosis Carapace more or less deep, slightly broader than long, regions indistinct. Front broad, vertically deflexed, deep, overhanging the epistome, post-frontal lobes indistinct. Lateral borders slightly curved and converging posteriorly. Antennae extremely small. Antennules transverse. Orbits deep, oval, the tooth at the inner angle of the orbit meeting the thickened angle of the front excluding the antennae entirely from the orbit. Merus of external maxillipeds broader than long. The reticulation of the pterygostomian and its adjacent regions finer, closer and more confused than those in *Sesarma*. Chelipeds subequal, finger tips subacute, hollowed. Legs not much broad, compressed. Abdomen seven-segmented in both sexes.

Distribution Indo-Pacific.

40. *Metasesarma rousseauxii* (H. Milne Edwards, 1853)

(Pl. 7, Fig. 6 ; Pl. 20, Figs. 9, 10)

Metasesarma rousseauxii H. Milne Edwards, 1853 : 188 ; Kingsley, 1880 : 211 ; Henderson, 1893 : 392 ; Ortmann, 1894 : 717 ; Alcock, 1900 : 427 ; Rathbun, 1902 : 125 ; Borradaile, 1903 : 68, 97 ; Lenz, 1910 : 560 ; Tesch, 1917 : 212 ; Estampador, 1937 : 538 ; Forest et Guinot, 1961 : 158, fig. 170 ; Crosnier, 1965 : 73, figs. 116, 119.

Sesarma aubryi de Man, 1888 : 168.

Material examined South Andaman : 8♂♂, 6♀♀, Havelock Island, 27.3.1987.

Measurement : W = 13.0 mm, F = 7.5 mm, L = 12.0 mm.

Diagnosis : Gastric region of carapace separated from the cardiac by a short semilunar groove. Middle pair of post-frontal lobes hardly recognisable from the outer ones. Antero-lateral borders without any tooth.

Description

Carapace : Deep, squarish, slightly convex before backwards; surface smooth to the naked eye but covered with microscopic granules particularly near the frontal areas, epibranchial regions rugulose. Regions quite distinct, gastric region separated from the cardiac by a short semilunar groove.

Front : Vertical, deep and about half of the greatest breadth of carapace; its free edge convex, smooth but very little sinuous. Post-frontal lobes four, middle two prominent, outer pair hardly recognizable, median notch deep.

Lateral borders : Entire, curved, convergent posteriorly and without any tooth behind the external orbital angle.

Orbits : Deep, oval. Eye-stalk thick.

Chelipeds : Stout and markedly unequal in opposite sex but almost equal in the same sex. Outer surface of arm and wrist tuberculate. Arm with denticulate borders. Inner corner of the wrist sharply pronounced. Outer surface of palm smooth, inner surface with a patch of granules near the middle. Upper border of palm and base of dactylus with a few small blunt serrulations. Dactylus about three times the length of upper border of palm. Cutting edges of both fingers adorned with 3-4 big teeth. Finger tips subacute, slightly hollowed with a narrow gap when apposed.

Legs Joints slender, smooth and without any spine. Meropodites narrow; their upper and lower borders crest-like, outer surfaces granular. Dactyli as long as propodites, their edges fringed with dark spine-like bristles. Third pair of legs longest.

Abdomen : Seven segmented in both sexes, last segment of male abdomen almost triangular in shape.

Male pleopod : Short, stout appendage with a squarish projection; tip of the pleopod covered with dense setae.

Type locality : Zanzibar (H. Milne Edwards).

Distribution : Indo-West Pacific. India : East coast : Gangetic Delta (West Bengal); Chennai (Tamil Nadu) ; Andaman and Nicobar Islands. West coast : Minicoy (Lakshadweep). Elsewhere : East Africa, Madagascar, Maldives, Mergui Archipelago, Philippines and Samoa.

Remarks : The specimens in general agree well with the description of Alcock (1900) except that the present specimens are (1) smaller than that of Alcock (*op. cit.*) and that (2) palm of larger cheliped is not as high as long ; rather, it has been observed that the upper border of palm is about half of its length.

Genus *Clistocoeloma* A. Milne Edwards, 1873

Clistocoeloma A. Milne Edwards, 1873b : 310; Kingsley, 1880 : 219; de Man, 1888 : 195; Alcock, 1900 : 428; Tesch, 1917 : 235, 259; 1918 : 115; Sakai, 1939 : 648, 700 ; 1976 : 674.

Type species : *Clistocoeloma balansae* A. Milne Edwards, 1873 ; by subsequent designation by International Commission of Zoological Nomenclature; by monotypy; gender : feminine ; name no. 850 on Official List.

Diagnosis : Differing from the genus *Sesarma* Say by the following characters : Tooth at the inner angle of the lower orbital border meeting the front as in *Metasesarma* excluding antennae entirely from the orbit; reticulation of side walls of carapace made up of hairs only; merus of external maxillipeds shorter. Differing from *Metasesarma* by the lobulation of the dorsum of carapace and the dentate lateral borders.

Distribution : Indo-Pacific.

41. *Clistocoeloma merguiense* de Man, 1888

(Pl. 7, Fig. 7 ; Pl. 20, Figs. 7, 8)

Clistocoeloma merguiense de Man, 1888 : 195, pl. 13, fig. 10 ; 1895 : 339 ; Alcock, 1900 : 429; Tesch, 1917 : 222 ; Tweedie, 1936 : 68, pl. 15, fig. 4; Chopra and Das, 1937 : 431; Sakai, 1939 : 700, fig. 128; 1976 : 675; Aksornkoae, 1987 : 240.

Material examined : Middle Andaman : 7 ♂♂, 1 ♀♀, Bakultala, 14.3.1987. South Andaman : 1 ♀, Havelock Island, 8.6.1980.

Measurement : W = 14.0 mm, F = 6.0 mm, L = 8.0 mm.

Diagnosis : The whole body and appendages covered with a dark, dense adherent fur. Free edge of front not turned up to form a trenchant horizontal crest.

Description

Carapace : Entire surface of carapace and its appendages excepting the dactyli of the legs covered with a dense, blackish adherent fur; numerous clusters of short tomentum on dorsal surface giving the carapace a tubercular appearance. Carapace quadrangular, flat, much broader than long, regions well outlined and weakly lobulate.

Front : Vertically deflexed, broad, about half of the greatest breadth of carapace, its free edge little sinuous medially, not turned up to form a horizontal crest; post-frontal lobes prominent, inner lobes broader than the outer pair.

Lateral borders : Antero-lateral borders of carapace tomentose, cristate and indistinctly cut into three lobes including the outer orbital angle; first lobe largest and truncated, others much smaller and prominent; postero-lateral border also tomentose but not cristate.

Orbits : Wide, both the margins of the orbit smooth; eye-stalk thick.

Chelipeds : Unequal in opposite sex, but equal in the same sex; massive in male, slenderer in female. Outer surface of arm, wrist and palm smooth. Arm with denticulate margins, its inner border dilated distally. Palm tumid, upper border of it crested. Fingers subacute, hollowed at tips; dactylus double the size of the upper border of the palm, its upper border milled with very fine, microscopic lamellar tubercles.

Legs : Joints compressed, unarmed and thickly fringed with blackish tomentum, merus about 2.5-3.0 times as broad as long. Dactylus claw-shaped, about half of its propodus.

Abdomen : Male abdomen consisting of 7 distinct segments, last segment narrowest and twice as broad as long.

Male pleopod : Short and stout stump; tip of pleopod broad and densely hairy.

Type locality : Kisseraing Islands, Mergui Archipelago (de Man).

Distribution : Indo-West Pacific. India : East coast : Andaman Islands (present record); Nicobars. Elsewhere : Mergui Archipelago, Singapore. Indonesia, Thailand, Korea and Japan.

Remarks : The specimens examined agree well with the description of de Man (1888), Alcock (1900) and Sakai (1939), but, differ in size. In the course of present studies, it has been observed that the upper border of dactylus of major chela is milled with 20-25 lamellar tubercles.

Family MICTYRIDAE Dana, 1851

Mictiridae Dana, 1851c : 247 (corrected to Mictyridae by Alcock, 1900 : 383) ; Manning and Holthuis, 1981 : 191.

Type genus *Mictyris* Latreille, 1806

Diagnosis : Carapace thick, elongate and globose, Front narrow, deflexed. Antennular flagellum rudimentary, folded vertically and concealed under the front. Inter-antennular septum broad. Orbits represented by a small post-ocular spine, eyes uncovered. Buccal cavity enormous, completely closed by the external maxillipeds, their palps articulating with the antero-external angle of the merus; exognath small, slender and very inconspicuous. Abdomen broad in both sexes, covering the greater part of the sternum. Sternum and merus of legs without any membranous space or tympanum. Male openings sternal.

Remarks : The family is represented by a monotypic genus *Mictyris* Latreille, 1806. Members

belonging to this family are usually gregarious in habit and congregates in vast armies on the tidal sand flats of estuarine waters and mangroves.

Genus *Mictyris* Latreille, 1806

Mictyris Latreille, 1806 : 40 ; Desmarest, 1823 : 235 ; de Haan, 1833 : 24 ; H. Milne Edwards, 1837 : 36. 1852 : 154 ; Haswell, 1882 : 116 ; Miers, 1886 : 278 ; Alcock, 1900 : 383 ; Tesch, 1918 : 41 ; Sakai, 1939 : 646, 1976 : 627.

Type species : *Mictyris longicarpus* Latreille, 1806 ; by monotypy ; gender : masculine.

Diagnosis : Carapace thick, long, globose and oval but truncated posteriorly; cervical and cardio-branchial grooves prominent. Front narrow, deflexed. Anterior end of the lateral border spine-tipped, posterior border short, almost straight and fringed with bristles. Antennae small, well formed. Antennular flagellum rudimentary, hidden under the front; its basal joint large and exposed. Orbits represented by a small, post-ocular spine ; eyes unconcealed, eye-stalk short. Buccal cavity enormous, more or less oval in shape. Chelipeds long, slender ; stouter and slightly shorter than the legs ; wrist long, trigonal. Legs compressed, first pair longest, rest decreasing in length progressively. Abdomen broad in both sexes, second to sixth segments gradually increasing in length, seventh segment narrow.

Distribution : Indo-West Pacific.

***Mictyris longicarpus* Latreille, 1806**

(Pl. 5, Fig. 6 ; Pl. 16, Figs. 7, 8)

Mictyris longicarpus Latreille, 1806 : 41 ; Desmarest, 1823 : 235, 236 ; H. Milne Edwards, 1837 : 37 ; Lamarck, 1838 : 408, 409 ; White, 1847a : 34 ; Dana, 1852b : 389 ; H. Milne Edwards, 1852 : 154 ; Stimpson, 1858b : 99 ; Hess, 1865 : 142 ; Heller, 1865 : 40 ; A. Milne Edwards, 1873b : 276 ; Haswell, 1882 : 116 ; Miers, 1886 : 278 ; Alcock, 1900 : 384 ; Rathbun, 1914b : 661 ; Tesch, 1918 : 42 ; Balss, 1922 : 144 ; McNeill, 1926 : 102, pl. 9, figs. 1, 2 ; Sakai, 1939 : 645, pl. 73, fig. 5 ; Sankarankutty, 1961a : 116, figs. 1a, 5a-b ; Sakai, 1976 : 627, pl. 213, fig. 1 ; Holthuis, 1978 : 17.

Material examined : South Andaman : 1♂, Carbyn's Cove, 8.12.1980. 3♀♀, Carbyn's Cove, 7.1.1981 ; 1♀, Chidyatapu, 23.1.1981 ; 2♂♂, Carbyn's Cove, 22.8.1981.

Measurement : W = 7.0 mm, F = 1.5 mm, L = 8.0 mm.

Diagnosis : Carapace thick, subglobose. Male abdomen as broad as that of female. No tympanum.

Description

Carapace : Subglobular, very thick with smooth surfaces. Regional grooves well defined, deeply furrowed.

Front : Narrow, deflexed, about 1/5th of the greatest breadth of carapace and broadly triangular at the edge.

Lateral borders : Antero-lateral spines prominent, recurved and directed obliquely upward and outward ; posterior border straight and fringed with long, thick row of reddish brown hairs.

Orbits Orbital cavity shallow. Eye-stalk thick, not much long.

Chelipeds Moderately long, compressed and folded vertically. Lower border of the arm adorned with 3-4 spinules distally. Wrist trigonal, very long and broadened distally. Palm compressed, short and slender. Fingers narrow, pointed and longer than the palm. Outer surface of both the fingers ridged, the middle two ridges extended almost up to the tip of the fingers. Dactylus of male armed with a strong tooth near its base.

Legs : Joints long, narrow and almost smooth, the edges of the propodus and dactylus finely hairy. Legs not much unequal in length excepting the last pair.

Abdomen : Seven segmented, male abdomen as broad as that of female abdomen.

Male pleopod : Short, stout appendage, broadly truncate at the apex. The distal part with an outwardly projecting pointed tip.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Mayabunder (Andaman Island) ; Nicobar. Elsewhere : Malay Peninsula, Singapore, Indonesia, Hong Kong, Philippines, Taiwan, Japan, Australia, Tasmania and New Caledonia.

Remarks : The specimens examined agree well with the description of Alcock (1900) and McNeill (1926). The present specimens are, however, smaller than those of Sakai (1976). Further, it has been observed that the upper and lower borders of wrist, palm and fingers of chelipeds are fringed with long hairs.

Superfamily OCYPODOIDEA Rafinesque, 1815

Ocypodia Rafinesque, 1815 : 96

Ocypodoidea Glaessner, 1969 : R 530 ; Bowman and Abele, 1982 : 25

Diagnosis : Carapace rectangular, deep or flat, usually broader than long. Front narrow, projecting. Orbits large, developed as long grooves containing the elongated eye stalks. Antennules short, without fossae, antennae small. Sternal plate broad, gonoducts opening on sternum.

Remarks : This superfamily includes three families, namely, Ocypodidae Rafinesque, 1815, Palicidae Rathbun, 1898 and Retroplumidae Gill, 1894 (Bowman and Abele *op. cit.*). Out of these, representatives of only one family Ocypodidae has been found to occur in the mangroves of Andaman Islands.

Family : OCYPODIDAE Rafinesque, 1815

Ocypodia Rafinesque, 1815 : 96 (corrected to Ocypodidae by MacLeay, 1838 : 63, 64 ; name no. 375 in Official List).

Dotinae Dana, 1815b : 286.

Macrophthalminae Dana, 1851b : 286.

Ucainae Dana, 1851b : 289.

Helocciacaea H. Milne Edwards, 1852 : 153.

Dotillidae Stimpson, 1858b : 98.

Camptandriidae Stimpson, 1858b : 106.

Gelasimiden Nauck, 1880 : 8, 17, 23, 64, 66.

Gelasimidae Miers, 1886 : VIII.

Scopimerinae Alcock, 1900 : 290, 295, 363.

Camptandriinae Serène and Kumar, 1971 : 75.

Camptandriini Pretzmann, 1974 : 443.

Cleistotomatini Pretzmann, 1977 : 66.

Type genus *Ocypode* Weber, 1795

Diagnosis : Carapace deep or flat, subquadrangular, subcubical or subglobose, usually broader than long ; regions generally not well defined. Front narrow, deflexed usually a mere lobe between the long eye stalks. Orbits occupying almost the entire anterior border of the carapace ; eye-stalks slender, often elongate. Palp of external maxillipeds coarse, articulating at or near the antero-external angle of the merus ; exognath usually slender, often concealed ; buccal cavity large, covered entirely by the carapace. Chelipeds markedly unequal either in both sexes or in males only. Male abdomen narrow, male genital openings sternal. With an orifice or recess thickly fringed with hairs along the edges between the bases of second and third pair of legs.

Remarks : Four subfamilies, namely, Ocypodinae Rafinesque, 1815, Dotillinae Stimpson, 1858, Macrophthalminae Dana, 1851 and Camptandriinae Stimpson, 1858, are now recognized within the family Ocypodidae by Manning and Holthuis, 1981. The representatives of all these subfamilies have been found to occur in the mangroves of Andaman Islands.

Members belonging to this family are inter-tidal, marine or estuarine (may occur far inland) and inhabit sandy or muddy shores of the tropics, burrowing and are usually gregarious in habit.

Key to the subfamilies of the family Ocypodidae from Andaman Mangroves

1. A hairy-ridged pouch between bases of 2nd and 3rd pair of legs Ocypodinae
- No hairy-ridged pouch between bases of 2nd and 3rd pair of legs 2

2. Carapace deep, merus of legs, chelipeds and sternal segments bearing membranous spaces or tympana *Dotillinae*
- Carapace depressed, no tympanum on merus of legs, chelipeds and sternal segments ...3
3. Merus of external maxillipeds shorter than ischium and its last two segments thick, male gonopod straight or slightly bent *Macrophthalminae*
- Merus of external maxillipeds as long as or longer than ischium and the distal two segments slender, male gonopod strongly recurved *Camptandriinae*

Subfamily OCYPODINAE Rafinesque, 1815

Ocypodinae Rafinesque, 1815 : 96 ; Dana, 1851b : 312 ; Miers, 1886 : 236 ; Alcock, 1900 : 290, 294, 343 ; Borradaile, 1907 : 486 ; Tesch, 1918 : 34 ; Rathbun, 1918 : 366 ; Sakai, 1939 : 611, 1976 : 597, 598.

Diagnosis : Carapace deep, subquadrilateral, regions ill-defined. Front narrow, deflexed, usually a mere lobe between the eye-stalks. Lateral borders with or without any tooth behind the outer orbital angle. Antennules folding obliquely or nearly vertically, flagellum short, inter-antennular septum broad. Buccal cavity enclosed by the external maxillipeds entirely. An orifice or recess between bases of 2nd and 3rd pair of legs. Chelipeds unequal, often remarkably in males.

Key to the genera of the subfamily OCYPODINAE of Andaman Mangroves

- Antennular flagella rudimentary completely concealed under the front, antennae small, almost rudimentary ; eyes very large, occupying the major part of ventral surface of eye-stalks ; male chelipeds unequal ; ambulatories large *Ocypode*
- Antennular flagella small, not concealed under the front, antennae long ; eyes small, terminal on long, slender eye-stalks ; one of the male chelipeds enormously enlarged, the other being very small ; ambulatories short *Uca*

Genus *Ocypode* Weber, 1795

Ocypode Weber, 1795 : 92 ; Fabricius, 1798 : 347 ; de Haan, 1835 : 29 ; Ortmann, 1984 : 761 ; Stebbing, 1910 : 325 ; Rathbun, 1918 : 366 ; Barnard, 1950 : 83 ; Crosnier, 1965 : 92 ; Sakai, 1976 : 598 ; Manning and Holthuis, 1981 : 217.

Ocypoda Lamarck, 1801 : 149 ; Latreille, 1803 : 27 ; H. Milne Edwards, 1837 : 41, 1852 : 141 ; Dana, 1852b : 324 ; Miers, 1886 : 237 ; Ortmann, 1897 : 359 ; Alcock, 1900 : 343 ; Tesch, 1918 : 35 ; Sakai, 1939 : 611 ; Monod, 1956 : 390 ; Sakai, 1965 : 187, 188.

Monolepis Say, 1817 : 155.

Ceratophthalma MacLeay, 1838 : 64.

Parocypoda Neumann, 1878 : 26.

Type species : *Cancer ceratophthalmus* Pallas, 1772 ; by selection by Holthuis, 1962 ; gender : feminine ; name no. 1637 on Official List.

Diagnosis : Carapace deep, subquadrilateral, slightly broader than long. ; regions ill defined. Front narrow, deflexed. Lateral borders with or without any tooth behind the outer orbital angle. Basal antenna joint short, flagellum rudimentary. Antennules extremely small, almost hidden beneath the front. Orbits large, divided into two fossae — one for the basal portion of the eye-stalk, the other for the eye ; eye-stalk often prolonged in a horn or style. Epistome short. Buccal cavity as broad as long in its widest part, but narrowed anteriorly; external maxillipeds more or less narrow, elongate. Chelipeds unequal in both sexes, palm of the larger chela short, high, usually with a stridulating ridge of granules or striae for scrapping against a corresponding ridge on the ischium. Legs strong, fourth pair much shorter and less massive than the other pairs, dactylus flute-like ; an orifice, thickly fringed with hairs between the basal joints of 2nd and 3rd pair of legs. Abdomen consisting of 7 segments in both sexes.

Distribution : Indo-Pacific, Mediterranean, West Africa and coasts of North and South America.

43. *Ocypode ceratophthalma* (Pallas, 1772)

(Pl. 4, Fig. 5 ; Pl. 14, Figs. 1, 2)

Cancer ceratophthalmus Pallas, 1772 : 83, pl. 5, figs. 7, 8.

Cancer cursor Herbst, 1790 : 74, pl. 1, figs. 8, 9.

Ocypoda ceratophthalma Fabricius, 1798 : 347 ; H. Milne Edwards, 1837 : 48 ; Heller, 1865 : 42 ; Haswell, 1882 : 94 ; Miers, 1886 : 238 ; de Man, 1887 : 107 ; Walker, 1890 : 110 ; Henderson, 1893 : 387 ; Ortmann, 1897 : 364 ; Alcock, 1900 : 345 ; de Man, 1903 : 469, 477, pl. 19 ; Laurie, 1906 : 426 ; Tesch, 1918 : 36 ; Balss, 1922 : 141 ; Gravely, 1927 : 148 ; Chopra and Das, 1937 : 418 ; Tweedie, 1937 : 141 ; Sakai, 1939 : 614, pl. 104, figs. 9, 91a ; Chhapgar, 1957b : 506, pl. 13, figs. a-c ; Sankarankutty, 1961a : 112 ; Chakraborty, Choudhury and Deb, 1986 : 57 ; Soemodihardjo, 1987 : 103.

Ocypode ceratophthalma Latreille, 1806 : 32 ; Ortmann, 1894 : 767, pl. 23, fig. 20 ; de Man, 1895 : 570 ; Lanchester, 1900 : 751 ; Rathbun, 1902 : 123 ; Borradaile, 1903 : 96 ; Rathbun, 1906b : 833 ; Stimpson, 1907 : 108, pl. 12, fig. 2 ; Maki and Tsuchiya, 1923a : 202, pl. 23, fig. 2 ; Urita, 1926 : 27 ; Estampodor, 1937 : 542 ; Chopra and Das, 1937 : 418, Crosnier, 1965 : 93, figs. 152, 160, 167, 168, pl. 8, fig. 1, pl. 10, fig. 3 ; Sakai, 1976 : 600, pl. 207, fig. 32b.

Ocypode ceratophthalmus Barnard, 1950 : 86 ; Holthuis, 1978 : 16.

Material examined : North Andaman : 2♂♂, Carlew Island, 10.3.1987 ; South Andaman : 1♀, Peel Island, 12.6.1980 ; 1♂, Neill Island, 21.6.1980 ; 2♂♂, Chidyatapu, 3.12.1980 ; 1♂, Havelock Island, 27.3.1987 ; 2♂♂, 1♀, Neill Island, 28.3.1987.

Measurement : W = 40.0 mm, F = 4.0 mm, L = 38.0 mm.

Diagnosis : Eye stalks extended beyond the carapace forming a horn or style. A stridulatory organ present on the inner surface of palm of the larger chela.

Description

Carapace : Deep, squarish, surface studded with fine granules, regions faintly outlined.

Front : Narrow, diagonally deflexed, about 1/10th of the greatest breadth of carapace, its free edge rounded.

Lateral borders : Anterior 1/3rd of the lateral borders almost straight, parallel ; margins of carapace finely beaded excepting the posterior border.

Orbits : Elongated. Upper orbital edge diagonal, wavy and finely crenulated, lower edge also crenated with an obscure notch to its middle. Eye-stalk extended beyond the carapace as a blunt, narrow horn ; eyes large, occupying the ventral surface of the eye-stalk.

Chelipeds : Markedly unequal. Upper edge of the arm scabrous, granules arranged in transverse rows ; inner and lower edges crenulated. Outer surface of the wrist roughened with granules, inner corner of it adorned with a strong spine. Palm compressed, high ; its upper and lower edges serrated ; outer surface of palm coarsely granular, inner surface roughened with patch of granules on the upper half ; palm of both the chelipeds, especially the smaller chelae compressed ; inner surface of palm of the larger chela with a stridulatory organ very close to the base of the fixed finger ; upper half of it made up of tubercles gradually passing to striae ; lower half consisting of a comb of fine, regular and very close set of striae for scraping against a polished ridge running across the inner surface of the ischium. Upper border of dactyl, outer surface of both dactyl and fixed finger granular ; lower border of fixed finger also granular, often spinate or dentiform or tuberculate ; fingers of both the chelipeds pointed at tips, their cutting edges armed with several large teeth.

Legs : Joints long, stout. Merus of the first three pairs of walking legs broadened, that of the fourth pair shortest with much narrower merus ; upper edges of meri of all legs scabrous, their lower edges bicarinate and serrated. An orifice thickly protected by hairs lying between the basal joints of second and third pair of legs. Anterior surface of propodus of first and second pair of legs adorned conspicuously with brushes of hairs ; dactylus claw-shaped, hairy.

Abdomen : Consisting of 7 distinct segments in both sexes ; sixth segment larger than broad in male.

Male pleopod : Long and stout process, sharply curved at the apex, bearing a more or less rounded lobe ; tip and the inner border of the appendage bearing numerous setae.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal), Palk Bay, Gulf of Mannar (Tamil Nadu) ; Neill Island (Andamans) ; Nicobars. West coast : Umarsadi,

Kolak, Mumbai (Maharashtra) ; Karwar (Karnataka) ; Kavaratti, Amindivi and Minicoy Islands (Lakshadweep). Elsewhere : East coast of Africa, Madagascar, Mauritius, Maldives, Sri Lanka, Malay Peninsula, Singapore, Indonesia, Japan, Australia, Sandwich Islands, Tahiti and Hawaii.

Remarks : The specimens examined agree well with the description of Alcock (1900). Compared to Sankarankutty (1961a) these are smaller in size but bigger than those reported by Sakai (1939) and Chhapgar (1957b). A few additional points of interest have been noticed while studying the specimens. These are : both upper and lower edges of merus, carpus and propodus of leg joints are serrated, both outer and inner surfaces of merus and propodus of legs are scabrous, all abdomen and sternal segments are studded with vesiculous granules and the fingers of both the chelipeds are with longitudinal ridges on their outer surfaces. Tip of first male pleopod was reported to consist of two rounded lobes (Chopra and Das, 1937 ; Chhapgar, 1957b) but, this has been found to bear a single lobe in the present specimens.

Genus *Uca* Leach, 1814

Uca Leach, 1814 : 430 ; Rathbun, 1897 : 154, 1918 : 374 ; Tesch, 1918 : 37 ; Barnard, 1950 : 89 ; Crosnier, 1965 : 105 ; Glaessner, 1969 : R530 ; Crane, 1975, : 15 ; Sakai, 1976 : 600.

Gelasimus Latreille, 1817b : 517 ; Desmarest, 1825 : 122 ; de Haan, 1835 : 25 ; H. Milne Edwards, 1837 : 49 ; 1852 : 144 ; Dana, 1852b : 312, 315 ; Hess, 1865 : 445 ; Miers, 1886 : 241 ; Ortmann, 1894 : 749-753 ; Alcock, 1900 : 350 ; Gordon, 1934 : 10 ; Sakai, 1939 : 615.

Acanthoplax H. Milne Edwards, 1852 : 151.

Eurychelus Rathbun, 1914a : 126.

Minuca Bott, 1954 : 155, 160.

Mesuca Bott, 1973b : 316.

Latuca Bott, 1973b : 317.

Tubuca Bott, 1973b : 322.

Austruca Bott, 1973b : 322.

Paraleptuca Bott, 1973b : 322.

Heteruca Bott, 1973b : 323.

Planuca Bott, 1973b : 324.

Leptuca Bott, 1973b : 324.

Deltuca Crane, 1975 : 21.

Australuca Crane, 1975 : 621.

Thalassuca Crane, 1975 : 75.

Amphiuca Crane, 1975 : 96.

Boboruca Crane, 1975 : 109.

Afruca Crane, 1975 : 116.

CelUCA Crane, 1975 : 211.

Type species : *Cancer vocans major* Herbst, 1782, by monotypy ; gender : feminine ; name no. 1648 on Official List.

Diagnosis : Carapace deep, subquadrilateral or subhexagonal, broader than long, surface usually smooth, seldom setose or tuberculate, regions not well defined excepting the H-form depression. Front deflexed, moderate to very narrow, spatulate to broadly arcuate. Antero-lateral angles generally pointed, slightly produced, often at right angle. Antero-lateral margins absent or moderately parallel, converging or sometimes diverging slightly. Antennae with well developed flagella. Antennules very small, folded obliquely. Orbits deep, little sinuous and oblique, suborbital border cut into numerous more or less truncated lobules ; eyes small, terminal ; eye-stalk slender. Epistome short but quite distinct. Palp of external maxilliped articulating at or near antero-external angle of merus ; exognath slender often concealed ; the maxillipeds completely covering the buccal cavity. Chelipeds remarkably unequal in male, small and equal in female. Legs strong, meropodites of second and third pair foliaceous, dactyli very sharp. Abdomen consisting of 7 distinct segments in both sexes, often two or more segments fuse together.

Distribution : Indo-Pacific, Mediterranean, Red Sea, West Africa and Atalantic coasts of North and South America.

Key to the species of the genus *Uca* from Andaman Mangroves

1. Front narrow2
 - Front wide *U. lactea*
2. Outer surface of major dactyl in males without any long distinct groove, no enlarged teeth in gape of female chelae3
 - Outer surface of major dactyl in males with 2 long distinct grooves, 1 or 2 enlarged teeth in gape of female chelae *U. dussumieri*
3. In males major dactyl conspicuously broad and flat, cutting edge of fixed finger blade-like or marked with two deep sinuses, palm covered with large granules; in females no pilosity on sides of carapace *U. vocans*
 - In males major dactyl of conventional shape, cutting edge of fixed finger not blade-shaped, palm covered with tiny granules; in females a patch of pile present posteriorly on sides of carapace *U. tetragonon*

Remarks : The systematics of the fiddler crab is still very puzzling and in a confused state. Bott (1973b) splitted the genus *Uca* into 10 genera while Crane (1975) placed all fiddler crabs under a single genus *Uca* within which she recognized 9 subgenera, many of which did not coincide with those genera and subgenera proposed by Bott (*op. cit.*). Hagen (1976) had opined that Crane's names were objective synonyms and a great deal of nomenclatural chaos would result if these are used. While reviewing of Crane's monograph, Hagen (*op. cit.*) pointed out that many non-taxonomists who would use the monograph as standard reference, "will unsuspectingly use her new but invalid subgeneric names, while taxonomists would, of course have to use Bott's name (regardless, whether on a subgeneric or generic level)" Manning and Holthuis (1981) while dealing with *Uca* remarked the situation as follows — "we have now the most unpleasant situation that Crane's subgenera are well defined and exhaustively treated in an ideal way, while Bott's names, published in a short, not too well-documented paper, have priority"

Under the circumstances and in view of the fact that the taxonomy of the genus *Uca* is in an unstable state, Hagen (1976) preferred to use the simple binomials for the genus *Uca* and its species without accepting any further subdivisions like subgenus and subspecies. According to him, "..... the formal grouping or splitting of *Uca* appears premature as we are only beginning to understand the evolution of the genus" Already such simple binomials have been practised by George and Jones (1982) in their monographic work, "A Revision of the Fiddler Crabs of Australia (Ocypodinae, *Uca*)"

In the present work, the above mentioned binomial system has been followed in order to avoid nomenclatural hazards in the taxonomy of the genus *Uca*.

44. *Uca dussumieri* (H. Milne Edwards, 1852)

(Pl. 4, Fig. 6 ; Pl. 14, Figs. 3, 4)

Gelasimus dussumieri H. Milne Edwards, 1852 : 148, pl. 4, fig. 2 ; A. Milne Edwards, 1868 : 71, 1873b : 274 ; Haswell, 1882 : 93 ; de Man, 1888 : 108, pl. 7, figs. 2-7 ; Ortmann, 1894 : 755 ; de Man, 1895 : 576 ; Alcock, 1900 : 361 ; de Man, 1902 : 486 ; Gordon, 1934 : 12, figs. 5a-c ; Chhappargar 1957b : 510, pl. 14, figs. a-f ; Chandy, 1970 : 402.

Gelasimus dubius Stimpson, 1858b : 99, 1907 : 104 ; Sakai, 1939 : 621.

Uca dussumieri Ortmann, 1897 : 348 ; Lanchester, 1900 : 753 ; Grant and McCulloch, 1906 : 20, 26 ; Tesch, 1918 : 39 ; Estampador, 1937 : 543, 1959 : 100 ; Crosnier, 1965 : 112 ; George and Jones, 1982 : 31, figs. 19a, 20a, 39a-g, 55e ; Soemodihardjo, 1987 : 103 ; Aksornkoae, 1987 : 240.

Uca dubia Miyake, 1936 : 511, 1939 : 222, 241.

Uca (Deltuca) dussumieri spinata Crane, 1975 : 36, pl. 3, figs. E-H, figs. 27A-C, 38E-H, 46B, 54 B, 60A-B, 61G.

Material examined : North Andaman : 1♂, Austin IX, 10.3.1987. Middle Andaman : 1♂, Uttara Jetty, 23.8.1979 ; 10♂♂, 1♀, Betapur, 12.3.1987 ; 10♂♂, 1♀, Bakultala, 14.3.1987 ; 2♂♂, 1♀, Pitcher Nallah, 15.3.1987 ; 2♂♂, Uttara Jetty, 17.3.1987 ; 2♂♂, Rangat, 24.3.1987.

South Andaman 4♂♂, 2♀♀, Guptapara, 7.6.1978 ; 2♂♂, Kadakachang, 29.7.1978 ; 3♂♂, Wright Myo, 3.8.1978 ; 3♂♂, 1♀, Sippighat, 18.10.1978 ; 3♂♂, Rangachang, 28.10.1978 ; 1♂, Wandoor, 5.11.1978 ; 6♂♂, 2♀♀, Baratang Island, 17.7.1979 ; 1♂, Chidyatapu, 6.5.1981 ; 2♂♂, 2♀♀, Manjeri, 25.9.1981 ; 2♂♂, 3♀♀, Barakhari, 23.1.1982 ; 1♂, 1♀, Barakhari, 7.10.1982 ; 1♂, Guptapara, 25.8.1984 ; 3♂♂, 2♀♀, Gandhi Ghat Jetty, 27.7.1985 ; 2♂♂, Ferrargunj, 18.8.1985 ; 1♂, Bambooflat, 27.2.1987 ; 5♂♂, 1♀, Nilambur Jetty, 19.3.1987. Little Andaman : 1♂, Dugong Creek, 22.2.1982 ; 2♀♀, Hut Bay Jetty, 24.2.1982 ; 3♂♂, 2♀♀, South Bay, 4.3.1982.

Measurement : W = 30.0 mm, F = 1.0 mm, L = 16.0 mm.

Diagnosis : Two distinct long grooves running most of the length in major dactyl of male on its outer surface and a similar groove on outer pollex. Fingers very long, strong. Inner dorsal margin of arm of major male chela adorned with an enlarged bicuspid distal tubercle. Merus of last pair of leg in male markedly slender, that of female bordered conspicuously with pile along its postero-ventral margin.

Description

Carapace : Deep, strongly convex from front to back, regions recognizable but not strongly defined. Dorso-lateral margins long, definite, extending to the level of third walking legs, finely beaded but becoming very weak or absent posteriorly. Antero-lateral angles acute but slightly directed forward.

Front : Extremely narrow, about 1/30th of the greatest breadth of carapace.

Lateral borders : Antero-lateral margins short, definite, converging and finely beaded, postero-lateral stria absent.

Orbits : Crenellations of the lower orbital border low but separate and truncate, little larger towards the antero-lateral angle ; outer angle rectangular, entire, often projecting slightly.

Chelipeds : Major cheliped — Antero-dorsal margin of arm tuberculate in a single row, the tubercles increasing in size regularly near the distal end, terminal tubercle enlarged and bicuspid. Upper surface of wrist tuberculate. Outer surface of palm adorned with enlarged tubercles, its dorsal margin with double tuberculate ridge ; supra-marginal groove of outer surface of palm well developed, extending to or beyond one-quarter length of pollex ; oblique ridge of inner surface of palm with large tubercles. Subdorsal groove broad and deep proximally, running parallel to long median groove. Median groove of dactylus long, distinct, broad and shallow proximally, extending to most of its length ; that of the pollex also long, distinct, deep and broad, continuing most of its length. Outer and inner surfaces of dactyl and pollex covered with microscopic granules. Cutting edge of dactylus with two enlarged teeth in its proximal half, the dentary edge of the pollex adorned with an enlarged median or submedian triangular lobe or tooth. Fingers crossing, curved like a hook at their tips, leaving a wide gap when closed.

Minor cheiped — Gape of male extremely small, evenly serrated with few long dense setae distally ; dorsal margin of merus with a few spinules, postero-ventral margin serrated ; anterior border of dactylus with a dense brush of setae, ventral margin of pollex with less hairs. Gape of female small, with a central pair of enlarged teeth in both the chelae.

Legs : Joints smooth, slender. Merus of the last leg not foliaceous although compressed and broadened to some extent, its upper border crest-like, serrated ; in female, merus of third and fourth pairs conspicuously bordered with pile along the postero-ventral margin. Ridges of carpus finely granular. Dactylus claw-shaped, fringed with bristles.

Abdomen Consisting of 7 distinct segments in both sexes.

Male pleopod Long, stout process tip broad, flat with a chitinous projection covered with dense setae.

Type locality Malabar and Samarang (H. Milne Edwards).

Distribution Indo-West Pacific. India East coast Sundarbans (West Bengal) , Orissa Bimlipatnam (Andhra Pradesh) , Andaman and Nicobar Island. West coast Gulf of Kachchh (Gujarat) , Umarsadi, Kolak, Mumbai (Maharashtra). Elsewhere Madagascar, Mergui Archipelago, Malay Peninsula, Singapore, Indonesia, Thailand, Philippines, Hong Kong, China, Japan, Ryukyu Island, Palau Island, East Indies, New Guinea and Australia, New Caledonia, Solomon Islands and Caroline Islands.

Remarks The specimens examined agree well with the descriptions of Alcock (1900), Crane (1975) and, George and Jones (1982). These, however, differ from that of Alcock (*op. cit.*) in the extent of frontal breadth which is less in the specimens studied. Further, it has been observed that subdorsal groove of dactylus of major chela is not so much prominent in small specimens and in adult females and meri of legs are strongly serrated both on the upper and lower borders. This species was earlier reported from Andaman mangroves under the name *Uca dussumieri spinata* (Das and Dev Roy, 1989) following Crane (1975).

45. *Uca tetragonon* (Herbst, 1790)

(Pl. 4, Fig. 7 ; Pl. 15, Figs. 3, 4)

Cancer tetragonon Herbst, 1790 : 257, pl. 20, fig. 110.

Gelasimus tetragonon Rüppell, 1830 : 25, pl. 5, fig. 5 ; H. Milne Edwards, 1837 : 52 ; White, 1847a : 36 ; H. Milne Edwards, 1852 : 147, pl. 3, fig. 9 ; Heller, 1865 : 37 ; Hilgendorf, 1869 : 84 ; A. Milne Edwards, 1873b : 274 ; Kossmann, 1877 : 52 ; Miers, 1886 : 243 ; Ortmann, 1894 : 750, 754 ; Whitelegge, 1897 : 138 ; Bouvier, 1915 : 303.

Gelasimus tetragonum Alcock, 1900 : 357.

Uca tetragona Ortmann, 1897 : 348.

Uca tetragonon Lanchester, 1900 : 754 ; Rathbun, 1902 : 123 ; Nobili, 1906a : 151, 1907 : 408 ; Laurie, 1915 : 416 ; Tesch, 1918 : 39 ; Crosnier, 1965 : 112, figs. 187, 197-200 ; George and Jones, 1982 : 63, figs. 31a, 32, 33a, 48a-f, 57e.

Uca (Thalassuca) tetragonon Crane, 1975 : 77, pl. 13, figs. A-H; Sakai, 1976 : 605, fig. 332a.

Material examined : North Andaman : 1♂, 1♀, Aereal Bay, 6.3.1987; 2♂♂, 3♀♀, Stewart Island, 11.3.1987. South Andaman : 4♂♂, 3♀♀, Manjeri, 25.7.1981; 1♀, Chidyatapu, 29.9.1981; 4♂♂, Neill Island, 28.3.1987.

Measurement : W = 24.0 mm, F = 1.5 mm, L. = 16.0 mm.

Diagnosis : Dorso-lateral margins short, marked by a fine microscopic granular line. Postero-lateral stria present on adult male carapace, female with an oblong patch of pile on postero-lateral part of carapace near the enlarged granules. Major dactyl devoid of any distinct groove. Pollex of the larger chela in male with a shallow, triangular depression at base, extending to about one third of its length; its cutting edge bearing two enlarged tubercles beyond the middle of the gape.

Description

Carapace Smooth to the naked eye but covered with microscopic granules, convex from front to back, roughly pentagonal in shape, regional boundaries faintly outlined. Length of carapace about two-thirds of its greatest breadth at the acute antero-lateral angles. Dorso-lateral margins short, marked by fine raised line, extending to the level of second leg. Antero-lateral angles acute and directed forward.

Front : Narrow, deflexed, about 1/16th of the greatest breadth of carapace.

Lateral borders : Antero-lateral borders short, finely beaded, converging from antero-lateral angle, distinguished from dorso-lateral border by a slight bend. Postero-lateral stria represented by a short line of large granules in male; female with an oblique patch of pile near the enlarged granules of the postero-lateral region of carapace.

Orbits : Suborbital crenellations extending from extreme outer angle of orbit to its inner boundary; crenellations in outer half strong, truncate and well separated from each other, smaller but distinct, close-set and well formed in inner half.

Chelipeds : Major cheliped—In major cheliped, both upper and lower border of arm roughened with an irregularly row of granules; inner corner with a large, sharp distal tooth. Wrist smooth to the naked eye, inner corner of it prominent but not spiniform. Outer surface of palm roughened with tubercles, upper and lower edges granular; oblique ridge of the inner surface of the palm represented by fine, low, granules. Median groove and subdorsal groove of dactylus absent. Tubercles of outer surface of dactyl extending from one-fourth to half the length of dactyl; both dactyl and pollex rounded, slender and tapering, their outer and inner surfaces roughened with

small tubercles. Median groove of pollex extending upto $\frac{1}{3}$ rd the length of pollex. A scar or triangular depression lying near the base of the pollex. Cutting edge of fixed finger adorned with two enlarged teeth at the middle and beyond.

Minor cheliped—Fingers of moderate length in both sexes and longer than palm. Base of pollex usually broad; gape smooth, often with few, feeble serrations, and without any continuous fringe of setae excepting the subdistal tuft.

Legs : Joints smooth. slender. Meri slightly expanded, their upper margins granular with long hairs, propodus also with long hairs but towards the lower border. Dactyls claw-shaped, fringed with hairs.

Abdomen : Same as in the preceding species.

Male pleopod : Long, stout process, tip broadly truncate covered under dense setae. A chitinous process projecting from the apex.

Type locality : Unknown.

Distribution : Indo-West Pacific. India : East coast : Andaman and Nicobar Islands. Elsewhere : East Africa, Red Sea, Madagascar, Mauritius, Seychelles, Maldives, Malay Peninsula, Singapore, Japan, Ryukyu Archipelago, Polynesian Islands, Australia, Gilbert Island, Society Island and Tuamotu.

Remarks : The specimens in general agree well with the descriptions of Alcock (1900), Crane (1975) and George and Jones (1982). These differ from Alcock's (*op. cit.*) report in size and in the extent of frontal width which is slightly less in the present specimens.

46. *Uca vocans* (Linnaeus, 1758)

(Pl 4, Fig. 8 ; Pl. 15, Figs. 1, 2)

Cancer vocans Rumphius, 1705 : 14, pl. 10, fig. E; 1711 : pl. 10, Fig. E; Linnaeus, 1758 : 626, 1767 : 1041 ; Fabricius, 1793 : 446.

Ocypode vocans Bosc, 1802 : 198.

Gelasimus vocans Desmarest, 1825 : 123; H. Milne Edwards, 1852 : 145; Stimpson, 1858b : 99 ; Heller, 1865 : 37 ; Hilgendorf, 1869 : 83 ; A. Milne Edwards, 1873b : 272 ; Miers, 1880 : 308 ; Lenz and Richters, 1881 : 423; Haswell, 1882 : 92 ; Miers, 1886 : 242; de Man, 1895 : 572 ; Stimpson, 1907 : 104.

Gelasimus marionis Desmarest, 1825 : 124, pl. 13, fig. 1; H. Milne Edwards, 1852 : 145, pl. 3, fig. 5; Miers, 1880 : 308; Ortmann, 1894 : 754 ; Alcock, 1900 : 359 ; de Man, 1902 : 487 ; Lenz, 1910 : 559 ; Gravely, 1927 : 148 ; Tweedie, 1937 : 143, figs. 1d-e; Chopra and Das, 1937 : 422; Shen, 1940 : 232; Pillai, 1951 : 29 ; Chhappargar, 1957b : 509, pl. 13, figs. p, q, t.

Gelasimus cultrimanus White, 1847a : 35; Adams and White, 1848 : 49 ; Ortmann, 1893 : 58, 67 ; 1894 : 752.

- Gelasimus nitidus* Dana, 1851c : 248, 1852b : 316, pl. 19, figs. 5a-d; H. Milne Edwards, 1852 : 147.
- Gelasimus marionis nitidus* Alcock, 1900 : 360; de Man, 1902 : 487; Tweedie, 1937 : 143; Shen, 1940 : 232 : Chhapgar, 1957b : 510, pl. 13, figs. u-w.
- Uca cultrimana* Ortmann, 1897 : 348; Borradaile, 1900 : 595; Estampador, 1937 : 545, 1959 : 103.
- Uca vocans* Lanchester, 1900 : 754 ; Holthuis, 1959 : 115, pl. 10, fig. 1; Soemodihardjo, 1987 : 103 ; Aksornkoae, 1987 : 240.
- Uca marionis* Nobili, 1906a : 314, 1907 : 408; Laurie, 1915 : 416 ; Tesch, 1918 : 38 ; McNeill, 1920 : 105 ; Maccagno, 1928 : 23; Estampador, 1937 : 544 ; Sakai, 1939 : 625 ; Chace, 1942 : 202 ; Buitendijk, 1947 : 280 ; Barnard, 1950 : 90; Crosnier, 1965 : 107, figs. 185, 188, 194.
- Uca marionis* var. *nitida* Nobili, 1906a : 314; Laurie, 1915 : 416; Maccagno, 1928 : 24 ; Gordon, 1931 : 528; Miyake, 1936 : 511; Estampador, 1937 : 544; Miyake, 1939 : 190, 223, 242, pl. 16, fig. 1; Estampador, 1959 : 102.
- Uca marionis* forma *excisa* Nobili, 1906a : 314; Crosnier, 1965 : 109, fig. 189, 190.
- Uca marionis* var *vomeris* McNeill, 1920 : 106.
- Uca marionis excisa* Sankarankutty, 1961a : 113.
- Uca (Thalassuca) vocans vocans* Crane, 1975 : 92, pl. 14, figs. e-h ; figs. 38i-l, 56b, 60c-e, 64f; Sakai, 1976 : 605, pl. 208, fig. 3.

Material examined : North Andaman : 22♂♂, 8♀♀, Mayabunder, 9.3.1987; 6♂♂, 1♀, Austin IX, 10.3.1987; 2♂♂, Stewart Island, 11.3.1987. Middle Andaman : 3♂♂, Uttara Jetty, 27.7.1985; 2♂♂, 5♀♀, Gandhi Ghat Jetty, 27.7.1985; 2♂♂, Rangat, 24.3.1987. South Andaman : 3♂♂, 4♀♀, Carbyn's Cove, 15.11.1980; 5♂♂, 2♀♀, Chidyatapu, 6.5.1981; 3♂♂, 4♀♀, Guptapara, 25.8.1984; 2♂♂, 2♀♀, Alexandra Island, 23.3.1985; 4♂♂, 1♀, Baratang Island, 17.7. 1985; 3♂♂, Baratang Island, 4.3.1986; 5♂♂, 2♀♀, Baratang Island, 18.3.1987; 2♂♂, 2♀♀, Neill Island, 28.3.1987.

Measurement : W = 21.5 mm, F = 1.0 mm, L = 18.5 mm.

Diagnosis : Dactyl and pollex of major cheliped in male flattened, dactyl very broad and without any groove, pollex with a deep furrow in basal two-thirds; outer surface of palm with large tubercles especially near the depression at pollex base; oblique ridge of the inner surface of palm high with strong tubercles. In female, no pile on postero-lateral part of carapace and dorso-lateral margins strongly beaded.

Description

Carapace : Surface of carapace in both male and female apparently smooth but covered with microscopic granules. Carapace moderately convex, posterior border of its dorsum slightly less than half of its greatest breadth in adult male ; regions well defined. Antero-lateral angles acute, claw-like.

Front : Narrow, deflexed, 1/21.5th of the greatest breadth of carapace.

Lateral borders : True lateral borders slightly convergent posteriorly; defined by a short, fine raised line confined to almost up to the base of the antero-lateral angles.

Orbits : Moderately oblique, sinuous, suborbital crenellations low, truncate, well separate, large towards the antero-lateral angle, often bicuspid.

Chelipeds : Major cheliped—Postero-dorsal ridge of arm of major cheliped distinctly crested, antero-dorsal margin with a short, low crest the Upper surface of wrist granular, inner corner denticulate. Palm compressed, tubercles on its upper half large but largest at the lower half; a triangular depression extending to about 1/3rd the length of pollex; oblique ridge of inner surface high, thin and sharp; upper border of palm tuberculate. Fingers broad, thin and laminar. Dactylus nearly twice the length of upper border of palm and shaped like a knife-blade. Pollex and dactyl strongly compressed, almost smooth but for some small tubercles on outer surfaces of dactyl. Both the edges of the gape sinuous and uneven, those of pollex with a ω -shaped curve due to the presence of two large triangular projections, margined with fine tubercles, one adjacent to the middle of the gape, the other occurring subdistally.

Minor cheliped—In minor cheliped, fingers of both sexes distinctly longer than palm, serrations absent, with wide gape and long setae; dorsal margin of dactyl and ventral margin of pollex with long, sparse setae, their tips with a dense brush.

Legs : Merus of the last pair slender. Upper border of meropodites weakly serrated. Dactylus claw-shaped. Lower surface of propodus and both the edges of dactylus fringed with hairs.

Abdomen : Same as in the preceding species.

Male pleopod : Long, stout process. Anterior flange broader than the posterior. Two strong chitinous processes projecting from the tip.

Type locality : "In Indiis" (Rumphius). East Indies probably Ambonia (Vide Crane, 1975).

Distribution : Indo-West Pacific. India : East coast : Gulf of Mannar (Tamil Nadu) ; Mayabunder (Andaman Island ; Nicobars ; West Coast : Mumbai (Maharashtra). Elsewhere : South Africa, East Africa, Red Sea, Madagascar, Mauritius, Mergui Archipelago, Malay Peninsula , Singapore, Thailand, Indonesia, East Indies, Philippines, Hong Kong, Taiwan, Japan, Palau, New Guinea, Australia, Fiji and Samoa.

Remarks : The specimens examined agree well with the descriptions of Alcock (1900) and Crane (1975) differing from that of Alcock (*op. cit.*) in size, extent of frontal width and posterior border of dorsum of carapace which are slightly less. In some specimens, inner corner of wrist of male major chela has been found to be bidentate.

47. *Uca lactea* (de Haan, 1835)
(Pl. 5, Fig. 1 ; Pl. 15, Figs. 5, 6)

Ocypode (Gelasimus) lacteus de Haan, 1835 : 54, pl. 15, fig. 5.

Gelasimus annulipes H. Milne Edwards, 1837 : 55, pl. 18, figs. 10-13; White, 1847a : 36; Dana, 1852b : 317; H. Milne Edwards, 1852 : 149, pl. 4, figs. 15a-b; Heller, 1865 : 38 ; Hilgendorf, 1869 : 85; Kossmann, 1877 : 55; Hilgendorf, 1878 : 803 ; Richters, 1880 : 155; Miers, 1880 : 310 ; Lenz and Richters, 1881 : 423 ; Miers, 1886 : 244 ; de Man, 1887 : 118; Henderson, 1893 : 388 ; Ortmann, 1894 : 758 ; de Man, 1895 : 577 ; Alcock, 1900 : 353; de Man, 1902 : 483 ; Lenz, 1905 : 365, 1910 : 558 ; Kemp, 1915 : 221, 1918 : 227 ; Gravely, 1927 : 148; Gordon, 1934 : 10; Tweedie, 1937 : 141, fig. 1a ; Sakai, 1939 : 616 ; Pillai, 1951 : 28 ; Chhappgar, 1957b : 508, pl. 13, figs. j-n.

Gelasimus lacteus Krauss 1843 : 14, 39 ; H. Milne Edwards, 1852 : 150 ; Stimpson, 1858b : 100 ; Ortmann, 1894 : 759 ; Alcock, 1900 : 355 ; Stimpson, 1907 : 108 ; Shen, 1940 : 231 ; Lin, 1949 : 26.

Gelasimus porcellanus White, 1847a : 36 ; Adams and White, 1848 : 50 ; H. Milne Edwards, 1852 : 151.

Uca annulipes Ortmann, 1897 : 354 ; Nobili, 1906a : 312; Borradaile, 1910 : 408 ; Kemp, 1915 : 221; Laurie, 1915 : 416 ; Maccagno, 1928 : 35, fig. 20 ; Miyake, 1936 : 511 ; Estampador, 1937 : 542 ; Miyake, 1939 : 190, 222, 241, pl. 16, fig. 2; Sakai, 1939 : 616; Chace, 1942 : 202 ; Stephensen, 1945 : 189, 210; Buitendijk, 1947 : 280 ; Barnard, 1950 : 97 ; Estampador, 1959 : 100 ; Sankarankutty, 1961a : 113; Forest et Guinot, 1961 : 141 ; Soemodihardjo, 1987 : 103.

Gelasimus annulipes var. *lacteus* Ortmann, 1894 : 759.

Uca lactea Ortmann, 1897 : 355 ; Stebbing, 1910 : 327 ; Tesch, 1918 : 39 ; Maccagno, 1928 : 29, fig. 15; Kellogg, 1928 : 356 ; Gordon, 1931 : 528 ; Miyake, 1936 : 511 ; Sakai, 1939 : 618; Miyake, 1939 : 222, 242; Buitendijk, 1947 : 280; Barnard, 1950 : 96 ; Jayewardene, 1987 : 224.

Uca (Celuca) lactea lactea Crane, 1975 : 300, pls. 40A-B, figs. 19A, 54J-JJ; Sakai, 1976 : 608, pl. 209, fig. 1.

Material examined : North Andaman : 10♂♂, 6♀♀, Mayabunder, 8.3.1987 ; 2♂♂, 1♀, Stewart Island, 11.3.1987. Middle Andaman : 3♂♂, Uttara Jetty, 20.7.1979 ; 1♂, Uttara Jetty, 23.7.1979 ; 15♂♂, 4♀♀, Betapur, 12.3.1987; 2♂♂, Bakultala, 14.3.1987 ; 3♂♂, 1♀, Pitcher Nallah, 15.3.1987; 1♂, Panchawati, 15.3.1987; 11♂♂, Uttara Jetty, 17.3.1987 ; 1♂, 1♀, Rangat, 24.3.1987. South Andaman : 2♂♂, 2♀♀, Chidyatapu, 12.7.1978; 2♂♂, 2♀♀, Baratang Island, 17.7.1979; 3♂♂, Wandoor, 23.12.1979; 4♂♂, Rutland Island, 22.1.1982; 1♂, Komio, 5.10.1982; 1♀, Carbyn's Cove, 8.5.1984; 1♂, 1♀, Manjeri, 11.11.1984; 1♂, 1♀, Gandhi Ghat Jetty, 27.7.1985; 2♂♂, Guptapara, 7.8.1985 ; 3♂♂, Bambooflat, 27.2.1987; 16♂♂, 3♀♀, Baratang Island, 21.3.1987; 1♂, Havelock Island, 27.3.1987; 2♂♂, Neill Island, 28.3.1987. Little Andaman : 3♂♂, 3♀♀, Hut Bay Jetty, 24.2.1982 ; 4♂♂, 2♀♀, South Bay, 4.3.1982.

Measurement : W = 16.0 mm, F = 2.0 mm, L = 9.0 mm.

Diagnosis : Front broad. A predistal triangular tooth on pollex of the major cheliped in male.

Description

Carapace : Deep, subquadrilateral, much broader than long, regions not well marked. Antero-lateral angles acute, claw-like, produced diagonally outwards.

Front : Broad, 1/8th of the greatest breadth of carapace, free edge smooth.

Lateral borders : Antero-lateral borders almost straight, converging. Dorso-lateral margin moderately converging, extending beyond the level of second walking leg and finely beaded.

Orbits : Sinuous, oblique, their upper borders smooth ; lower border finely crenated in inner half, the crenellations increasing in size near antero-external angle.

Chelipeds : Major cheliped—Outer surface of arm, wrist and palm smooth to the naked eye. Antero-dorsal margin of arm marked by a cluster of tubercles at its distal portion. Inner surface of wrist denticulate. Upper border of palm about half the length of dactylus; inner surface of palm with oblique tuberculate ridge. Dactylus hook-like, compressed, wider than pollex at its base, its tip pointing downwards; pollex also compressed, slightly curved upwards, shorter than dactylus and truncated at the distal end owing to the presence of a tooth near the tip; outer and inner surfaces of dactylus and pollex, their upper and lower borders studded with microscopic granules. Cutting edge of both the fingers dentate. Fingers leaving a wide gap when closed.

Minor cheliped—In minor cheliped, gape of male feebly serrated, without enlarged tooth; dorsal and ventral surfaces of dactyl and pollex with few scattered setae, their distal ends with a brush of setae; gape of female smooth and devoid of setae.

Legs : Joints stout. Merus of last pair of legs not foliaceous but markedly slender. Dactylus claw-shaped, fringed with hair on both sides. Few scattered long bristles present on the ventral part of merus and on both sides of propodus.

Abdomen : Same as in the preceding species.

Male pleopod : Anterior process longer and wider than the posterior, thumb ending below the flange base.

Type locality : Japan (de Haan).

Distribution : Indo-West Pacific. India : East coast : Sundarbans (West Bengal) ; Chilka Lake (Orissa) ; Chennai, Gulf of Mannar (Tamil Nadu) ; Pondicherry ; Aberdeen bay, Bimlitan, Mayabunder (Andaman Islands) ; Nicobars. West coast : Gulf of Kachchh (Gujarat) ; Umarsadi, Kolak, Mumbai (Maharashtra) ; Karwar (Karnataka) ; Travancore (Kerala). Elsewhere : South Africa, East Africa, Madagascar, Mauritius, Red Sea, Persian Gulf, Pakistan, Mergui Archipelago, Malay Peninsula, Singapore, Thailand, East Indies, Philippines, China, Japan, Ryukyu Island, New Guinea, Australia, New Caledonia and Samoa.

Remarks : The specimens examined agree well with the descriptions of Alcock (1900) and Crane (1975). This species was earlier reported from Andaman mangroves as *Uca lactea lactea* by Das and Dev Roy, 1989 following Crane (1975).

Subfamily DOTILLINAE Stimpson, 1858

Dotillinae Stimpson, 1858b : 98 ; Manning and Holthuis, 1981 : 192.

Diagnosis : Carapace very deep, subglobose or quadrilateral in outline. Front narrow, deflexed, often a mere lobe. Lateral borders with or without tooth. Antennular flagellum rudimentary, almost folding vertically, remaining concealed under the front, interantennular septum broad. Orbits shallow. Buccal cavity large, often enormous, entirely closed by the external maxillipeds. Chelipeds equal or subequal in both sexes. A conspicuous membranous area known as "tympana" present on the merus of the legs, sometimes on chelipeds and on some of the sternal segments. Legs slender, long; no hairy recess between bases of second and third pair of legs.

Genus *Dotilla* Stimpson, 1858

Doto de Haan, 1835 : 24 ; H. Milne Edwards, 1837 : 38, 1852 : 152.

Dotilla Stimpson, 1858b : 98 ; Alcock, 1900 : 363.

Type species : *Cancer sulcatus* Forskål, 1775, by monotypy; gender : feminine.

Diagnosis : Carapace deep, subcubical or subglobose, as long as broad or broader than long, dorsal and lateral surfaces curiously sculptured resembling brain-convolutions. Front narrow, deflexed. Lateral borders with or without tooth. Antennae with short flagellum. Antennular flagellum rudimentary, almost vertically folded and hidden under the front. Orbits shallow ; eye-stalks long, slender; eyes terminal. Buccal cavity enormous, suboval or subcircular; external maxillipeds very large, completely covering the buccal cavity as a strong hemispherical bulge. Chelipeds equal in both sexes; fingers slender, acute, slightly deflexed and without any prominent tooth. Legs moderate not much variable in length ; upper surface of meri of leg joints and chelipeds with a characteristic oval membranous space or "tympanum", similar space often occurring on some of the segments of the sternum. Abdomen consisting of 7 segments in both the sexes, distal end of fourth segment thickly fringed with setae, fifth segment not constricted in male.

Distribution : Indo-Pacific.

48. *Dotilla myctiroides* (H. Milne Edwards, 1852)

(Pl. 5, Fig. 2; Pl. 15, Figs. 7, 8)

Doto myctiroides H. Milne Edwards, 1852 : 152, pl. 4, fig. 24.

Dotilla myctiroides Stimpson, 1858b : 98; Walker, 1890 : 111; Alcock, 1900 : 368 ; Laurie, 1906 : 426; Kemp, 1915 : 227, figs. 8a-b ; Tesch, 1918 : 43 ; Kemp, 1919a : 326 ; Gravely, 1927 : 149 ; Tweedie,

1937 : 147 Pillai, 1951 : 29 ; Chhapgar, 1957b : 511, pl. 14, figs. g-j; Sankarankutty, 1961a : 114, figs. 3D-E, 4A Vogel, 1984 : 226.

Scopimera myctiroides Henderson, 1893 : 390 ; Lanchester, 1900 : 760.

Material examined : North Andaman : 2♂♂, 1♀, Aereal Bay, 6.3.1987 ; 15♂♂, 9♀♀, Mayabunder, 9.3. 1987; 1♂, 2♀♀, Austin IX, 10.3.1987. South Andaman : 1♂, Chidyatapu, 3.12.1980; 3♀♀, Carbyn's Cove, 7.1.1981.

Measurement : W = 7.0 mm, F = 1.0 mm, L = 8.0 mm.

Diagnosis : No sculpture on carapace excepting the lateral grooves. Chelipeds at least three times the length of carapace. Tympanum present on all segments of sternum.

Description

Carapace : Almost as long as or little longer than broad and subcubical in shape, its upper surface faintly grooved, antero-lateral parts granular.

Front : Extremely narrow, deflexed and grooved. A groove running parallel with each of the lateral margins and a second longitudinal groove, slightly fainter than the preceding one, also running in parallel with the upper one.

Lateral borders : Strongly divergent backward. Sidewalls of carapace sculptured anteriorly with grooves resembling "brain convolution"

Orbits : Very oblique and shallow, almost rudimentary.

External maxillipeds : Merus of the external maxillipeds finely granular, almost twice as big as the ischium. A faint groove running parallel anteriorly with its outer border.

Chelipeds : Stouter than legs, all of their joints long, slender and unarmed; fingers slender, pointed, longer than the palm, little deflexed and without any prominent tooth on their cutting edges.

Legs : Joints long, outer surface of meropodites conspicuously dilated with a curious membranous area known as "tympanum" Dactylus long, slender; propodus shorter than dactylus in the last pair of legs.

Abdomen : Consisting of 7 separate segments and fringed with hairs, sixth segment of male abdomen longer than broad. Tympanum on either side of the last four thoracic sterna.

Male pleopod : Short, stout appendage with a rounded tip, apex hairy.

Type locality : Mahe, Seychelles (H. Milne Edwards).

Distribution : Indo-West Pacific. India : East coast : Chilka Lake (Orissa); Ennore, Palk Bay, Gulf of Mannar (Tamil Nadu) ; Aberdeen Bay (Andaman Island). West coast : Mumbai

(Maharashtra) ; Panaji, Marmagao (Goa); Karwar (Karnataka); Mahe (Pondicherry) ; Travancore (Kerala). Elsewhere : Seychelles, Sri Lanka, Tenasserim coast, Mergui Archipelago, Malay Peninsula, Singapore, Indonesia and Philippines.

Remarks : Original description of the species by H. Milne Edwards (1852) is very brief. The specimens in general agree well with the description of Alcock (1900). It has been observed in the present materials that (1) all segments of the chelipeds are microscopically granular, outer surface of palm and chelipeds are carinated and cutting edges of the fingers are feebly serrated and (2) propodus and dactylus of all leg segments are fringed with hairs.

Subfamily MACROPHTHALMINAE Dana, 1851

Macrophthalminae Dana, 1851b : 186, 1852b : 312 ; Miers, 1886 : 237 ; Ortmann, 1894 : 741 ; Alcock, 1900 : 290, 294, 372 ; Tesch, 1918 : 57 ; Sakai, 1939 : 611 ; Crosnier, 1965 : 121 ; Barnes, 1967 : 200 ; Glaessner, 1969 : R530 ; Sakai, 1976 : 609.

Diagnosis : Carapace rectangular, broader than long, moderately flat, not very deep; regions well marked. Front variable but never very broad. Antennules folding transversely, their flagellum well developed, inter antennular septum very narrow. Eye-stalks usually elongate. External maxillipeds leaving somewhat wide median hiatus. Chelipeds usually subequal. No special recess between bases of any of the legs.

Genus *Macrophthalmus* Desmarest, 1823

Macrophthalmus Desmarest, 1823 : 144 ; de Haan, 1834 : 26 ; Ortmann, 1897 : 340 ; Alcock, 1900 : 375 ; Tesch, 1915 : 149 ; Sakai, 1939 : 611, 623 ; Barnard, 1950 : 101 ; Crosnier, 1965 : 122 ; Barnes, 1967 : 201 ; Glaessner, 1969 : R530 ; Sakai, 1976 : 609.

Type species : *Goneplax transversus* Latreille, by selection by H. Milne Edwards, 1841 ; gender : masculine.

Diagnosis : Carapace depressed, broader than long; regions well outlined, cervical and branchial grooves markedly prominent both on the dorsum of the carapace and on the lateral borders. Front narrow, deflexed. Lateral borders cut out in two distinct teeth or lobes. Basal antennal joint short, flagellum of good length. Antennules folding transversely. Orbits and eye-stalks very long. Epistome very short from front to back. Buccal cavity rather large, somewhat curved anteriorly. Chelipeds equal or subequal, much enlarged in male, shorter and slenderer in female, fingers of both sexes curiously deflexed, bent or curved inwards distally. First and last pair of legs usually short and slender compared to second and third pairs; third pair longest and stoutest, fourth pair shortest and weakest of all; dactylus broad, stout and laterally compressed in all the legs. No brushes of hairs between bases of the legs. Abdomen in both sexes consisting of 7 distinct segments, male abdomen narrower at base than the breadth of the sternum.

Distribution : Indo-West Pacific.

Remarks : The genus *Macrophthalmus* is divided into six subgenera (Barnes, 1967), but the crabs belonging to only two subgenera, namely, *Macrophthalmus* Latreille, 1829 and *Mareotis* Barnes, 1967 have been found to occur in the mangroves of Andaman Islands.

Subgenus *Macrophthalmus* Latreille, 1829

Macrophthalmus Latreille, 1829 : 44 ; Barnes, 1967 : 202, 205; Sakai, 1976 : 610.

Diagnosis : Carapace very broad and marked with two prominent granular eminences on either side of the branchial region. Lateral teeth narrow and pointed strongly. Eye-stalks extending to tip of or projecting beyond the external orbital angle. Outer surface of palm of both the chelipeds in male bearing a prominent longitudinal ridge close to and parallel with the lower margin. Male abdomen broad compared to its length.

49. *Macrophthalmus (Macrophthalmus) convexus* Stimpson, 1858

(Pl. 5, Fig. 3 ; Pl. 16, Figs. 1, 2)

Macrophthalmus convexus Stimpson, 1858b : 97, pl. 13, fig. 2; Miers, 1880 : 307 ; Haswell, 1882 : 89 ; Ortmann, 1897 : 343 ; Alcock, 1900 : 378 ; de Man, 1902 : 493, pl. 19, figs. 6, 6a; Tesch, 1915 : 175, pl. 7, fig. 8; 1918 : 59 ; Kemp, 1919b : 389; Balss, 1922 : 145; Tweedie, 1937 : 163; Sakai, 1939 : 625; Sankarankutty, 1961a : 116, fig. 1B; Soegiarto, 1984 : 74; Soemodihardjo, 1987 : 103.

Macrophthalmus inermis A. Milne Edwards, 1867 : 286, 1873b : 277, pl. 12, fig. 5.

Macrophthalmus (Macrophthalmus) convexus Barnes, 1967 : 211, pl. 1, fig. 3; Sakai, 1976 : 613, fig. 336.

Material examined : South Andaman : 1♂, Chidyatapu, 3.12.1980; 2♂♂, 1♀, Chidyatapu, 29.7.1981.

Measurement : W = 24.0 mm, F = 2.5 mm, L = 12.0 mm.

Diagnosis : Carapace with two conspicuous granular eminences on either side of the branchial region. Lateral teeth narrow, acute. A distinct longitudinal ridge on outer surface male cheliped.

Description

Carapace : Rectangular, flat, smooth to the naked eye but studded with pearl-like granules near the lateral margins, its length about half of the greatest breadth of carapace. Gastric area well outlined by a deep groove. Carapace with two distinct granular eminences on both sides of the branchial region behind the branchial groove.

Front : Deflexed, very narrow, its free edge faintly bilobed.

Lateral borders : Slightly convergent posteriorly, beaded and cut anteriorly into 3 acute teeth; first tooth most conspicuous, spine-like, directed diagonally and much the largest, second recognizable, third tooth very minute.

Orbits : Considerably long, oblique. Upper orbital border finely crenulated, lower border elegantly serrated. Eye-stalk long, slender and curved; eyes terminal reaching upto the extreme end of the orbital trench.

External maxillipeds : Suture between ischium and merus of external maxillipeds strongly oblique, a distinct gap between these two appendages even when their flagellum folded.

Chelipeds : Longer and stouter in male, shorter and slenderer in female. Outer surface of arm, wrist and palm finely granular. Arm triangular, its inner border crenulated and fringed with hairs, other borders granular. Inner angle of wrist adorned with a few spinules. Both upper and lower borders of palm finely granular, a fine raised granular line running along the outer surface of the palm in parallel with the lower border ; inner surface of palm studded with microscopic granules. Fingers short, strongly curved like a hook and thickly coated with hair at their inner surfaces; dentary edge of dactylus armed with a molariform tooth, fixed finger also bearing a large prominent tooth at the middle.

Legs : Second and third pair of legs remarkably long and strong, first and fourth pair shorter and slenderer. Anterior and posterior border of meropodites (excepting the last pair) serrated ; legs unarmed but for a subterminal spine on the anterior border of meropodites of first, second and third pair. Dactylus long, slender, curved and claw-shaped.

Abdomen : Consisting of 7 distinct segments in both the sexes.

Male pleopod : Stout, slightly curved with a small angular projection at the distal corner, densely setose at the apex and along the outer borders.

Type locality : Loo Choo Island (Stimpson).

Distribution : Indo-West Pacific. India : East coast : Palk Bay, Gulf of Mannar (Tamil Nadu); North Bay (Andamans). Elsewhere : Red Sea, Mauritius, Malay Peninsula, Indonesia, Gulf of Thailand, Loo Choo Island, East Indies, Australia and as far as Hawaii.

Remarks : The specimens examined agree well with the description of Alcock (1900) although they differ from Alcock (*op. cit.*) as follows : (1) the specimens in the present collection are slightly bigger in size than those of Alcock, and (2) in the presence of a subterminal spine on anterior border of merus of first pair of leg in addition to second and third pairs. They differ from Sankarankutty (1961a) in the arrangement of hairs on first male pleopod.

In the present specimens anterior border of merus, carpus and both the borders of propodus and dactylus of last pair of leg are fringed with long hairs. A female specimen (carapace breadth 21.0 mm) has been found to be infested with bopyrid parasite. This species was earlier recorded from Andaman mangroves under the name *Macrophthalmus convexus* (Das and Dev Roy, 1989) following Alcock (1900).

Subgenus *Mareotis* Barnes, 1967

Mareotis Barnes, 1967 : 203, 213; Sakai, 1967 : 610.

Diagnosis : Carapace narrow, with no eminence on its surface. Lateral teeth very broad, rectangular. Eye-stalks not projecting beyond the tip of the external orbital angle. No longitudinal ridge on palm of larger cheliped in male. Male abdomen narrow compared to its length.

50. *Macrophthalmus (Mareotis) depressus*, Rüppell, 1830

(Pl. 5. Fig. 4 ; Pl. 16, Figs. 3, 4)

Macrophthalmus depressus Rüppell, 1830 : 19, pl. 4, fig. 6; H. Milne Edwards, 1837 : 66, 1852 : 159 ; Heller, 1861 : 362 ; de Man, 1888 : 124 ; Henderson, 1893 : 389 ; de Man, 1895 : 578 ; Ortmann, 1897 : 341, 342; Alcock, 1900 : 380; Nobili, 1906a : 155, 1906b : 318 ; Tesch, 1915 : 196, pl. 9, fig. 13; Kemp, 1919b : 392 ; Gravely, 1927 : 150 ; Stephensen, 1945 : 191, fig. 58A ; Chhapgar, 1957b : 514, pl. 15, figs. e-g; Crosnier, 1965 : 133, fig. 243 ; Jayewardene, 1987 : 224.

Macrophthalmus (Mareotis) depressus Barnes, 1970 : 226, figs. a-b.

Material examined : Middle Andaman : 2♂♂, 1♀, Yereta Jetty, 24.3.1987. South Andaman : 1♀, Chidyatapu, 3.12.1980 ; 4♂♂, Baratang, 20.3.1987.

Measurement : W = 17.0 mm, F = 2.0 mm, L = 12.0 mm.

Diagnosis : No granular eminence on carapace. Lateral teeth very broad, rectangular. Male cheliped without any longitudinal ridge on its outer surface.

Description

Carapace : Rectangular, broader than long; deep in male, depressed in female. Surface of carapace studded with minute granules excepting the central gastric region, not visible to the naked eye. Epibranchial region marked with two nearly parallel obliquely longitudinal, finely granulated lines, of which inner one fainter.

Front : Narrow, deflexed, about 1/8th the greatest breadth of carapace, furrowed deeply in the middle but not bilobed; its free edge straight, granular.

Lateral borders : Parallel, antero-lateral angles truncated, cutting into one small and two large lobes; first lobe large, quadrangular and broad; second largest, broad, rectangular and separated from the preceding one by a deep, wide U-shaped incision; third lobe smallest, margins of the lobes beaded with rounded granules.

Orbits : Upper orbital border slightly sinuous and little sloping backwardly, its margin studded with round granules; lower border finely and evenly denticulate. Eye-stalk long, slender; eyes extending almost to the end of orbital trenches.

External maxillipeds : Suture between ischium and merus of external maxillipeds hardly oblique, a little gap left between these two appendages.

Chelipeds : Markedly unequal in opposite sex but almost equal in the same sex, very much long and stout in male. Outer surface of arm finely granular, inner surface densely coated with hairs, borders denticulate. Outer surface of wrist and palm smooth. Inner corner of wrist bearing tubercles. Upper and lower border of palm granular, inner surface not smooth, rather finely granular. Dactylus strongly curved, its upper border and outer surface granular, inner surface matted with dense hairs; a large rectangular, crenulated tooth present proximally on the dactylus in additions to rows of low, less distinct tooth extending from base to almost its tip. Fingers leaving a wide gap when closed, their tips hollowed and fringed with hairs.

Legs : Merus flattened. Surfaces of meri of all the legs tuberculate; their upper margins serrated and adorned with a subterminal spine, posterior border serrated distally. Dactylus long, claw-shaped and fringed with thick hairs.

Abdomen Consisting of 7 distinct segments in both sexes, abdomen and sternal segments with scattered hairs.

Male pleopod Straight and stout process, tip broad, covered with dense setae.

Type locality Unknown.

Distribution Indo-West Pacific. India East coast Palk Bay, Gulf of Mannar (Tamil Nadu); Pondicherry; Andaman Islands (present record). West coast Kolak, Mumbai (Maharashtra). Elsewhere East coast of Africa, Madagascar, Persian Gulf, Red Sea, Sri Lanka and Mergui Archipelago, Ryukyu Islands, Australia, Samoa and Hawaiian Islands.

Remarks The specimens agree in general with the original description of Rüppell (1830). They correspond well with Alcock's (1900) description excepting the following (1) the specimens examined are smaller in size than Alcock's (*op. cit.*), (2) anterior border of merus of all leg segments culminating with a subterminal spine and (3) dactylus of larger cheliped is not more than two-thirds the length of palm, rather it is much smaller. Further, scattered hairs have been observed on the lateral borders of carapace, inner surface of the joints of chelipeds and upper and lower borders of leg-joints. This species is reported for the first time from Andaman Islands.

Subfamily CAMPTANDRIINAE Stimpson, 1858

Camptandriinae Stimpson, 1858b : 106; Manning and Holthuis, 1981 : 193.

Diagnosis : Resembling Macrophthalminae closely except in the shape of male gonopod and merus of maxillipeds. Gonopod strongly recurved in male and merus of external maxillipeds as long as or longer than ischium, the distal two segments being slenderer in camptandriinae.

Genus *Leipocten* Kemp, 1915

Leipocten Kemp, 1915 : 243 ; Tweedie, 1937 : 162; Sakai, 1939 : 612, 635; Barnes, 1967 : 249 ; Sakai, 1976 : 619 ; Manning and Holthuis, 1981 : 207.

Type species : *Leipocten sordidulum* Kemp, 1915 ; by monotypy ; gender : neuter.

Diagnosis : Carapace subquadrilateral, little broader than long, slightly convex in both the directions; regional boundaries faintly indicated, surface tuberculate and hairy. Front moderately broad, deflexed and notched in the middle. Antero-lateral borders cut into one or two blunt lobes or teeth (excluding the orbitals), postero-lateral borders very short. Basal joint of antenna short and broad, flagellum lodged in the orbital hiatus. Antennules transversely folded. Orbits large and without any fissure or suture. Epistome very short, buccal cavity enormous and closed entirely by external maxillipeds. Chelipeds much larger in male than in female. Palm of female chela with a small but strong spine, fingers almost as long as palm, their cutting edges without any tooth; male chela stout, smooth for the most part with a molariform tooth on the cutting edges of its dactylus. Legs short, stout; merus more or less dilated with spiny tubercles on the lower border. Male abdomen consisting of 6 segments with first somite narrow, not reaching coxae of last legs, 2nd and 3rd abdominal somites fused.

Distribution : Indo-West Pacific.

51. *Leipocten sordidulum* Kemp, 1915

(Pl 5, Fig. 5 ; Pl. Figs. 5, 6)

Leipocten sordidulum Kemp, 1915 : 244, pl. 12, fig. 9; figs. 16, 20 ; Tweedie, 1937 : 162, fig. 7; Sakai, 1939 : 635, figs. 105a, b; Barnes, 1967 : 249; Sakai, 1976 : 619, figs. 339a, b; Manning and Holthuis, 1981 : 207, figs. 52a-f.

Material examined : South Andaman : 2♂♂, 4♀♀, Sippighat, 10.6.1980.

Measurement : W = 9.0 mm, F = 4.0 mm, L = 7.0 mm.

Diagnosis : Carapace tomentose and studded with pearl-like granules. Last pair of leg remarkably small.

Description

Carapace : Subquadrilateral, slightly convex in both the directions, surface covered with short hairs, mid-gastric and cardiac regions bare, almost smooth to the naked eye, gastric and cardiac regions faintly outlined; on denudation of hairs, surface appearing to be finely pitted with small (often enlarged) pearl-like granules variable in number and disposition.

Front : Deflexed, about half of the maximum breadth of carapace, its free edge smooth, straight and not projected beyond the orbital edge.

Lateral borders : Convex, curved denticulate or tuberculate and fringed with hairs. Postero-lateral borders shorter than the antero-laterals.

Orbits : Upper border of orbits slightly curved, crenulated; lower border evenly curved and also crenulated. Eye-stalk short, stout; cornea not swollen.

Chelipeds : Much larger and stouter in males than females, but equal in the same sex. Wrist swollen. Palm strongly tumid, its upper border crenulate, lower border smooth, inner surface of palm smooth; anterior border and upper half of palm coarsely granular in male. Fingers broad, about half of upper border of palm in male. Cutting edges of fingers feebly dentate, dactylus adorned with a strong molariform tooth; fingers leaving no gap when closed.

Legs : First three segments of legs short, stout, broad and tomentose, last pair remarkably small. Merus trigonal, almost as long as broad, upper border of merus bearing tubercles, lower border with spinules and tubercles, spinules of last pair much longer than the others. In females, upper and lower border of carpus strongly tuberculate, one or two tubercles much larger than the others. Dactylus strongly curved.

Abdomen : Male abdomen consisting of 6 segments and female abdomen 7-segmented. First four segments of male although made up of 4 distinct segments apparently forming a single immovable piece.

Male pleopod : Loop-like, twisted and curved with a spine-tipped process.

Type locality : India (Kemp).

Distribution : Indo-West Pacific. India : East coast : Chilka Lake (Orissa) ; Chennai (Tamil Nadu); Andaman Islands (present record). Elsewhere : Malay Peninsula, Singapore, Taiwan, Japan and Australia.

Remarks : The specimens agree well with the original description of the species by Kemp (1915). Tan and Ng (1994) reported that this species occurs in India and northern Penninsular Malaysia in non-mangrove habitats. But, the present materials have been collected from mangrove areas of South Andamans. This species is reported for the first time from Andaman Islands.

ECOBIOLOGY

Brachyuran crabs constitute one of the major components of the mangrove ecosystem. They occupy diverse ecological niches, such as, mudflats, rocks, log and stone crevices, burrows, tree holes, pneumatophores and puddles; some crabs also lead a commensal life with other benthic animals. The ecology and biology of mangrove inhabiting crabs are poorly known although there is enormous scope to study these aspects. Most of the ecological investigations carried out so far are concerned either with their abundance or zonation pattern within the mangrove swamps. But habitat ecology and breeding biology of these crabs including the commonly occurring ones is very inadequately known particularly from the Indian mangroves.

In this context, ecobiological investigations of mangrove inhabiting crabs of Andaman Islands have been taken up to fill up the lacunae. The present study is based mainly on the data collected from the field as well as through laboratory studies. This communication deals with field

observations on the habitat ecology of 51 species of mangrove inhabiting crabs of Andaman Islands supplemented by published records of various workers from other coasts. Records made on the distribution and abundance (especially with reference to the burrowing forms) of these crabs in mangrove shores have also been incorporated. Breeding pattern of some of the common crabs has been discussed in this treatise. For the sake of convenience, ecobiological studies have been dealt with separately under two major heads, namely, habitat ecology and breeding biology.

Brief notes on ecology and biology of mangrove crabs have been published by Marcgraf (1648), Rumphius (1705), Rathbun (1918, 1930), Irvine (1947), Tweedie (1937), Capart (1951), Monod (1956), Gauld (1960), Uschakov (1970), Manning and Holthuis (1981). The ecology of mangrove crabs of the Indo-Pacific has been discussed at length by Macnae (1968). Distribution and zonation pattern of crabs in mangrove swamps have been investigated by Verwey (1930), Warner (1969), Sasekumar (1974), Frith *et al.* (1976) and Macintosh (1984). Some of these studies project on the density and abundance of crabs. Warner (1967) studied the life-history of the mangrove tree crab, *Aratus pisoni* while Macintosh (1982) reported the breeding cycle of four species of crabs from mangrove habitats of Malaysia. Tan and Ng (1993) also dealt with in brief the ecology and biology of a mangrove dwelling leucosid crab species, *Praosia punctata*.

There is hardly any information on the ecobiological aspect of mangrove inhabiting crabs of India barring a single paper by Chakraborty *et al.* (1986), dealing with crabs from the mangrove ecosystem of Sundarbans. Laboratory reared larval stages of some crabs of Pichavaram mangroves have been studied and described by several workers (Krishnan and Kannupandi, 1987; Pasupathi and Kannupandi, 1986 ; Vijaykumar and Kannupandi, 1986). The first exhaustive study on the habitat ecology of crabs from Indian mangroves has been published by Das and Dev Roy (1989). This work includes habitat ecology of 23 species of crabs from the mangroves of Andaman Islands and distribution, zonation, quantitative studies and breeding pattern of some of those crabs.

HABITAT ECOLOGY

Habitat ecology of 51 species of crabs has been presented in Table 1. The following discussion encompasses other ecological observations and the numerical abundance of some crabs (especially the burrowing forms) made during the present investigation.

Matuta : Two species, namely, *Matuta banksii* and *M. lunaris* have been found to invade clean, sandy bottom areas of mangroves with high tide water. These are shallow water species living near the shore to a depth of 10-20 m.

Scylla : This genus is represented by a single species, *Scylla serrata* which lives in burrows of muddy creeks, channels or in puddles and also on the forest floor of *Rhizophora* spp. and *Bruguiera* spp. Their burrows are elliptical in shape, usually very deep having connection with

water level. Maximum diameter of the burrow recorded during the present investigation is 129 mm. The burrows may extend down to about 1.5 m from the surface. Average density of this crab is 1 m^{-2} (Das and Dev Roy, 1989) and the maximum density recorded is 3 m^{-2} . Maximum density of this species recorded from Sundarban and Malaysian mangroves are 1.20 m^{-2} (Nandi and Dev Roy, 1991) and 5.6 m^{-2} (Sasekumar, 1974). This crab is exported from these Islands.

Portunus : Two species, namely, *Portunus pelagicus* and *P. sanguinolentus* invades in those parts of the mangrove where there is clean water and sandy bottom. These are shallow water crabs occurring at 10-20 m depth and enter mangroves during the high tide.

Charybdis : Two species, such as, *Charybdis (Charybdis) helleri* and *C. (C.) orientalis* enter in such part of the mangroves where there is clean water and sandy bottom. Like the two previous species of *Portunus* they also occur at a depth of 10-20 and enter mangroves during the high tide.

Thalamita : This genus is represented by three species, namely, *Thalamita crenata*, *T. prymna* and *T. admete*. These crabs enter mangroves in large number during high tides. Their stranded individuals are often found under corals and rocks in soft or hard substratum where they take shelter at low tide. Quite a large number of these crabs are caught alongwith *Charybdis* spp. by the local inhabitants mainly from the mangrove swamps during high tide.

Actaeodes : This genus is represented by the species, *Actaeodes tomentosus* inhabiting rocky or coralline areas. These crabs are occasionally found in mangroves adjacent to coral reefs.

Atergatis : This genus is represented by two species, namely, *Atergatis floridus* and *A. integerrimus*, which are found in hard substratum in rocky and coralline areas. Of these, the former being more common. These crabs also occasionally invade mangroves adjacent to coral reefs.

Platypodia : This is represented by the species, *Platypodia cristata*. They are mostly found among corals but occasionally encroach nearby mangroves.

Leptodius : This genus is represented by two species, namely, *Leptodius exaratus* and *L. sanguineus*. Both the species are quite common among corals and rocks. These are occasionally found in Andaman mangroves, although these species are reported as prominent xanthoids in the mangrove creeks and sheltered pools in Somalia (Galil and Vannini, 1990).

Pilodius : This is represented by a single species, *Pilodius nigrocrinitus*, usually occurring in coralline habitat. However, this species often invades mangroves from adjacent coral reefs.

Pilumnus : It is represented by the species, *Pilumnus vespertilio*. This species has been found to be associated with the branching corals, especially the *Acropora* spp. The legs of *P. vespertilio* are adapted for clinging. They are occasionally found in mangroves adjacent to coral reefs.

Carpilius : This genus is represented by two species, namely, *Carpilius convexus* and *C. maculatus*. Both the species have been found in shallow creeks having coralline or rocky bottom surrounded by mangroves.

Baptozius : This genus is represented by the monotypic species, *Baptozius vinosus*. The average density of the species has been reported to be 1 m^{-2} (Das and Dev Roy, 1989) in the mangroves of these islands.

Epixanthus : This genus is represented by two species, namely, *Epixanthus dentatus* and *E. frontalis* in Andaman mangroves, the latter being more common. The first species, however, is much bigger in size and has always been found associated with mangrove logs.

Lydia : This genus is represented by the species, *Lydia annulipes* which is mostly found among corals and stones. This species also invades mangroves occasionally.

Eriphia : Only one species of this genus, *Eriphia sebana* occurs in the mangroves of these islands. This species is, however, common in rocky substratum.

Ocypode : This genus is represented by the species, *Ocypode ceratophthalma* which is essentially a sand dweller. This crab has been found to invade mangrove zones during high tide especially at night. They make burrows in sandy flats and muddy sand areas adjacent to the mangroves between the High Water Spring Tide (HWST) and High Water Neap Tide (HWNT). Burrows of adult crabs are circular at the top, their diameter may extend up to 75 mm. The burrows are usually deep, often descending more than a meter from the surface. Burrows of the juveniles are found in the lower shore areas wetted by all tides, their depth ranging from 8 cm to 25 cm. *O. ceratophthalma* is a nocturnal species, but their juveniles are seen during the day. Average density of adult crabs has been found to vary from 1 to 3 m^{-2} and the maximum density recorded is 7 m^{-2} . This species has been reported to occur in hundreds near the edge of water in sandy beach fringed with mangroves at Neill Island, South Andaman (Das and Dev Roy, 1989).

Uca : Four species of *Uca*, namely, *Uca dussumieri*, *U. tetragonon*, *U. vocans* and *U. lactea* occur in the mangroves of these islands. The distribution of these crabs in the mangroves has been found to vary from place to place even in the same island depending upon local environmental conditions. The distribution of the "narrow-front" fiddler crabs such as *Uca dussumieri*, *U. tetragonon* and *U. vocans* and the "broad-front" fiddler crab, *Uca lactea* is very interesting. Members of the broad-front fiddler crab being the most terrestrial of all the fiddler crabs occupy higher level on the shore (up to Extreme High Water Spring) than the narrow front fiddler crabs which are less advanced towards a terrestrial existence. In general, *U. dussumieri* is confined to damp muddy substrates in relatively shaded situations although this crab may also be found in unshaded areas (Das and Dev.Roy, 1989) but only occasionally. The association of this crab with shade is related to its lower temperature tolerance and higher transpiration rate (Edney, 1962).

In general, *Uca vocans* is found near low water mark although its range extends from Mean Low Water Neap (MLWN) to Mid Tide Level (MTL). The distribution of *U. vocans* to lower tide level in open areas has been found to be related to its lower temperature tolerance (Edney, (1962). That is why, *U. vocans* is confined to such areas which are inundated regularly by tides and the substratum remains sufficiently moist to reduce the heat exposure. The third narrow-front crab, namely, *U. tetragonon* is found in shores where a thin layer of coarse muddy sand covers firm substrates of coral and shelly conglomerates. Such habitat is in many respects sheltered from the rigours of the intertidal zone and reduce stresses such as desiccation and thermal fluctuation. It is very difficult to catch this species of crab as they immediately disappear into their burrows which are usually located in the crevices of dead corals. This is to mention here that Crane (1975) recorded this crab "always" in regions rich in living corals. The burrows of this crab may also be found among the stilt roots of *Rhizophora* spp., pneumatophores of *Sonneratia* spp. and knee roots of *Bruguiera* spp. where the substratum becomes firm due to the tangle of mangrove roots under the muddy sand. This species has been recorded in shady areas, e.g., at Chidyatapu, South Andaman (Das and Dev Roy, 1989) as a sympatric associate of *U. dussumieri*. This species has also been observed in open areas of Neill Island. It can withstand high temperature confirming Crane's observation (1975). During the present investigation, the burrows of these crabs were noticed within the range of Mid Tide Level (MTL) to Mean High Water Neap (MHWN) whereas Crane (*op. cit.*) found these crab always near the low tide level (LTL).

The only broad-front fiddler crab *Uca lactea* was found to be distributed ubiquitously throughout the mangrove zone from landward to seaward. These crabs occur in muddy sand to sandy mud between EHWS and MLWN from open to relatively shaded areas and even in the drier areas of the substratum. However, they are always more abundant in unshaded areas clear of vegetation. The shaded conditions, such as, those found in mangrove forests are unsuitable for the social activities of this species (Crane, 1975). The ecological versatility as exhibited by this species is due to its ability to withstand high temperature and low transpiration rate (Edney, 1962). This enables it to feed from drier substrates to which its mouth parts are adapted (Frith and Brunenmeister, 1980).

The average density of *U. lactea* varies from 28 to 30 m⁻², 8-10 m⁻² in *U. dussumieri*, 18 to 20 m² in *U. vocans* and 3 to 5m⁻² in *U. tetragonon* and the maximum density recorded is 50 m² in *U. lactea*, 12 m⁻² in *U. dussumieri*, 34 m⁻² in *U. vocans* and 7 m⁻² in *U. tetragonon* in these islands. Maximum density of *U. dussumieri* as reported from Malaysian mangroves is 4 m² (Sasekumar, 1974).

Dotilla : The only species of this genus found in mangroves of these islands is *Dotilla myctiroides*. These crabs have often been found to co-exist with *Uca* at Carbyn's Cove. Average density of this species usually varies from 14 to 22 m⁻² and maximum density recorded is 33 m⁻². An extensive bed of this species was seen at Mayabunder, North Andaman at Mid Tide Level

(MTL). These crabs found only in open areas of mangroves and has never been seen under the vegetation cover of mangroves.

Macrophthalmus : Two species, namely, *Macrophthalmus (Macrophthalmus) convexus* and *M. (Mareotis) depressus* are found in the mangrove areas of these islands. The latter is more common in Andaman mangroves usually found around small pools of water. Macnae (1968) reported that this crab remains burried in moist sand during low tides and migrates up and down during spring and neap tides. Maximum density of *M. (M.) convexus* is reported to be 3 m^{-2} (Das and Dev Roy, 1989).

Leipocten : This genus is represented by the species, *Leipocten sordidulum*. In this species, males are found to be very rare.

Mictyris : This genus is represented by the species, *Mictyris longicarpus*. Like *Dotilla myctiroides*, this species also prefers unshaded areas of mangroves. Average density of this crab is found to vary from 12 to 14 m^{-2} and the maximum density recorded is 30 m^{-2} .

Grapsus : The only species of this genus observed to inhabit mangroves of these islands is *Grapsus albolineatus*. These crabs are very swift in movement on rocks and tree trunks. They climb up the stilt roots of mangrove up to a considerable height if chased.

Metopograpsus : Two species, namely, *Metopograpsus frontalis* and *M. oceanicus* occur in the mangroves. These crabs can move on rocks and absend trees with ease. *M. oceanicus* is a larger species and is more abundant than *M. frontalis* in the mangroves of these islands.

Sesarma : This genus is represented by two species, namely, *Sesarma (Chiromantes) bidens* and *Sesarma (Parasesarma) plicatum*. The average density of *S. (C.) bidens* and *S. (P.) plicatum* are 2 m^{-2} and 1 m^{-2} respectively and their maximum densities are 5 m^{-2} and 4 m^{-2} respectively in the mangroves of these islands.

Nanosesarma : This genus is represented by a single species, namely, *Nanosesarma andersoni*. As the name indicates, these crabs are very small in size. The average density of this crab is between 7 to 8 m^{-2} and the maximum density recorded is 15 m^{-2} in the mangroves of these islands.

Neoepisesarma : This genus is represented by two species, namely, *Neoepisesarma (Neoepisesarma) taeniolata* and *Neoepisesarma (Muradium) tetragonum* in Andaman mangroves. Their burrows are usually located at the bases of landward fringe of mangrove trees. Their average density varies from 1 to 2 m^{-2} and maximum density recorded for *N. (N.) taeniolata* from Andaman mangroves is 3 m^{-2} (Das and Dev Roy, 1989).

Sesarmops : This is represented by a single species, namely, *Sesarmops intermedium*. Their burrows are usually found towards landward fringe of mangroves. The diameter of their burrows varies from 30 to 40 mm. The burrows are circular at the top but spirally inside with 1 - 3 ends.

The burrows are 50 to 70 cm deep and descends upto the ground water level. Their burrows were abundantly seen (3-4 burrows per m^2) by the side of a newly constructed road at Block nos. 6 and 7 of Havelock Island (South Andaman) just above the High Tide Level (HTL).

Sesarmoides : This genus is represented by the species, *Sesarmoides longipes*. This species occurs in firmer substratum in mangroves of these islands. Maximum density of this crab is $4 m^{-2}$.

Metaplex : The genus is represented by three species, namely, *Metaplex crenulata*, *M. distincta* and *M. elegans* in the mangroves of these islands. The former species is the largest, usually occupying the shallow mangrove foreshores. The average density of this species is between $2-3 m^{-2}$ and its maximum density recorded is $12 m^{-2}$ (Das and Dev Roy, 1989). The density of this species is reported to be $2 m^{-2}$ in the mangroves of Malaysia (Macintosh, 1984) and $1 m^{-2}$ in Thailand (Frith *et. al.*, 1976). *M. crenulata* is reported to make tall, lipped chimney around its burrow in Malaysia (Macintosh *op. cit.*) but, no such structure has been observed during the present study. The other two species are much smaller in size. *Metaplex distincta* has been found to be quite abundant in mangrove-fringed mudflat especially around the small puddles containing water. Mention may be made that this species was reported as one of the rare species of brachyuran crustacea by de Man (1888). The third species, *M. elegans* is comparatively rare in the mangroves of these islands. This species has been found to prefer mangrove-fringed mudbanks and mudflats. Maximum density of the species recorded during the present investigation is $3 m^{-2}$. Density up to $15-25 m^{-2}$ of this species has been reported from Malaysia (Macintosh, 1984).

Metasesarma : It is represented by the species, *Metasesarma rousseauxii*. The species has been found to occur near supralittoral zone under stones, logs and timbers. The average density of this species varies from 1 to $2 m^{-2}$ (Das and Dev Roy, 1989) and the maximum density recorded from Andaman mangroves is $5 m^{-2}$.

Clistocoeloma : This genus is represented by the species, *Clistocoelma merguense* which occurs in soft and wet muddy substratum of mangroves. The average density of this species is $1-2 m^{-2}$ and the maximum density recorded is $3 m^{-2}$. The maximum density of this species recorded from Malaysian mangroves is $10.6 m^{-2}$ (Sasekumar, 1974) whereas Macintosh (1984) reported its average density to exceed rarely $4 m^{-2}$. According to Macintosh (*op. cit.*), the density figure of Sasekumar (*op. cit.*) is exceptionally high.

Cardisoma : This genus is represented by the species, *Cardisoma carnifex* which invades supralittoral region of the mangroves, often just above the high water mark. This crab excavates heaps of soil which look like a mound from the top, the basal part being widest in diameter (recorded upto 94.0 mm) which diminishes considerably (recorded upto 20.0 mm) as the height increases. The height of the castle in mangroves has been reported to vary from 0.5 to 1.0 m (Das and Dev Roy, 1989). The burrows are deep 1.5 to 2.0 m, arranged spirally and circular in cross-section tending to continue up to the water level. The castle building habit of this

Table 1. Habitat ecology of mangrove inhabiting crabs of Andaman Islands.

SL No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
1.	<i>Matuta banksii</i>	Sandy substratum	At Low Tide Level	Inhabits sandy beach, below Low Tide Level in Japan (Sakai, 1976).
2.	<i>Matuta lunaris</i>	Sandy bottom	At Low Tide Level	Occurs in sandy sublittoral zone of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986). Inhabits sandy beach between High and Low Tide Level at a depth varying from 10-15 metres in Japan (Sakai, 1976).
3.	<i>Scylla serrata</i>	In burrows at muddy banks of creeks, channels, puddles and within thickets of mangroves (especially forest floor of <i>Rhizophora</i> spp. and <i>Bruguiera</i> spp.)	Between High to Low Tide Level	Inhabits bottom of rivers and creeks surrounded by mangrove vegetation in Sundarbans (Chakraborty <i>et al.</i> , 1986) as well as in open mudflats or reclaimed mangrove areas (present record). Inhabits bottom of mud in estuary or river mouth near the shore in Japan (Sakai, 1976) ; at low water level in creeks or banks of creek, also in the <i>Bruguiera</i> or <i>Rhizophora</i> forests or among the pneumatophores of <i>Avicennia</i> and <i>Sonneratia</i> at the seaward fringe, often burrow at the landward fringe in Thailand (Naiyanetr, 1985).
4.	<i>Portunus pelagicus</i>	Muddy or sandy substratum	At Low Tide Level	Occurs in muddy bottom at sublittoral zone of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986). Inhabits bottom of sand or sandy mud at depths varying from 10-30 metres in Japan (Sakai, 1976).
5.	<i>Portunus sanguinolentus</i>	Muddy or sandy bottom	At Low Tide Level	From freshwater of Malay Archipelago (de Man, 1902). Inhabits muddy or sandy substratum or among broken shells of intertidal areas upto a depth of 30 metres in Japan (Sakai, 1976).
6.	<i>Charybdis</i> (<i>Charybdis</i>) <i>helleri</i>	Sandy or muddy substratum	Below Low Tide Level	Under rocks or stones, among live coral at a depth of 3-7 fathoms.
7.	<i>Charybdis</i> (<i>Charybdis</i>) <i>orientalis</i>	Under boulder and dead corals in or adjacent to mangroves	Between Mid to Low Tide Level	Among coral reefs in Sri Lanka (Laurie, 1906). Inhabits bottom of sand, pebbles or weedy rocks at depths varying from 10-30 metres in Japan (Sakai, 1976).
8.	<i>Thalamita crenata</i>	In mudflats, under dead corals and boulder in or near mangroves especially of <i>Rhizophora</i> and <i>Avicennia</i> groves.	Between Mid to Low Tide Level	Inhabits mud flats, under stones, boulders and mussel clumps or mud banks adjacent to mangroves, often among corals near the mainland of Australia (Stephenson and Hudson, 1957). Occurs in mudflats, sandy beach or mangroves in Japan (Sakai, 1976). Among algae in tidal pools, estuaries and mangroves of South India (Thomas <i>et al.</i> , 1980).

Sl. No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
9.	<i>Thalamita prymna</i>	In coral reefs or coral localities adjacent to mangroves or under stones, boulders and dead corals of mangroves	Between Mid to Low Tide Level	In coral localities of Australia, among reefs flats and coral shingles (Stephenson and Hudson, 1957). In rocky or sandy beach upto a depth of 20 metres in Japan (Sakai, 1976).
10.	<i>Thalamita admete</i>	Under stones and corals in mangrove areas especially of <i>Rhizophora</i> and <i>Avicennia</i> groves	Between Mid to Low Tide Level	Occurs in coral reefs at Gulf of Mannar (Laurie, 1906). Among coral reef, mussel clumps or under stones in Australia upto a depth of 7 fathoms (Stephenson and Hudson, 1957). In rocky beach or coral reef of Japan (Sakai, 1976).
11.	<i>Actaeodes tomentosus</i>	Among corals within or adjacent to mangroves	Between Mid to Low Tide Level	Among coral reefs in Australia (Ward, 1932). Inhabiting among corals of shallow water in Japan (Sakai, 1976).
12.	<i>Atergatis floridus</i>	Among corals or beneath boulders within or adjacent to mangroves	Between Mid to Low Tide Level	In hard substratum at or below Low Tide Level in Japan (Sakai, 1976).
13.	<i>Atergatis integerrimus</i>	Among corals or beneath boulders within or adjacent to mangroves	Between Mid to Low Tide Level	Among rocks in Mumbai (Chhappgar, 1957a).
14.	<i>Platypodia cristata</i>	Among coral or beneath boulders within or adjacent to mangroves	Between Mid to Low Tide Level	
15.	<i>Leptodius exaratus</i>	Among corals, under stones or in the crevices of rocks in or adjacent to mangroves	Between Mid to Low Tide Level	Among rocks in Mumbai (Chhappgar, 1957a). Inhabits rocky areas, among crevices or rocks or beneath stones between High and Low Water mark in Japan (Sakai, 1976).
16.	<i>Leptodius sanguineus</i>	Among corals, under stones or in the crevices of rocks in or adjacent to mangroves	Between Mid to Low Tide Level	Generally found under the slabs of conglomerate beach rock on sand of Australia (Ward, 1932). Occurs in rocky or stony areas, among crevices of rocks or below stones in Japan (Sakai, 1976).
17.	<i>Pilodius nigrocrinitus</i>	Among crevices of rocks, corals or beneath stones within or adjacent to mangroves	Between Mid to Low Tide Level	Among coral reefs, crevices of rocks or under stones of shallow waters of Japan (Sakai, 1976).
18.	<i>Pilumnus vespertilio</i>	Always associated with the branching corals mainly <i>Acropora</i> spp. within or adjacent to mangroves	Between Mid to Low Tide Level	Occurs under stone in Maldives (Borradaile, 1902-1903). Inhabits rocky shores of littoral zone in Philippines (Estampador, 1937). Among coral reef or rocky beach of shallow waters of Japan (Sakai, 1976).
19.	<i>Carpilius convexus</i>	Among corals of shallow water bordering mangroves	At or below Low Tide Level	Associated with masses of corals of the outer lagoon zone; each crab was generally found in compartments formed by the stems of corals in Australia (Ward, 1932). In coral reef or rocky beach of Japan at a depth between 5-35 metres (Sakai, 1976).

Sl. No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
20.	<i>Carpilius maculatus</i>	Among corals of shallow water bordering mangroves	At or below Low Tide Level	Beneath superficial layer or living corals in Australia (Ward, 1932). In coral reef or rocky beach of Japan at a depth of 5-35 metres (Sakai, 1976).
21.	<i>Baptozius vinosus</i>	Inhabits muddy bottom of mangroves swamps ; also occurs in sandy substratum beneath dead corals, stones and boulders	Between Mid to High Tide Level	Below stones near marshy swamps of Philippine Islands (Estampador, 1937). Inhabits mangroves or mudflats near river mouths of Japan (Sakai, 1976).
22.	<i>Epixanthus dentatus</i>	In crevices of mangrove logs riddled by marine borers.	Between Mid to High Tide Level	In the crevices of the eroding shores in Malay (Macnae, 1968). In woods confined to forest floor in mangroves of Malay Peninsula (Sasekumar, 1974). Among coral reefs in Japan (Sakai, 1976). In <i>Rhizophora</i> and <i>Sonneratia-Camptostemnon</i> zones of Australia (Hutchings and Recher, 1981).
23.	<i>Epixanthus frontalis</i>	Inhabits sandy areas generally under pebbles, stones or rocks	Between Mid to High Tide Level	Rocky areas of Mumbai (Chhappgar, 1957a). In stony or pebbly beach between High and Low Tide water marks of Japan (Sakai, 1976).
24.	<i>Lydia annulipes</i>	Among corals and stones in or within mangrove thickets	Between Mid to High Tide Level	In coral reefs or shallow waters in Japan (Sakai, 1976).
25.	<i>Eriphia sebana</i>	In hard substratum, among pebbles, stones and underneath of dead corals	Between Mid to Low Tide Level	—
26.	<i>Cardisoma carnifex</i>	In muddy areas of landward fringe of mangroves, often under roots and fallen logs or in castle-like mounds	Above High Tide Level, often extending up to the Superalittoral forest floor	In burrows under coconut tree near the edges of <i>Kuli</i> or swamps, the openings are often covered during High tide (Borradaile, 1902-1903). Occurs in sandy shores just above extreme High Water Mark, between it and that of spring tides in Thailand (Naiyanetr, 1985).
27.	<i>Grapsus albolineatus</i>	Usually among dead corals, rocks and boulders ; sometimes on tree trunks and crevices of mangrove trees and logs, often on surfaces of floating logs and rafts.	Between Mid to High Tide Level	In rocky beaches of High Water Mark of Japan (Sakai, 1976).
28.	<i>Metopograpsus frontalis</i>	Among corals and stones either adjacent to or within mangrove thickets. Associated with prop roots of <i>Rhizophora</i> on which they move with ease ; occasionally found near the edge of freshwater or in crevices of log, pneumatophore and knee root of mangroves perforated by marine borers.	Between Mid to High Tide Level	Inhabits firm muddy substratum of <i>Bruguiera</i> or <i>Rhizophora</i> forests in Australia and South East Asia, usually found in the crevices provided by knee roots, logs etc. (Macnae, 1968).

Sl. No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
29.	<i>Metopograpsus oceanicus</i>	Among dead corals and stones near to or within mangrove thickets. Often ascends prop roots of <i>Rhizophora</i> spp. and pneumatophores of <i>Sonneratia</i> spp.	Between Mid to High Tide Level	—
30.	<i>Sesarma (Chirromantes) bidens</i>	Open mudflats and forest floors covered by Spring Tides	At or near High Tide Level, often extending upto the Supralittoral Zone	Between Mid to High Tide Level of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986).
31.	<i>Sesarma (Parasesarma) plicatum</i>	Among root of mangroves specially of <i>Rhizophora</i> spp. and <i>Avicennia</i> spp., under stones or logs, often at the edge of freshwater	Between Mid to High Tide Level	Among rocks in Bombay (Chhapgar, 1957b).
32	<i>Nanosesarma (Beanium) andersoni</i>	In sqft substratum of Mangroves	Between Mid to High Tide Level	Recorded from burrows of dead bivalve namely, <i>Navaculina</i> sp. at Low Water Mark on the banks of Tenasserim river at Minthantoung, Mergui (de Man, 1888). Reported to occur in wood confined to streams in mangroves of Malay Peninsula (Sasekumar, 1974).
33.	<i>Neoepisesarma (Neoepisesarma) taeniolata</i>	Landward mangrove forests, especially thickets of the fern, <i>Acrostichum</i> spp., <i>Avicennia</i> groves and other mixed mangrove vegetation	High Tide Level to Supra-littoral Areas	Occurs in Mid and Supra-littoral zones of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986).
34.	<i>Neoepisesarma (Muradium) tetragonum</i>	Landward mangrove forests, especially near thickets of the fern, <i>Acrostichum</i> spp., <i>Avicennia</i> groves and other mixed mangrove vegetation	High Water Mark to Supra-littoral Zone	Inhabits soft to hard substratum, from High to Supra-littoral zone in Sundarban mangroves (Dev Roy, unpublished observations).
35.	<i>Sesarmops intermedium</i>	In semi-wet substratum of mangroves	At High Tide Level	In mangrove swamps of Zediwon, Mergui (de Man, 1888). In swamps or bushes close to seashore or river mouths of Japan (Sakai, 1976).
36.	<i>Sesarmoides longipes</i>	In semi-wet substratum of mangroves	Between Mid to High Tide Level	In hard substratum, among <i>Phoenix paludosa</i> in Sundarban mangroves (Chakraborty <i>et al.</i> , 1986).
37	<i>Metaplax crenulata</i>	Open mudflats bordering mangroves with soft well-drained substratum	At or near Low Tide Level	In mud banks devoid of large trees at Low Tide Water Zone of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986). Juveniles of this species usually occur near High Tide Level, often among mangrove thickets while the large specimens have always been observed in very soft, fluvial muddy areas of Low Tide Level (not very far from the water, inundated by all tides) in Sundarban mangroves (Dev Roy, unpublished observations). Inhabits soft but well drained mudflats of mangrove foreshore in Malaysia (Sasekumar, 1974 ; Macintosh, 1984).

Sl. No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
38.	<i>Mataplex distincta</i>	In small depressions of mudflats containing water in mangrove areas.	Between Mid to High Tide Level	—
39.	<i>Metaplex elegans</i>	Mudflats and creek banks of mangroves	Between Mean high Water Neap Tide and Mid Tide Level	Inhabits mud banks along seaward fringe of mangroves in Malaysia (Macintosh, 1984).
40.	<i>Metasesarma rousseauxii</i>	Under stones, logs and timbers	Supra-littoral areas	From a stream in Flores (de Man, 1892). At dry edges of mangrove swamps in Maldives (Borradaile, 1902-1903).
41.	<i>Clistocoeloma merguense</i>	In soft substratum of mangrove swamps ; burrows among the grasses	At or near High Tide Level	Inhabits muddy substratum of Sundarban mangroves (Dev Roy, unpublished observations). From a freshwater Stream of Kamachaung, on the east coast of Doung Island, Mergui Archipelago (Chopra and Das, 1937). Muddy bottom at or above High Water of Neap Tide in mangroves of Singapore (Berry, 1962). Reported to occur in logs of forest floor (Sasekumar, 1974) or in areas of mixed mangrove forest with little ground cover (Macintosh, 1984) in Malaysia. Very abundant in logs at High Tide Level in mangroves of Australia (Hutchings and Recher, 1982).
42.	<i>Mictyris longicarpus</i>	Inhabits soft bottom of mangrove swamps	At or near High Water Mark	In sandy mud between High Neap and Mean Sea Level in Australia (Snelling, 1959). Occurs in sandy areas or mudflats of sea inlets and river mouths of Japan (Sakai, 1976).
43.	<i>Ocypode ceratophthalma</i>	Sandy shores and muddy sand areas adjacent to mangroves	Between High Water Spring Tide and High Water Neap Tide	Inhabits sandy areas of upper littoral zone of Sundarban mangroves (Chakraborty <i>et al.</i> , 1986). In mangrove swamps of Sri Lanka (Laurie, 1906). In burrows close along the High Water Mark of the sandy shore of lagoon in Maldives (Borradaile, 1902-1903).
44.	<i>Uca dussumieri</i>	Open mudflat bordering mangroves and banks of the creeks with muddy to sandy substratum, sometimes among conglomerates of dead corals and shells (as in Chidyatapu, South Andaman). Also occur in shaded patches of mangroves especially <i>Rhizophora</i> spp.	Between Mid Tide Level and Mean High Water Neap Tide	—
45.	<i>Uca tetragonon</i>	Inhabits shaded areas of mangroves especially under the forest floor of <i>Rhizophora</i> spp. and <i>Bruguiera</i> spp. Occurs under crevices of stones, dead corals, especially among conglomerates of shells and	Between Mean High Water Neap Tide and Mid Tide Level	Associated with stony areas (Hartnoll, 1975) or silt and sand overlying dead coral (Crane, 1975).

Sl. No.	Name of the species	Habitat	Distribution/ Zonation	Remarks
		dead corals with muddy sand substratum at the bottom. Rarely in soft muddy substratum (Manjeri, South Andaman), often in open shores (Neill Island, S. Andaman)		
46.	<i>Uca vocans</i>	Open sandy mud to mud with soft bottom	Usually at low Tide Level, often extending upto Mid Tide Level	—
47.	<i>Uca lactea</i>	Open sandflats bordering mangroves ; also along banks of creeks ; occurs among sparsely distributed mangroves	Ubiquitously present between Extreme High Water Spring Tide and Mean Low Water Neap Tide	At the base of sand slopes to the landward side of mangroves in East Africa (Hartnoll, 1975).
48.	<i>Dotilla myctrioides</i>	Inhabits sandy substratum with little admixture of mud in or near mangroves. Burrows usually vertical or nearly vertical tubes, closely packed together. The entire substratum covered with pellets due to their activities during low tides.	Between Mid to High Tide Level	Inhabits muddy areas in Mumbai (Chhappgar, 1957b). Among coral reefs in Gulf of Mannar (Laurie, 1906).
49.	<i>Macrophthalmus (Macrophthalmus) convexus</i>	Swampy areas of mangroves	In areas covered by every high tide, usually around Mid Tide Level, sometimes down upto the level of Mean Low Water Spring Tide	Mangrove swamps, mudflats of river mouth or inland sea of Japan (Sakai, 1976).
50.	<i>Macrophthalmus (Mareotis) depressus</i>	In small pools containing water within mangrove areas	Between Mid to Low Tide Level	Inhabits sandy bottom of shallow creeks from Malaysia to Australia (Macnae, 1968). Occurs at mid to lower littoral areas of muddy shores in the Arabian Gulf (1994). Common in mangroves and mud flats of Bahrain (Jones 1985, 1986 ; Vousden, 1988, Sheppard et al, 1992), Madagascar (Crosnier, 1965), Mozambique (Macnae and Kalk, 1962), Tanzania (Hartnoll, 1975) and in Umm Al Quwaim, United Arab Emirates (Al-Ghais and Cooper, 1996)
51	<i>Leipocteen sordidulum</i>	Inhabits muddy substratum of <i>Rhizophora</i> forest	At High Tide Level	Among cavities in laterite blocks forming a seawall at Ennur backwaters near Channai, among barnacles growing on stone walls at High Tide Water mark (Kemp, 1915). Occurs among the root of mangroves (Tweedie, 1937). In muddy areas under stones, between Mean Sea Level and Low Water Neap in Australia (Snelling, 1959). Associated with wood in Malaysian mangroves (Sasekumar, 1974).

species has been reported from these islands by Silas and Sankarankutty (1960). They opined that castle building nature of the species is a seasonal one for its protection against tidal water and also against the intruders. The entrances of the castles are plugged during day time. But their presence can be ascertained by fresh layer of soft and wet mud which is added on the top. These crabs are nocturnal in habit; but occasionally they come out of their burrows during day time in cloudy weather.

BREEDING BIOLOGY

The breeding pattern of 18 species of brachyuran crabs under 12 genera and 8 families have been depicted in Text-figures 6 to 9. The details of the breeding pattern are discussed below.

Matuta lunaris (Forskål) : The reproductive cycle of this species is illustrated in text-figure 6A. Berried females are found throughout the year in the mangrove areas of these islands ; the peak period of activity is attained during March (70%). This species has been recorded as continuous breeder at Waltair coast (Rajabai, 1975). However, breeding females of this species have been encountered from September to March with peak period in November in West coast of India (Pillai and Nair, 1973).

Scylla serrata (Forskål) : Data regarding the breeding cycle of this crab is plotted text-figure 6B. In Andamans, ovigerous females have been found to occur throughout the year and the peak period of breeding activity has been recorded during September (71%) (Das and Dev Roy, 1989). Ovigerous females of this species have been recorded during November to April at Kakinada Bay with peak period of activity in December and February (Lalitha Devi, 1985). This species has been reported as a continuous breeder with peak breeding season in January at west coast of India (Pillai and Nair, 1973).

Portunus pelagicus (Linnaeus) : Reproductive cycle of this crab is illustrated in in Text-figure 6B. This species has been reported to be a continuous breeder in Andaman Islands (Das and Dev Roy, 1989) and the peak period of its activity is registered during January (65%). It breeds throughout the year at Tamil Nadu coast (Prasad and Tampi, 1952 ; Rahaman, 1967). Berried females of this species have been reported to occur in every month throughout the year at Kakinada Bay and the peak period is registered from September to December and in February (Lalitha Devi, 1985). This crab has been reported as irregular breeder in 'Bombay waters' (Chhappgar, 1959). However, this species breeds throughout the year at Batavia (Delsman and de Man, 1925).

Portunus sanguinolentus (Herbst) : Data regarding this species is depicted in Text-figure 6B. This species has been reported to be a continuous breeder in Andaman Islands (Das and Dev Roy, 1989) with maximum breeding activity during January (55%). It breeds from January to October at Waltair coast (Rajabai, 1975). This species breeds throughout the year at Kakinada Bay and its peak period of activity is during February (Lalitha Devi, 1985). The species is known to breed during February and March on the Malabar coast (Menon, 1952) and during December

and April along and Mangalore coast with peak activity from March to April (George and Nayak, 1961). These crabs have been reported as irregular breeders in 'Bombay waters' (Chhapgar, 1959). Spawning females occur all through the season along the South Kanara coast with peak activity in February and, April and May (Sukumaran *et al.* 1986). Rao *et. al.* (1973) have recorded its breeding period during February and April. Year round spawning of this species has also been reported by Ryan (1967) from Hawaii.

Thalamita crenata (Latreille) : Data regarding breeding cycle of this species has been illustrated in to Text-figure 7A. Ovigerous females occur throughout the year, the peak month being during October (66%). This species has been recorded as an annual breeder at Waltair coast and breeding females are reported during late winter (late November and December) (Rajabai, 1975).

Thalamita admete (Herbst) : Berried females of this species occur throughout the year, peak period being found during June (85%). The reproductive cycle of this crab has been depicted in Text-figure 7A. This species breeds from February to June at Waltair coast (Rajabai, 1975).

Leptodius exaratus (H. Milne Edwards) : Data regarding the breeding activity of this crab has been presented in Text-figure 7B. It breeds throughout the year at this locality. The peak month registered is March (50%).

Pilumnus vespertilio (Fabricius) : The breeding activity of this crab is illustrated in Text-figure 7B from which it is evident that the species breeds throughout the year in these islands. Its peak period has been recorded during November (64%).

Epixanthus frontalis (H. Milne Edwards) : Reproductive cycle of this crab is depicted in Text-figure 7B. This species has been reported to be a continuous breeder in Andaman Islands and the peak period being recorded during March (48%) (Das and Dev Roy, 1989).

Uca dussumieri (H. Milne Edwards) : Breeding cycle of this species has been presented in Text-figure 8A. Ovigerous females have been reported to occur all the year round. Peak breeding period for this species has been recorded during December (80%) (Das and Dev Roy, 1989).

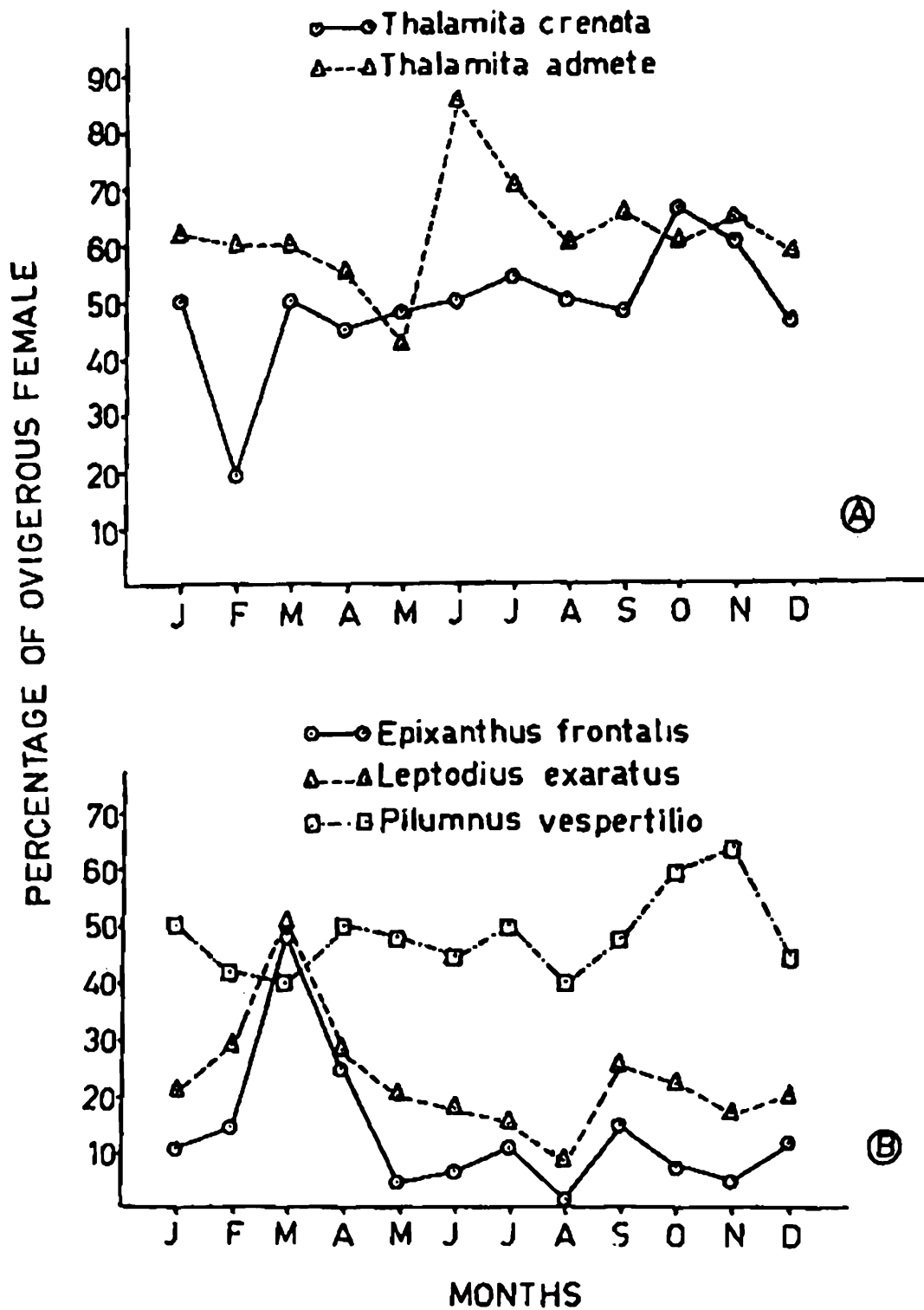
Uca tetragonon (Herbst) : The reproductive cycle of this crab has been depicted in Text-figure 8A. Ovigerous females of this species have been found to occur through all months of the year indicating that it is a continuous breeder in these islands. Maximum breeding activity of this species has been registered during October (82%).

Uca vocans (Linnaeus) : Data regarding breeding cycle of this species has been illustrated in Text-figure 8A. Ovigerous female of this species has been reported to occur throughout all the months of the year and its peak breeding activity has been registered in the month of September (92%) (Das and Dev Roy, (1989).

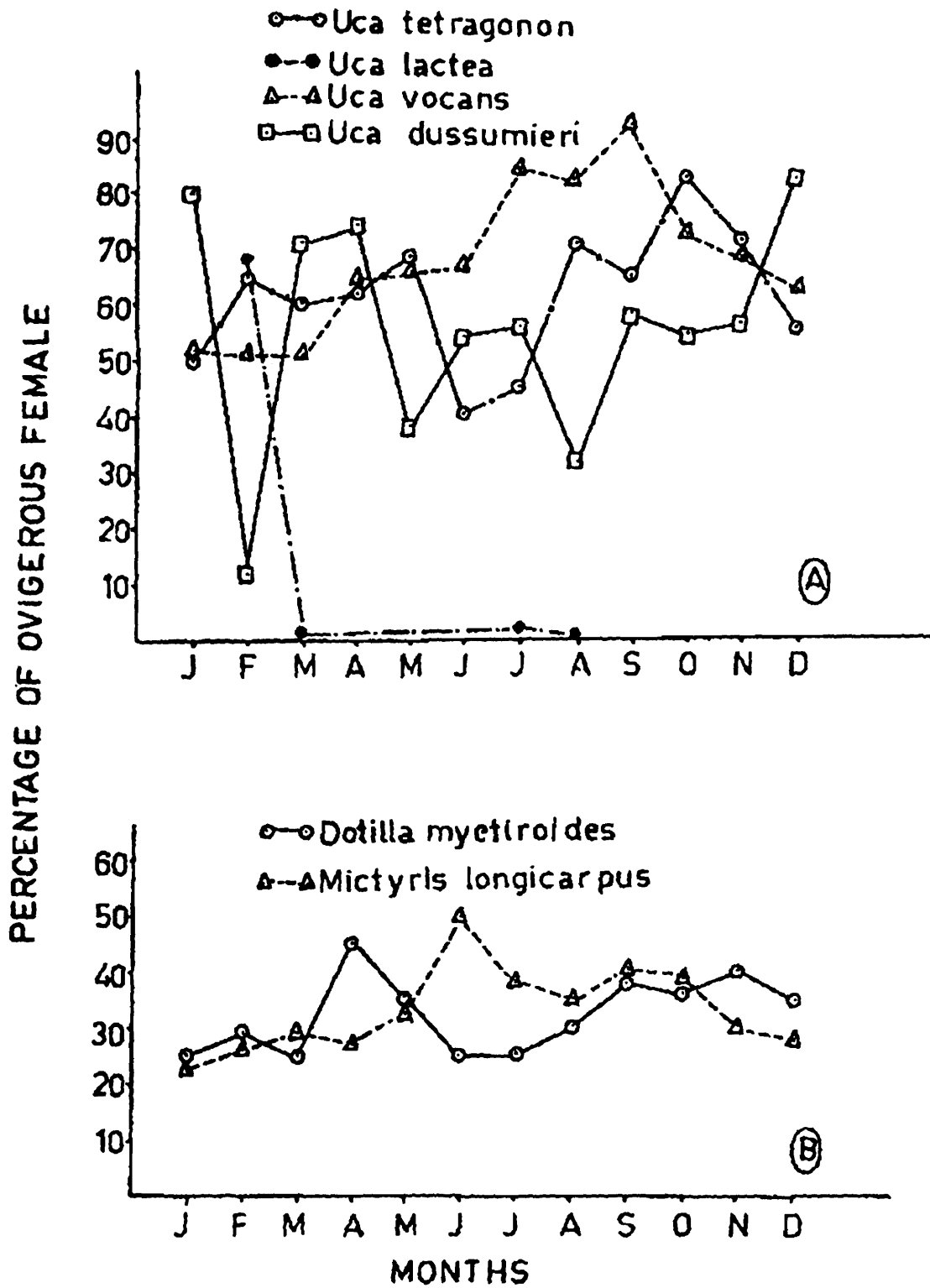
Uca lactea (de Haan) : Data regarding this species is plotted in Text-figure 8A. The noteworthy feature of this species is that ovigerous females are found only during February



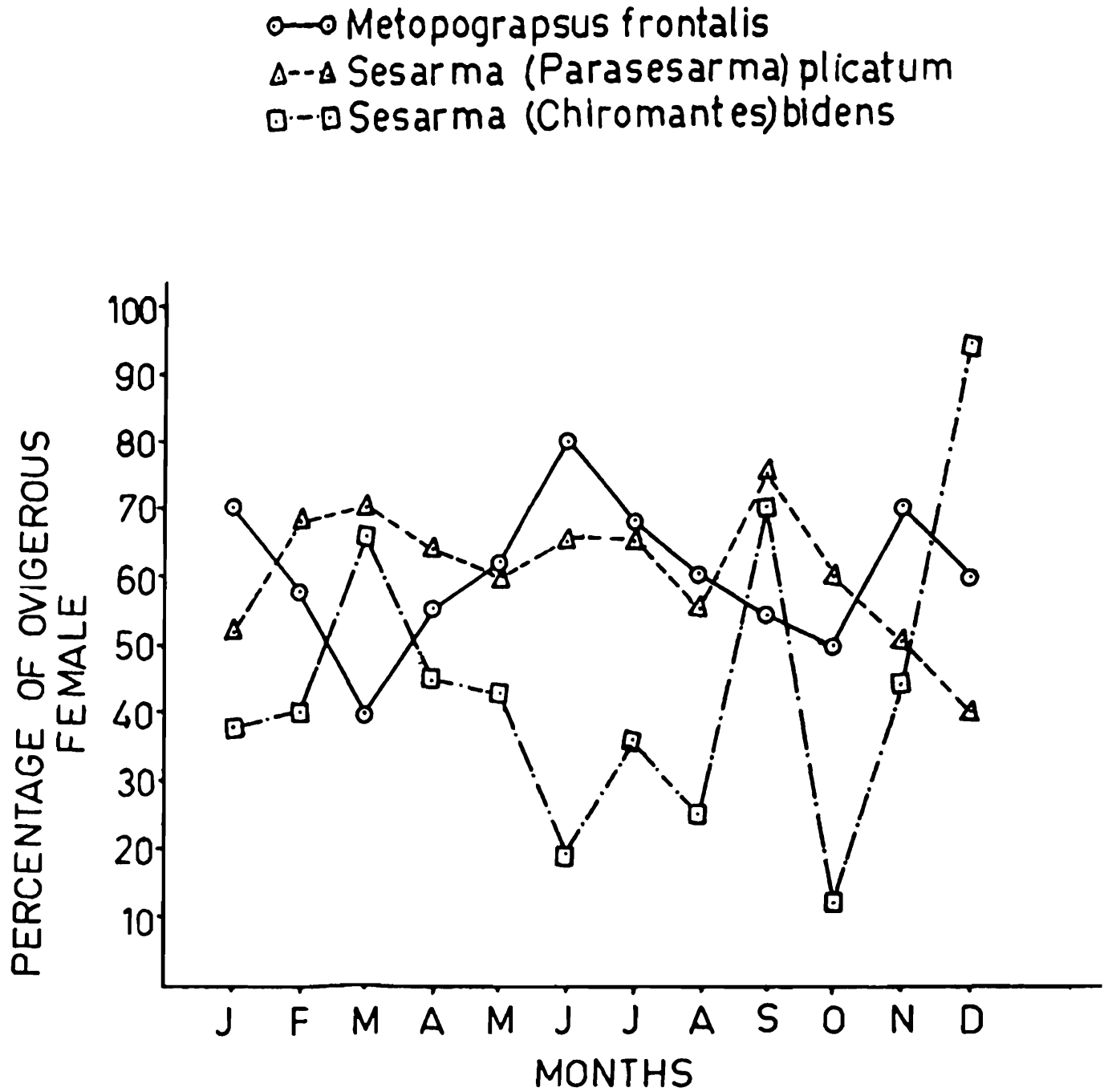
Text fig. 6. Breeding pattern of some mangrove inhabiting crabs of Andaman Islands.
 A. *Matuta lunaris*
 B. *Scylla serrata*, *Portunus pelagicus* and *Portunus sanguinolentus*.



Text fig. 7. Breeding pattern of some mangrove inhabiting crabs of Andaman Islands.
 A. *Thalamita crenata* and *Thalamita admete*
 B. *Epixanthus frontalis* ; *Leptodius exaratus* and *Pilumnus vespertilio*.



Text fig. 8. Breeding pattern of some mangrove inhabiting crabs of Andaman Islands. A. *Uca tetragonon* ; *Uca lactea* ; *Uca vocans* and *Uca dussumieri*. B. *Dotilla myctiroides* and *Mictyris longicarpus*.



Text fig. 9. Breeding pattern of some mangrove inhabiting crabs of Andaman Islands.
Metopograpsus frontalis, *Sesarma (Parasesarma) plicatum* and *Sesarma (chiromantes) bidens*

and August. Its peak period of breeding activity has been recorded during February (68%). Scattered ovigerous female, however, has been found to occur from March to August (Das, and Dev Roy, 1989).

Dotilla myctiroides (H. Milne Edwards) : Text-figure 8B presents the data regarding breeding cycle of this species. Berried females occur throughout the year, peak breeding activity of this species has been recorded during April (45%).

Mictyris longicarpus Latreille : Data regarding this species is presented in Text-figure 8B. Berried females are found throughout the year, peak period of breeding activity for this species, has been registered in June (50%).

Metopograpsus frontalis Miers : The breeding cycle of this species has been plotted in Text-figure 9. Ovigerous females occur all the year round and the maximum intensity of its breeding activity is in the month of July (80%). This species breeds from August to November at Waltair coast (Rajabai, 1975) and from September to February at south-west coast of India. Peak period of activity for this species has been recorded in December (75%) (Pillai and Nair, 1973).

Sesarma (Parasesarma) plicatum (Latreille) : Data regarding this species has been depicted in Figure 9. Berried females occur through all the months of the year, peak period being noted in September (75%). The species has been reported to breed during September February at south-west coast of India and maximum intensity of its breeding activity (54%) has been registered in October (Pillai and Nair, 1973).

Sesarma (Chiromantes) bidens (de Haan) : Reproductive cycle of this crab has been plotted in Text-figure 9. Ovigerous females of this species have been reported to occur throughout the year, peak month of breeding activity (94%) is recorded during December (Das and Dev Roy, 1989).

DISCUSSION

The present study reveals the predominance of marine crab components in the mangroves of these islands. This may be attributed to the fact that true estuarine condition is not so conspicuous in these island ecosystems and that mangroves are more dominant on the outer seaward fringe and between the creeks. Further, mangroves of these islands are often found on or near the wave swept rocky shores and coral reefs, e.g., Wandoor, Chidyatapu, Neill Island, Aereal Bay, Austin IX and Stewart Island. Therefore, molluscan and crustacean fauna of these areas as a whole are very rich and mostly marine as they invade mangroves from the adjacent rocky habitats or coral reefs mostly during the high tide (Das and Dev Roy, 1989). This also explains why the crab fauna is so rich in the mangroves of these islands. For example, several crab species, such as, *Thalamita crenata*, *T. prymna*, *T. admete*, *Charybdis (Charybdis) helleri*, *C. (C.) orientalis*, *Actaeodes tomentosus*, *Atergatis floridus*, *A. intergerrimus*, *Platypodia cristata*, *Leptodius exaratus*, *L. sanguineus*, *Pilodius nigrocrinitus*, *Pilumnus vespertilio*, *Carpilius convexus*, *C. maculatus*,

Epixanthus frontalis, *Lydia annulipes*, *Eriphia sebana*, *Grapsus albolineatus* and *Metopograpsus frontalis* which are common in coral reefs or rocky shores are sometimes available in the mangales of these islands.

Large number of portunid crabs, viz., *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis* (*Charybdis*) *helleri*, *C. (C.) orientalis*, *Thalamita admete*, *T. crenata*, *T. prymna* and also the calappids such as *Matuta banksii* and *M. lunaris* enter the mangroves during the high tide and retreat to deeper waters as tide recedes ; but, occasionally some of the crabs are stranded taking refuge under the bounders, rocks or corals till the onset of the following tide. Merus and carpus of the last pair of legs of these crabs are shortened and broadened and propodus and dactylus become foliaceous and paddle-like. These characteristics aid these crabs in swimming.

A good number of mangrove dwelling crabs are burrowers. The crabs that have been observed to inhabit self-constructed burrows belong to the families Ocypodidae, Grapsidae, Portunidae, Mictyridae and Gecarcinidae. In general, the burrows penetrate through the oxygenated layer of the mud into the anaerobic layers. Depth of the burrows are, however, restricted by the fibrous matted root systems of the mangroves. The burrows may be a simple vertical tube or they may exhibit V or Y-like configurations. The burrows not only protect the crabs from extremes of temperature and salinity stresses but also save them from predators and aggression from neighbouring crabs besides serving as an arena for courtship. These are also important as a source of relative humidity which is necessary for aerial respiration and prevention of desiccation by transpiration of water across the gill surface (Malan *et. al.*, 1988). Compared to soil surface temperature burrow temperature of mangrove dwelling crabs fluctuates very little in Andamans (Das and Dev Roy, 1989). The same has also been reported in Malaysian mangroves (Macintosh, 1977)

Gecarcinids and ocypodids are efficient burrowers. A good number of species belonging to these groups inhabit substrates consisting of soft mud or sand. Gecarcinids excavate relatively unspecialised tunnels. Burrowing is most diverse and specialised in ocypodids. None of the crabs belonging to the families Xanthidae, Pilumnidae, Carpilidae and Menippidae (with the exception of *Baptozius vinosus*) has been found to construct burrow in the mangroves of these islands. Among the portunids, the only crab which has been found to make burrow in mangroves is the mud crab, *Scylla serrata*. Some species of grapsids have been observed to occupy the burrows of other crabs. In general, burrowing is considered to be a poorly developed form of activity among the grapsids. This is due to the fact that they have adapted to live on land through rocky intertidal zone (Powers and Bliss, 1983). Occasionally, males of some species of brachyaran crabs build different types of special structures over their burrow entrance, such as, "sand-pyramid" by some species of *Ocypode*, "chimney", "pillar" and "hood" by some species of *Uca*, "igloo" by *Dotilla* and some *Uca* and "castle" by *Cardisoma*. All these structures have been reported to serve a number of functions (Linsenmair, 1967 ; Von Hagen, 1968 ; Zucker, 1974 ; Crane, 1975 ; Silas and Sankarankutty, 1960 ; Das and Dev Roy, 1989) for a particular species

in a particular habitat although more intensive research is required to understand their functional significance in specific situations (Powers and Bliss, 1983).

Decaying logs lying in mangrove areas have been found to harbour many crab species. Besides providing refuge to the crabs, logs also protect these animals from desiccation. Six species, namely, *Epixanthus dentatus*, *Grapsus albolineatus*, *Metopograpsus frontalis*, *M. oceanicus*, *Sesarma (Parasesarma) plicatum* and *Metasesarma rousseauxii* were collected from mangrove logs riddled by marine borers especially the teredinids. Some of these crabs are also found beneath the bark of logs. It may be mentioned here that Hutchings and Recher (1982) recorded as many as nine species of crabs from logs among mangroves of Gladstone, Australia.

Majority of the crabs inhabiting the mangroves are primarily diurnal while a few are nocturnal or crepuscular taking advantage of lower temperature and increased ground moisture in the evening, at night or dawn. Crabs of the genera such as, *Uca*, *Dotilla*, *Metaplex*, *Clistocoeloma*, *Grapsus*, *Sesarma*, *Nanosesarma*, *Mictyris*, *Macrophthalmus* and *Leipocten* dealt with in this communication are mainly active during daytime at low tide. Some species may be either nocturnal or diurnal depending upon the various local conditions, such as, tidal exposure, interaction with predator or prey and disturbances due to anthropogenic pressures. In contrast to these, gecarcinids, such as, *Cardisoma carnifex*, portunids, namely, *Scylla serrata* and ocypodids, such as, *Ocypode ceratophthalma* are mainly nocturnal although the juveniles of the last species are active at day time.

Present investigation on the breeding biology on mangrove inhabiting crabs highlights some interesting aspects. The reproduction of marine invertebrates as a whole and the complexity of factors governing it has been extensively reviewed by Giese (1959), while the role of ecological factors on the breeding cycles was brought into light by Reese (1968). This is to mention here that Sastry (1983) has reviewed in details the ecological aspects of crustacean reproduction. Although, it was believed earlier that tropical animals breed continuously through all months of the year (Semper, 1881), recent findings strongly suggest the existence of a definite periodicity in many species. Stephenson (1934) recognized four different types of breeding cycles among marine invertebrates of Great Barrier Reef such as (1) **Continuous breeder** when animals breed throughout the year with breeding activity being more pronounced at one particular period of the year than in the remaining months, (2) **discontinuous breeder** when breeding takes place in relation to lunar phases during greater or shorter period of the year, (3) **annual breeder** when the breeding period is not continued through all months of the year and (4) **biannual breeder** when there exist two spawning periods in a year with a quiescent phase in between. Such different types of breeding pattern have been reported from both the coasts of India by several workers (Panikkar and Aiyar, 1939 ; Paul, 1942 ; Pillay and Nair, 1971 ; Rajabai, 1975 ; Khan and Natarajan, 1981).

A perusal of literature shows that the breeding season of crabs may vary much not only among different species of the same genus but also within the same species. The onset and peak period of activity may also vary from place to place and from year to year. For example, *Portunus sanguinolentus* breeds during February and March on the Malabar coast, during December to April on the Mangalore coast, from January and October at Andhra coast and as irregular breeder at 'Bombay' coast whereas this species breeds throughout the year in Andaman Islands. Similarly, the breeding season of *Portunus pelagicus*, *Thalamita crenata*, *T. admete*, *Sesarma (Parasesarma) plicatum*, *Metopograpsus frontalis* and *Matuta lunaris* also varies considerably from coast to coast. This apparent differences in breeding season at aifferent coasts may be suggested as due to different hydrological and meteorological conditions on account of strong influences of north-east and south-west monsoons.

Various factors (exogenous or endogenous or a combination of both) are known to induce breeding in marine crabs. Pillay and Nair (1971), Rajabai (1975) and Khan and Natarajan (1977, 1981) have discussed at length the role of various factors on the breeding activity of marine crabs. Among the extrinsic factors, temperature is considered to have immense influence on the reproductive activity of marine crabs. Orton (1920) opined that marine animals would breed continuously in those parts of the sea where the temperature conditions are constant or nearly constant and also where there is not much variation of biological conditions. However, several other workers have shown that temperature may not be sole factor in influencing breeding of tropical marine animals (Nicholls 1931 ; Malpas, 1933 ; Moorehouse, 1933 ; Galtsoff, 1934 ; Stephenson, 1934 ; Rajabai, 1975 ; Pillay and Nair, 1971 ; Khan and Natarajan, 1977).

A number of workers have correlated the breeding of animal with changes in salinity. Orton (1920) who stressed the influence of temperature on breeding had never discounted the role of salinity. Stephenson (1934) has noted that majority of animals of Great Barrier Reef breed during summer when the precipitation is maximum. Reduced salinity due to the onset of north-east monsoon has been reported to influence breeding of invertebrates along the Tamul Nadu coast (Panikkar and Aiyar, 1939). Lowering of salinity due to south-westerly current has been reported to stimulate reproductive activity at Waltair coast (Rajabai, 1975). Changes in salinity affects breeding of marine animals in two ways. Lowering of salinity may stimulate spawning in some animals while in others it may trigger off breeding activities (Chandran, 1968 ; Pillay and Nair, 1973. Several crustaceans (including crabs) of south-west coast of India have not displayed any breeding activity during monsoon months (Pillay and Nair, *op. cit.*). They explained that these animals had a prolonged stress due to very low salinity. Higher salinity and higher temperature have been shown to induce breeding in a number of marine crabs. High salinity has been reported to stimulate breeding in a number of crabs probably by way of helping directly in ripening and spawning of sexual products (Orton, 1920 ; Broekema, 1941 as reviewed by Thorson, 1950 ; Mortensen, 1921). The present study also endorses this observation.

Giese (1959) pointed out that larvae are produced at such time when suitable environmental conditions exist, i.e., life cycle of animal is so timed as to provide maximum larval survival. Pillay and Nair (1973). also suggested that breeding time of animals is so adjusted that their plankto-trophic larvae will have a better chance of finding an adequate food supply. Larvae are released at a time when suitable types of planktonic food are available in the medium.

In the tropics, breeding is often continued throughout the year and may exhibit lunar periodicity. Fox (1924) demonstrated that breeding of crabs in the Red sea was correlated with phases of the moon. Macintosh (1982) showed semi-lunar rhythm of breeding activity among crabs of Malaysian mangroves. Similar rhythm has been noticed among the crabs of these islands too, especially among the genera *Leptodius*, *Epixanthus*, *Uca*, *Dotilla*, *Mictyris*, *Metopograpsus*, *Sesarma* and *Metaplax*.

In the present study, ovigerous females of various crab species have been found to occur during all months of the year. This indicates that most of the crab species of these islands breed all the year round although they may show monthly fluctuations in breeding intensity. This type of continuous breeding has been demonstrated among crabs of Malaysian mangroves. During the present investigation sample of crabs collected in the same month were found to contain different stages of reproductive activity, i.e., some crabs of the same species were in the earlier stages of maturation and some were already spent up. In the course of this study, crabs of all ages (sizes) especially of the genera *Leptodius*, *Epixanthus*, *Uca*, *Dotilla*, *Mictyris*, *Metopograpsus*, *Metaplax* and *Sesarma* have been observed either in the mangroves or in areas adjacent to mangroves throughout the year. This indicates that adequate supply of food is available throughout the year in these islands in surrounding waters. Further, it has been observed that larval release is synchronised to the days of spring tides associated with full moon and new moon. This, as Macintosh (1982) opines, invariably favours survival of planktonic larval stages because spring tides are more likely to carry them beyond the mangrove zone into the coastal waters where temperature and salinity conditions are more stable. The present study intends to contradict the view expressed by Pillai and Nair (1973) that the tropical crabs never attain peak activity with all the adult females attaining berried condition. The present author, on the other hand, has recorded above 90 percent of the adult females attaining berried condition from Andaman mangrove environment. Similar results were reflected in the work of Macintosh (1982) in Malaysian mangroves.

From the detailed review of literature, it becomes apparent that the geo-climatic conditions of Andaman group of islands are almost similar to those of Malaysia-Thailand to Philippines and Indonesian Archipelago. And so, the breeding biology and behaviour of the crab species from the mangrove environment of Andamans have significant similarities with those of the crabs of Malaysia and other South-East Asian regions.

DISTRIBUTION PATTERN

Global distribution of each of 51 species of brachyuran crabs occurring in Andaman mangroves and dealt with in the present communication has already been shown during the taxonomic treatment of the respective species. An over all analysis of such distribution reveals that 44 species of crabs of Andaman mangroves are distributed throughout the Indo-Pacific region from Africa in the west to Australia and Hawaiian islands in the east. The remaining 7 species, namely, *Platypodia cristata*, *Macrophthalmus (Mareotis) depressus*, *Nanosesarma andersoni*, *Neoepisesarma (Muradium) tetragonum*, *Metaplax crenulata*, *M. distincta* and *M. elegans* are, however, known so far to be restricted to the Indian Ocean. It needs to mention here that 3 species, namely, *Lydia annulipes*, *Nanosesarma andersoni* and *Sesarmops intermedium* are recorded for the first time from India while 7 species, namely, *Charybdis (Charybdis) orientalis*, *Platypodia cristata*, *Macrophthalmus (Mareotis) depressus*, *Leipocten sordidulum*, *Neoepisesarma (Muradium) tetragonum*, *Metaplax crenulata* and *M. elegans* constitute new records for Andaman and Nicobar islands.

A perusal of literature shows that mangroves bordering Bay of Bengal, Malay Peninsula, Philippines, Singapore, Thailand, Indonesia, Japan and Australia are very rich in crab fauna (Table 2). This may be due to prevailing thick and luxuriant mangrove forests in those regions and also due to presence of coral reefs adjacent to mangroves in some of the areas including Andamans, offering diversified habitats for the crabs and also that crabs of some regions are well explored and studied in comparison to other areas. The occurrence of very few species of crabs along the Atlantic coast may be due to presence of poor mangroves in those regions. From Table 2 it is quite evident that crab fauna of Andaman mangrove is quite rich, being next to that of Australia (113 species), Malay Peninsula (87), Singapore (77) and Indian part of Sundarbans (55 species).

Further analysis of crab components of Andaman mangroves reveals that marine elements are prevalent here so also the mangrove fauna of these islands as a whole as detailed by Das and Dev Roy (1989).

In a recent publication Das (1996) has elaborated the distribution pattern of mangrove fauna of Andaman and Nicobar islands including some littoral crabs. Our present study also shows that *Macrophthalmus (Macrophthalmus) convexus* occurs in the lower littoral zone and is found to be distributed up to Mean Low Water Spring (MLWS), well below mangrove tree zone. *Metaplax crenulata* is distributed above this zone sometimes with *Uca vocans*. Fiddler crabs (*Uca* spp.) are dominant and abundant from Mean Tide Level (MTL) and upwards. Sesarmid crabs inhabit landward mangrove forests whereas the crabs belonging to *Cardisoma carnifex* construct castle in the mangroves even on supralittoral forest floor. The fiddler crabs in Andaman mangroves display more distinct distribution pattern in shaded and unshaded areas as elaborated earlier.

Table 2. Comparison of number of genera and species of crabs inhabiting Andaman mangroves with those occurring in mangroves of other countries / regions.

Sl. No.	Name of the country/ Region	No. of genera reported	No. of genera common with Andaman mangroves	No. of species reported	No. of species common with Andaman mangroves	References	Remarks
1.	Costa Rica	5	2	10	—	Rathbun, 1906a, 1918, 1930	—
2.	Panama	1	1	1	—	Abele, 1977	—
3.	Peru	2	—	2	—	Rathbun, 1918, 1930	—
4.	West Indies	2	—	2	—	Rathbun, 1930	—
5.	Jamaica	7	2	13	—	Rathbun, 1918, 1930; Warner, 1969	—
6.	Brazil	7	2	12	—	Rathbun, 1918, 1930	—
7.	Venezuela	1	—	1	—	Rathbun, 1930	—
8.	Porto Rico	2	—	2	—	Rathbun, 1930	—
9.	Florida	2	—	4	—	Rathbun, 1918, Abele, 1973, 1977	—
10.	Colombia	1	1	2	—	Rathbun, 1918	—
11.	West Africa	7	1	12	—	Manning and Holthuis, 1981	—
12.	East Africa	7	5	11	2	Macnae, 1963, 1968; Hart noll, 1975 ; Vannini, 1976	—
13.	South Africa	6	3	11	2	Macnae, 1963, 1968	—
14.	Madagascar	6	3	18	4	Crosnier, 1965	—
15.	Maldives	2	2	2	1	Borradaile, 1902-1903	—
16.	Pakistan	15*	8	3	1	Ansari, 1987	*Names of only three species are listed ; rest contains generic names only.
17.	India (excluding Andaman Islands)	31	14	55	14	Chakraborty <i>et al.</i> , 1986 ; Anonymous, 1987a; Mandal and Nandi, 1989	—
18.	Sri Lanka	9	7	14	6	Laurie, 1906; Jeyewardene, 1987	—
19.	Mayanmar	3	2	3	2	de Man, 1887-1888	—
20.	Malay Peninsula	45	14	87	12	Tweedie, 1937, 1950; Sasekumar, 1974; Tai and Manning, 1984; Ng, 1988, 1990; Ng and Tan, 1987 ; Tan and Ng, 1993, 1994.	—
21.	Singapore	39	15	77	11	Tweedie, 1937; Berry, 1962; Tan and Ng, 1994; Tan and Humphreys, 1995.	—
22.	Indonesia	15	9	43	11	Verwey, 1930; Soemodihardjo, 1937 ; Soegiarto, 1984.	—
23.	Thailand	13	9	48	9	Naiyanetr, 1983 ; Aksornkoe, 1987	—
24.	Philippines	15	11	27	10	Anonymous, 1987b	—
25.	Japan	14	8	23	8	Ono, 1965; Sakai, 1976	—
26.	Australia	34	11	113	9	Campbell, 1967; Hutchings and Recher, 1982 ; Davie, 1982, 1984	—
27.	Papua New Guinea	2	2	2	2	Rao, 1984	—
28.	Fiji	4	4	4	4	Anonymous, 1987c	—
29.	United arab Emirates	11	6	16	5	Al-Ghais & Cooper, 1996	—

SUMMARY

Taxonomic account, distribution pattern and habitat ecology of 51 species of brachyuran crabs belonging to 33 genera under 10 families is presented in the paper.

Each species is illustrated with photographs and text-figures. In addition, key to the families, genera and species is provided to facilitate identification of mangrove dwelling crabs of India in general and Andaman islands in particular.

Distribution pattern of these crabs reveals that 44 species occur throughout the Indo-Pacific, 7 species are confined to the Indian Ocean and 3 species are reported for the first time from India.

Breeding pattern of 18 species of crabs belonging to 12 genera under 8 families is also included in the paper. Role of important environmental parameters, such as, temperature, rainfall, salinity, food availability and lunar productivity is also discussed in the light of recent findings.

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REFERENCES

- ABELE, L.G. 1973. Taxonomy, Distribution and Ecology of the Genus *Sesarma* (Crustacea, Decapoda, Grapsidae) in Eastern North America, with special reference to Florida. *Am. Midl. Nat. Monogr.*, **90** (2) : 375-386.
- ABELE, L.G. 1977. The taxonomic status of *Sesarma festae* Nobill, 1901 and *S. biolleyi* Rathbun, 1906 (Crustacea, Decapoda, Grapsidae) in the Eastern Pacific. *Proc. biol. Soc. Wash.* **89** : 631-644.
- ADAMS, A. and WHITE, A. 1848. Crustacea. In : A. Adams. *The Zoology of the voyage of H.M.S. Samarang, 1843-1846*. London, pp. i-viii + 1-66, pls. 1-13.
- AKSORNKOAE, S. 1987. Country Reports : Thailand. *Mangroves of Asia and the Pacific : Status and Management, Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/002)*. National Resources Management Center and National Mangrove Committee, Philippines, pp. 231-261.
- ALCOCK, A. 1896. Materials for a Carcinological fauna of India. No. 2. Brachyura Oxystomata. *J. Asiat. Soc. Bengal*, **65** (2) : 134-296, pls. 6-8.
- ALCOCK, A. 1898. *Id.* No. 3. Brachyura Cyclometopa. Part 1. The Family Xanthidae. *J. Asiat. Soc. Bengal*, **67** (2) : 67-233.
- ALCOCK, A. 1899. *Id.* No. 4. Brachyura Cyclometopa. Part 2. The Families Portunidae, Cancridae and Corystidae. *J. Asiat. Soc. Bengal* **68** (2) : 1-103.
- ALCOCK, A. 1900. *Id.* No. 6. Brachyura Catametopa or Grapsoidea. *J. Asiat. Soc. Bengal*, **69** (2) : 280-456.
- AL, GHAI, S. M. and COOPER, R. T. 1906. Brachyura (Grapsidae, Ocypodidae, Portunidae, Xanthidae and Leucosiidae) of Umm Al Quwain mangal, United Arab Emirates. *Tropical Zoology* **9** : 409-430.
- ANONYMOUS 1987a. *A long term multidisciplinary research approach and report on mangrove ecosystem of Sundarbans*. Department of Marine Science, University of Calcutta, India, pp. iii – vii + 1–117.
- ANONYMOUS 1987b. Country Reports : Philippines. *Mangrove of Asia and the Pacific : Status and Management, Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/002)*. National Resources Management Center and National Mangrove Committee, Philippines, pp. 175-210.
- ANONYMOUS 1987c. Country Reports : Fiji. *Ibid.*, pp. 281-298.
- ANSARI, T. A. 1987. Country Reports : Pakistan. *Ibid.*, pp. 151-173.

- APEL, M. 1994. Identification Key for soft sediment intertidal brachyura. In : E. Feltkamp and F. Krupp (Eds.) *Establishment of a Marine habitat and Wildlife sanctuary for the Gulf region. Final Report for Phase II. Hubail & Frankfurt CEC NCWCD*, pp 434-437.
- BALSS, H. 1922-1924. Studien an fossilen Decapoden. *Paldont Z.*, 5 : 123-147 (1922); 6 : 174-184 (1924).
- BALSS, H. 1938. Ueber einige Xanthidae (Crustacea : Dekapoda) von Singapore and Umgebung. *Bull. Raffles Mus.*, 14 : 48-63, pls, 2-3, figs. 1-2.
- BALSS, H. 1957. Decapoda : Systematik. In : H.G. Bronn (Ed.). *Klassen und Ordnungen des Tierreichs*, Band 5, Abteilung 1, 7 (12) : 1505-1672, figs. 1131-1199. Akademische Verlagsgesellschaft : Leipzig.
- BALSS, H., BUDDENBROCK, W., GRUNER, H.E. and KORSCHULT, E. 1940-1961. Decapoda. In : H.G. Bronn (Ed.). *Klassen und Ordnungen des Tierreichs*, 5(6) : 1-173, figs. 1-144. Akademische Verlagsgesellschaft : Leipzig.
- BANERJEE, J. 1958. The mangrove forests of the Andamans. *Wld. For. Congr.*, pp. 425-430.
- BANERJEE, L.K. and GHOSH, D. 1998. Species diversity and distribution of mangroves in India. In : ENVIS Center, CAS in Marine Biology, Annamalai University (Eds.). *An Anthology of Indian mangroves*, pp. 20-24.
- BANERJEE, S.K. 1960. Biological results of the Snellius Expedition. XVIII. The genera *Grapsus*, *Geograpsus* and *Metopograpsus* (Crustacea : Brachyura). *Temminckia*, 10 : 132-199, figs. 1-6.
- BARNARD, K.H. 1950. Descriptive catalogue of South African Decapod Crustacea (crabs and shrimps). *Ann. S. Afr. Mus.*, 38 : 1-837, figs. 1-154.
- BARNES, R.S.K. 1967. The Macrophthalminae of Australasia with a review of the evolution and morphological diversity of the type genus *Macrophthalmus* (Crustacea Brachyura). *Trans. zool. Soc. Lond.*, 31 : 195-262.
- BATE, C.S. 1888. Report on the Crustacea Macrura collected by H.M.S. Challenger during the years 1873-1876. *Rep.zool. Chall. Exp.*, 24 : 1-942.
- BELL, S.S., WATZIN, M.C. and COULL, B.C. 1978. Biogenic structure and its effect on the spatial heterogeneity of meiofauna in a salt marsh. *J. Exp. Mar. Biol. & Ecol.*, 35 : 99-107.
- BELL, T. 1835. Observations on the genus *Cancer* of Dr. Leach (*Platycarcinus* Latr.) with descriptions of three new species. *Trans. zool. Soc. Lond.*, 1 : 335-342, pls. 43-46.
- BERG, C. 1900. Datos sobre algunos Crustáceos nuevos para la fauna Argentina. *Commun. Mus. nac. B. Aires*, 1(7) : 223-236, fig. 1.
- BERRY, A.J. 1962. Faunal zonation in mangrove swamps. *Bull. natn. Mus. St. Singapore*, 32 : 90-98.

- BERTNESS, M.D. 1985. Fiddler crab regulation of *Spartina alterniflora* production on a New England salt marsh. *Ecology*, **66** 1042-1055.
- BEURLEN, K. 1928. *Die Decapoden des schwäbischen Jura mit Ausnahme der aus den oberjurassischen plattenkalken stammenden* Palaeontographica, **70** 115-278, pls. 6-8.
- BEURLEN, K. 1930. Nachträge zur Decapodan-fauna des schwäbischer Jura. Neues Jahrb. Mineral. Geol. & Paläont., ser. B, **64** 219-234, pl. 15.
- BEURLEN, K. and GLAESSNER, M.F. 1930. Systematik der Crustacea Decapoda auf stammesgeschichtlicher Grundalge. *Zool. Jb. (Syst.)*, **60** 49-84.
- BLASCO, F. 1977. Outlines of ecology, botany and forestry of the mangales of the Indian subcontinent. In V. J. Chapman (Ed.). *West Coastal Ecosystem*, pp. 241-260. Pondicherry.
- BOAS, J.E.V. 1880. Studier over Decapodernes Slaegtskabsforhold. (Avec un résumé en francais Recherches sur les affinités des Crustacés Décapodes, 163-207). *K. danske Vidensk. Selsk. Skr.*, **1** 25-210.
- BOOLOOTIAN, R.A., GIESE, A.C., FARMANFARMAIAN, A. and TUCKER, T. 1959. Reproductive cycles of five west coast crabs. *Physiol. Zool.*, **32** 213-220.
- BOONE, L. 1934. Stomatopoda and Brachyura. Scientific results of the World Cruise of the Yacht "Alva", 1931. *Bull. Vanderbilt. mar. Mus.*, **5** 1-210, pls. 1-109.
- BORRADAILE, L.A. 1900. On some Crustaceans from the South Pacific. Part IV. The Crabs. *Proc. zool. Soc. Lond.*, pp. 568-596, pls. 40-42.
- BORRADAILE, L.A. 1902-1903. Crustaceans. In J. Stanley Gardiner. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*. Cambridge University Press London. Vol. 1 64-100, 190-208, 237-271, 424-443.
- BORRADAILE, L.A. 1907. On the classification of the Decapod crustaceans. *Ann. Mag. nat. Hist.* ser. 7, **19** 457-486.
- BORRADAILE, L.A. 1910. On the land and amphibious Decapoda of Aldabra. *Trans. Linn. Soc. Lond. Zool.*, **13** (3) 405-409.
- BOSC, L.A.G. 1802. *Histoire naturelle des Crustacés, contenant leur description et leurs moeurs, avec figures dessinées d'après nature*. Paris. Vol: 1, pp. 1-258, pls. 1-8, Vol. 2. pp. 1-296, pls. 9-18.
- BOTT, R. 1954. Dekapoden (Crustacea) aus El Salvador. I. Winkerkrabben (*Uca*). *Senckenberg. biol.*, **35** (3-4) 155-180, pls. 14-19, figs. 1-23.
- BOTT, R. 1973a. Die Typus-Art der Gattung *Uca* Leach 1814 (Decapoda Ocypodidae). *Senckenberg. biol.*, **54** (4-6) 311-314, figs. 1-3.

- BOTT, R. 1973b. Die Verwandtschaftlichen Beziehungen der *Uca* Arten (Decapoda Ocypodidae). *Senckenberg. biol.*, **54** (4-6) 315-325, figs. 1-31.
- BOUVIER, E.L. 1915. Décapodes Marcheurs (Reptantia) et Stomatopodes, recueillis à l'île Maurice par M. Paul Carie. *Bull. scient. Fr. Belg.*, ser. 7, **48** (3) 178-318 (1-141), pls. 4-7, figs. 1-42.
- BOUVIER, E.L. 1940. *Décapodes Marcheurs. Faune de France*. Lechevalier Paris. **37** 1-404, pls. 1-14, figs. 1-222.
- BOWMAN, T.E and ABELE, L.G. 1982. Classification of the Recent Crustacea. In L.G. Abele (Ed.). *The Biology of Crustacea*, **1** : 1-27. Academic Press, New York.
- BROCCHI, M. 1875. Recherches sur les organes génitaux males des Crustacés Décapodes. *Annls. Sci. nat. Zoologie*, (6), **2** (2) 1-131, pls. 13-19.
- BUTTENDIJK, A.M. 1939. Biological results of the Snellius Expedition. V. The Dromiacea, Oxystomata and Oxyrhyncha of the Snellius Expedition. *Temminckia*, **4** : 223-276.
- BUTTENDIJK, A.M. 1941. *Id.* XIII. On some Xanthidae, chiefly of the genus *Platypodia* Bell. *Temminckia* **6** 295-312.
- BUTTENDIJK, A.M. 1947. Zoological notes from Port Dickson. III. Crustacea Anomura and Brachyura. *Zool. Meded., Leiden*, **28** 280-284.
- BUTTENDIJK, A.M. 1960. Biological results of the Snellius Expedition. XXI. Brachyura of the families Atelecyclidae and Xanthidae. *Temminckia*, **10** 252-338, figs. 1-9.
- BÜRGER, O. 1894. Beiträge zur Kenntniss der Gattung *Sesarma*. *Zool. Jb. (Syst.)*, **7** 613-631.
- CALMAN, W.T. 1900. On a collection of Brachyura from Torres Straits. *Trans. Linn. Soc. Lond. Zool.*, ser. 2, **8** (1) 1-49, pls. 1-3.
- CALMAN, W.T. 1927. Report on the Crustacea Decapoda (Brachyura). Zoological results of the Cambridge Expedition to the Suez Canal, 1924. XIII. *Trans. zool. Soc. Lond.*, **22** : 211-217.
- CAMPBELL, B.M. 1967. The Australian Sesarminae (Crustacea ; Brachyura) Five species of *Sesarma* (*Chiromantes*). *Mem. Qd. Mus.*, **15** (1) 1-19, pls. 1-5, figs. 1-2.
- CAPART, A. 1951. Crustacés Décapodes Brachyures. *Exp. Océanogr. Belge, Eaux Côtières afr. Atlant. Sud.* (1948-1949), **3** (1) 11-205, pls. 1-3, figs. 1-8.
- CHACE, F.A. Jr. 1942. Scientific results of a Fourth Expedition to forested areas in Eastern Africa. III. Decapoda Crustacea. *Bull. Mus. comp. Zool. Harv.*, **91** 185-233.
- CHAKRABORTY, S.K., CHOUDHURY, A. and DEB, M. 1986. Decapoda Brachyura from Sunderbans mangrove estuarine complex, India. *J. Beng. nat. Hist. Soc. (N.S.)*, **5** (1) 55-68.

- CHAKRABORTY, S.K. and CHOUDHURY, A. 1992. Ecological studies on the zonation of brachyuran crabs in a virgin mangrove island of Sundarbans, India. *J. mar. biol. Ass. India*, **34** (1-2) 189-194.
- CHANDRAN, M.R. 1968. Studies on the Marine Crab, *Charybdis (Goniosoma) variegata* (de Haan). 1. Reproductive and nutritional cycles in relation to breeding periodicities. *Proc. Indian Acad. Sci.*, **67B** 215-223.
- CHANDY, M. 1970. New records of brachyuran decapods from the Gulf of Kutch. *J. Bombay nat. Hist. Soc.*, **70** (2) 401-402.
- CHANG, C. 1963. A Check-list of Taiwan crabs with descriptions of 19 new records. *Tunghai J.*, **5** (2) 95-118, pls. 1-2, figs. 1-10.
- CHAUDHURI, A.B. and CHOUDHURY, A. 1994. Mangroves of the Sundarbans, India, IUCN: Bangkok. Thailand, **1** : 1-247.
- CHEN, H.L. and LAN, J. 1978. Preliminary studies on the Xanthidae (Brachyura, Crustacea) of Xisha Islands, Guangdong Province, China. In *Report on the Scientific results of marine biology of the Xisha Islands and Zhongsha Islands (South China Sea)*. South China Sea Institute of Oceanology, Academia Sinica, pp. 261-286, pls. 1-8, figs. 1-12.
- CHENGAPPA, B.S. 1944. Andaman forests and their regeneration. *Indian Forester*, **70** 297-304, 421-430.
- CHHAPGAR, B.F. 1957a. On the Marine Crabs (Decapoda Brachyura) of Bombay State. Part I. *J. Bombay nat. Hist. Soc.*, **54** (2) 399-439, pls. 1-11.
- CHHAPGAR, B.F. 1957b. On the Marine crabs (Decapoda Brachywra) of Bombay State. Part II. *J. Bombay nat. hist. Soc.*, **54** (3) 503-549, pls. B and 12-16.
- CHHAPGAR, B.F. 1959. On the breeding habits and larval stages of some crabs of Bombay. *Rec. Indian Mus.*, **54** (1-2) 33-52, figs. 1-13.
- CHOPRA, B. 1933. Further notes on Crustacea Decapoda in the Indian Museum. III. On the Decapod Crustacea collected by the Bengal Pilot Service off the mouth of the River Hughli. Dromiacea and Oxystomata. *Rec. Indian Mus.* **35** (1) 25-52, figs. 1-7.
- CHOPRA, B. 1935. *Id.* VIII. On the Decapoda Crustacea collected by the Bengal Pilot Service off the mouth of the River Hooghly. Brachygnatha (Oxyrhyncha and Brachyrhyncha). *Rec. Indian Mus.* **37** (4) 463-514, pls. 9-18, figs. 1-18.
- CHOPRA, B. and DAS, K.N. 1937. *Id.* IX. On three collections of crabs from Tavoy and Mergui Archipelago. *Rec. Indian Mus.* **39** (4) 337-434, figs. 1-17.
- COLMAN, J. 1933. The nature of the intertidal zonation of plants and animals. *J. mar. biol. Ass. U. K.*, **18** (2) 435-476.
- CRANE, J.C. 1975. *Fiddler Crabs of the World. Ocypodidae Genus Uca*. Princeton University Press New Jersey, pp. xxiii + 1-736, pls. 1-21, figs. 1-101, maps 1-21.

- CROSNIER, A. 1962. Crustacés Décapodes Portunidae. *Fauna Madagascar*, 16 : 1-154, pls. 1-13, figs. 1-256.
- CROSNIER, A. 1965. Crustacés Décapodes Grapsidae et Ocypodidae. *Fauna Madagascar*, 18 : 1-143, pls. 1-11, figs. 1-260.
- DANA, J.D. 1851a. On the classification of the cancroidea. *Amer. J. Sci. Art.*, ser. 2, 12 : 121-131.
- DANA, J.D. 1851b. On the Classification of the Crustacea Grapsoidea. *Amer. J. Sci. Art.* ser. 2, 12 : 283-291.
- DANA, J.D. 1851c. Crustacea grapsoidea (Cyclometopa, Edwardsii) Conspectus Crustaceorum quae in Orbis Terrarum Circumnavigations, Carolo Wilkes e Classes Reipublicae Foederatae Duce, 8. *Proc. Acad. nat. Sci. Philad.*, 5 : 247-254.
- DANA, J.D. 1852a. Conspectus Crustaceorum etc. Conspectus of the Crustacea of the Exploring Expedition under Capt. C. Wilkes, U.S.N. *Proc. Acad. nat. Sci. Philad.*, 6 : 73-86.
- DANA, J.D. 1852b. Crustacea. Part 1. *United States Exploring Expedition during the years 1823-1842 under the Commands of Charles Wilkes, U.S.N.* Philadelphia, 13(1) : 1-685. Atlas (1855), 1-27, pls. 1-96.
- DAS, A.K. 1985. Estuarine fauna of Andaman and Nicobar Islands. In *State of Art Report : Estuarine Biology*. Zoological Survey of India : Calcutta, Paper No. 12, pp. 1-12.
- DAS, A.K. 1996. Faunal diversity, distribution pattern and zonations in the mangrove ecosystem of Andaman and Nicobar Islands. *Proc. zool. Soc., Calcutta*, 49 (2) : 57-65.
- DAS, A.K. and DEV ROY, M.K. 1989. A general account of the mangrove fauna of Andaman and Nicobar Islands. *Fauna of Conservation Areas* : 4, Zool Surv. India : 1-173.
- DAVIE, P.F.J. 1982. A preliminary checklist of brachyura (Crustacea : Decapoda) associated with Australian mangrove forests. *Operculum*, 5 : 204-207.
- DAVIE, P.F.J. 1984. The biogeography of littoral crabs (Crustacea : Decapoda : Brachyura) associated with tidal wetlands in tropical and subtropical Australia. In K.N. Bardsley, J.D.S. Davie and C.D. Woodroffe (Eds.). *Coasts and tidal wetlands of the Australian monsoon region*, Australian National University North Australia Research Unit mangrove Monograph 1 : 259-275. Darwin.
- DE HAAN, W. 1833-1850. Crustacea. In P.F. de Siebold. *Fauna Japonica sive descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum, qui summum in India Batava Imperium tenent, suscepto, annis 1823-1830 collegit, notis, observationibus et adumbrationibus illustravit*. Lugduni-Batavorum : Leiden, pp. i-xvii, i-xxxii, ix-xvi + 1-244, pls. 1-55, A-Q, tab. 1-2.
- DELSMAN, H.C. and DE MAN, J.G. 1925. On the "Radjungans" of the Bay of Batavia. *Treubia*, 6 : 308-323, figs. 1-8.

- DE MAN, J.G. 1887-1888. Report on the podophthalmous Crustacea of the Mergui Archipelago, collected for the Trustees of the Indian Museum. *J. Linn. Soc. Zool.*, **22** 1-312, pls. 1-19.
- DE MAN, J.G. 1891. Carcinological studies in the Leyden Museum. No. 5. *Notes Leyden Mus.*, **13** : 1-61, pls. 1-4.
- DE MAN, J.G. 1892. Decapoden des Indischen Archipels. In : M. Weber. *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien*. **2** 265-527, pls. 15-29.
- DE MAN, J.D. 1895. Bericht über die von Herrn Schiffscapitän Storm Zu Atjeh, an den westlichen küsten von Malakka, Borneo und Celebes sowie in der Java-see gesammelten Decapoden und Stomatopoden. *Zool. Jb. (Syst.)*, **8** 485-609, figs. 1-15.
- DE MAN, J.G. 1902-1903. Ergebnisse einer zoologischen Forschungsreise in den Molukken Und Broneo, im Auftrage der Senckenbergischen naturforsch enden gesellschaft ausgeführt von Dr. Willy Kükenthal. Theil 2, Reseergebn. Bd. 3, Heft 3. *Abh. Senckenberg. Naturf. Ges.*, **25** (3) 467-929, pls. 19-31.
- DE SAINT-LAURENT, M. 1980a. Sur la classification et la phylogénie des Crustacés Décapodes Brachyours. I. Podotremata Guinot, 1977, et Eubrachyura sect. nov. *C.R. Hebd Séances Acad. Sci., Ser. D* **290** 1265-1268.
- DE SAINT-LAURENT, M. 1980b. Sur la classification et la phylogénie des Crustacés Décapodes Brachyours II. Heterotremata et Thoracotremata Guinot, 1977. *C. R. Hebd. Séances Acad. Sci., Ser. D* **290** 1317-1320.
- DESMAREST, A.G. 1823. Malacostracés, Malacostraca. In *Dictionnaire des Sciences Naturelles*. F.G. Lev Rault Paris and Strasbourg, **28** 138-425.
- DESMAREST, A.G. 1825. *Considérations générales sur la Classes des crustacés et description des espèces de ces animaux, qui vivent dans la Mer, sur les côtes, ou dans les eaux douces da la France*. F. G. Lev Rault Paris, Strasbourg, pp. xix+1-446, pls. 1-56.
- EDMONDSON, C.H. 1954. Hawaiian Portunidae. *Occ. Pap. Bernice P. Bishop Mus.*, **21** (12) 217-274, figs. 1-44.
- EDMONDSON, C.H. 1959. Hawaiian Grapsidae. *Occ. Pap. Bernice P. Bishop Mus.*, **22** (10) 153-202, figs. 1-27.
- EDMONDSON, C.H. 1962. Xanthidae of Hawaii. *Occ. Pap. Bernice P. Bishop Mus.* **22** (13) 215-309, figs. 1-34.
- EDNEY, E.B. 1962. Some aspects of the temperature relations of fiddler crabs (*Uca* spp.). In S.W. TROMP (Ed.). *Biometerology*, pp. 79-85. Pergamon Press, Oxford, New York.
- ESTAMPADOR, E.P. 1937. Philippine crustacean decapods-Tribe Cyclometopa or Cancroidea. *Philipp. J. Sci.*, **62** (4) 465-559.

- ESTAMPADOR, E.P. 1949a. Studies on *Scylla* (Crustacea Portunidae). 1. Revision of the genus. *Philipp. J. Sci.*, **78** (1) 95-108, pls. 1-3.
- ESTAMPADOR, E.P. 1949b. *Scylla* (Crustacea Portunidae). Comparative studies on spermatogenesis and oogenesis. *Philipp. J. Sci.*, **78** (3) 301-353.
- ESTAMPADOR, E.P. 1959. Revised check-list of Philippine crustacean decapods. *Nat. appl. Sci. Bull. Univ. Philipp.*, **17** (1) 100-103.
- FABRICIUS, J.C. 1775. *Systema Entomologiae, sistens insectorum Classes, Ordines, Genera, Species, Adjectis Synonymies, Locis, Descriptionibus, Observationibus*. Libraria Kortii Flensburgi, Lipsiae, pp. 1-832.
- FABRICIUS, J.C. 1793. *Entomologia Systematica Emendata et Aucta, Secundum Classes, Ordines, Genera, Species, Adjectis Synonimas, Locis, Observationibus, Descriptionibus*. Hafniae. Vol. 2 viii + 1-519.
- FABRICIUS, J.C. 1798. *Entomologiae Systematicae Supplementum*. Hafniae, pp. 1-572 + 1-52 (index).
- FOREST, J. and GUINTO, D. 1961. Crustacés Décapodes Brachyours de Tahiti et des Tuamotu. *Expéd. Française sur les Récifs Coralliens de la Nouvelle Calédonie*, pp. 1-187, pls. 1-18, figs. 1-178.
- FORSKAL, P. 1775. *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium*. Hauniae, pp. 1-9 + i-xxxiv + 1-164.
- FOX, H.M. 1924. Lunar periodicity in reproduction. *Proc. R. Soc.*, ser. B, **14** : 523-550.
- FRAUENFELD, G.R. 1868. Beiträge zur Fauna der Nikobaren. II. Aus den Verhandlungen d.k.k. zoologisch-botanischen Gesellschaft in Wien (Jahrgang, 1868) besonders abgedruckt, pp. 289-300 (1-12).
- FIRTH, D.W. and BRUNENMEISTER, S. 1980. Ecological and population studies of Fiddler Crabs (Ocypodidae, Genus *Uca*) on a mangrove shore at Phuket Island, Western Peninsular Thailand. *Crustaceana*, **39** (2) 157-184.
- FRITH, D.W. and FRITH, C.B. 1977. Observations on Fiddler Crabs (Ocypodidae Genus *Uca*) on Surin Island, Western Peninsular Thailand, with special reference to *Uca teragonon* (Herbst). *Phuket mar. biol. Center Res. Bull.*, **18** : 1-14.
- FIRTH, D.W., TANTANSIRIWANG, R. and BHATIA, O. 1976. Zonation of macrofauna on a mangrove shore, Phuket Island. *Phuket mar. biol. Center Res. Bull.*, **10** 1-37.
- FUSEYA, R. and WATANABE, S. 1996. Genetic variability in the Mud crab Genus *Scylla* (Brachyura Portunidae). *Fisheries Science*, **62** (5) 705-709.
- GALL, B. and VANNINI, M. 1990. Research on the coast of somalia. Xanthidae, Trapeziidae, Carpilidae and Menippidae (Crustacea Brachyara). *Tropical Zoology*, **3** 21-56.

- GALTSOFF, P.S. 1934. Factors governing the propagation of oysters and other marine invertebrates. *Proc. Pacif. Sci. Congr.*, 5 (1933).
- GARTH, J.S. 1946. Littoral brachyuran fauna of the Galapagos Archipelago. *Allan Hancock Pacif. Exped.*, 5 (10) i-iv + 341-600, pls. 49-87, fig. 1.
- GAULD, D.T. 1960. Brachyura An annotated check-list of the crustacea of Ghana, IV. *Jl. W. Afr. Sci. Ass.*, 6(1) 68-72.
- GEORGE, P.C. and NAYAK, K.R. 1961. Observations on the crab fishery of Mangalore coast. *Indian J. Fish.*, 8 (1) 44-53.
- GEORGE, R.W. and JONES, D.S. 1982. A revision of the fiddler crabs of Australia (Ocypodinae *Uca*). *Rec. West. Aust. Mus. Suppl.* No. 14 5-99, figs. 1-58.
- GERSTAECKER, A. 1856. Carcinologische Beiträge. *Arch. Naturgesch.* 22 (1) 101-162, pls. 4-6.
- GLAESSNER, M.F. 1929. Crustacea Decapoda. In *Fossilium Catalogus*. Berlin. Vol. I (41) 1-464.
- GLAESSNER, M.F. 1969. Decapoda. In R.C. Moore (Ed.). *Treaties on Invertebrate Palaeontology Arthropoda 4*, Vol. 2(R) R400-R533, R626-R628, figs. 217-340. Boulder, Colorado. The Geological Society of America, Inc.
- GIESE, A.C. 1959. Comparative Physiology Annual reproductive cycles of marine invertebrates. *A. Rev. Physiol.*, 21 547-576.
- GISTEL, J.N.E.X. 1848. *Naturgeschichte des Thierreichs für höhere Schulen*. Stuttgart., pp. i-xxi + 1-216, pls. 1-32.
- GORDON, I. 1931. Brachyura from the coasts of China. *J. Linn. Soc. Zool.*, 37 525-558, figs. 1-36.
- GORDON, I. 1934. Crustacea Brachyura. In Rés. scient. Voyage aux Indes Or. Néerland. Prince et Princesse Léopold de Belgique. *Mém. Mus. Hist. nat. Belg.*, hors sér. 8(15) 1-78, figs. 1-37.
- GORDON, I. 1937. Notes on several Indo-Pacific species of *Sesarma* (Crustacea Brachyura). *Proc. Linn. Soc. Lond.*, 3 150-156, figs. 1-5.
- GRANT, F.E. and MC CULLOCH, A.R. 1906. On a collection of crustacea from the Port Curtis District, Queensland. *Proc. Linn. Soc. N.S.W.*, 31(1) 2-53, pls. 1-4, figs. 1-3.
- GRAVELY, F.H. 1927. Orders Decapoda (except Paguridea) and Stomatopoda. In The littoral fauna of Krusadai Island in the Gulf of Mannar. *Bull. Madras Govt. Mus. (N.S.)*, 1 (1): 135-155, pls. 20-26.
- GRAVELY, F.H. 1941. Shells and other animal remains found on the Madras beach. 1. Groups other than snails, etc. (Mollusca Gastropoda). *Bull. Madras Govt. Mus. (N.S.)*, 5 (1) 1-112, fig. 31.

- GRIFFIN, D.J.G. 1968. Breeding and moulting cycles of two Tasmanian grapsid crabs (Decapoda, Brachyura). *Crustaceana*, 16 (1) 88-94.
- GUÉRIN-MÉNEVILLE, F.E. 1829-1844. *Iconographie du règne animal de G. Cuvier, ou représentation d'après nature de l'une des espèces les plus remarquables, et souvent non figurées, de chaque genre d'animaux, avec un text descriptif mis au courant de la science : Ouvrage pouvant servir d'atlas à tous les traités de zoologie. Crustacés.* J.B. Baillière Paris. Vol.1 5-48 , Vol. 3 pls. 1-35.
- GUINOT, D. 1964a. Sur une collection de Crustacés Décapodes Brachyures de Mer Rouge et de Somalie. Remarques sur les genres *Calappa* Weber, *Menaethiops* Alcock, *Tyche* Bell, *Ophthalmias* Rathbun et *Stilbognathus* von Martens. *Boll. Mus. civ. Stor. nat. Venezia*, 15 7-63, pls. 1-4, figs. 1-39.
- GUINOT, D. 1964b. Crustacés Décapodes Brachyures (Xanthidae) des campagnes de la Calypso en Mer Rouge (1952), dans le Golfe Persique et a l'île Aldabra (1954). *Mém. Mus. natn. Hist. nat., Paris. Sér. A, Zool.* 32 (1) 1-108 + i-iii, pls. 1-12, figs. 1-57.
- GUINOT, D. 1967. La faune Carcinologique (Crustacés Brachyures) de l'Océan Indien Occidental et de la Mer Rouge. Catalogue, remarques biogéographiques et bibliographie. In Réunion de Spécialists C.S.A. sur les Crustacés, Zanzibar, 1964. *Mém. Inst. fr. Afr. noire.*, 77 237-352.
- GUINOT, D. 1968a. Recherches préliminaires sur les groupements naturels chez les Crustacés Décapodés Brachyures. IV. Observations sur quelques genres de Xanthidae. *Bull. Mus. natn. Hist. nat. Paris, sér.2*, 39 (4) 695-727, figs. 1-60.
- GUINOT, D. 1968b. Recherches préliminaires sur les groupements naturels chez less Crustacés Décapodés Brachyures. VI. Les *Carpilina*. *Bull. Mus. natn. Hist. Nat. Paris Sér. 2*, 40 (2) 320-324, figs. 1-16.
- GUINOT, D. 1971. *Id.* VIII. Synthèse et bibliographie. *Bull. Mus. natn. Hist. Nat. Paris Sér. 2*, 42 (5) 1063-1090.
- GUINOT, D. 1977. Propositions pour une nouvelle classification des Crustacés Décapodes Brachyures. *C.R. Acad. Sc., Paris, sér. D*, 285 1049-1052.
- GUINOT, D. 1978, Principes d'une classification évolutive des Crustacés Décapodes Brachyures. *Bulletin biol. Fr. Belg.*, 112(3) 211-292, figs. 1-3, tabl. 1.
- HALE, H.M. 1927. The crustaceans of South Australia, Part 1. In *Handbooks of Flora and Fauna of South Australia*. Adelaide: 1-201, figs. 1-202.
- HARTNOLL, R.G. 1975. The Grapsidae and Ocypodidae (Decapoda Brachyura) of Tanzania. *J. Zool., London*, 177 305-328.
- HASWELL, W.A. 1882. *Catalogue of the Australian stalk and sessile-eyed Crustacea*. The Australian Museum Sydney, pp. iii-xxiv+1-323, pls. 1-4.

- HAWORTH, A.H. 1825. A new binary arrangement of the macrurous Crustacea. *Philosophical Magazine & Journal*, 65 183-184.
- HENDERSON, J.R. 1888. Report on Anomura collected by H.M.S. Challenger during the years 1873-1876. *Rep. Zool. Chall. Exp.*, 27 xi + 1-221, pls. 1-21.
- HENDERSON, J.R. 1993. A contribution to Indian Carcinology. *Trans. Linn. Soc. Lond. Zool.*, ser. 2, 5 325-458, pls. 36-40.
- HELLER, C. 1861. Beiträge zur Crustaceen fauna des Rothen Meeres. 1. *Stizungsber, math. nat. Cl. K. Akad, Wiss. Wien.*, 43 (1) 297-374, pls. 1-4.
- HELLER, C. 1862. Neue Crustaceen, gesammelt während der Weltumseglung der K.K. Fregatte Novara Zweiter vorläufiger Bericht. *Verh. zool. -bot. Ges Wien.*, 12 519-528.
- HELLER, C. 1865. *Reise der Österreichischen Fregatte Novara Um die Erde in den Jahren 1857-58-59 unter den Befehlen des Commodors B. von Wüllerstorff-Urbair. Zool. Crustaceen*, 2(3) 1-280.
- HERBST, J.F.W. 1782-1804. *Versuch einer Naturgeschichte der Krabben und Krebse, nebst einer systematischen Beschreibung ihrer verschiedenen Arten*. Berlin und Stralsund, Vol. 1 5-274 (1742-1790), Vol. 2 iv – viii + 1-225 (1796), Vol. 3 1-65, pls. 47-50, A-9 (1799), 1-46, pls. 51-54, A-F (1801), 1-54, pls. 55-58, A-G (1803), 1-49, pls. 59-62, A-G (1804).
- HERKLOTS, J.A. 1851. *Addimenta ad Faunam Carcinologicam Africae Occidentalis, sive descriptiones specierum novarum e crustaceorum ordine, quas in Guinea collegit vir strenuus H.S. Pel, praefectus residentiis in littore guineae*. Lugduni-Batavorum Leiden, pp. 1-28, pls. 1-2.
- HERKLOTS, J.A. 1861. *Symbolae' carcinologicae : Études sur la classe des Crustacés*. Leiden, pp. 1-43.
- HESS, W. 1865. Beiträge zur Kenntniss der Decapoden Krebse Ost-Australiens. *Arch. Naturgesch.*, 1 127-173, pls. 6-7.
- HIATT, R.W. 1948. The biology of the lined shore crab. *Pachygrapsus crassipes* Randall. *Pacif. Sci.*, 2 135-213, pls. 1-2, figs. 1-18.
- HILGENDORF, F. 1878. Die von Herrn Dr. Peters in Mocambique gesammelten Crustaceen. *Monatsber. K. Preuss Akad. Wiss, Berl.*. 782-851, pls. 1-4.
- HILGENDORF, F. 1896. Crustaceen. Baron Carl Claus von der Decken. *Reisen in Ost-Afrika in den Jahren 1859-1865*, 3(1) 67-116, pls. 1-6.
- HOLTHUIS, L.B. 1953. Enumeration of the Decapod and Stomatoped Crustacea from the Pacific Coral Islands. *Atoll. Res. Bull.*, 24 1-66, cartes 1-2 (Ronéotypé).
- HOLTHUIS, L.B. 1959. Notes on Pre-Linnean Carcinology (including the study of Xiphosura) of the Malay Archipelago. In H.C.D. de Wit (Ed.). *Rumphius Memorial Volume*, pp. 63-125, pls. 7-11. Baarn.

- HOLTHUIS, L.B. 1978. A collection of Decapod Crustacea from sumba, Lesser Sunda Islands, Indonesia. *Zool. Verh. Leiden*, **162** : 1-55, pl. 1, figs. 1-14.
- HUTCHINGS, P.A. and RECHER, H.F. 1982. The fauna of Australian mangroves. *Proc. Linn. Soc. N.S.W.*, **106**(1) 83-121.
- IHLE, J.E.W., 1918. Decapoda Brachyura der Siboga-Expedition. III. Oxystomata Calappidae, Leucosiidae, Raninidae. In *Siboga-Expeditie, Monogr., Leiden*, **39B** 159-322, figs. 78-148.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1955. Direction 11. Determination of the gender to be attributed to the names of one hundred seventy genera of the order Decapoda (Class Crustacea) placed in the Official List of generic names in the period upto the end of 1936. *Bull. Zool. Nom.* **1C** 15-34.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1956a. Completion of the entries relating to names of certain genera of the order Decapoda (Class Crustacea) placed on the Official List of generic names in Zoology in the period upto the end of 1936. *Bull. Zool. Nom.*, **1D** 47-82.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1956b. Opinion 423. Addition to the Official List of generic names in Zoology of the generic name *Xantho* (Leach) (1814) (Class Crustacea, Order Decapoda), and validation under the plenary powers of the Family group name Xanthinae Dana, 1851. *Bull. Zool. Nom.*, **14** (7) 197-214.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1956c. Opinion 394. Addition to the Official List of generic names in Zoology of the name *Portunus* Weber, 1795 and to the Official Index of Rejected and Invalid generic names in Zoology of the name *Portunus* Fabricius (Class Crustacea, Order Decapoda). *Bull. Zool. Nom.*, **12** (17) 315-336.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1958a. Official Index of Rejected and Invalid generic names in Zoology. First Instalment Names 1-1169. *Internat. Trust. Zool. Nom., London*.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1958b. Opinion 73. Five generic names in Crinoidea, eighty six generic names in Crustacea and eight generic names in Acarina placed in the Official List of generic names. *Bull. Zool. Nom.*, **1B** 207-212.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. 1964. Opinion 712. Forty seven genera of decapod Crustacea placed on the Official List. *Bull. Zool. Nom.* **21** 336-351.
- IRVINE, F.R. 1947. *The Fishes and Fisheries of the Gold Coast*. Crown Agents for the Colonies. pp. xv + 352, figs. 1-247.
- JACQUINOT, H. 1842-1853. In Homborn & H. Jacquinot. *Voyage au pôle Sud et dans l'Océanie sur les Corvettes l'Astrolabe et la Zélée*. Paris. Atlas, Crustacea, pls. 1-9.

- JACQUINOT, H. 1853. In H. Jacquinot & H. Lucas. *Id. Crustacés*, Vol. 3 1-107.
- JAYEWARDENE, R.P. 1987. Country Reports Sri Lanka. *Mangroves of Asia and the Pacific Status and Management. Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/2000). National Resources Management Center and National Mangrove Committee, Philippines*, pp. 219-230.
- JOEL, D.R. and RAJ, P.J.S. 1980. Taxonomic remarks on two species of the genus *Scylla* de Haan (Portunidae Brachyura) for Pulicat lake. *J. Inland Fish. Soc. India.*, 12 (2) 39-50.
- JONES, D.A. 1985. The biological Characteristics of the marine habitats found within the ROPME Sea Area. *Proceedings of the ROPME Symposium on Regional Marine Pollution Monitoring and Research Programmes (ROPME/GC-4/2)*, pp. 71-89.
- JONES, D.A. 1986. *A field guide to the seashores of Kuwait and the Arabian Gulf*. University of Kuwait and Blanford Press, Poole, 192 pp.
- KELLOGG, C.R. 1928. Crustacea of Fukien Province. *Lingnan Sci., J.*, 5 (4) 351-356.
- KEMP, S. 1915. Fauna of the Chilka Lake. *Mem. Indian Mus.*, 5 199-325, pls. 1-11, figs. 1-20.
- KEMP, S. 1918. Zoological results of a tour in the Far East, Decapod and Stomatopod Crustacea. *Mem. Asiatic Soc. Bengal*, 6 210-297.
- KEMP, S. 1919a. Notes on Crustacea Decapoda in the Indian Museum, XII. Scopimerinae. *Rec. Indian Mus.*, 16 (5) 305-348, pls. 12-13.
- KEMP, S. 1919b. *Id.* XIII. The Indian species of *Macrophthalmus*. *Rec. Indian Mus.*, 16 (5) 383-394, pl. 24.
- KENSLEY, B. 1918. On the Zoogeography of Southern Africa Decapod Crustacea, with a distributional check-list of the species. *Smithson. Contrib. Zool.*, No. 338, pp. 1-46, figs. 1-4.
- KHAN, M.A. 1977. Xanthidae (Crustacea, Decapoda, Brachyura) from Karachi coasts. *Biologia*, 23 179-187.
- KHAN, S.A and NATARAJAN, R. 1977. Annual reproductive cycle of the hermit crab *Clibanarius longitarsus* (de Haan) and factors influencing breeding. *Indian J. Mar. Sci.*, 6 (1) 102-104.
- KHAN, S.A and NATARAJAN, R. 1981. Reproductive strategy in hermit crabs of Vellar estuary. *Indian J. Mar. Sci.*, 10(1) 70-73.
- KIM, H.S. 1970. A check-list of the Anomura and Brachyura (Crustacea, Decapoda) of Korea. *Seoul Univ. J.*, ser. B, 21 1-34, pls. 1-5, fig. 1.
- KIM, H.S. 1973. A catalogue of Anomura and Brachyura from Korea. In : *Illustrated Encyclopedia of Fauna of Korea*, 14 1-694, pls. 1-112, figs. 1-265, tab. 1-2, 1 carte. Samhwa Publishing Company.

- KINGSLEY, J.S. 1880. Carcinological notes. IV. Synopsis of the Grapsidae. *Proc. Acad. nat. Sci. Philad.*, pp. 187-224.
- KLUNZINGER, C.B. 1906. *Die spitz-Und Spitzmundkrabben des Rothen Meeres*. Stuttgart, pp. 1-88, pls. 1-2.
- KLUNZINGER, C.B. 1913. Die Rundkrabben des Rothen Meeres. *Nova Acta K. Leopold. Carol. (Abhandl. K. Leop. - Carol. Deutsch. Akad. Naturf.)*, 99 (2) : 97-402 (1-306), pls. 5-11 (1-7).
- KOHLI, G.R. 1921-1922. Brachyura of the Karachi coast. *Proc. Lahore phil. Soc.*, 3 : 81-85.
- KOSSMANN, R. 1877. *Zoologische Ergebnisseiner Reise in die Kustengebiete des Rothen Meeres. Erste Halfte, Malacostraca (1. Theil Brachyura)*, pp. 1-66, pls. 1-3.
- KRAUSS, F. 1843. *Die Sudafrikamischen Crustaceen'* Stuttgart, pp. 1-68, pls. 1-4.
- KRISHNAMURTHY, K. and JEYASEELAN, M.J.P. 1981. The early life-history of fishes from Pichavaram mangrove ecosystem of India. *Rapp. P.-v. Reun. Cons. int. Explor. Mer.*, 178 416-423.
- KRISHNAM, T. and KANNUPANDI, T. 1987. Larval development of the mangrove crab *Sesarma bidens* (de Haan, 1835) in the Laboratory. *Mahasagar-Bull. nat. Inst. Oceanogr.*, 20 (3) 171-181.
- KUMAR, R. S. 1995. Macrobenthos in the mangrove ecosystem of Cochin back waters, Kerala South west Coast of India. *Indian J. Mar. Sci.*, 24 55-61.
- LALITHA DEVI, S. 1985. The fishery and biology of crabs of Kakinada region. *Indian J. Fish.*, 32(1) 18-32.
- LAMARCK, J.B.P.A. DE. 1801. *Système des animaux sans vertèbres*. Daterville Paris. Crustacés 145-170, 1 table.
- LAMARCK, J.B.P.A. DE. 1838. *Histoire naturelle des animaux sans vertèbres. Tome Cinguième Archnides, Crustacés, Annelides, Cirrhipedes* (1st ed.), Paris. Vol. 5, pp. 1-699.
- LANCHESTER, W.F. 1900. On a collection of crustaceans made at Singapore and Malacca. Part 1. Crustacea Brachyura. *Proc. zool. Soc. Lond.*, pp. 719-770, pls. 44-47.
- LATREILLE, P.A. 1796. *Précis des caractères génériques des insects, disposés dans un ordre naturel*. F. Bourdeaux Brive, pp. xiii + 201.
- LATREILLE, P.A. 1803. *Histoire naturelle, générale et particulière, des Crustacés et des Insectes.*, Paris. Vol. 3, pp. 1-467 Vol. 5, pp 1-406, pls. 38-43 , Vol. 6, pp. iii + 1-392, pls. 44-57.
- LATREILLE, P.A. 1806. *Genera Crustaceorum et Insectorum secundum ordinem naturalem in familias disposita, iconibus exemplisque plurimis explicata*. Tomus Primus. Parisiis et Argentorati, Apud Amand Koenig Bibliopolam, pp. i-xviii + 1-302.

- LATREILLE, P.A. 1817a. Les Crustacés, les Arachnides et les Insectes. In G. Cuvier. *Le règne animal distribué d'après son organization, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée* (1st ed.), Paris. vol. 3, pp. xxix + 653.
- LATREILLE, P.A. 1817b. Gêlasime, Gelasimus (Buffon). In *Nouveau dictionnaire d'histoire naturelle, appliquée aux arts, à l'agriculture, à l'économie rurale et domestique, à la médecine, etc.* (2nd ed.), Vol. 12: pp. 517-520.
- LATREILLE, P.A. 1828. *Encyclopédie méthodique histoire naturelle, entomologie ou histoire naturelle des Crustacés, des Archnides et des Insectes*, pp. 1-832.
- LATREILLE, P.A. 1829. Crustacés, Arachnides et partie des Insectes. In G. Cuvier. *Le règne animal distibué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée* (2nd ed.), Vol. 4, pp. xxvii + 1-584.
- LAURIE, R.D. 1906. Report on the Brachyura collected by Prof. Herdman at Ceylon in 1902. *Ceylon Pearl Oyster Fisheries Report*, London, 5 349-432, pls. 1-2, figs. 1-12.
- LAURIE, D. 1915. On the Brachyura. Report of the marine biology of the Sudanese Red sea, from collection made by C. Crossland. *J. Linn. Soc. Zool.*, 31: 407-475, pls. 42-45.
- LEACH, W.E. 1814. Crustaceology. In D. Brewster. *The Edinburgh Encyclopedia*, 7 383-437, pl. 221.
- LEACH, W.E. 1815. A tabular view of the external characters of four classes of animals, which Linne arranged under Insecta, with the distribution of the genera composing three of these classes into orders and descriptions of several new genera and species. *Trans. Linn. Soc. Lond.*, 11 : 306-400.
- LEACH, W.E. 1817. *The zoological miscellany, being descriptions or new or interesting animals.* London, Vol. 3, pp. vi + 151, pls. 121-149.
- LEENE, J.E. 1938. Die Decapoda Brachyura der Siboga Expedition. VII. Brachygnatha¹ Portunidae. *Siboga Expeditie Monogr., Leiden*, 39C 1-156, figs. 1-87.
- LENZ, H. 1905. Ostafrikanische Dekapoden und Stomatopoden. Gesammelt von Herrn Prof. Dr. A. Voeltzkow. *Ibid.*, 27 (4) 341-392, pls. 47-48.
- LENZ, H. 1910. Crustaceen von Madagaskar Ostafrika und Ceylon. In A. Voeltzkow. *Reise in Ostafrika in den Jahren 1903-1905. Wissenschaftliche Ergebnisse*, II 539-576, figs. 1-4, Stuttgart.
- LENZ, H. and RICHTERS, F. 1881. Beiträge sur krustoceenfauna von Madagascar. *Abh. Senckenb. naturf. Ges.*, 12. 421-428.
- LIN, C.C. 1949. A catalogue of brachyurous Crustacea of Taiwan. *Q. J. Taiwan Mus.*, 2(1) 10-33.

- LINNAEUS, C. 1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis.* (10th ed.). Holmiae Stockholm. Vol. 1. pp. iii + 823.
- LINNAEUS, C. 1767. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis.* (12th ed.). Holmiae Stockholom, Vol. 1 (2), pp. 533-1327.
- LINSENMAIR, K.E. 1967. Konstruktion und signalfunktion der sand pyramide der Reiterkrabbe *Ocypode saratan* Försk. (Decapoda Brachyura Ocypodidae). *Z. Tierpsychol.* **24** : 403-456.
- MACCAGNO, T. 1928. Crostacei Decapodi La specie del genere *Uca* Leach conservate nel Regio Museo Zoologico di Torino. *Boll. Musei. Zool. Ant. Comp. R. Univ. Torino*, ser 3, **41** (11) 1-52, figs. 1-33.
- MACINTOSH, D.J. 1977. Some responses of tropical mangrove fiddler crabs (*Uca spp*) to high environmental temperature. In *Proc. 12th Europ. mar. biol Symp.*, pp. 49-56. (Eds.) D.S. Mclusky and A. J. Berry. Pergamon Press Oxford.
- MACINTOSH, D.J. 1982. Ecological comparisons of mangrove swamp and salt marsh fiddler crabs. *Proc. 1st International Wetland Conference*, National Institute of Ecology, Jaipur and International Scientific Publication, Jaipur, pp. 243-257.
- MACINTOSH, D.J. 1984. Ecology and productivity of Malaysian mangrove crab populations (Decapoda Brachyura). *Proc. As. Symp. Mangr. Env. Res. & Manag.*, pp. 354-377.
- MACLEAY, W.S. 1838. On the brachyurous decapod Crustacea brought from the Cape by Dr. Smith. In *Illustrations of the Annulosa of South Africa; being a portion of the objects of Natural History chiefly collected during an expedition into the interior of South Africa, under the direction of Dr. Andrew Smith, in the years 1834-1836; Fitted out by "The Cape of Good Hope Association for Exploring Central Africa"*, London, pp. 53-71, pls. 2-3.
- MACNAE, W. 1963. Mangrove swamps in South Africa. *J. Ecol.*, **15** 1-25.
- MACNAE, W. 1968. A general account of the fauna and flora of mangrove swamps and forests in the Indo-West Pacific region. In F.S. Russel and M. Younge (Eds.). *Adv. Mar. Biol.*, **6** 73-270. Academic Press, New York.
- MACNAE, W. and KALK, M. 1962. The ecology of the mangrove swamps at Inchaca Island, Monzambique. *J. Ecol.*, **50** 19-34.
- MAKI, M. and TSUCHIYA, K. 1923a. Illustrations of the decapod crustaceans of Formosa. *Rept. Dep. Agric. Formosa Govt. Res.*, **3** 1-215, pls. 1-24.
- MAKI, M. and TSUCHIYA, K. 1923b. A monograph of the decapod Crustacea of Formosa. *Rept. Dep. Agric. Formosa Govt. Res.*, **3** 1-195, pls. 1-14.

- MALL, L.P., SINGH, V.P. and PATHAK, S.M. 1985. Mangrove forest of Andamans and some aspects of its ecology. *The Mangroves. Proc. Nat. Symp. Biol. Util. Cons. Mangroves Kolhapur, India*, pp. 25-38.
- MALPAS, A.H. 1933. Further observations on the age and growth rate of the Ceylon pearl oyster, *Margaritifera vulgaris*, with special reference to oysters of Donnass Mutturarattu Paar. *Ceylon J. Sci.*, 5C 21-48.
- MANDAL, A.K. and NANDI, N.C. 1989. Fauna of Sundarban mangrove ecosystem, West Bengal, India. *Fauna of Conservation Areas*. 3, *Zool Surv. India* 1-116, pls. 1-15.
- MANNING, R.B. and HOLTHUIS, L.B. 1981. West African brachyuran crabs (Crustacea Decapoda). *Smithson. Contrib. Zool.*, No. 306, pp. iii-xii + 1-379.
- MCNEILL, F.A. 1920. Studies in Australian carcinology. No. 1. *Rec. Aust. Mus.*, 13 : 105-109.
- MCNEILL, F.A. 1926. *Studies in Australian Carcinology*. No. 2. *Rec. Aust. Mus.* 15 : 100-131, pls. 9-10.
- MENON, M. K. 1952. A note on the bionomics and fishery of the swimming crab *Neptunus sanguinolentus* (Herbst) on the Malabar coast. *J. zool. Soc. India*, 4(2) 177-184.
- MIERS, E. J. 1876. *Catalogue of the stalk and sessile-eyed Crustacea of New Zealand*. London, pp. iii + xii + 1-136, pls. 1-3.
- MIERS, E. J. 1877. On a collection of Crustacea made by the Rev. G. Brown, C.M.Z.S., on Duke-of-York Island. *Proc. zool. Soc. Lond.*, année 1877 133-138.
- MIERS, E. J. 1880. On a collection of crustacea from the Malaysian Region. II. *Ann. Mag. nat. Hist.*, ser. 5, 5 : 304-317.
- MIERS, E. J. 1882. On some crustaceans collected at the Mauritius. *Proc. zool. Soc. Lond.*, pp. 538-543.
- MIERS, E. J. 1884. *Report of the zoological collections made in the Indo-Pacific Ocean during the voyage of H. M. S. "Alert" Crustacea (Brachyura)*. London, pp. 513-575, pls. 46-52.
- MIERS, E. J. 1886. The Brachyura collected by H. M. S. *Challenger* during the years 1873-1876. *Chall. Rep. Zool.*, 17 : 1-362, pls. 1-29.
- MILNE EDWARDS, A. 1861. Études zoologiques sur les Crustacés récents de la famille des Portuniens. *Archs. Mus. natn. Hist. nat.*, Paris, sér. 1, 10 : 309-428, pls. 28-38.
- MILNE EDWARDS, A. 1863. Monographie des Crustacés fossiles de la famille des Cancériens. *Annls. Sci. nat. (zool.)*, sér. 4, 20 : 273-324, pls. 5-12.
- MILNE EDWARDS, A. 1865. Études zoologiques sur les Crustacés récents de la famille des Cancériens. *Nouv. Arch. Mus. Hist. nat. Paris*, 1 : 177-308, pls. 11-19.
- MILNE EDWARDS, A. 1867. Descriptions de quelques espèces nouvelles de Crustacés Brachyures. *Annls. Soc. ent. Fr.*, sér. 4, 7 : 263-288.

- MILNE EDWARDS, A. 1868. Description de quelques Crustacés nouveaux provenant des voyages de M. Alfred Grandidier à Zanzibar et à Madagascar. *Nouv. Archs. Mus. Hist. nat. Paris*, 4 : 69-92, pls. 19-21.
- MILNE EDWARDS, A. 1873a. Description de quelques Crustacés nouveaux ou peu connus provenant du Musée de M. C. Godeffroy. *J. Mus. Godeffroy*, 1 (4) 77-88 (1-12), pls. 1-2.
- MILNE EDWARDS, A. 1873b. Recherches sur la faune carcinologique de la Nouvelle – Calédonie. Deuxième Partie. *Nouv. Archs. Mus. Hist. nat. Paris*, 9 : 155-332, pls. 4-18.
- MILNE EDWARDS, H. 1834-1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*, Paris. Vol. 1, pp. xxxv + 468 (1834) ; Vol. 2 : pp. 1-532 (1837).
- MILNE EDWARDS, H. 1852. Observations sur les affinités Zoologiques et la classification naturelle des Crustacés. *Annl. Sci. nat. (Zool.)*, sér. 3, 18 : 109-166, pls. 3-4.
- MILNE EDWARDS, H. 1853. Mémoire sur la Famille des Ocypodiens. Observations sur la classification des Crustacés. *Ibid.*, sér. 3, 3 (20) : 163-228, pls. 6-11.
- MIYAKE, S. 1936. Reports on the Brachyura of the Riukiu Islands collected by the Yaeyama Expeditions during the years 1932-1934. II. A list of the known species of the Brachyura from Ishigakishima. *Annot. zool. jap.*, 15 (4) 506-513.
- MIYAKE, S. 1939. Notes on Crustacea Brachyura collected by Professor Teiso Esaki's Micronesia Expeditions 1937-1938 together with a check-list of Micronesian Brachyura. *Res. Oceanogr. Wks. Japan*, 10 (2) 168-247, pls. 12-17 (1-6), tab. 1.
- MONOD, TH. 1934. Mission Robert ph. Dollfus en. Egypte. Decapoda Brachyura. *Mem. Inst. égypt.*, 37 : 91-162.
- MONOD, TH. 1956. Hippidea et Brachyura Ouest-africiens. *Mem. Inst. fr. Afr. noire*, 45 : 1-674, figs. 1-884.
- MONTAGUE, C.L. 1980. A natural history of temperate western Atlantic fiddler crabs with reference to their impact on salt marshes. *Contr. Mar. Sci.*, 23 : 25-55.
- MONTAGUE, C.L. 1982. The influence of Fiddler Crab burrows on metabolic processes in salt marsh sediment. In V. S. Kennedy (Ed.). *Estuarine Comparisons*, pp. 283-302. Academic Press, New York.
- MONTGOMERY, S.K. 1931. Report on the crustacea Brachyura of the Percy Sladen Trust Expedition to the Abrolhos Islands — under the leadership of Prof. W. J. Dakin in 1913 along with other crabs from western Australia. *J. Linn. Soc. Zool.*, 37 : 405-465, pls. 24-30.
- MOOREHOUSE, F.W. 1933. Note on *Trochus niloticus*. *Scient. Rep. Gt. Barrier Reef Exped.*, 3 : 145-155.
- MORTENSEN, TH. 1921. *Studies on the development and larval forms of echinoderms*. G.E.C. Gad Copenhagen, pp. 1-261, pls. 1-33.

- MUSTAQUIM, J. and RABBANI, M.M. 1976. Species of portunid crabs (Decapoda Brachyura) from Karachi. *Pakistan J. Sci. Ind. Res.*, **19** : (3-4) 161-164.
- NAIYANETR, P. 1983. Crabs in mangroves and adjacent areas. *First UNDP/UNESCO Regional Training Course on Introduction to Mangrove Ecosystems*, 2-30 March 1983. National Research Council, Bangkok, Thailand.
- NAIYANETR, P. 1985. Life history of selected species of crabs in mangroves. In *Report of the Training Course on Life History of Selected Species of Flora and Fauna in Mangrove Ecosystem. UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/002)*, National Research Council and National Mangrove Committee, Thailand, pp. 179-184.
- NANDI, N.C. and DEV ROY, M.K. 1991. Burrowing activity and distribution of *Scylla serrata* (Forskål) from Hooghly and Matla estuaries, Sundarban, West Bengal. *J. Bombay nat. Hist. Soc.*, **88** (2) 167-171.
- NAUCK, E. 1880. Das Kaugerüst der Brachyures. *Z. wiss Zool. (Leipzig)*, **34** : 1-69, pl. 1.
- NEUMANN, R. 1878. *Systematische uebersicht der Gattungen der Oxyrhynchen catalog der podophthalmen Crustaceen des Heidelberger Museums. Beschreibung einiger neuer Arten.* Leipzig, pp. 1-39.
- NEWELL, R.C. 1979. *Biology of Intertidal Animals.* Marine Ecological Surveys Ltd., Faversham, Kent, pp. vii-ix + 1-781.
- NG. P.K.L. 1988. *Elamenopsis mangalis*. sp. nov., a new species of mangrove-dwelling hymenosomatid crab from Singapore (Decapoda, Brachyura). *Crustaceana*, **55** : (3) 274-278.
- NG. P.K.L. 1990. *Luteocarcinus sordidus*, new genus and species from mangrove swamps in Peninsular Malaysia (Crustacea Decapoda Brachyura Rhizopinae). *Proc. Biol. Soc. Wash.*, **103** : 95-99.
- NG. P.K.L. and TAN, L.W.H. 1987. The leaf carrying behaviour of *Neodorippe (Neodorippe) callida* (Fabricius, 1798) with a note on carrying behaviour of dorippid crabs (Crustacea, Decapoda, Brachyura). *J. Singapore Natl. Acad. Sci.*, **15** : 45-47.
- NICHOLLS, A.G. 1931. On the breeding and growth rate of black-lip pearl oyster, *Pinctada margaritifera*. *Rep. Gt. Barrier Reef Comm.*, **3**.
- NOBILI, G. 1906a. Faune Carcinologique de la Mer Rouge. Décapodes et Stomatopodes. *Annl. Sci. nat. (Zool.)*, Sér. 9, **4** : 1-347, pls. 1-11, figs. 1-12.
- NOBILI, G. 1906b. Diagnoses préliminaires de Crustacés Décapodes et Isopodes nouveaux recueillis par M. le Dr. G. Seurat aux îles Tuamotu. *Bull. Mus. Hist. nat. Paris*, **12** : 256-270.
- NOBILI, G. 1907. Ricerche sui Crostacei della Polinesia. Decapodi, Stomatopodi, Anisopodi and Isopodi. *Memorie R. Accad. Sci. Torino*, sér. 2, **57** : 351-430, pls. 1-3.

- ODHNER, T. 1925. Monographierte Gattungen der Krabbenfamilie Xanthidae. *T. Göteborgs K. Vetensk-O Vetterhsamh. Handl.*, ser. 4, 29 (1) 1-42, pls. 1-5, figs. 1-7.
- ONG, K.S. 1964. The early developmental stages of *Scylla serrata* Forsskål (Crustacea Portunidae) reared in the laboratory. *Proc. Indo-Pacif. Fish Coun.*, 11 (2) 135-146.
- ONO, Y. 1965. On the ecological distribution of ocypodid crabs in the estuary. *Mem. Fac. Sci. Kyushu Univ.*, ser. E., 4 (1) 1-60.
- ORTMANN, A. 1893. Die Decapoden-Krebse des Strassburger Museums. VII. Theil. Abtheilung Brachyura (*Brachyura genuina* Boas). II. Unterabtheilung Cancroidea, 2. Section Cancrinea, 1. Gruppe Cyclometopa. *Zool. Jb. (Syst.)*, 7 (1) 23-88, 7 (2) 411-495.
- ORTMANN, A. 1894. *Id.* III. Unterabtheilung Cancroidea 2. Section Cancrinea, 2. Gruppe Catometopa. *Zool. Jb. (Syst.)*, 8 : 683-772. pl. 23.
- ORTMANN, A. 1896. Das System der Decapoden-Krebse. *Zool. Jb. (Syst.)*, 9 (3) 409-453.
- ORTMANN, A. 1897. Carcinologische Studien. *Zool. Jb. (Syst.)* 10 (3) 258-372, pl. 17.
- ORTMANN, A. 1899. Crustacea, Zweite Hälfte Malacostraca. In H. G. Bronn. *Klassen und Ordnungen des Thier-Reichs*, Band 5, Abtheilung II (Gliederfüssler Arthropoda), Lieferung 53-56 1169-1232, pls. 117-122, Leipzig.
- ORTON, J.H. 1920. Sea temperature, breeding and distribution in marine animals. *J. mar. biol. Ass. U. K.*, 12 : 339-366.
- OSHIRO, N. 1988. Mangrove crabs (*Scylla* spp.). In S. Shokita (Ed.). *Aquaculture in tropical areas*, pp. 198-209. Midorishobo, Tokyo.
- OSWIN, S.D. 1998. Biodiversity of the Muthupet mangroves, Southeast Coast of India. *Seshaiyana*, 6 (1) : 9-11.
- PALLAS, P.S. 1772. *Spicilegia zoologica. Quibus novae imprimis et obscurae animalium species. Iconibus, descriptionibus atque commentariis illustrantur (Fasciculus Nonus)*. Berolini, pp. 83-84.
- PANIKKAR, N.M. and AIYAR, R.G. 1939. Observations on breeding in brackish water animals of Madras. *Proc. Indian Acad. Sci.*, 9B : 343-354.
- PARISI, B. 1914. I Decapodi giapponesi del Museo di Milano. 1. Oxystomata (Can tre tavole). *Atti. Soc. ital. Sci. nat.*, 33 : 5-35.
- PARISI, B. 1916. *Id.* IV. Cyclometopa. *Atti. Soc. ital. Sci. nat.*, 55 (2-3) 153-190, pls. 7-11, figs. 1-4.
- PARKINSON, C.E. 1923. *A forest flora of the Andaman Islands*. Indian Government Central Press Simla, pp. 1-325.
- PASUPATHI, K. and KANNUPANDI, T. 1986. Laboratory reared larval stages of the mangrove grapsid crab, *Metopograpsus maculatus* H. Milne Edwards. *Mahasagar - Bull. nat. Inst. Oceanogr.*, 19 (4) 233-244.

- PAUL, M.D. 1942. Studies on the growth and breeding of certain sedentary organisms of the Madras Harbour. *Proc. Indian Acad. Sci.*, **15B** : 1-42.
- PILLAI, K.K. and NAIR, N.B. 1973. Observations on the breeding biology of some crabs from the south-west coast of India. *J. mar. biol. Ass. India*, **15** (2) 754-770.
- PILLAI, N.K. 1951. Decapoda (Brachyura) from Travancore. *Bull. Cent. Res. Inst. Univ. Travancore*, ser. C, **2** (1) 1-46, figs. 1-5.
- PILLAY, K. K. and NAIR, N. B. 1971. The annual reproductive cycles of *Uca annulipes*, *Portunus pelagicus* and *Metapenaeus affinis* (Decapoda Crustacea) from the south-west coast of India *Mar. Biol.*, **11** : 152-166.
- POWERS, L. W. and BLISS, D. E. 1983. Terrestrial adaptations. In F. J. Vernberg and W. B. Vernberg (Eds.). *The Biology of Crustacea*, **8** : 271-331. Academic Press, New York.
- PRASAD, R.R. and TAMPI, P.R.S. 1953. A contribution to the biology of the Blue Swimming Crab, *Neptunus pelagicus* (Linnaeus) with a note on the zoea of *Thalamita crenata* Latreille. *J. Bombay nat. Hist. Soc.*, **51** (3) 674-689, pl. 1.
- PRETZMANN, G. 1974. Die unterfamilie Macrothelminae Dana im Wiener Naturhistorischen Museum. *Annl. Naturh. Mus. Wien*, **78** : 437-444, pls.1-8.
- PRETZMANN, G. 1977. Die Macrothelminae des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg. *Mitt. hamb. Zool. Mus. Inst.*, **74** : 65-67, pl. 7.
- RAFINESQUE, C.S. 1814. *Précis des découvertes et travaux somiologiques de Mr. C. S. Rafinesque-Schmaltz, entre 1800 et 1814, ou choix raisonné de ses principales découvertes en zoologie et en botanique, pour servir d'introduction à ses ouvrages futurs*. Palermo, pp. 1-55.
- RAFINESQUE, C.S. 1815. *Analyse de la nature ou tableau de l'univers et de corps, organisés*. Palermo, pp. 1-224.
- RAFINESQUE, C.S. 1815. (Review of) Journal of the Academy of Natural Sciences of Philadelphia. Vol. i, Part 1, Philadelphia, 8vo. pp. 220 and 9 plates, May to December, 1817. *American Monthly Magazine & Critical Review*, **3** : 269-274.
- RAHAMAN, A.A. 1967. Reproductive and nutritional cycles of the crab *Portunus pelagicus* (Linnaeus) (Decapoda Brachyura) of the Madras coast. *Proc. Indian Acad. Sci.*, **65B** : 76-82.
- RAJABAI, B.S. 1975. The breeding season of twenty marine decapods of Visakhapatnam – Waltair coast. *J. zool. Soc. India*, **27** (1-2) 69-79.
- RAO, A.N. 1987. Mangrove Ecosystems of Asia and the Pacific Status and Management. In *Technical Report of the UNDP/UNESCO Research and Training Pilot Programmes of Mangrove Ecosystems in Asia and the Pacific (RAS/79/002)*, National Resources Management Center and National Mangrove Committee, Philippines, pp. 1-48.

- RAO, P.V., THOMAS, M.M. and RAO, G.S. The crab fishery resources of India. *Proc. Symposium on Living Resources of the Seas around India, Cochin*, pp. 581-591.
- RATHBUN, M.J. 1897. A revision of the nomenclature of the Brachyura. *Proc. biol. Soc. Wash.*, **11** : 153-167.
- RATHBUN, M.J. 1902. Crabs from the Maldive Islands. *Bull. Mus. comp. Zool. Harv.*, **39** (5) : 123-128.
- RATHBUN, M.J. 1906a. Descriptions of three mangrove crabs from Costa Rica. *Proc. biol. Soc. Wash.*, **19** : 99-100.
- RATHBUN, M.J. 1906b. The Brachyura and Macrura of the Hawaiian Islands. *Bull. U.S. Fish Commn.*, **23** : 827-930, pls. 1-24.
- RATHBUN, M.J. 1911. Marine Brachyura, Number 11. In The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner, Volume 3. *Trans. Linn. Soc. Lond. Zool.*, ser. 2, **14** (2) 191-261, pls. 15-20.
- RATHBUN, M.J. 1914a. New Genera and Species of American brachyrhynchus crabs. *Proc. U.S. natn. Mus.*, **47** : 117-129, figs. 1-10.
- RATHBUN, M.J. 1914b. Stalk-eyed crustaceans collected at the Monto Bello Islands. *Proc. zool. Soc. Lond.*, pp. 653-664, pls. 1-2.
- RATHBUN, M.J. 1918. The grapsoid crabs of America. *Bull. U.S. natn. Mus.*, **97** : i-xxii + 1-461, pls. 1-161, figs. 1-172.
- RATHBUN, M.J. 1923. Report on the crabs obtained by the F.I.S. "Endeavour" on the coasts of Queensland, New South Wales, Victoria, South Australia and Tasmania. *Zool. (biol.) Results Fish. Exp. 'Endeavour'*, **5** (3) 95-156, pls. 16-42, figs. 1-3.
- RATHBUN, M.J. 1930. The Cancroid crabs of America of the families Euryalidae, Portunidae, Atelecyclidae, Cancridae and Xanthidae. *Bull. U.S. natn. Mus.*, **152** : i-xvi + 1-609, pls. 1-230.
- RATHBUN, M.J. 1937. The Oxystomous and allied crabs of America. *Bull. U.S. natn. Mus.*, **166** : i-iv + 1-272, pls. 1-86.
- REESE, E.S. 1968. Annual breeding seasons of three sympatric species of tropical intertidal hermit crabs, with a discussion of factors controlling breeding. *J. Exp. Mar. Biol. Ecol.*, **2** : 308-318.
- RICE A.L. 1980. Crab zoeal morphology and its bearing on the classification of the Brachyura. *Trans. zool. Soc. Lond.*, **35** : 271-424.
- RICHTERS, F. 1880. Decapoda. In K. Möbius, *Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen*, pp. 139-178, pls. 15-18.
- RUMPHIUS, G.E. 1705. *D'Amboinsche Rariteikamer, behelzende eene Beschryvinge van allerhande zoo weeke als harde Schaalvisschen, te weeten raare Krabben, Kreeften, en diergelyke*

Zeedieren, als mede allerhande Hoorntjes en Schulpen, die men in d'Amboinsche Zee vindt daar beneven zommige Mineraalen, Gesteenten, en soorten van Aarde, die in d'Ambionsche, en zommige omleggende Eilanden gevonden worden et. Lugduni Batavorum. pp. 1-340, pls. 1-60.

- RUMPHIUS, G.E. 1711. *Thesaurus Imaginum Piscium Testaceorum ; Quales sunt Cancrini, Echini, Echinometra, Stellae Marinae.....omnium maximam partem.* Lugduni Batavorum, Apud Petrum vander Aa, Bibliopolam, pp. 1-15, pls. I-LX, index LXI-LXVII.
- RÜPPELL E. 1830. *Beschreibung und Abbildung von 24 Arten Kurzschwänzigen Krabben, als Beiträge zur Naturgeschichte des Rothen Meeres.* Frankfurt, pp. 3-28, pls. 1-6.
- RYAN, E.P. 1967. Structure and function of the reproductive system of the crabs, *Portunus sanguinolentus* (Herbst.). 1. The male system. *Proc. Symp. Crustacea Ernakulum, Mar. Biol. Assoc. India*, 2 : 506-521.
- SAHANY, K.C. 1957. Mangrove forest in the Andaman and Nicobar Islands. *Proc. Mangrove Symposium, Calcutta*, Oct. 16-19, 1957, pp. 114-123.
- SAKAI, T. 1939. *Studies on the Crabs of Japan. IV. Brachygnatha, Brachyrhyncha.* Yokendo, Tykyo, pp. 365-741, pls. 42-111.
- SAKAI, T. 1953. Preliminary report on the brachyuran Crustacea of Hachijo Island. *Rec. Oceanogr. Works Japan*, 1 (2) 73-77.
- SAKAI, T. 1965. *The Crabs of Sagami Bay.* Imperial Household, Tokyo, pp. 1-206, pls. 1-100, figs. 1-27.
- SAKAI, T. 1976. *The Crabs of Japan and Adjacent Seas.* Kodansha Ltd., Tokyo, pp. 1-723, pls. 1-251, figs. 1-379.
- SAMOUELLE, G. 1819. *The Entomologist's Useful Compendium, or An Introduction to the Knowledge of British Insects.* London, pp. 1-496.
- SANKARANKUTTY, C. 1961a. On Decapoda Brachyura from the Andaman and Nicobar Islands. 1. Families Portunidae, Ocypodidae, Grapsidae and Mictyridae. *J. mar. biol. Ass. India*, 3 (1-2) 101-119, figs. 1-5.
- SANKARANKUTTY, C. 1961b. On some crabs (Decapoda Brachyura) from the Laccadive Archipelago. *J. mar. biol. Ass. India*, 3 (1-2) 120-136, figs. 1-2.
- SANKARANKUTTY, C. 1962a. On Decapoda Branchyura from the Andaman and Nicobar Islands. 2. Family Xanthidae. *J. mar. biol. Ass. India*, 4 (1) 121-150, figs. 1-50.
- SANKARANKUTTY, C. 1962b. On Decapoda Brachyura from the Andaman and Nicobar Islands. 3. Families Calappidae, Leucosiidae, Parthenopidae, Maiidae and Gecarcinidae. *J. mar. biol. Ass. India*, 4 (1) 151-164, figs. 1-23.
- SASEKUMAR A. 1974. Distribution of macrofauna on a Malayan mangrove shore. *J. Anim. Ecol.*, 43 : 51-69.

- SASTRY, A.N. 1983. Ecological aspects of reproduction in F.J. Vernberg and W.B. Vernberg (Eds.). *The Biology of Crustacea*, 8 : 179-270. Academic Press, New York.
- SAY, T. 1817. An account of the Crustacea of the United States. *J. Acad. nat. Sci. Philad.*, 1 (1-2) 65-80, 155-160.
- SEMPER, K. 1881. *Animal Life*. International Scientific Series, London.
- SENDLER, A. 1923. Die Decapoden and Stomatopoden der Hanseatischen Südsee Expedition. *Abh. Senckenb. naturforsch. Ges.*, 38 : 21-47. figs. 1-3. pls. 5-6.
- SERÈNE, R. 1952. Les espèces due genre *Scylla* à Nhatrang (Vietnam). *Proc. Indo-Pacif. Fish Coun.*, 3 (2) 133-137, pls. 1-2, fig. 1.
- SERÈNE, R. 1968. The Brachyura of the Indo-West Pacific Region. In Prodrumus for a checklist of the (Non-planctonic) marine fauna of South East Asia. *National Academy of Sciences Special Publication*, UNESCO/Singapore, 1 : 33-112. (Ronéotypé)
- SERÈNE, R. 1984. Crustacés Decapodes Brachyours de l'Océan Indien Occidental et de La Mer Rouge. Xanthoidea Xanthidae et Trapeziidae. *Faune Tropicale*, 24 : 1-349, pls. 1-48.
- SERÈNE, R. and SASEKUMAR, A. 1971. Rediscovery of three species of Brachyura in Malaysia. *Fedn. Mus. J. (N.S.)*, 16 : 75-84, pls. 9-10, figs. 10-11.
- SERÈNE, R. and SOH, C.L. 1970. New Indo-Pacific genera allied to *Sesarma* Say, 1817 (Brachyura, Decapoda, Crustacea). *Treubia*, 27 (4) 387-416, pls. 1-8.
- SHAW, G. and NODDER, F.P. 1803. *Naturalist's Miscellany*, 15 : pl. 589-612.
- SHEN, C.J. 1934. The crabs of Hong Kong. Part IV. *Hongkong Nat. (Suppl)*, 3 : 37-56, figs. 1-18.
- SHEN, C.J. 1937. Notes on a collection of swimming crabs (Portunidae) from Singapore. *Bull. Raffles Mus.*, 13 : 96-139.
- SHEN, C.J. 1940. The branchyuran fauna of Hong Kong. *J. Hongkong Fish. Res. Stn.*, 1 (2) 211-242.
- SILAS, E.G. and SANKARANKUTTY, C. 1960. On the castle building habit of *Cardisoma carnifex* (Herbst) (Family Gecarcinidae) of the Andaman Island. *J. mar. biol. Ass. India*, 2 (2) 237-240.
- SOEGIARTO, A. 1984. The mangrove ecosystem in Indonesia, its problems and management. In H.J. Teas (Ed.). *The Physiology and Management of Mangroves*, pp. 69-78. Dr. W. Junk Publishers, The Hague.
- SOEMODIHARDJO, S. 1987. Country Reports Indonesia. Mangroves of Asia and the Pacific Status and Management. In *Technical Report of the UNDP/UNESCO Research and Training Pilot Programme on Mangrove Ecosystems in Asia and the Pacific (RAS/79/002)*. National Resources Management Center and National Mangrove Committee, Philippines, pp. 89-129.

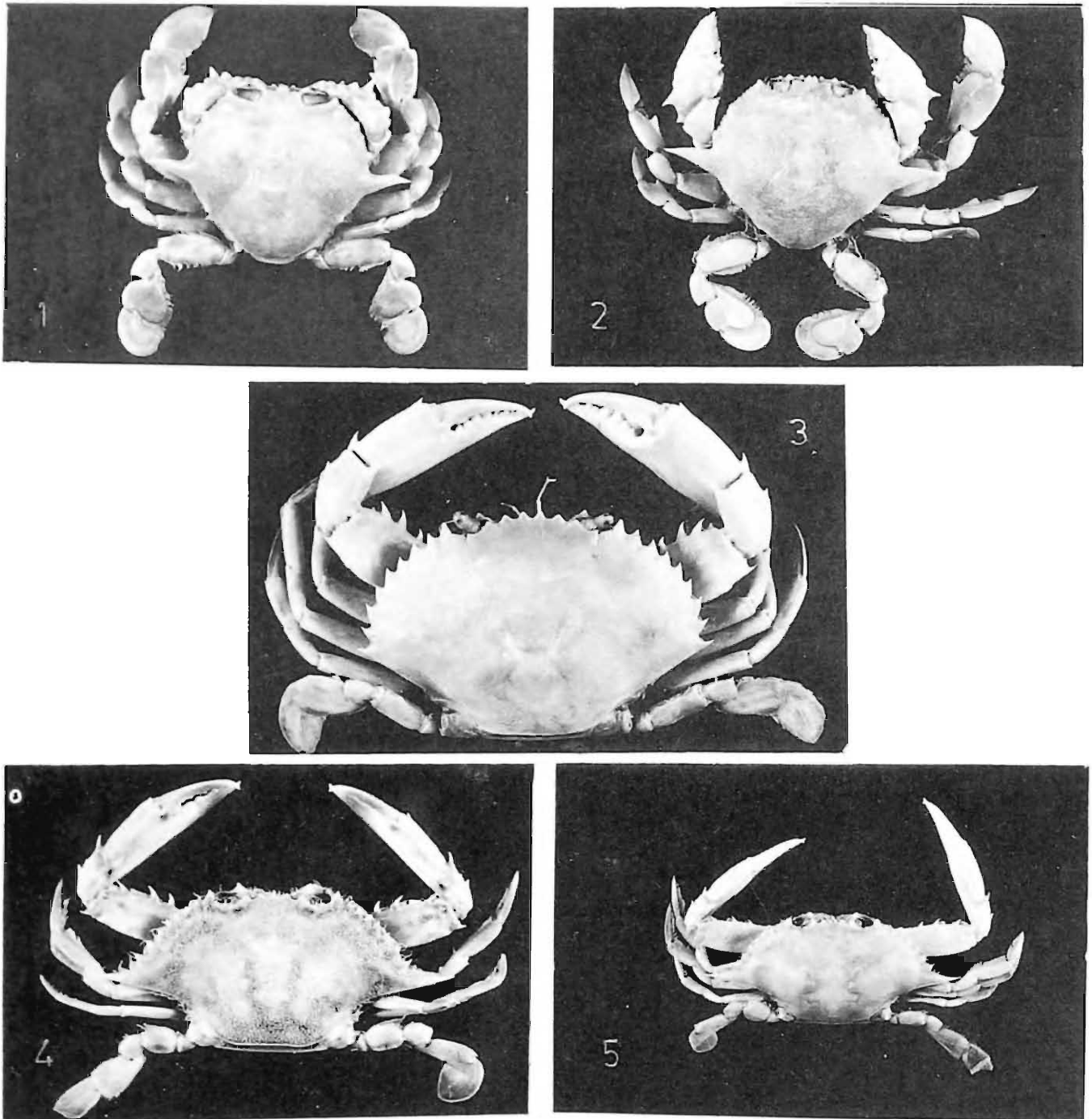
- SMITH, S.I. 1869. Notice of the Crustaea collected by Prof. C.F. Hartt on the coast of Brazil in 1867. *Trans. Conn. Aca. Arts. Sci.*, **2** : 1-42, pl. 1.
- SMITH, S.I. 1870. Ocyphodoidea Notes on American Crustacea, No. 1. *Trans. Conn. Aca. Arts. Sci.*, **2** : 113-176, pls. 2-5.
- SNELLING, B. 1959. The distribution of intertidal crabs in the Brisbane River. *Aust. J. mar. Freshwat. Res.*, **10** : 67-82.
- STEBBING, T.R.R. 1905. South African Crustacea. Part III. In *Mar. Invest. S. Afr.*, **4** : 21-123, pls. 17-26.
- STEBBING, T.R.R. 1910. General catalogue of South African Crustacea. *Ann. S. Afr. Mus.*, **6** (4) 281-593, pls. 15-22.
- STEPHENSON, K. 1945. The Brachyura of the Iranian Gulf with an appendix the male pleopoda of the Brachyura. Part IV. *Dan. Scient. Invest. Iran*, pp. 57-237, figs. 1-60.
- STEPHENSON, A. 1934. The breeding of reef animals. Part II. Invertebrates other than corals. *Sci. Rep. Gr. Barrier Reef Exped.*, **3** (4) 247-272.
- STEPHENSON, T.A. 1942. The causes of the vertical and horizontal distribution of organisms between tidemarks in South Africa. *Proc. Linn. Soc. Lond.*, **154** : 219.
- STEPHENSON, W. and CAMBELL, B. 1959. The Australian portunids (Crustacea Portunidae). III. The genus *Portunus*. *Aust. J. mar. Freshwat. Res.*, **10** (1) 84-124, pls. 1-5.
- STEPHENSON, W. and CAMBELL, B. 1960. *Id.* Remaining genera. *Ibid.*, **11** (1) 73-122, pls. 1-6, figs. 1-3.
- STEPHENSON, W. and HUDSON, J.J. 1957. *Id.* 1. The Genus *Thalamita*. *Ibid.*, **8**(3) 312-368, pls. 1-10.
- STEPHENSON, W., HUDSON, J.J. and CAMPBELL, B. 1957. *Id.* The Genus *Charybdis*. *Ibid.*, **8** (4) 491-507, pls. 1-5, figs. 1-3.
- STIMPSON, W. 1858a. Crustacea Cancroidea et Corysotidea Prodomous descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. Pars IV. *Proc. Acad. nat. Sci. Philad.*, **10** 31-40.
- STIMPSON, W. 1858b. Crustacea Ocyphodoidea Prodomous descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus observavit et descripsit. Pars V. *Proc. Acad. nat. Sci. Philad.*, pp. 39-56 (93-110).
- STIMPSON, W. 1907. Report on the Crustacea collected by the North Pacific Exploring Expedition 1853-1856. *Smithson. Misc. collns.*, **49** : 1-240, pls. 1-26.
- STREETS, T.H. 1877. Contributions to the natural history of the Hawaiian and Fanning Islands and Lower California. (Crustacea). *Smithsonian Misc. collns.*, **13** : 103-141.

- SUKUMARAN, K.K., TELANG, K.Y. and THIPPESWAMY, D. 1986. On the fishery and biology of the crab *Portunus sanguinolentus* (Herbst) along the South Kanara Coast. *Indian J. Fish.*, **33** (2) 188-200.
- TAI, A.Y. and MANNING, R.B. 1984. A new species of *Potamocypoda* (Crustacea Brachyura Ocypodidae) from Malaysia. *Proc. biol. Soc. Wash.*, **97** : 615-617.
- TAKEDA, M. 1978. Brachyura. In T. Kikuchi and S. Miyake (Eds.). Fauna and Flora of the sea around the Amakusa Marine Biological Laboratory. Part II. Decapoda Crustacea. *Contrib. Amakusa mar. biol. Lab. Kyushu Univ.*, **245** : 32-45.
- TAKEDA, M. and MIYAKE, S. 1976. Crabs of the Ogasawara Islands. 1. List of the known species. *Researches on Crustacea, Tokyo*, **7** : 101-115, fig. 1.
- TAKEDA, M. and NUNOMURA, N. 1976. Crabs collected by the Melanesia Expedition of the Osaka Museum of Natural History, 1958. *Bull. Osaka Mus. nat. Hist.*, **30** : 61-92, figs. 1-3.
- TAN, C. G. S. and HUMPHREYS, A. 1995. *Paracleistostoma tweedei*, a new species of Camptandriine crabs from Singapore and Brunei mangroves (Crustacea Decapoda Brachyura : Ocypodidae). *Raffles Bulletin of Zoology*, **43** (1) 251-256.
- TAN, C. G. S. and NG, P.K.L. 1993. *Praosia punctata*, a new genus and species of mangrove Leucosiid crab (Crustacea Decapoda Brachyura) from Singapore. *Crustaceana*, **64** (1) 40-47.
- TAN, C. G. S. and NG, P.K.L. 1994. An annotated checklist of mangrove brachyuran crabs from Malaysia and Singapore. *Hydrobiologia*, **285** : 75-84.
- TESCH, J.J. 1915. The catometopus genus *Macrophthalmus* as represented in the collection of the Leiden Museum. *Zoöl. Meded., Leiden*, **1** : 149-204, pls. 5-9.
- TESCH, J.J. 1917. Synopsis of the genera *Sesarma*, *Metasesarma*, *Sarmatium* and *Clistocoeloma*, with a key to the determination of the Indo-Pacific species. *Zoöl. Meded., Leiden*, **3** (2-3) 127-260, pls. 15-17.
- TESCH, J.J. 1918. The Decapoda Brachyura of the Siboga-Expedition. 1. Hymenosomidae, Retroplumidae, Ocypodidae, Grapsidae and Gecarcinidae. *Siboga Expeditie, Monogr., Leiden*, **39C** : 1-148, pls. 1-6.
- THOMAS, M., KHAN, S.A., KANNUPANDI, T. and NATARAJAN, R. 1980. Laboratory reared larval stages of the Portunid Crab *Thalamita crenata* Milne Edwards. *Indian J. Mar. Sci.*, **9** (4) 263-270.
- THORSON, G. 1950. Reproductive and larval ecology of marine bottom invertebrates. *Biol. Rev.*, **25** : 1-45.
- TWEEDIE, M.W.F. 1936. On the crabs of the Family Grapsidae in the collection of the Raffles Museum. *Bull. Raffles Mus.*, **12** : 44-70.

- TWEEDIE, M.W.F. 1937. On the crabs of the family Ocypodidae in the collection of the Raffles Museum. *Bull. Raffles Mus.*, **13** : 140-170.
- TWEEDIE, M.W.F. 1949. The species of *Metopograpsus* (Crustacea Brachyura). *Bijr. Dierk.*, Amsterdam, **28** : 466-471, figs. 1, a-g.
- TWEEDIE, M.W.F. 1950a. Notes on grapsoid crabs from the Raffles Museum. *Bull. Raffles Mus.*, **23** : 310-316.
- TWEEDIE, M.W.F. 1950b. Grapsoid crabs from Labuan and Sarawak. *Sarawak Mus. J.*, **5** (2) 338-369.
- TÜRKAY, M. 1973. Zur synonymie von *Epigrapsus notatus* and *Cardisoma carnifex* (Crustacea Decapoda). *Senckenberg. biol.*, **54** (1-3) 105-110.
- URITA, T. 1926. A checklist of Brachyura found in Kagoshima Prefecture, Japan. *The Tsingtao Times, Tsingtao*, pp. 1-40.
- USCHAKOV, P.V. 1970. Observations sur la repartition de la faune benthique du littoral Guinéen. *Cah. Biol. mar.*, **11**(4) 435-457, figs. 1-4.
- VANNINI, M. 1976. Researches on the coast of Somalia. The shore and the dune of Sar Uanle. 8. Notes on Atelecyclidae and Portunidae (Decapoda Brachyura). *Monitore zool. ital. N. S. Supple*, **8**(2) : 119-127.
- VASUDEVA RAO, M.M. 1986. A preliminary report on the angiosperms of Andaman-Nicobar Islands. *J. Econ. Tax. Bot.*, **8**(1) 107-184.
- VERWEY, J. 1930. Einiges über die biologie Ost - Indischer Mangrove Krabben. *Treubia*, **12** (2) 169-261, pls. 6-14.
- VIJAYKUMAR, G. and KANNUPANDI, T. 1986. Zoeae and megalopa of the mangrove crab *Sesarma andersoni* de Man reared in the laboratory. *Mahasagar - Bull. nat. Inst. Oceanogr.*, **19** (4) 245-255.
- VOGEL, F. 1984. Comparative and functional morphology of the spoon-tipped setae on the second maxillipeds in *Dotilla* Stimpson, 1858 (Decapoda, Brachyura, Ocypodidae). *Crustaceana*, **47**(3) 225.
- VON HAGEN, H.O. 1968. Studienen peruanischen Winterkrabben (*Uca*). *Zool. Jahrb., Abt. Syst. (Oekol), Geogr. Tiere*, **95** : 395-468.
- VON HAGEN, H.O. 1976. Review Jocelyn Crane, Fiddler Crabs of the World Ocypodidae Genus *Uca*. *Crustaceana*, **31**(2) 221-224.
- VOUSDEN, D.H.F. 1988. *The Bahrain marine habitat survey, Vol. 1. The Technical Report, ROPME*, 103 pp.
- WALKER, A.O. 1890. Notes on a collection of crabs from Christmas Island, Indian Ocean. *J. Linn. Soc. Zool.*, **20** : 105-139, pls. 6-9.

- WARD, M. 1932. The true crabs of the Capricorn Group, Queensland. *Aust. Zool.*, 7(3) : 237-255.
- WARD, M. 1934. Notes on a collection of crabs from Christmas Island, Indian Ocean. *Bull. Raffles Mus.*, 9 : 5-26, pls. 1-3.
- WARD, M. 1939. The Brachyura of the second Templeton Crocker - American Museum Expedition to the Pacific Ocean. *Am. Mus. Novit.*, 1049 : 1-15, figs. 1-17.
- WARD, M. 1942. Notes on the Crustacea of the Desjardins Museum, Mauritius Institute, with descriptions of new genera and species. *Bull. Maurit. Inst.*, 2(2) : 49-109, pls. 5-6.
- WARNER, G.F. 1967. The life-history of the mangrove tree crab, *Aratus pisoni*. *J. Zool.*, 153 : 321-335.
- WARNER, G.F. 1969. The occurrence and distribution of crabs in a Jamaican mangrove swamp. *J. Anim. Ecol.*, 38 : 379-389.
- WEBER, F. 1795. *Nomenclator entomologicus secundum Entomologiam Systematicam ill. Fabricii adjectis speciebus reconstitutis et varietatibus*. Chilonii and Hamburgi, pp. viii + 1-171.
- WHITE, A. 1847a. *List of the specimens of Crustacea in the collection of the British Museum*. London, pp. viii + 1-143.
- WHITE, A. 1847b. Short descriptions of new or little known Decapod Crustacea. *Proc. zool. Soc. Lond.*, 15 : 222-228.
- WHITE, A. 1848. Short descriptions of new or little known Decapod Crustacea. *Ann. Mag. nat. Hist.*, ser. 2, 2 : 282-288.
- WHITELEGGE, T.H. 1890. List of the marine and freshwater invertebrate fauna of Port Jackson and the neighbourhood. *J. Proc. R. Soc. N.S.W.*, 23 : 163-323.
- WHITELEGGE, T. 1897. The Crustacea of Funafuti. Part II. *Mem. Austral. Mus.*, 3 : 127-151.
- YOKOYA, Y. 1933. On the distribution of decapod crustaceans inhabiting the continental shelf around Japan, based upon the materials collected by s.s. Sōyō-Marū, during the years 1923-1930. *J. Coll. Agric. imp. Univ. Tokyo*. 12 (1) : 1-226, figs. 1-71.
- ZUCKER, N. 1974. Shelter building as a means of reducing territory size in the fiddler crab, *Uca terpsichores* (Crustacea Ocypodidae). *Am. Midl. Nat.*, 91 : 224-236.

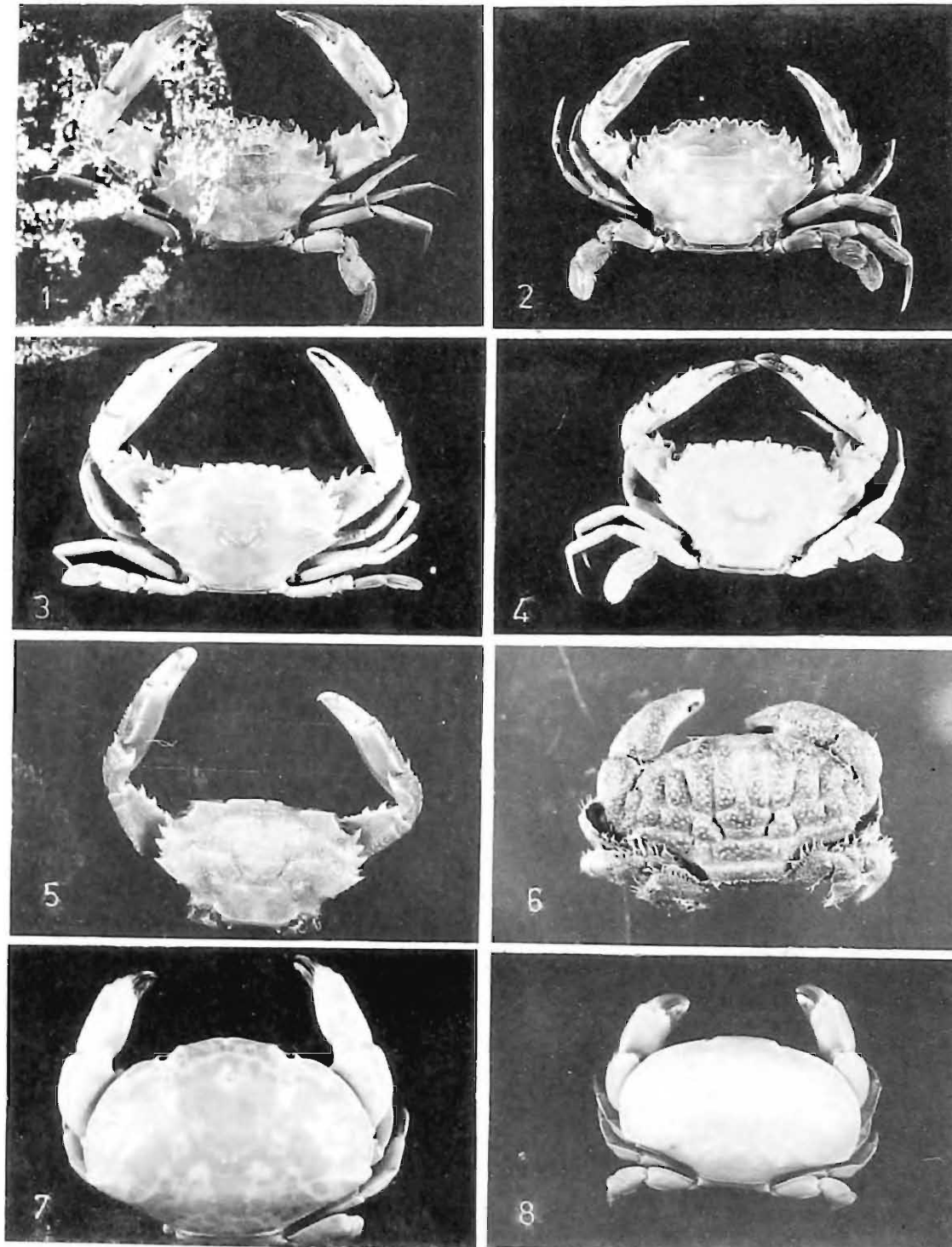
PLATE 1



Figs. 1-5. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

1. *Matuta banksii* Leach ; 2. *Matuta lunaris* (Forskål) ; 3. *Scylla serrata* (Forskål) ; 4. *Portunus pelagicus* (Linnaeus) ; 5. *Portunus sanguinolentus* (Herbst).

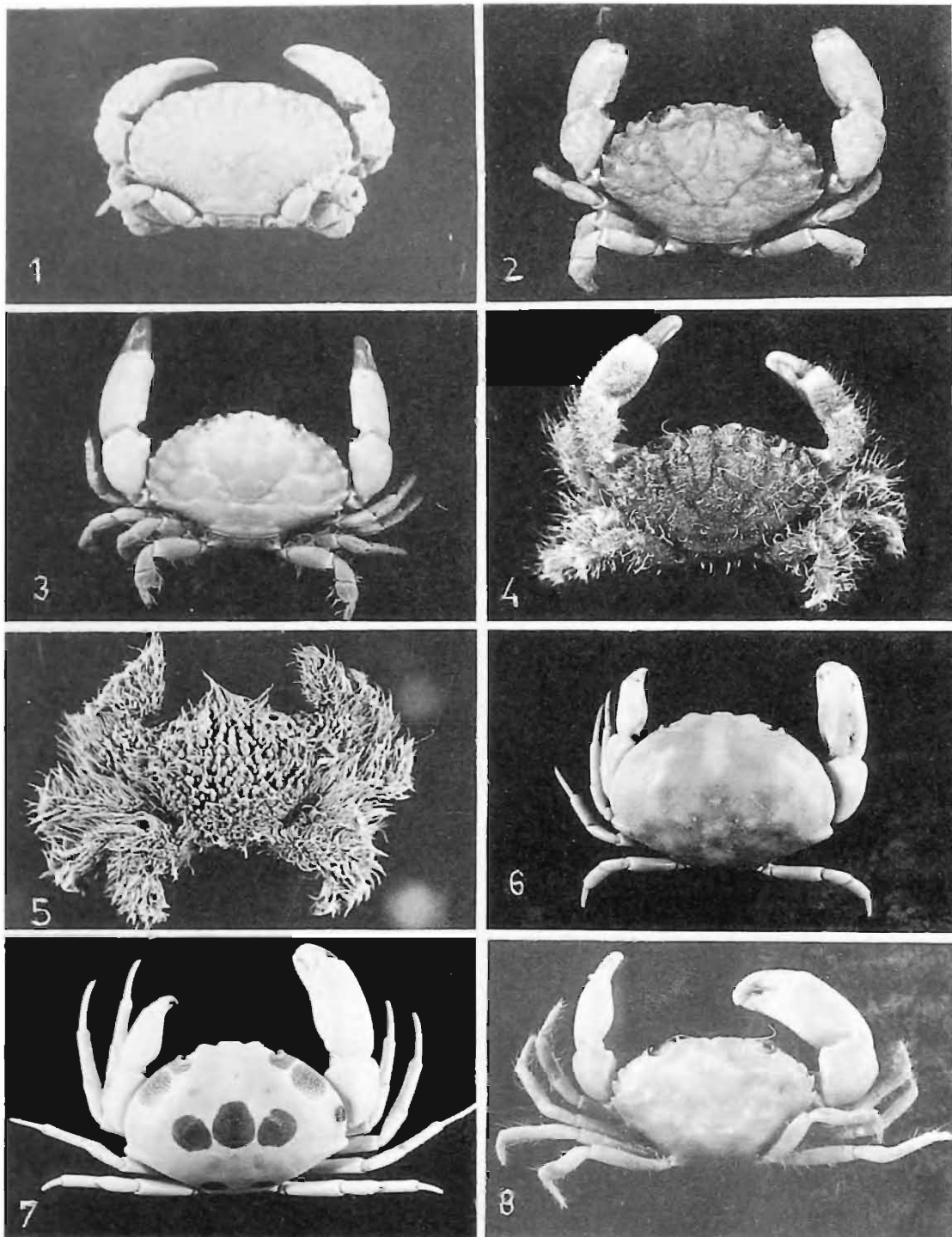
PLATE 2



Figs. 1-8. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

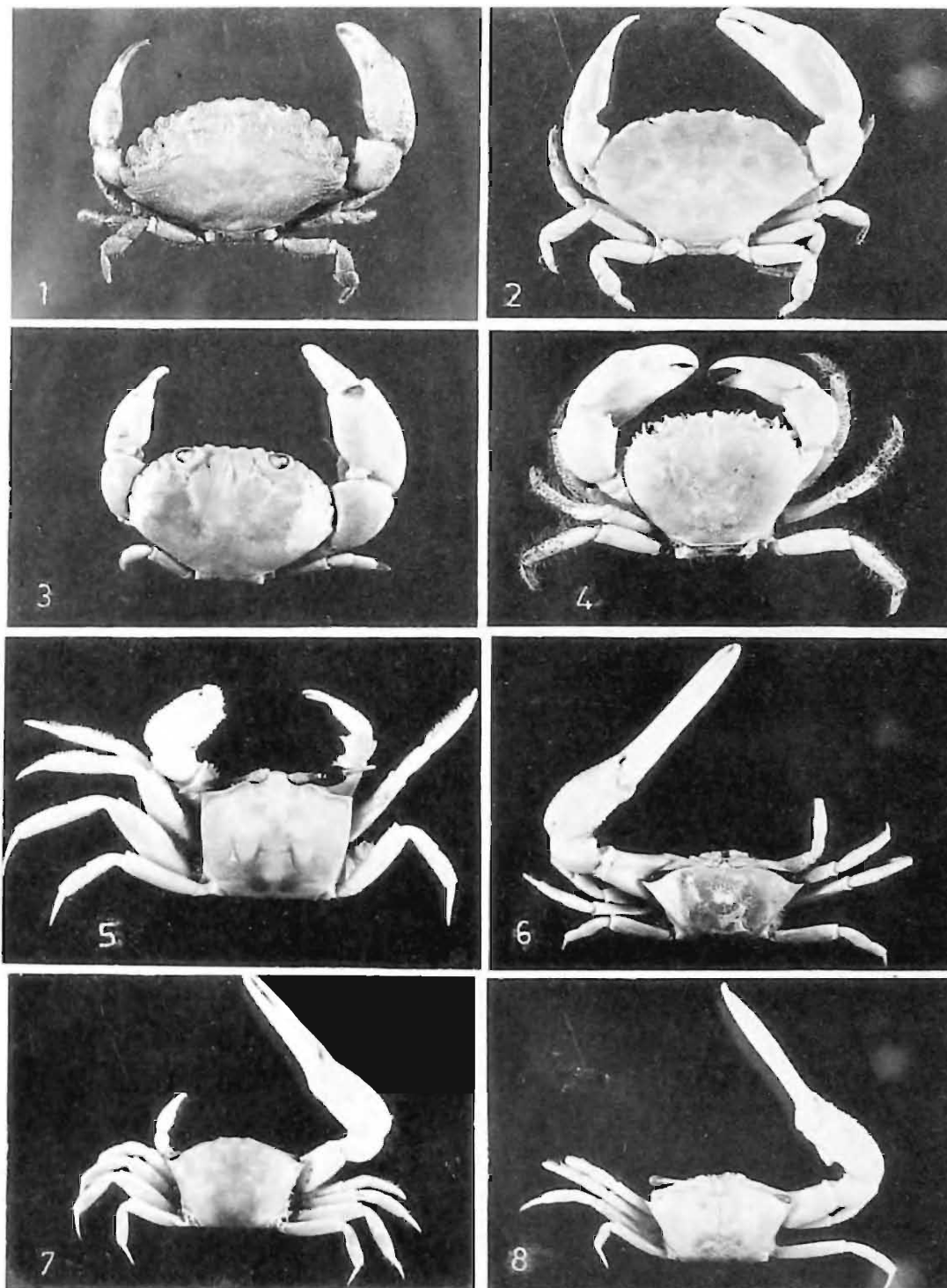
1. *Charybdis (Charybdis) helleri* A. Milne Edwards;
2. *Charybdis (Charybdis) orientalis* Dana;
3. *Thalamita crenata* (Latreille);
4. *Thalamita prymna* (Herbst);
5. *Thalamita admete* (Herbst);
6. *Actaeodes tomentosus* (H. Milne Edwards);
7. *Atergatis floridus* (Linnaeus);
8. *Atergatis integerrimus* (Lamarck).

PLATE 3



Figs. 1-8. Dorsal view of mangrove inhabiting crabs of Andaman Islands.
1. *Platypodia cristata* (A. Milne Edwards); 2. *Leptodius exaratus* (H. Milne Edwards);
3. *Leptodius sanguineus* (H. Milne Edwards); 4. *Pilodius nigrocrinitus* Stimpson; 5. *Pilumnus vespertilio* (Fabricius); 6. *Carpilius convexus* (Forskål); 7. *Carpilius maculatus* (Linnaeus);
8. *Baptozius vinosus* (H. Milne Edwards).

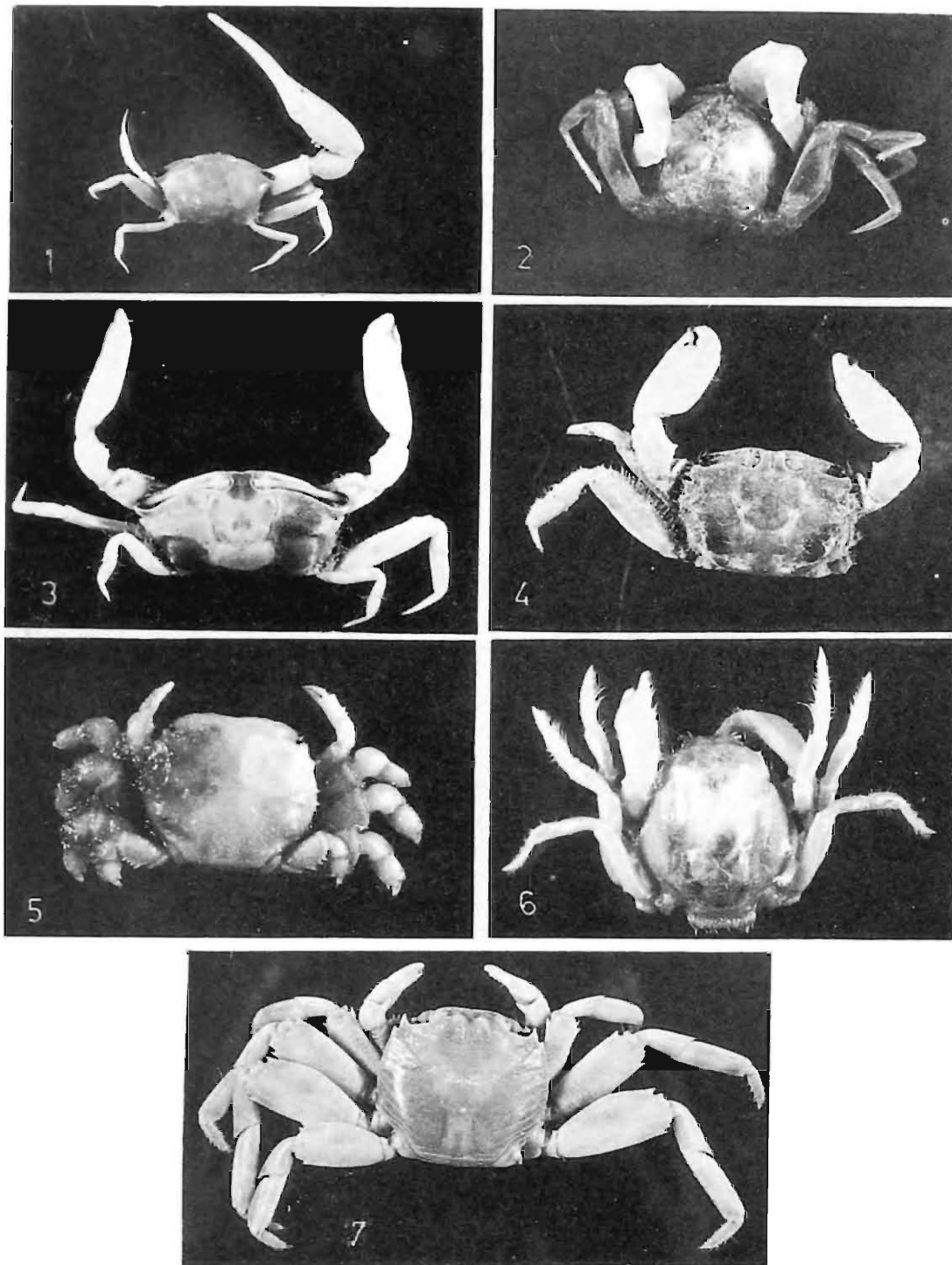
PLATE 4



Figs. 1-8. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

1. *Epixanthus dentatus* (White) 2. *Epixanthus frontalis* (H. Milne Edwards); 3. *Lydia annulipes* (H. Milne Edwards); 4. *Eriphia sebana* (Shaw and Nodder); 5. *Ocypode ceratophthalma* (Pallas); 6. *Uca dussumieri* (H. Milne Edwards); 7. *Uca tetragonon* (Herbst); 8. *Uca vocans* (Linnaeus).

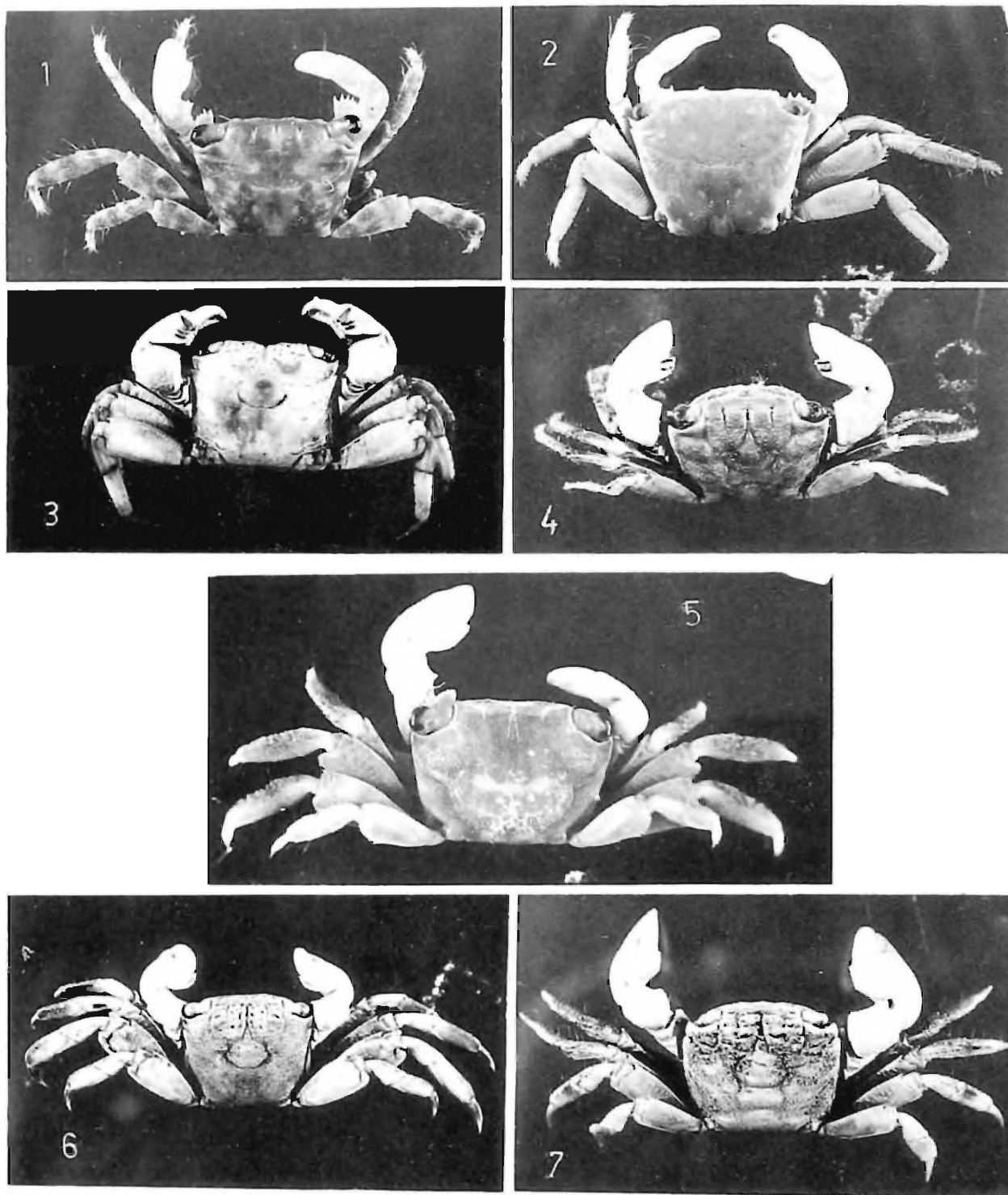
PLATE 5



Figs. 1-7. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

1. *Uca lactea* (de Haan); 2. *Dotilla myctiroides* (H. Milne Edwards) 3. *Macrophthalmus* (*Macrophthalmus*) *convexus* Stimpson 4. *Macrophthalmus* (*Mareotis*) *depressus* Rüppell; 5. *Leipocten sordidulum* Kemp 6. *Mictyris longicarpus* Latreille; 7. *Grapsus albolineatus* Lamarck.

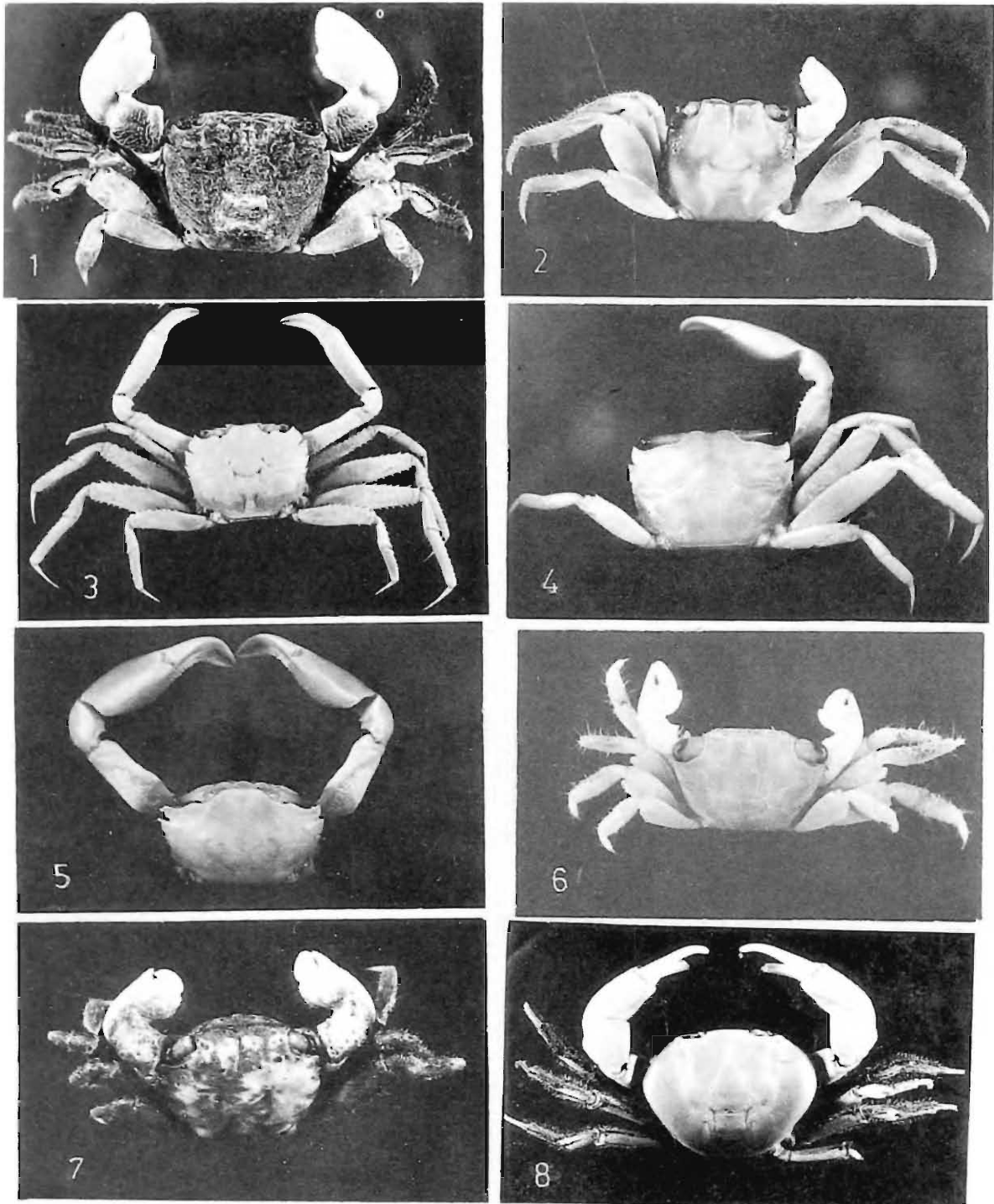
PLATE 6



Figs. 1-7. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

1. *Metopograpsus frontalis* Miers; 2. *Metopograpsus oceanicus* Jacquinet; 3. *Sesarma* (*Chiromantes*) *bidens* (de Haan); 4. *Sesarma* (*Parasesarma*) *plicatum* (Latreille); 5. *Nanosesarma* (*Beanium*) *andersoni* (de Man); 6. *Neopisesarma* (*Neopisesarma*) *taeniolata* White; 7. *Neopisesarma* (*Muradium*) *tetragonum* (Fabricius).

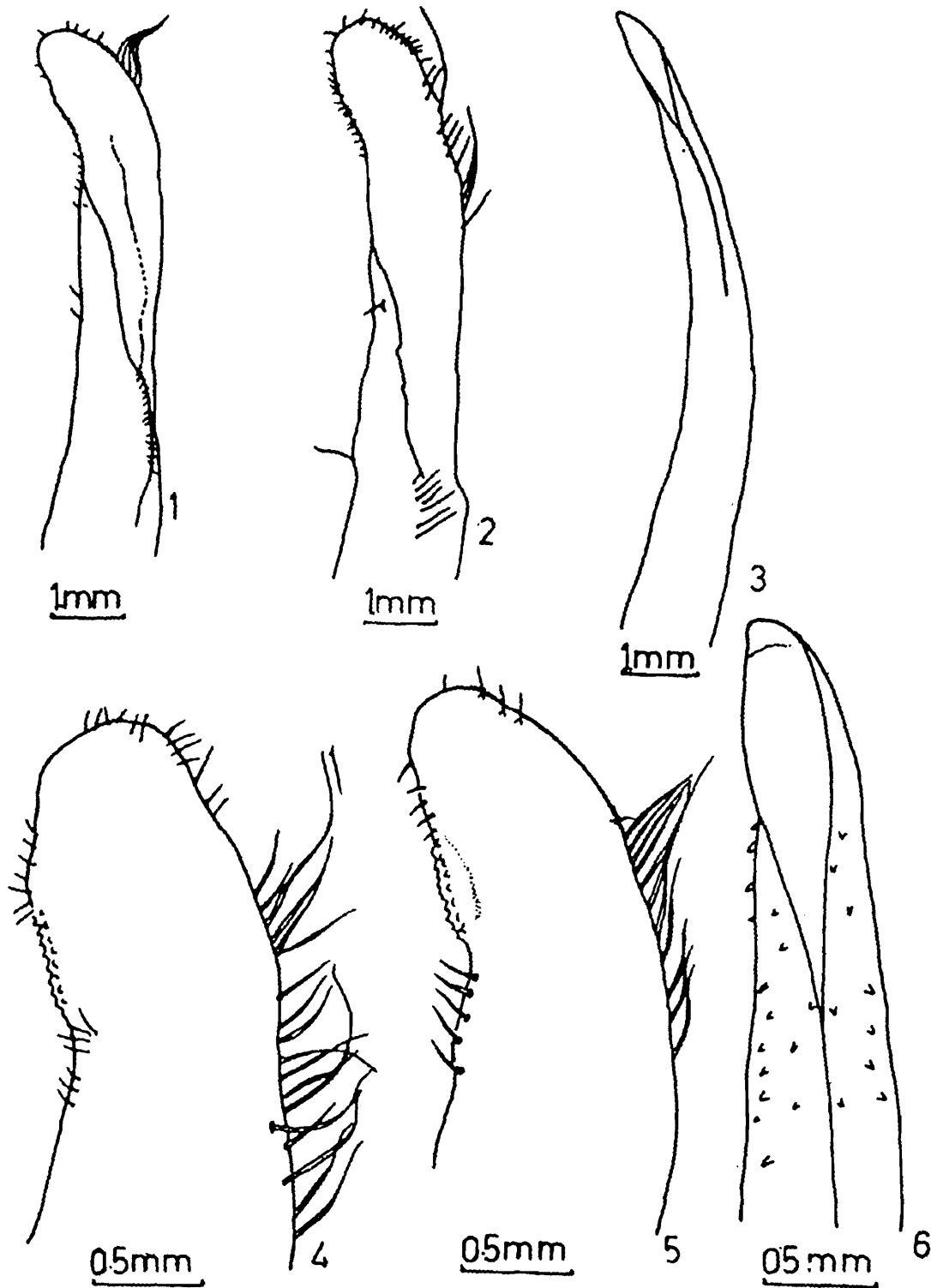
PLATE 7



Figs. 1-8. Dorsal view of mangrove inhabiting crabs of Andaman Islands.

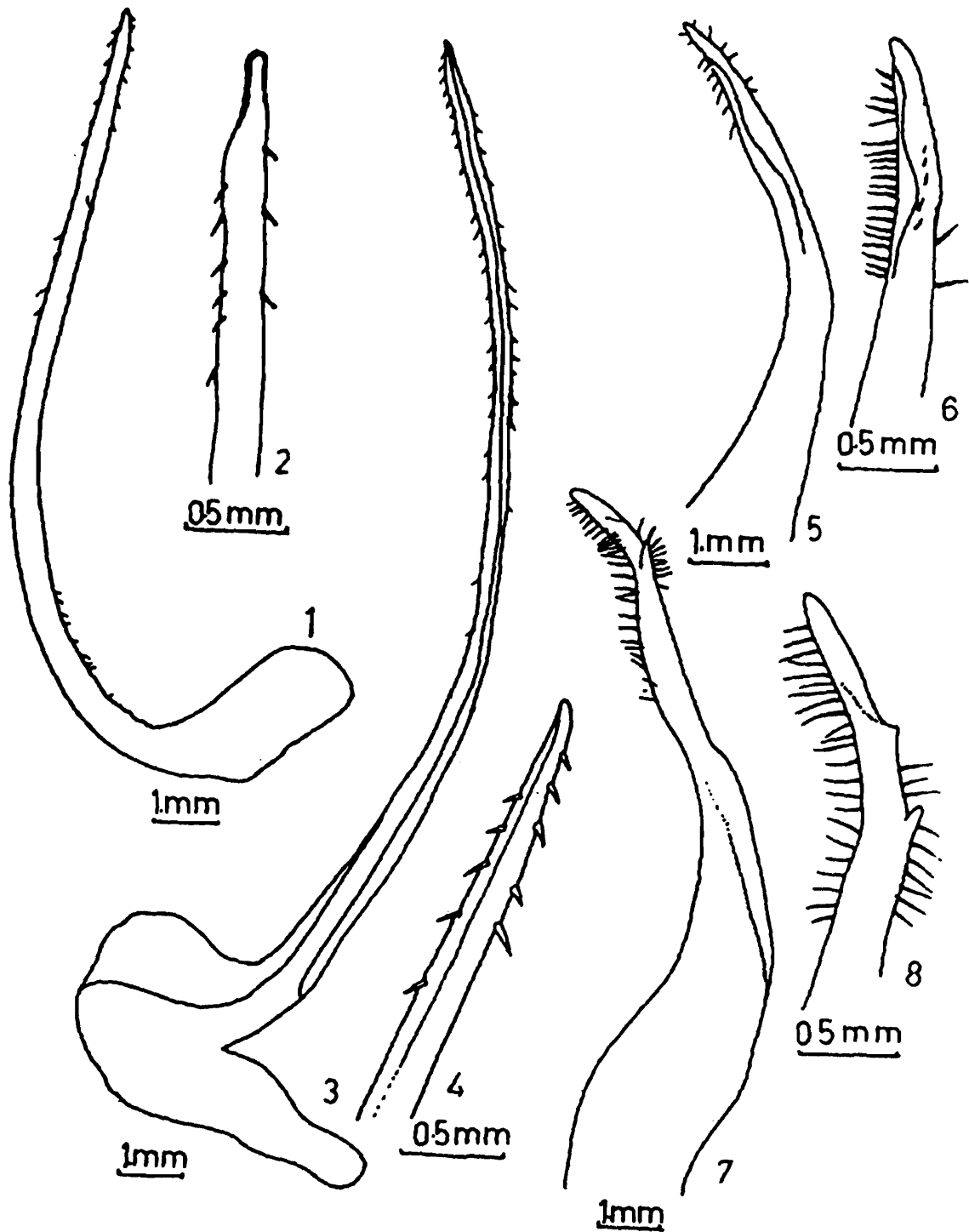
1. *Sesarmops intermedium* (de Haan);
2. *Sesarmoides longipes* (Krauss);
3. *Metaplex crenulata* (Gerstaecker);
4. *Metaplex distincta* H. Milne Edwards;
5. *Metaplex elegans* de Man;
6. *Metasesarma rousseauxii* (H. Milne Edwards);
7. *Clistocoeloma merguense* de Man;
8. *Cardisoma carnifex* (Herbst).

PLATE 8



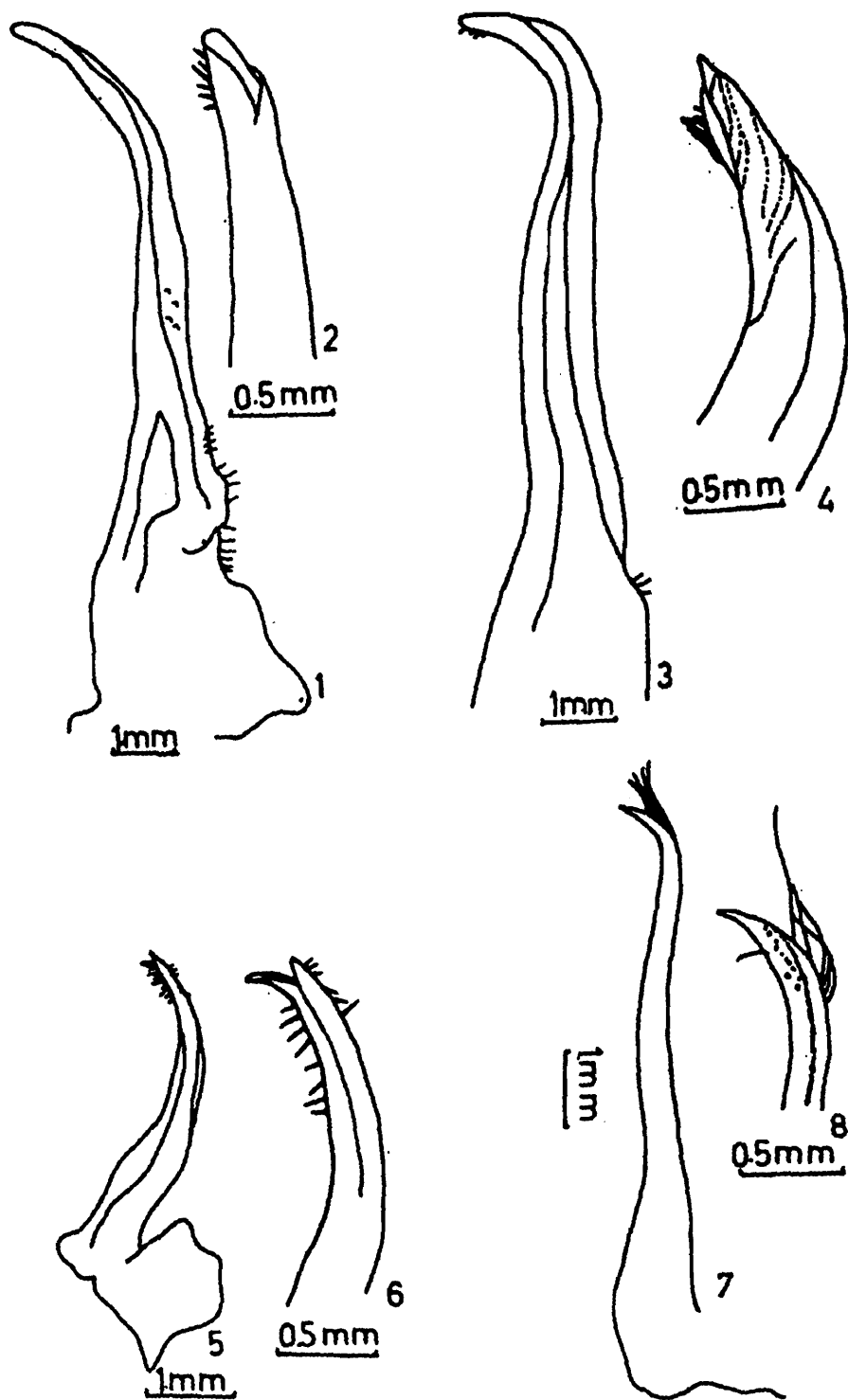
1. Male pleopod structure of *Matuta banksii* Leach ; 2. Male Pleopod structure of *Matuta lunaris* (Forskål) ; 3. Male pleopod structure of *Scylla serrata* (Forskål) ; 4. Enlarged tip of male pleopod of *Matuta banksii* Leach ; 5. Enlarged tip of male pleopod of *Matuta lunaris* (Forskål) ; 6. Enlarged tip of male of *Scylla serrata* (Forskål)

PLATE 9



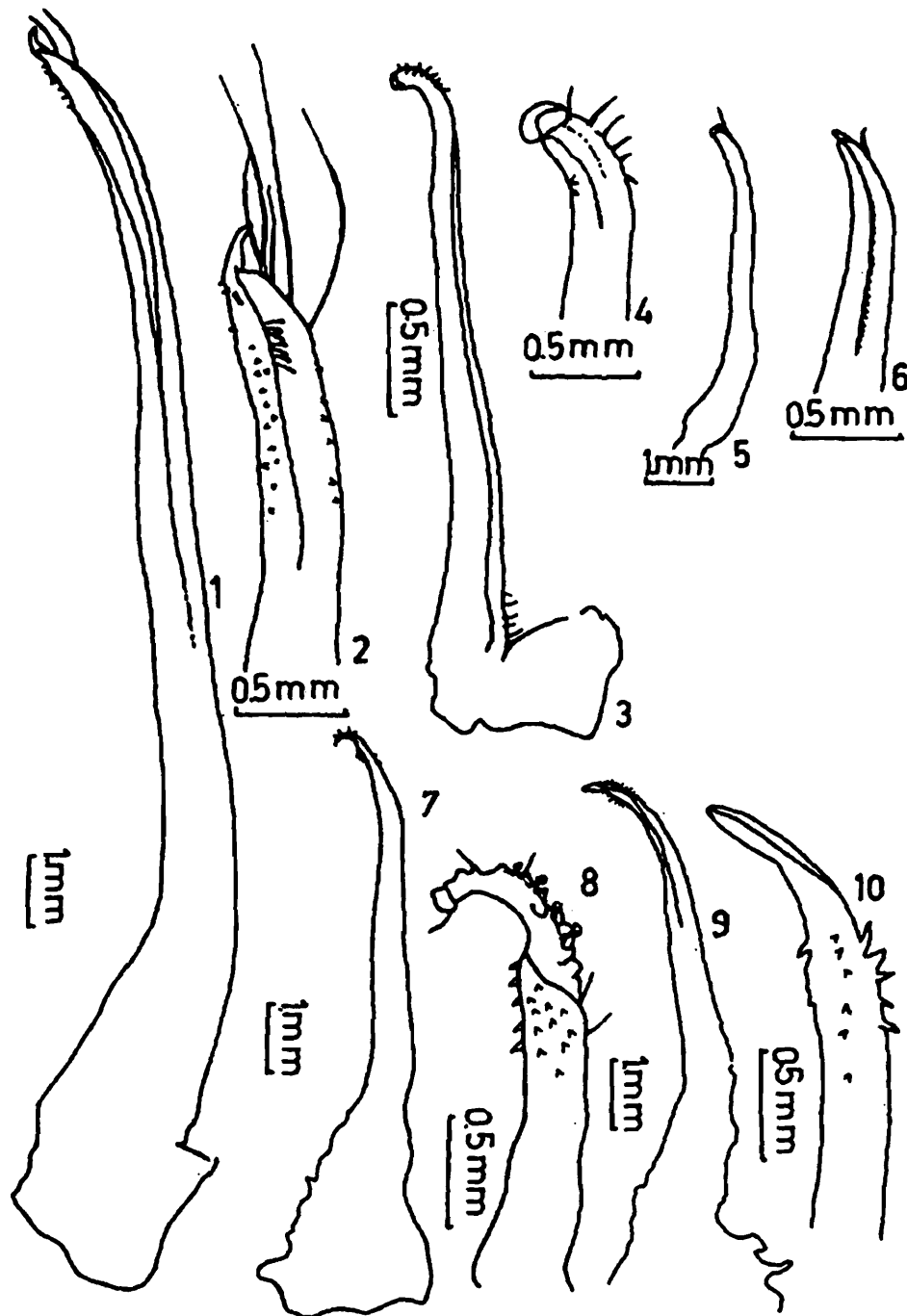
1. Male pleopod structure of *Portunus sanguinolentus* (Herbst) ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Portunus pelagicus* (Linnaeus) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Charybdis (Charybdis) orientalis* Dana ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Charybdis (Charybdis) helleri* (A. Milne Edwards) ; 8. Tip of the same enlarged.

PLATE 10



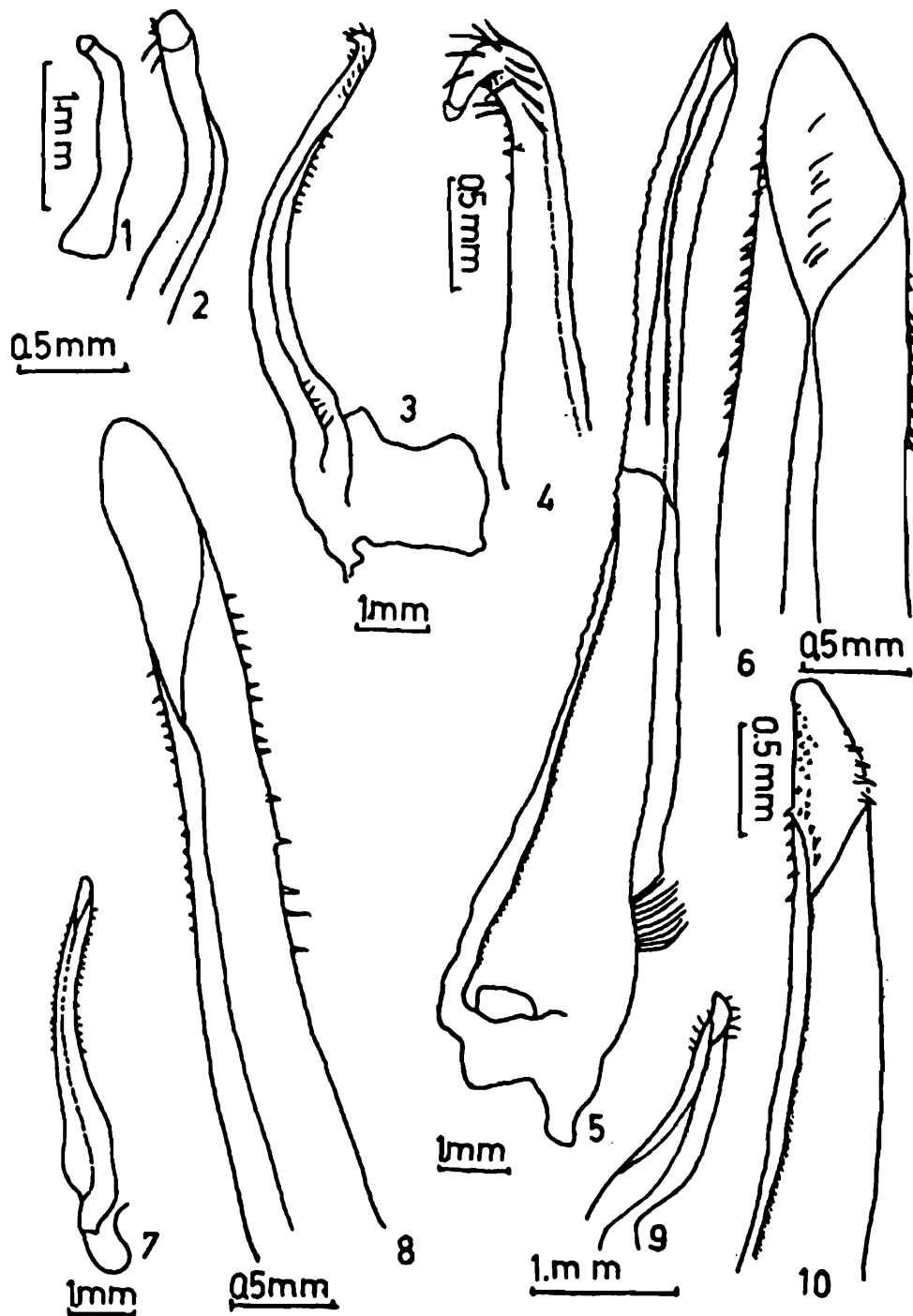
1. Male pleopod structure of *Thalaita crenata* (Latreille) ; 2. Tip of the same enlarged ;
 3. Male pleopod structure of *Thalamita prymna* (Herbst) ; 4. Tip of the same enlarged ;
 5. Male pleopod structure of *Thalamita admete* (Herbst) ; 6. Tip of the same enlarged ; 7. Male
 pleopod structure of *Actaeodes tomentosus* (H. Milne Edwards) ; 8. Tip of the same enlarged.

PLATE 11



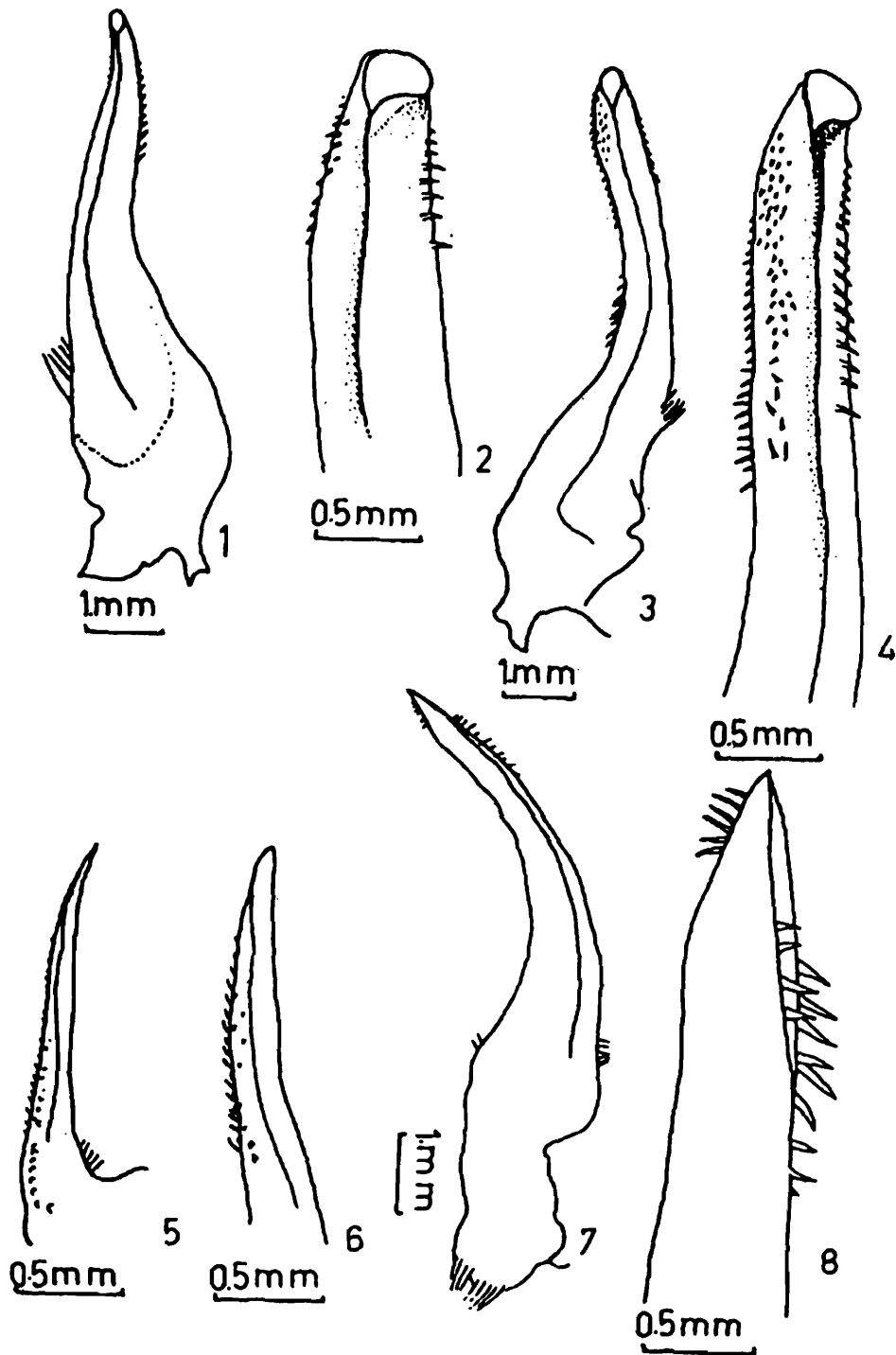
1. Male pleopod structure of *Atergatis floridus* (Linnaeus) ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Atergatis integerrimus* (Lamarck) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Platypodia cristata* (A. Milne Edwards) ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Leptodius exaratus* (H. Milne Edwards) ; 8. Tip of the same enlarged ; 9. Male pleopod structure of *Leptodius sanguineus* (H. Milne Edwards) ; 10. Tip of the same enlarged.

PLATE 12



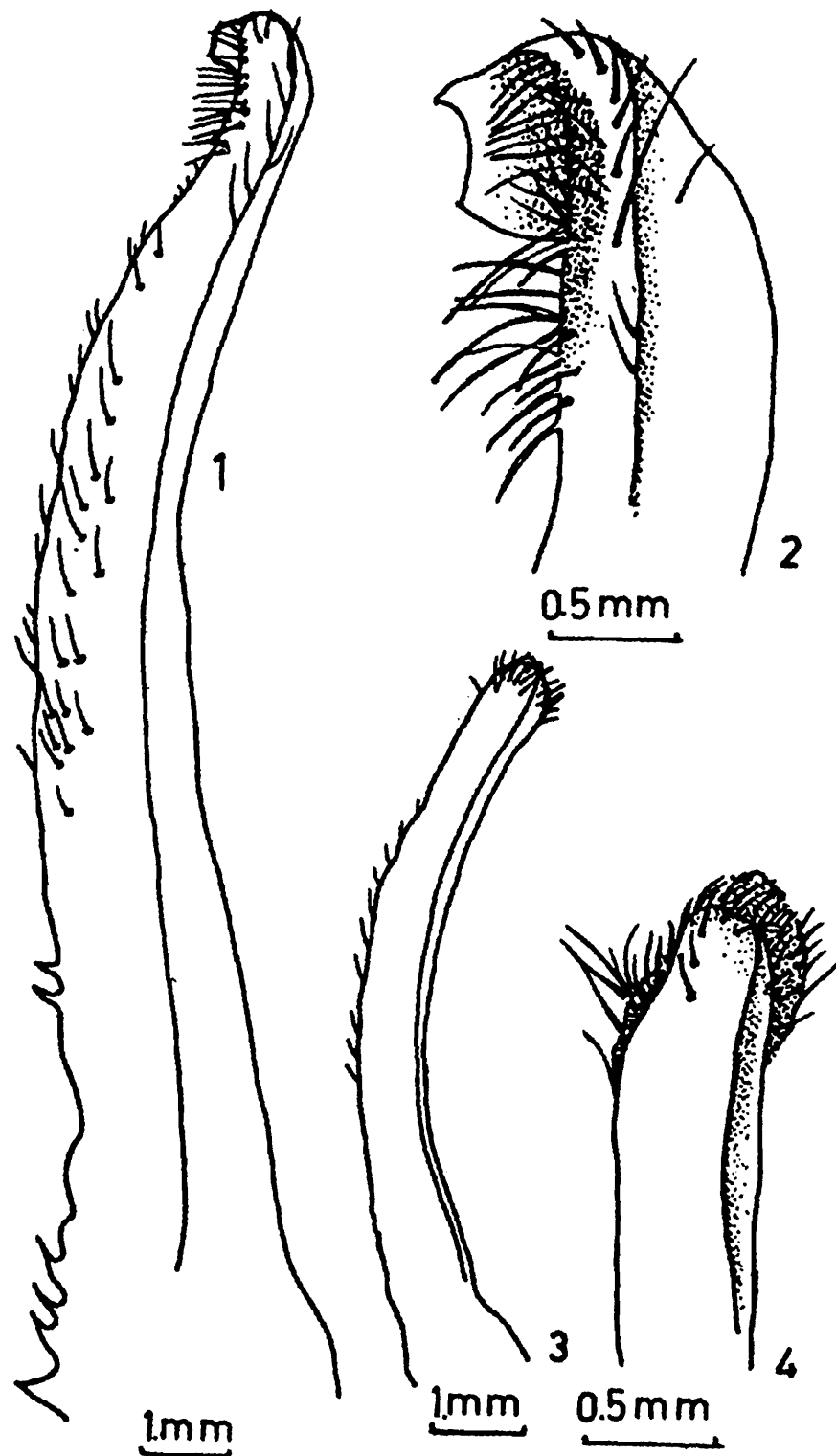
1. Male pleopod structure of *Pilodius nigrocrinitus* Stimpson ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Pilumnus vespertilio* (Fabricius) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Carpilius maculatus* (Linnaeus) ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Carpilius convexus* (Forskål) ; 8. Tip of the same enlarged ; 9. Male pleopod structure of *Epixanthus frontalis* (H. Milne Edwards) ; 10. Tip of the same enlarged.

PLATE 13



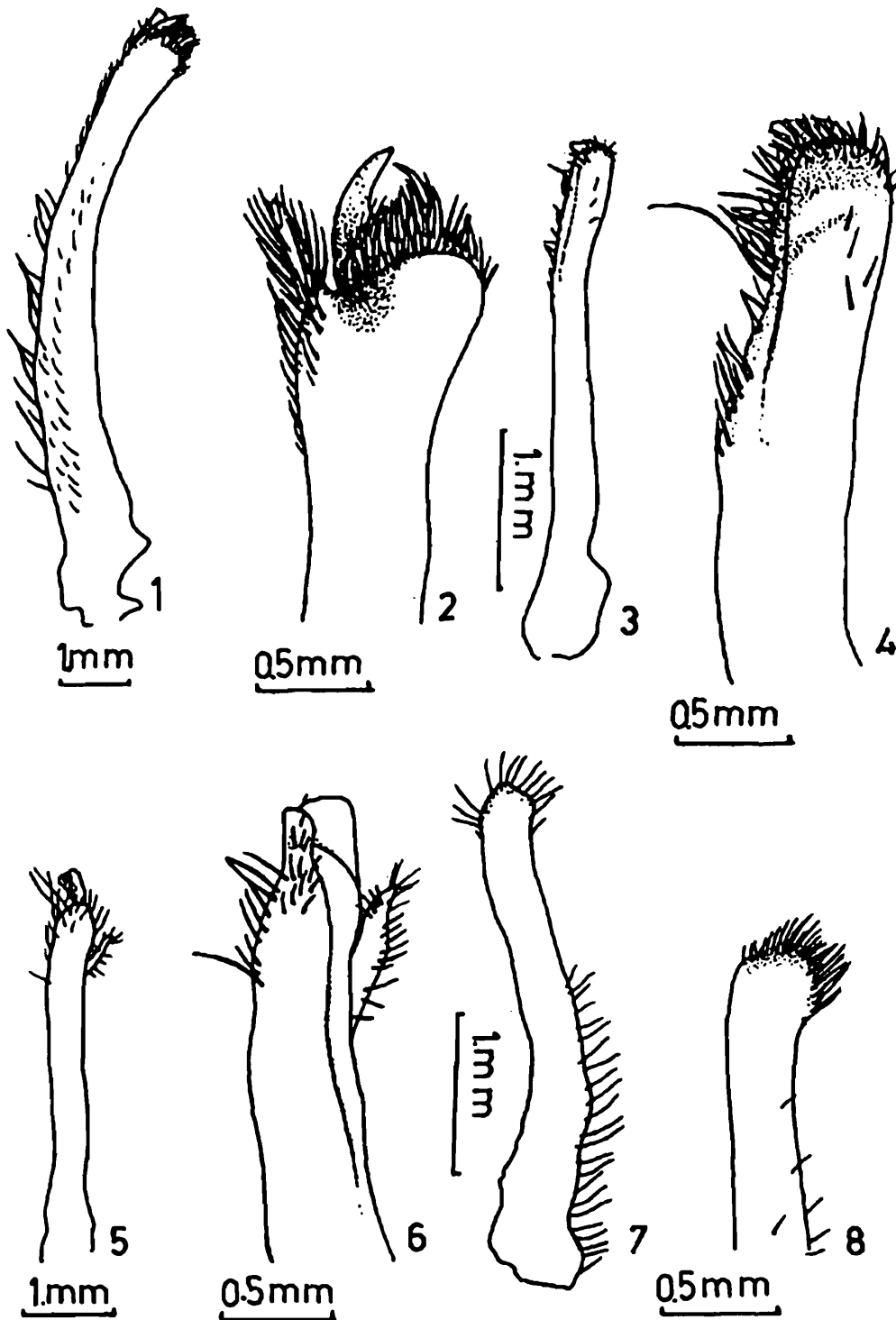
1. Male pleopod structure of *Epixanthus dentatus* (White) ; 2. Tip of the same enlarged ;
 3. Male pleopod structure of *Lydia annulipes* (H. Milne Edwards) ; 4. Tip of the same enlarged ;
 5. Male pleopod structure of *Baptozius Vinosus* (H. Milne Edwards) ; 6. Tip of the same enlarged ;
 7. Male pleopod structure of *Eriphia sebana* (Show and Nodder) ;
 8. Tip of the same enlarged.

PLATE 14



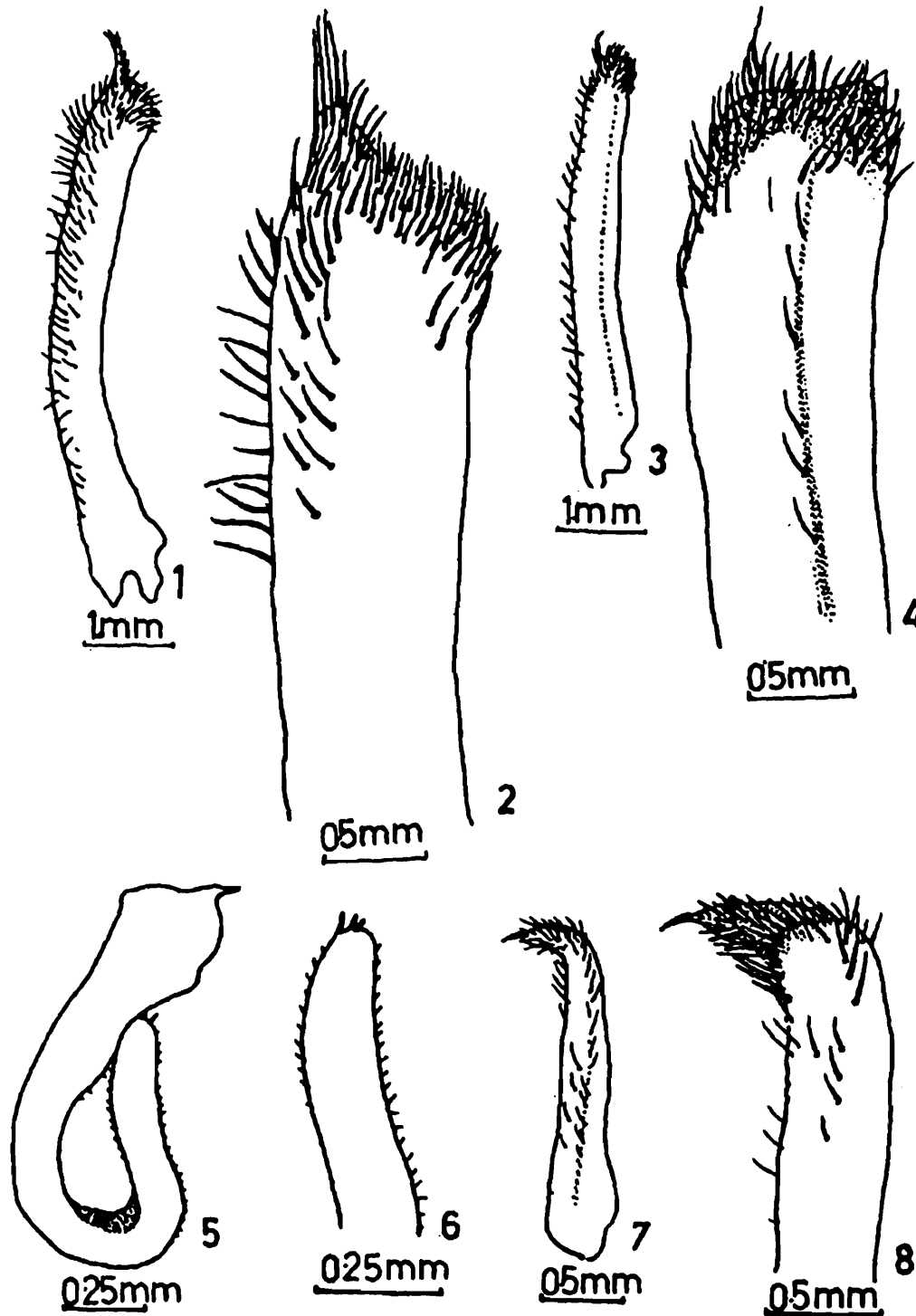
1. Male pleopod structure of *Ocypode ceratophthalma* (Pallas) ; 2. Tip of the same enlarged ;
 3. Male pleopod structure of *Uca dussumieri* (H. Milne Edwards) ; 4. Tip of the same enlarged.

PLATE 15



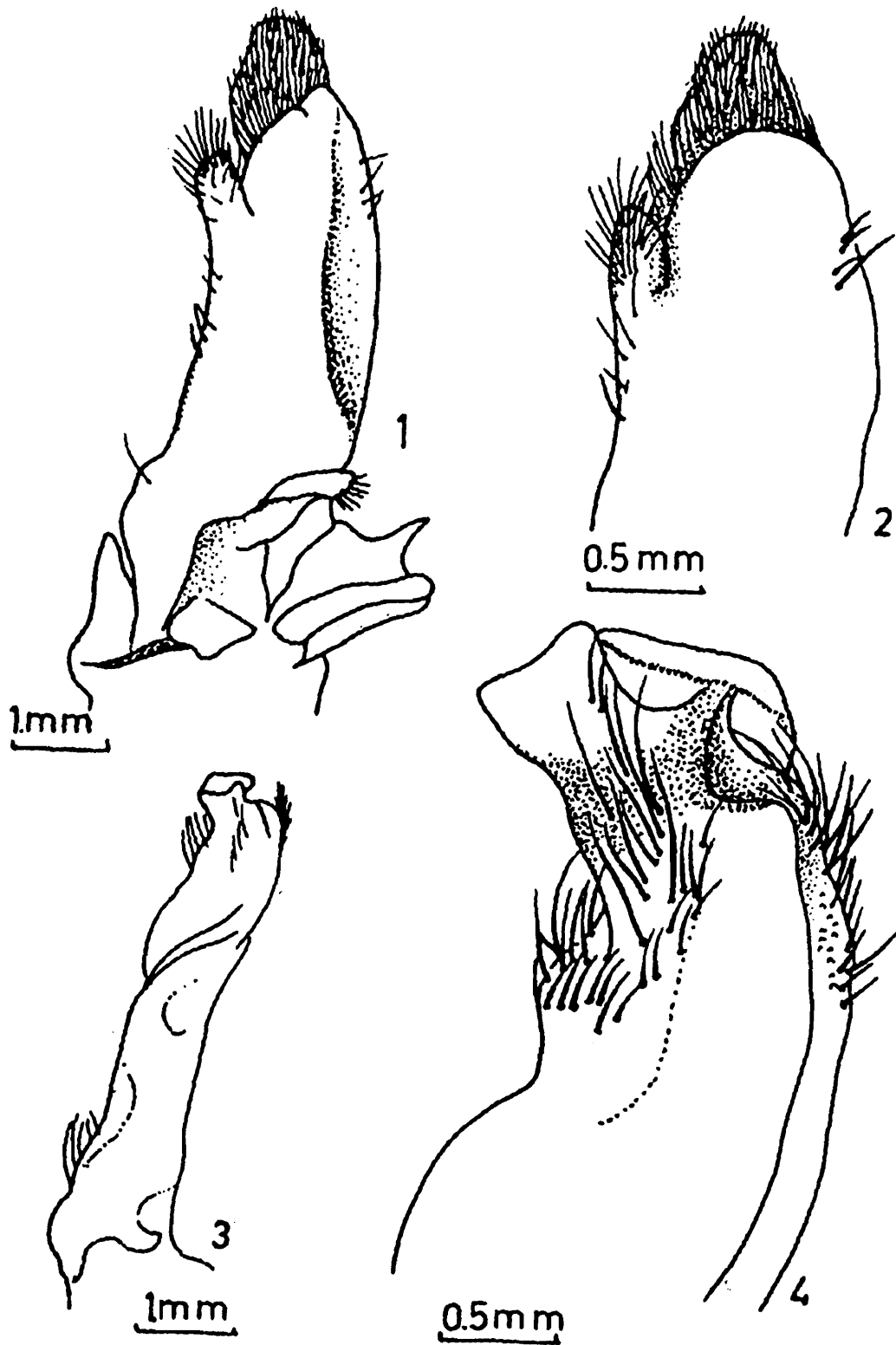
1. Male pleopod structure of *Uca vocans* (Linnaeus) ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Uca tetragonon* (Herbst) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Uca lactea* (de Haan) ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Dotilla myctiroides* (H. Milne Edwards) ; 8. Tip of the same enlarged.

PLATE 16



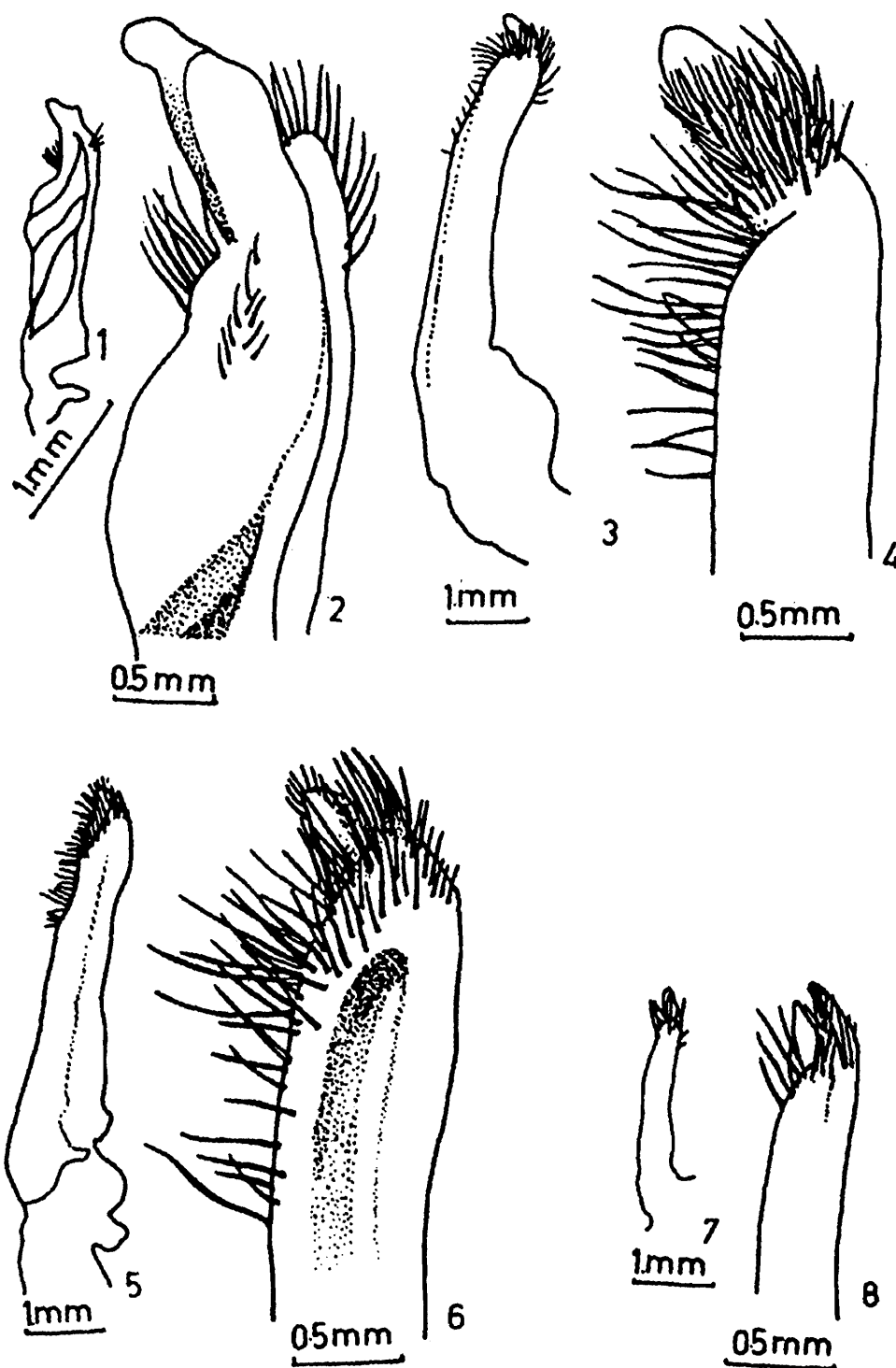
1. Male pleopod structure of *Macrophthalmus (Macrophthalmus) convexus* Stimpson ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Macrophthalmus (Mareotis) depressus* Ruppell ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Leipocten sordidulum* Kemp ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Mictyris longicarpus* Latreille ; 8. Tip of the same enlarged.

PLATE 17



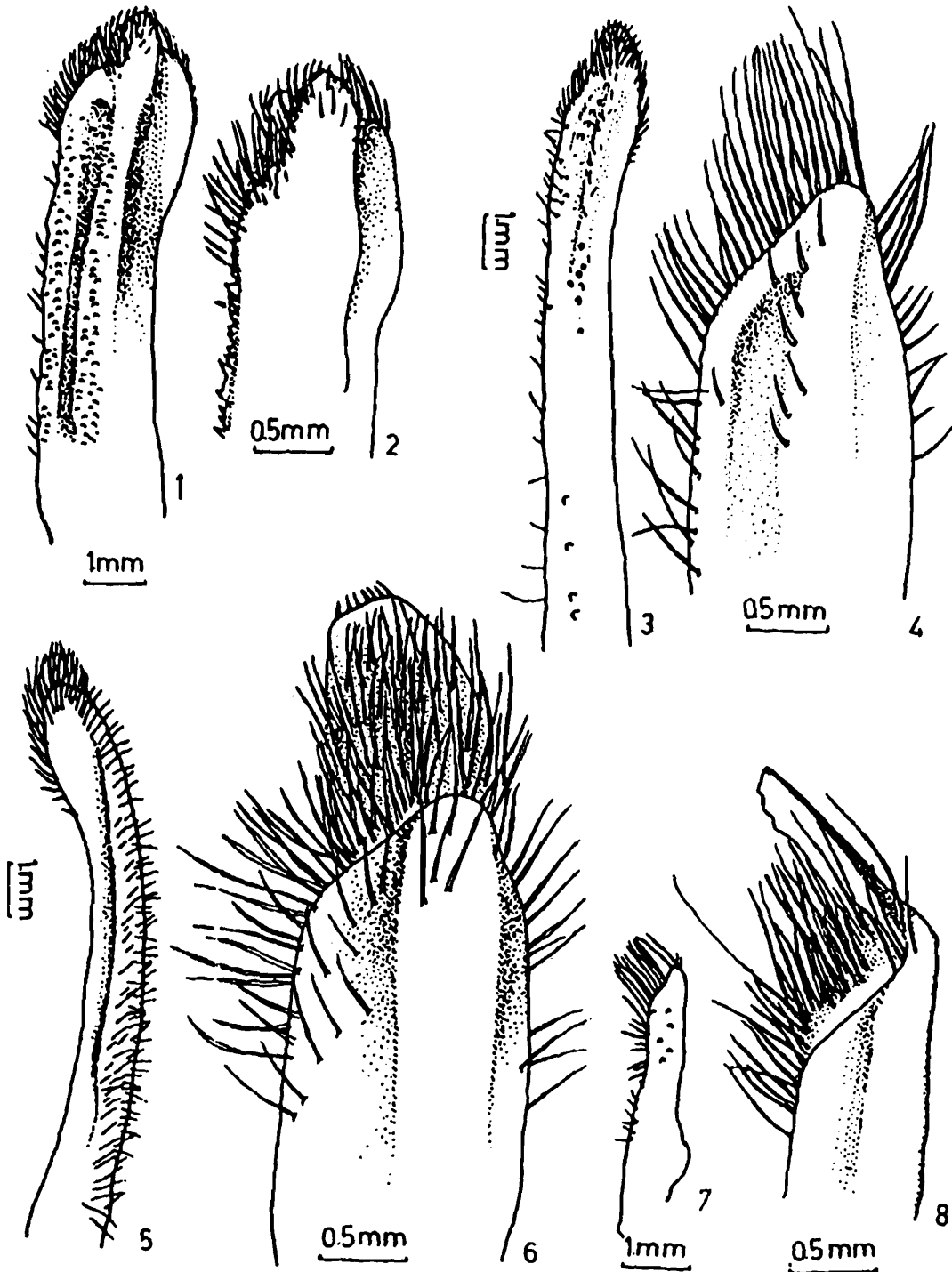
1. Male pleopod structure of *Grapsus albolineatus* Lamarck ; 2. Tip of the same enlarged ;
3. Male pleopod structure of *Metopograpsus oceanicus* Jacquinot ; 4. Tip of the same enlarged.

PLATE 18



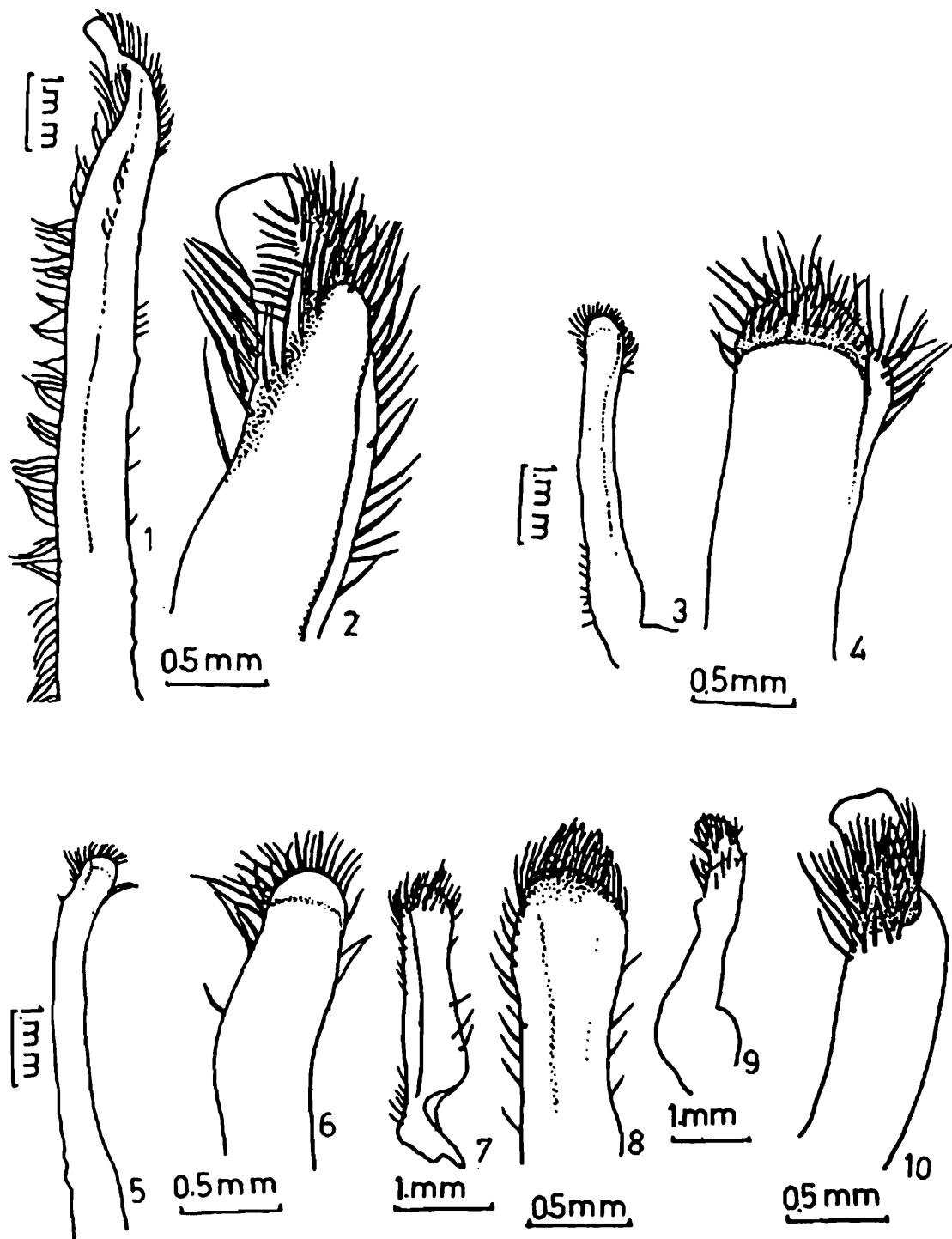
1. Male pleopod structure of *Metopograpsus frontalis* Miers ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Sesarma (Chiromantes) bidens* (de Haan) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Sesarma (Parasesarma) plicatum* (Latreille) ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Nanosesarma (Beanium) andersoni* (de Man) ; 8. Tip of the same enlarged.

PLATE 19



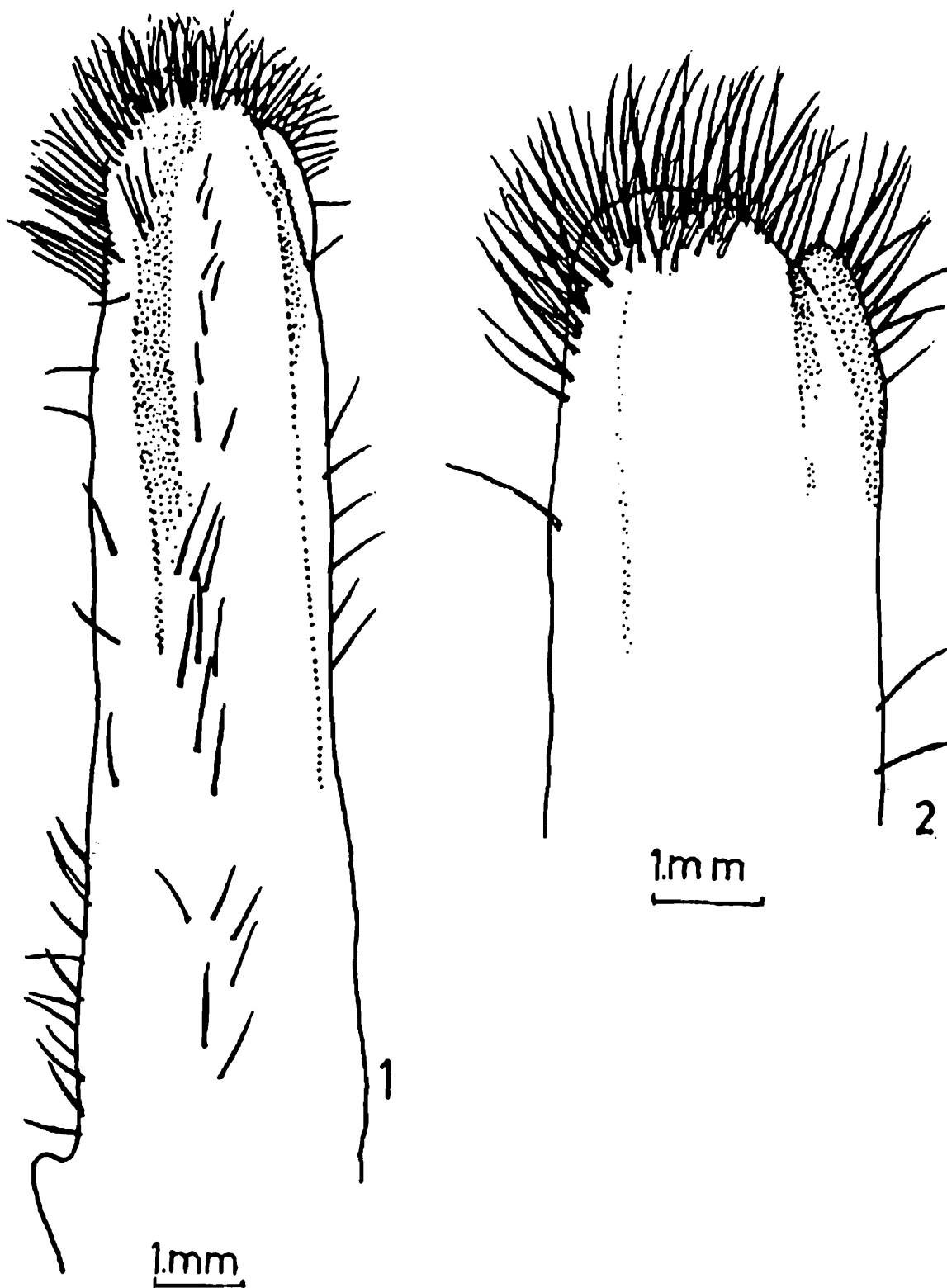
1. Male pleopod structure of *Neopisesarma (Neopisesarma) taeniolata* White ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Neopisesarma (Muradium) tetragonum* (Fabricius) ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Sesarmops intermedium* (de Haan) ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Sesarmoides longipes* (Krauss) ; 8. Tip of the same enlarged.

PLATE 20



1. Male pleopod structure of *Metaplax crenulata* (Gerstaecker) ; 2. Tip of the same enlarged ; 3. Male pleopod structure of *Metaplax distincta* H. Milne Edwards ; 4. Tip of the same enlarged ; 5. Male pleopod structure of *Metaplax elegans* de Man ; 6. Tip of the same enlarged ; 7. Male pleopod structure of *Clistocoeloma merguense* de Man ; 8. Tip of the same enlarged ; 9. Male pleopod structure of *Metasesarma rousseauxii* (H. Milne Edwards) ; 10. Tip of the same enlarged.

PLATE 21



1. Male pleopod structure of *Cardisoma carnifex* (Herbst) ; 2. Tip of the same enlarged.