

TAXONOMY OF COMMON HERMIT CRABS OF INDIA

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Introduction

Infraorder Anomura, commonly referred to as anomurans or false crabs in scientific literature, is one of the most diverse groups of crustaceans in the phylum Arthropoda. Infraorders Brachyura and Anomura comprise the entire crab community of the order Decapoda. Infraorder Anomura is represented by 6 superfamilies, 17 families, 223 genera and around 2500 species. The taxonomic status of several species is unclear and discovery of new species is increasing day by day. Infraorder Anomura Macleay, 1838 is represented by six superfamilies: Aegloidea, Hippoidea, Lithodoidea, Lomisoidea, Paguroidea and Galatheoidea. Superfamily Aegloidea Dana, 1852 is represented by a single family Agelidae comprising 69 species in one genus. Superfamily Hippoidea Latreille, 1825 comprises three families of sand and mole crabs in Albuneidae (48 species in 9 genera), Blepharipodidae (6 species in 2 genera) and Hippidae (27 species in 3 genera). Superfamily Lithodoidea Samouelle, 1819 is with two families- Hapalogastridae and Lithodidae (129 species in 15 genera). Superfamily Lomisoidea Bouvier, 1895 is represented by a single family Lomisidae comprising a single species *Lomis hirta* (hairy stone crab). Superfamily Paguroidea Latreille, 1802 comprises hermit crabs and their relatives in the families Coenobitidae (17 species in 2 genera), Diogenidae (428 species in 20 genera), Paguridae (542 species in 75 genera), Parapaguridae (76 species in 10 genera) (Lemaitre, 1996; McLaughlin, 2003), Pylochelidae (52 species in 10 genera) and Pylojacquesidae (2 species in 2 genera). Superfamily Galatheoidea Samouelle, 1819 includes squat lobsters and related animals in four families such as Galatheididae (675 species in 34 genera), Chirostylidae (192 species in 7 genera), Kiwaidae with only one species *Kiwa hirsuta* ('yeti lobster') and Porcellanidae (225 species).

Among anomurans hermit crabs of the super family Paguroidea Latreille, 1802 represent an important portion of the intertidal, sublittoral and moderately deep benthic marine communities worldwide, with high diversity in tropical and subtropical regions, where they play an important role in food web. Hermit crabs are ecologically important scavengers, feeding on organic deposits and also good predators. They are typically marine organisms seen in intertidal as well as subtidal environments, although some species have physiological and behavioural adaptations for living in almost all habitats such as estuarine, semi-terrestrial and terrestrial habitats; they therefore, form important specimen for research. Hermit crabs can be considered as ecological indicators of freshwater inundation as they have the physiological adaptations to withstand the fluctuating conditions in the intertidal zone. They are decapod crustaceans with ten pereopods, but the last pair of these is often hidden under the gill chamber and is used for keeping the gills clean. They have a soft abdomen and for safety from predation, desiccation and mechanical damage they keep the abdomen tucked away in a discarded gastropod shell or cavities of appropriate size.

Few hermit crabs are found inhabiting shelters other than shells, which includes bivalve and scaphopod shells, hollowed cylinders of wood or stone, calcareous tubes of polychaetes or vermetid gastropods which are immobile, corals, and sponges. Terrestrial hermit crab, popularly known as “coconut crab” [*Birgus latro* (Linnaeus, 1767)], is fully calcified and exist without a shell, although megalopa larvae and young crabs of this species require shells. Hermit crabs obtain new shells or housing by exchanging or sharing shells among individuals of same or different species, seeking empty shells or migrating to areas where gastropod shells are abundant. Hermit crabs seem to select among the available empty gastropod shells the most suitable one for their size and shape. The life cycle of hermit crabs depends on the process that makes suitable gastropod shells. Shells are considered as a limiting factor for hermit crab survival. The gastropod shells occupied by hermit crabs provide mobility and protection which had helped them to establish in marine and tropical terrestrial shores.

Despite their ecological importance the studies on the distribution patterns in hermit crabs are scarce. Members of the family Coenobitidae are commonly called as “land hermit crabs”. They are semi-terrestrial hermit crabs represented by 17 species in two genera viz., *Coenobita* (16 species) and *Birgus* (one species). Hermit crabs of the family Diogenidae are commonly known as “left- handed” hermit crabs as they have appreciably larger left cheliped than the right. They are seen in all habitats, mainly in tropical and temperate areas, in depths ranging from the intertidal to over 465 m. They are very rare in higher latitudes. Out of the six families Diogenidae is the most species-rich family.

Members of the family Paguridae are commonly called as “right handed” hermit crabs because the members have right cheliped larger than the left. This family has the highest number of genera and species. They are commonly found in the intertidal areas of temperate zone in depths of 50-500 m.

The Parapaguridae or “deep-water hermit crabs” are species typically found at depths ranging from 200 to 3000 m. There are five genera, *Oncopagurus* Lemaitre, 1996; *Parapagurus* Smith, 1879; *Sympagurus* Smith, 1883; *Tylaspis* Henderson, 1885 and *Probeebei* Boone, 1926, with species having reduced corneas, as they are mainly seen in the twilight zone (Lemaitre, 2006). Family Pylochelidae Bate, 1888 are known as “symmetrical” hermit crabs because they have symmetrical chelipeds, straight pleon, partially calcified articulated tergites, and generally symmetrical uropods. The habitats of pylochelids are pieces of wood, rocks, sponges, tusk shells, and rarely gastropods. They are found in depths ranging from 30 to 1570 m, most frequently occurring in depths from 200 to 500 m. Family Pylojacquesidae McLaughlin and Lemaitre, 2001 is unique among anomurans in having mandible which is chitinous and strongly toothed and they reflect an unusual neotenus or paedomorphic condition.

Hermit crabs are fascinating specimens for zoologists because of their intelligent selection of suitable discarded shells as their ‘home’. Hermit crabs are also used as an ideal experimental organism to study environmental influences as they are seen many in the intertidal and deep marine benthic communities and their presence in these areas are due to adaptive evolution of the population, thus forming an important organism in the living world.

Taxonomy

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Malacostraca

Order: Decapoda

Suborder: Pleocyemata, Infraorder Anomura

Crustaceans of the infraorder Anomura are characterized by having adult body shapes from lobster-like to true crab-like and highly reduced fifth pereopods which is used for keeping the gills clean. The abdomen may be elongated, short and folded under the body or tightly curved to fit into the gastropod shells. Markedly reduced fifth pereopods that are not used as ambulatory appendages, the articulated

or missing eighth thoracic sternite and the cephalothorax that is not fused to the epistome are the major characters of this infraorder. Body parts of hermit crabs and their taxonomic characters are shown in Figs. 1 to 6.

Common Families occurring in India

Hermit crab diversity in India is represented by over 110 species and the families represented in India are Coenobitidae, Diogenidae, Paguridae, Parapaguridae and Pylochelidae. Key to the identification of common families of hermit crabs (super family Paguroidea) are given below:

Keys to the families of Paguroidea

- | | | |
|---|-----|----------------------|
| 1. Antennules with upper rami of flagella terminating bluntly, somewhat “stick-like” (semiterrestrial) | ... | <i>Coenobitidae</i> |
| — Antennules with upper rami of flagella terminating in tapered filament, not “stick-like” (marine, estuarine) | ... | 2 |
| 2. Paired pleopods on abdominal somites 2–5; abdominal tergites 1–5 well defined, well calcified | ... | <i>Pylochelidae</i> |
| — No paired pleopods on abdominal somites 4 and 5; abdominal tergites variable, but most frequently not well calcified | ... | 3 |
| 3. Maxilliped 3 generally approximate basally; chelipeds equal, subequal or unequal, left frequently largest | ... | <i>Diogenidae</i> |
| — Maxilliped 3 generally widely separated basally; chelipeds unequal or less frequently subequal, right usually largest | ... | 4 |
| 4. Exopod of maxilliped 1 with flagellum | ... | <i>Paguridae</i> |
| — Exopod of maxilliped 1 without flagellum | ... | <i>Parapaguridae</i> |

I. FAMILY: COENOBITIDAE (Land hermit crabs)

The Coenobitidae are the family of terrestrial hermit crabs, widely known for their terrestrial habits, with 17 species in two genera. The genus *Birgus* is represented by a single species, the well-known *Birgus latro*.

Description: Carapace cylindrical or subcylindrical, well calcified ; elongate or broadened at posterior half. Rostrum obsolete or very prominent. Outer ocular spine absent, ocular acicles present. Cornea well developed. Antennal flagellum is biramous. Antennular peduncles elongate, distal two segments of antennular peduncles slender and cylindrical, flagellum with truncated tip. Antennae short,

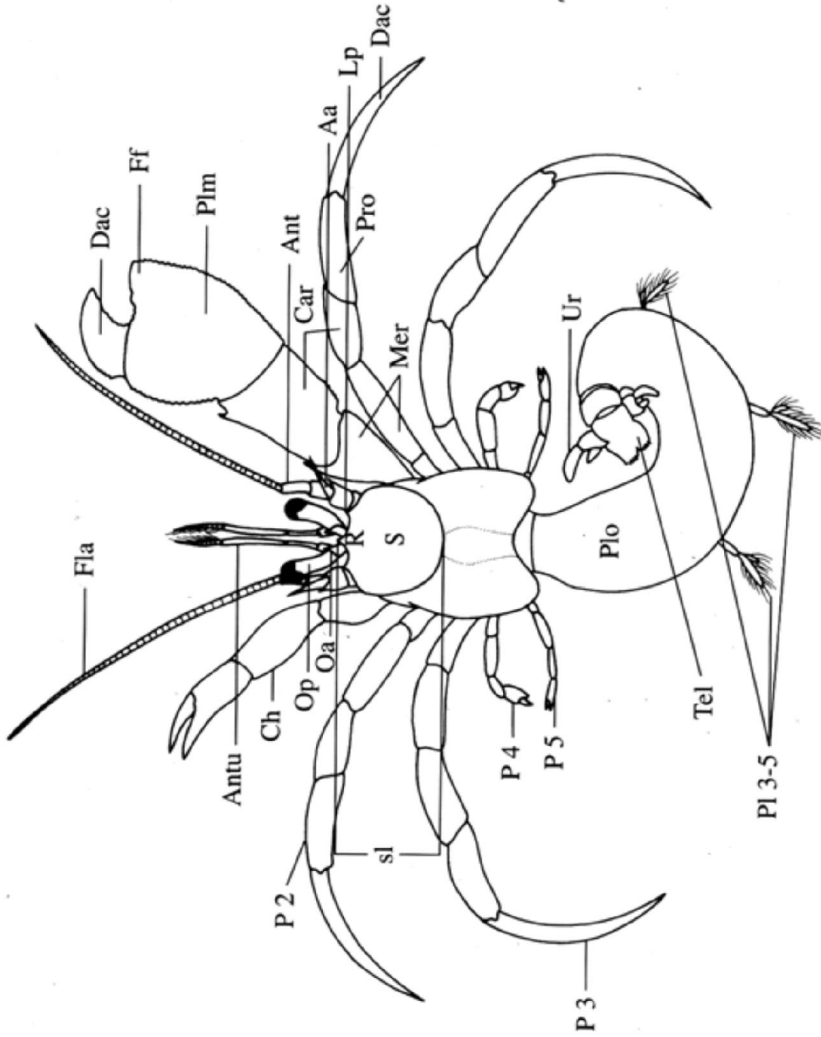


Fig. 1. Body parts of a hermit crab (Aa = antennal acic; Ant = antenna; Antu = antenna; e; Car = carpus; Ch = cheliped; Dac = Dactyl; Ff = fixed finger; Fla = antennal flagellum; Lp = lateral projection; Mer = merus; Oa = ocular acic; Op = ocular peduncle; P2-5 = pereopods; P13-5 = pleopods 3-5; Plm = palm; Plo = pleon; Pro = propodus; R = rostrum or rostral lobe; S = shield; sl = shield length; Tel = telson; Ur = uropod) (after McLaughlin et al., 2007)

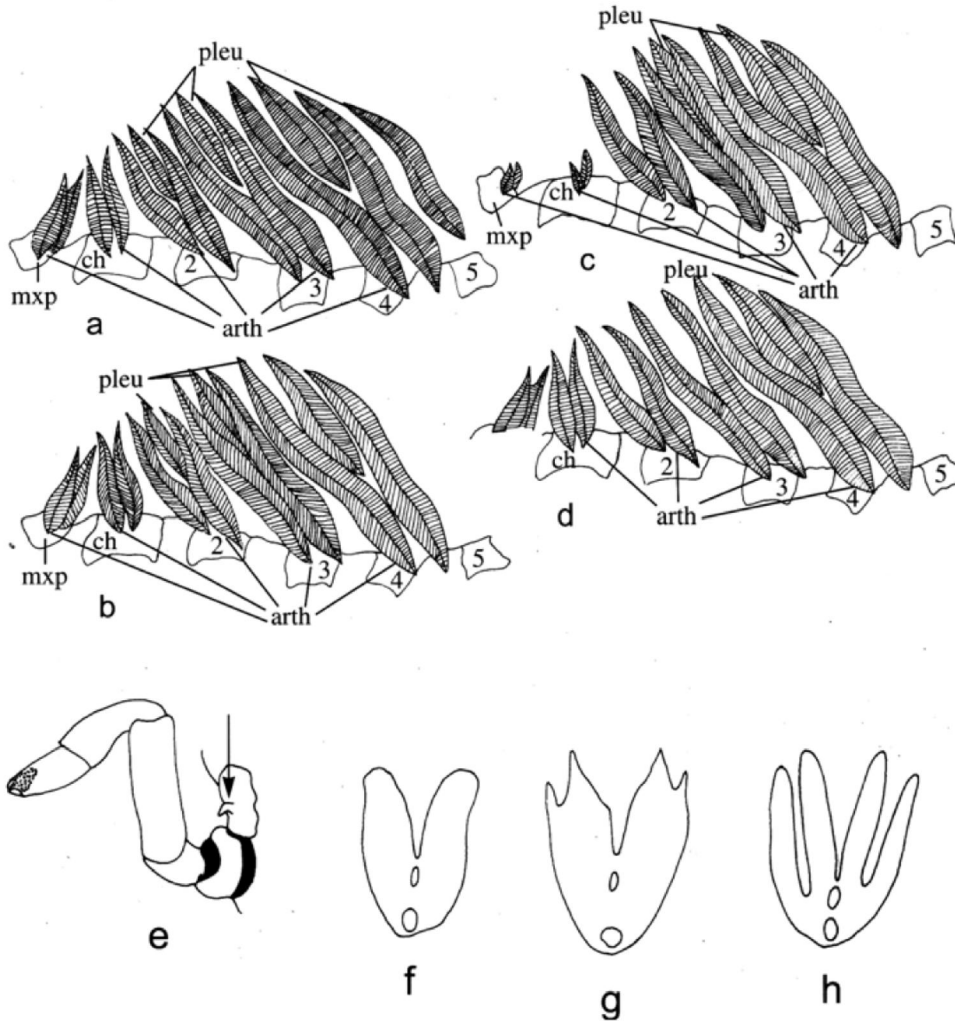


Fig. 2. Gills of hermit crabs. a. left gill series of 14 pairs (paired arthrobranchs on arthrodistal membranes of maxilliped 3, chelipeds and pereopods 2-4; single pleurobranchs on somites XI, XII, XIII and XIV (thoracomeres 5-8, above pereopods 2-5); b. left gill series of 13 pairs (paired arthrobranchs on arthrodistal membranes of maxilliped 3, chela and pereopods 2-4; single pleurobranchs on somites XI, XII and XIII (thoracomeres 5-7, above pereopods 2-4); c. left gill series with paired arthrobranchs reduced or vestigial on arthrodistal membranes of maxilliped 3 and cheliped; pleurobranchs absent from somites XI and XIV (thoracomeres 5 and 8, above pereopods 2 and 5); d. left gill series of 11 pairs (paired arthrobranchs on arthrodistal membranes of maxilliped 3, chelipeds and pereopods 2-4; single pleurobranchs on somite XIII (thoracomere 7, above pereopod 4); e. vestigial pleurobranch (see arrow) on somite XIV (thoracomere 8, above pereopod 5) in some parapagurids; f. biserial gill lamella; g. distally divided quadriserial gill lamella; h. deeply divided quadriserial gill lamella (after McLaughlin et al., 2007)

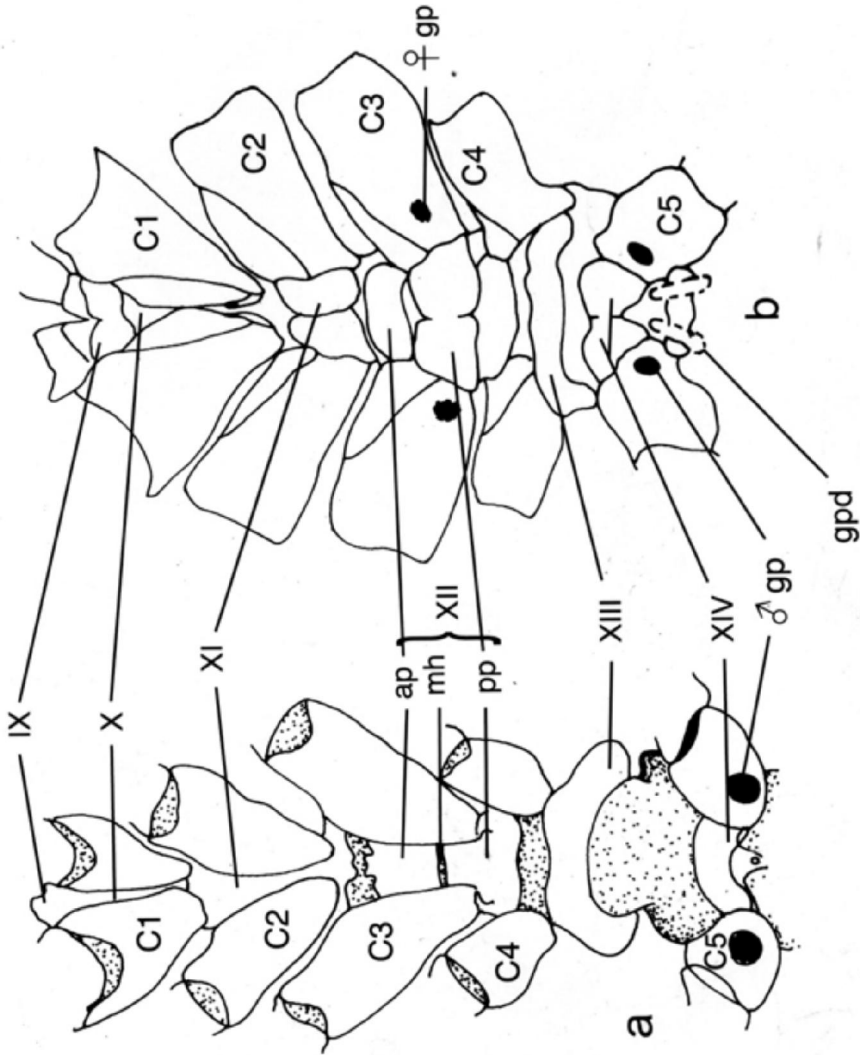


Fig. 3. a and b. Thoracic sternites and coxae of hermit crabs. Abbreviations: ap = anterior portion; C 1-5 = coxae of pereopods 1-5; gp = gonopore; gpd = paired first gonopods; mh = membranous hinge; pp = membranous hinge; pp = posterior portion (after McLaughlin et al., 2007)

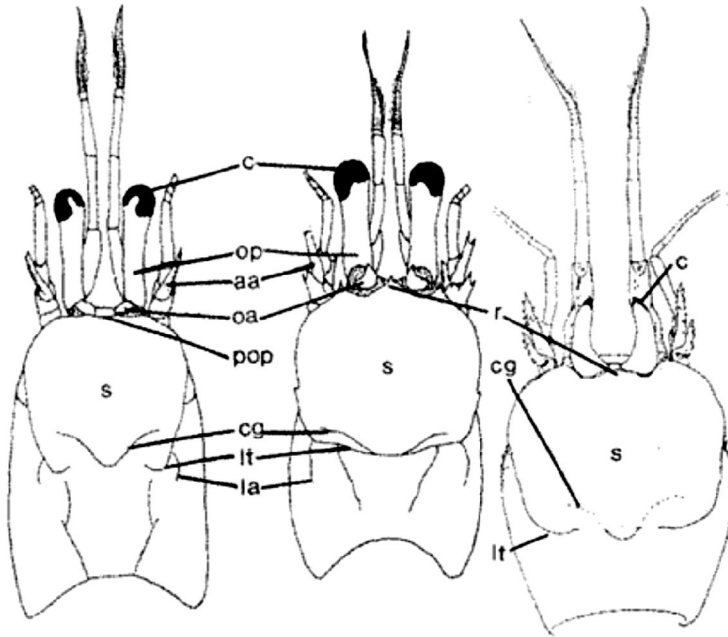


Fig. 4. Morphology of cephalothorax. Abbreviations: aa = antennal acicle; c = cornea; cg = cervical groove; la = linea anomurica; lt = linea transversalis; oa = ocular acicle; op = ocular peduncle; pop = postocular projection; s = shield (after McLaughlin, 2003)

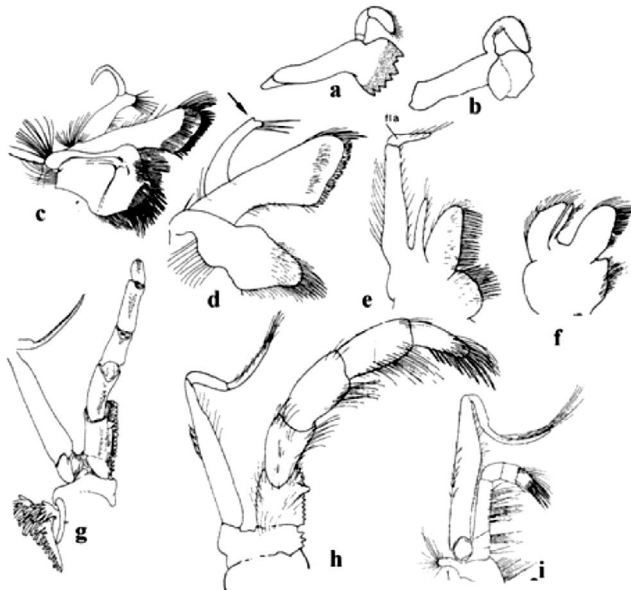


Fig. 5. a, b. Mandible; c, d. Maxillule; e, f. Maxilliped 1; g, h. Maxilliped 3; i. Maxilliped 2 (after McLaughlin, 2003)

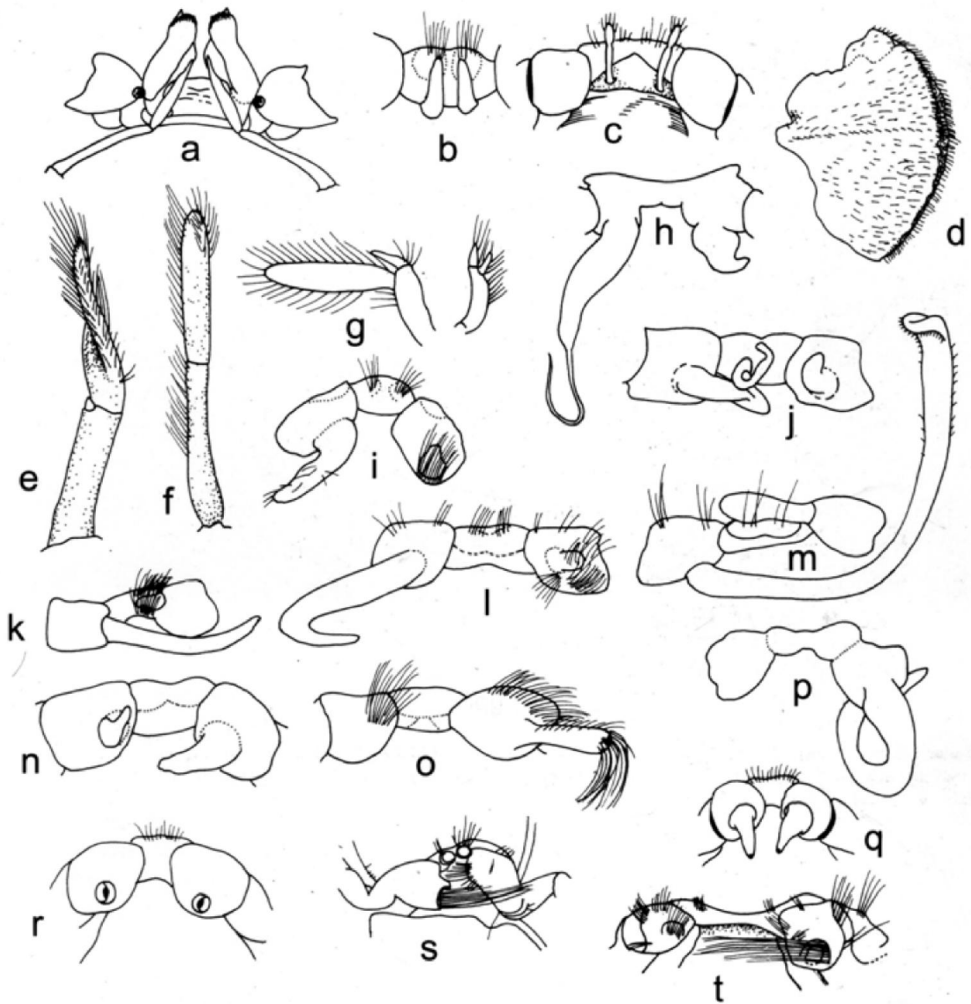


Fig. 6. Secondary sexual appendages and structures: a. coxae of pereopods 5 and pleonal somites 1 and 2, modified; b-c. coxae of pereopods 5 and abdominal somite 1 of female with pleopod 1 paired; d. female brood pouch; e-g. male pleopod 2; h-q. male sexual tubes; r. male sexual gonopores without sexual tube development; s. coxa of right pereopod 5 of male with gonopore masked by tuft of stiff setae; t = coxa of right pereopod 5 of male with gonopore masked by tuft of stiff setae (after McLaughlin et al., 2007)

antennal acicles small and fused to penultimate peduncular segment. Bases of third maxilliped close together, well-developed crista dentata; accessory tooth absent. Chelipeds unequal, left larger than right. Pereopods stout and longer than chelipeds. Fourth pereopods chelate or subchelate, fifth pereopod chelate. Abdomen well developed and carried under thorax or highly reduced and posteriorly located. Pleura absent. Males have 3-5 pleopods unpaired; no modification as gonopods. Female with no sexual modifications. Ventrolaterally placed uropods present which is not forming a tailfin, bears rasp used to grasp gastropod shell (except *Birgus*); propodal rasps on rami. Telson well developed.

Member of this family are land-hermits visiting sea occasionally to hatch-off eggs. The family contains two genera—*Coenobita* and *Birgus*. In *Coenobita* the body is a Paguroid form, the carapace elongate and abdomen soft and spirally coiled. All other characters are similar to Pagurine. In *Birgus* the carapace is almost crab-like due to the highly developed gill-chambers. Abdomen is symmetrical, flexed and is dorsally protected by large, overlapping, strongly-calcified terga; Fourth pereopod chelate, longer than stouter than fifth pereopod. Rostrum well developed. This genus is represented by a single species *B. latro*, the “robber-crab,”

Key to genera of Coenobitidae

1. Pereopod 4 elongate, chelate; abdomen somewhat flexed; rostrum well developed ... *Birgus* Leach, 1815
- Pereopod 4 short, not chelate; abdomen spirally twisted; rostrum obsolete ... *Coenobita* Latreille, 1829

1. *Birgus latro* (Linnaeus, 1767) (Plate 1, Fig. 7)

Common name: Coconut crab, Red List Category & Criteria: Data Deficient.

Description: Carapace anteriorly contracted and greatly expanded across the branchial regions, well calcified and more stronger in the gastric region. Prominent rostrum; eyestalks subcylindrical. Antennular peduncle as long as the carapace. Antennular flagella compressed and truncated at tip. Antennal peduncles short with a stout and long flagellum; antennal acicle fused with second joint. Large massive chelipeds with left slightly larger than the right; fingers with pincers obliquely placed. Extremely stout second and third pereopod. Fourth and fifth pereopods cheliform. Abdomen short, broad, straight, symmetrical and flexed beneath the thorax. Well calcified terga. Second, third, fourth, fifth terga broad and overlapping with small subsidiary platelets, sixth tergum and telson highly reduced and are ventral in position. Male abdominal appendages are rudimentary, females have large hairy biramous appendages on the left side of the second,

third, and fourth abdominal somites. Gills are phyllobranchise and are 14 in number on either side.

2. *Coenobita brevimanus* Dana, 1852 (Plate 1, Fig. 8)

Description: Adults brownish red, with chelae and ambulatory legs showing violet shades; young specimen light violet in colour. Eyestalks brown to black. Carapace longer than broader, shield strongly convex and punctuate. Ocular peduncles sub-cylindrical, extending beyond proximal margins of ultimate antennal peduncular segment. Ocular acicles serrate. Antennal acicles not fused to second antennal peduncular segments. Meri of chelipeds with transverse rumples; outer surfaces of carpi with irregular tubercles, which develop into spines at inner margin. Left chelae large, with smooth convex outer face; "stridulatory" ridge absent on outer surface. Outer surface of right chela with numerous tubercles; upper margin of palm with thick brush of long setae; left chela free of brush of setae on upper margin. Ambulatory legs with punctuate lateral faces; spinulose tubercles cover upper surfaces of carpi, propodi and dactyli; tubercles abundant on dactylus. Propodus and dactylus of second ambulatory leg flattened. Ventromesial face of left second and third pereopod each with longitudinal ridge of closely-set tubercles. Telson slightly asymmetrical. Coxa of male separated slightly, flattened and symmetrical; no sexual tube formation.

3. *Coenobita perlatus* H. Milne-Edwards, 1837 (Plate 1, Fig. 9)

Chelipeds, legs, and anterior half of carapace bright red profusely spotted with yellow (the tubercles) ; telson and posterior part of carapace dull red in colour. Carapace is punctated and with light-tipped vesiculous granules in front of the cervical groove. Eyestalks compressed, reaching beyond the middle of terminal antennal segment. Ocular acicles narrow and acute. Antennal acicles found fused to the 2nd joint of the peduncle. Dorsal surface of the chelipeds and legs with corneous tipped tubercles which form true spines on the dactylus and inner edges of propodus. Outer surface of left cheliped has stridulating apparatus formed of oblique series of oblique laminar tubercles which continues with the corneous tipped tubercles on the surface. Inner surface of right and left palm with thick brush of long hairs. The second pereopods are equal in length to the left cheliped, third pereopods slightly larger than the left cheliped. Concave inner surface of second left dactyli has a longitudinal ridge which is corneous. Outer surface of third left pereopod is convex. Found commonly in the jungles of the Andamans far from the shore.

4. *Coenobita rugosus* H. Milne Edwards, 1837 (Plate 1, Fig. 10)

Description: Specimens with various colouration, including reddish-orange, bluish-gray, cream, brown, purple, and a mixture of colours. Dark black patch on carapace and on outer face of left chela of most specimens. Shield longer than broader, convex, covered with numerous tubercles. Ocular peduncle elongated and slightly compressed laterally, reaching middle of ultimate segment of antennular peduncles. Ocular acicles, narrow and sharply pointed. Antennal acicles serrate and fused to second peduncular segment. Brush of setae present on upper margins of both chelae. Upper outer surface of palm of left chela with pronounced stitch mark or oblique laminar tubercles, usually six or seven in numbers, forming what has been called a stridulatory mechanism. Middle of inner surface of palm of left chela with strong longitudinal ridge below brush of setae. Mesial plane of merus of right cheliped without tuft of setae. Lateral surfaces of propodi and dactyli of left third pereopod flattened and separated from dorsal surface by distinct ridge or crest; ventromesial surfaces of dactyls of left second and third pereopod with longitudinal ridge of closely-set tubercles. Ambulatory legs covered with long setae. Coxae of male fifth pereopods forming asymmetrically short sexual tubes. Telson more or less symmetrical without spines.

II. FAMILY: DIOGENIDAE (Left-handed hermit crabs)

The Diogenidae are also known as “left-handed hermit crabs” because in contrast to most other hermit crabs, its left chela (claw) is enlarged instead of the right. It comprises 429 extant species, representing the second-largest family of marine hermit crabs, after the Paguridae (McLaughlin *et al.*, 2010).

Description: Carapace cylindrical or subcylindrical, longer than wide or wider than long (depending on sps.); outer ocular spines absent; rostrum reduced or absent. Cornea well developed or sometimes reduced; well developed ocular acicles. Antenna flagellum biramous. Third maxilliped closely placed, with crista dentata; Chelipeds unequal or subequal, commonly left cheliped largest, or right largest. 2-4 Pereopods present, second and third similar, fourth greatly reduced; dactyli of pereopods 2 and 3 simple. Pereopod 2 and 3 are of same length, or 3 shorter than pereopod 2; dactyli and propodi of pereopods 3 similar in right and left side. Pereopod 4 chelate. Abdomen well developed and carried posteriorly with distinct somites or with indistinct somites. Pleura absent. Male pleopods 3-5 unpaired; or pleopod 1 or pleopod 2 or both modified as gonopods. Male with single gonopore; Female with a single gonopore or no sexual modifications, or with first pleopods paired and modified as gonopods, or with brood pouch developed. Uropods present, not forming tailfan; propodal rasps on rami. Telson present.

5. *Paguristes longirostris* Dana, 1852 (Plate 2 Fig. 11)

Description: Chelipeds and legs reddish-brown with lighter bands near the joints and extremities. Merus of cheliped with purple colouration and bright red spot near inner distal border. General body colour creamy white to grey. Carapace longer than broad, rostrum prominent and deflexed, reaching upto the middle of ocular acicles. Ocular peduncles long, slender overreaching both antennal and antennular peduncles. Ocular acicles subtriangular with 1-2 spines on the terminal end. Antennal acicles long, extending beyond the middle of last peduncular segment, with 3-5 spines on the dorso-lateral margin; flagellum short. Chelipeds subequal with left slightly larger than right. Merus with spines on the anterior distal portion; dorsal upper surface with tubercles. Teeth; like spines present on the inner border of carpus; scale-like tubercles arranged in imbricating manner on propodus and dactylus. Ambulatory legs with thick setae on lower margins of merus, both upper and lower margins of carpus, propodus and dactylus. Dactylus with long and thick set of setae present. Propodus with squamiform markings on the inner surface, which is less prominent on the second pereopod. Telson asymmetrical with left slightly larger than right; both lobes covered with long thick setae.

6. *Paguristes luculentus* Komai, Reshmi and Bijukumar 2015 (Plate 2, Fig. 12)

Shield about 1.2 times as long as wide; rostrum narrowly triangular, usually distinctly overreaching lateral projections and overreaching midlength of ocular acicles. Anterodorsal portion of branchiostegite well calcified, with row of minute denticles or spinules on dorsal and anterior margins. Ocular peduncles relatively slender, subequal or slightly unequal (left longer than right), 0.7 times as long as shield. Antennular peduncles just reaching or slightly overreaching distal corneal margins; basal segment with small spine on distolateral margin of statocyst lobe. Antennal peduncles reaching corneal bases, but not reaching distal corneal margins; first segment unarmed on lateral face. Antennal flagellum slightly exceeding twice length of shield, consisting of more than 60 articles, each article with several short setae on distal margin. Third maxilliped moderately slender; carpus with minute dorsolateral distal and ventrolateral distal spinules; merus with row of 5 small spines on ventrolateral margin. Chelipeds slightly unequal, somewhat dissimilar (left stouter); armature and setation generally similar; spines on palms and carpi mostly corneous-tipped. Left cheliped with propodal/carpal articulation rotated counterclockwise about 15° from horizontal. Right cheliped without noticeable rotation of propodal/carpal articulation. Chela elongate subovate in dorsal view, about 2.3 times as long as wide. Telson with deep lateral indentations; median

cleft relatively deep, narrow; posterior lobes strongly asymmetrical, subtriangular with rounded tips, terminal and lateral margins unarmed, each with row of long setae. Shield entirely orange; calcified median part of posterior carapace orange, lateral parts whitish. Ocular peduncles orange, corneas dark gray. Antennular and antennal peduncles also orange, antennal flagellum red. Ambulatory legs with large white spots on red ground colour. Thirteen pairs of deeply quadriserial gills.

7. *Paguristes puniceus* Henderson, 1896 (Plate 2, Fig. 13)

Description: Carapace and basal segment of pereopods dark orange brown; the distal portion of pereopods light yellowish-brown. Shield slightly longer than broad; rostrum narrowly to broadly triangular, rarely broadly rounded and nearly obsolete. Branchiostegites each often with few widely-spaced spinules or small spines on dorsal margin and usually with 1-3 small spines on anterior margin. Ocular peduncles moderately short to moderately long; corneas slightly if at all dilated; ocular acicles triangular, each terminating acutely to bluntly, often with terminal spine. Antennular peduncles slightly to considerably overreaching distal margins of corneas; antennal peduncles not reaching corneal bases to overreaching distal margins of corneas, fourth segment commonly with small dorsodistal spine, second segment with dorsolateral distal angle usually terminating in bifid spine, occasionally 1 or 2 smaller spines on lateral margin; antennal acicle reaching, sometimes overreaching distal peduncular segment, with prominent terminal bifid spine, mesial margin with 0-6 spines, lateral margin with 0-3 spines; antennal flagellar length variable. Chelipeds approximately equal or occasionally subequal, left or right slightly larger; armature generally similar; mesial faces of dactyls each with irregular, vertical, oblique or longitudinal rows of very small spinules or spines; palms each with 3 or 4 moderate to prominent spines on dorsomesial margin, dorsolateral margin not delimited; weakly convex dorsal surface with 4-6 irregular rows of somewhat smaller spines; carpi each with 4-6 prominent spines on dorsomesial margin, irregular row, often double distally, of smaller tuberculate spines usually mesiad of midline. Telson with weakly asymmetrical posterior lobes separated by shallow median cleft.

8. *Ciliopagurus grandis* Komai, Reshmi and Biju Kumar 2012 (Plate 2, Fig. 14)

Cephalothorax fairly depressed dorsoventrally. Shield about 1.1 times longer than broad; anterolateral margins sloping; anterior margin between rostrum and lateral projections very slightly concave; posterior margin roundly truncate; dorsal surface flat, with scattered shallow pits anterolaterally and few tufts of stiff setae laterally; Y-shaped decalcified suture present posteriorly. Rostrum obtuse, rounded, slightly

exceeding lateral projections. Lateral projections also obtuse, unarmed. Ocular peduncles equal in length. Ocular acicles narrowly triangular, mesial margins nearly straight. Antennular peduncles moderately long. Antennal peduncles moderately short, reaching distal one-fourth to one-fifth of ocular peduncles. Chelipeds slightly unequal, short, left larger. Left cheliped with dactylus subequal in length to palm; cutting edge with 1 or 2 prominent calcareous teeth proximally, terminating in very strong, black corneous claw. Stridulating apparatus consists of 4 main ridges extending to ventral half of mesial surface (occasionally interrupted) and interspersing 4 or 5 short dorsal ridges or elevations bearing longitudinal corneous rods. Fourth pereopods semichelate; dactylus distinctly longer than palm, somewhat curved distally. Fifth pereopods chelate. Uropods asymmetrical. Shield orange, anterior margin whitish. Posterior carapace pale orange; branchiostegite and ventrolateral portion of posterior carapace crimson. Ocular peduncles white on dorsal face, red on lateral, ventral and mesial faces. Antennular and antennal peduncles whitish, antennal flagellum uniformly pale orange. Chelipeds and ambulatory legs generally orange, transverse ridges lined by red. Pleon generally white; sixth somite, telson and uropods orange. Claws of chelipeds and ambulatory legs and corneous spinules on ambulatory dactyli black or dark brown.

9. *Ciliopagurus krempfi* Forest, 1995 (Plate 3, Fig. 15)

Description: Shield orange-tan. Ocular peduncle, ocular acicle, antennae and antennules orange. Chelipeds with alternating broad bands of vermilion-red and thinner white band under fringe of setae. Fingers orange distally. Ambulatory legs with meri, carpi and propodi banded as chela; dactyls orange. Shield longer than broad; rostrum rounded. Ocular peduncle nearly as long as shield, overreaching antennal and antennular peduncles. Ocular acicles triangular, with single or bifid terminal spine. Antennular peduncle reaching the base of corneas. Antennal peduncles reaching the middle of ocular peduncle. Antennal acicle overreaching proximal margin of ultimate peduncular segment with 2 spines laterally and smaller spinules on dorsal surface. Chelipeds subequal; Merus with 3-4 striae long and 2-3 smaller striae. Carpus with 3 striae; palm with 4 striae and 5th interrupted by distal margin of carpi. Stridulatory apparatus present with 15 corneous parallel rods; mesial face with another series of parallel rods. Dactyl with series of ridges separated into 2 groups by large space and bordered by transverse proximal furrow. Ambulatory legs with dactyls slightly longer than propodi. Dactyls with numerous incomplete striae converging dorsally. Propodi with 6 striae; Carpus with 4 striae; 1 striae complete. Merus with 5 striae. Telson somewhat symmetrical, unarmed and rounded at terminal margin.

10. *Ciliopagurus liui* Forest, 1995 (Plate 3, Fig. 16)

Description: Cephalothorax strongly depressed dorsoventrally. Shield approximately as long as broad; anterior margin nearly transverse, with faint concavity either side of obsolete rostrum. Ocular peduncles equal in length, long and slender, about 0.8 times as long as shield and 5.5–6.0 times longer than corneal width, cylindrical, slightly inflated basally. Antennular peduncles not reaching corneal bases. Antennal peduncles reaching distal one-third of ocular peduncles. Maxillule with endopod bearing 2 bristles on moderately well developed internal lobe, external lobe well developed, slender, recurved. Chelipeds short, fairly flattened dorsoventrally, subequal or slightly unequal, when unequal, left larger. Right cheliped similar to left cheliped in armature and ornamentation. Stridulating apparatus on palm consisting of 4 distal ridges bearing corneous rods and 2 proximal ridges with minute corneous teeth. Ambulatory legs moderately stout, second slightly overreaching tips of chelipeds; generally similar in armature and ornamentation, but dactyli of third distinctly longer than those of second. Fourth pereopods semichelate. Dactylus about twice as long as palm, slightly curved, overreaching tip of fixed finger by about 0.3 length, terminating in minute corneous claw, lateral surface with row of small corneous spines ventrally; preungual process absent; ventral (opposable) surface broad, nearly flat. Uropods asymmetrical. Telson with distinct lateral indentations; anterior lobe slightly wider than posterior lobe; posterior lobes broadly and roundly subtriangular, slightly unequal (left slightly larger than right), with narrow, deep median cleft; terminal margins unarmed, but with row of moderately long stiff setae. Shield pale red, lateral parts yellowish. Posterior carapace translucent generally; posteromedian plate with red tinge medially. Ocular peduncle red, without conspicuous markings; cornea black. Antennular and antennal peduncles red, antennal flagellum uniformly light red. Palms of chelipeds generally orange-red, transverse ridges lined by red, transverse sulci whitish. Dactyli of ambulatory legs generally orange-red, becoming slightly paler distally; propodi with distal parts cream or light yellow with tinge of red, followed by 7 or 8 alternate rings of red and white (white ring corresponding to furrows), proximally part whitish; carpi similarly annulated with 4 or 5 white and red rings, proximal part yellow or cream; meri also annulated with 7 or 8 alternated white and red rings (red rings broader than white rings, sometimes bicolored with red and orange), proximal parts yellow or cream; ischia generally red or orange, with few white rings or short striae. Pleon with numerous, short to long, red and white transverse or obliquely transverse stripes.

11. *Ciliopagurus tricolor* Forest, 1995 (Plate 3, Fig. 17)

Description: Shield white; ocular peduncles, antennular and antennal peduncles orange-red. Corneas pale orange. Chelipeds and ambulatory legs with composite coloured rings, made of one white or cream median band, flanked by two bright red rings, set against an orange background; fingers of chelae uniformly pale orange, without composite coloured rings. Ambulatory legs with dactyls pale orange without composite coloured rings; terminal claws black. Shield longer than broad; rostrum rounded. Ocular peduncle nearly as long as shield, overreaching antennal and antennular peduncles. Ocular acicles triangular and truncated with 2-5 terminal spines. Antennular peduncle reaching the base of corneas. Antennal peduncles reaching beyond the middle of ocular peduncle. Antennal acicle overreaching proximal margin of ultimate peduncular segment with 5-7 spinules on dorso-mesial surface. Chelipeds equal; outer face of palm of chelae with 3 complete transvers striae; ventral half of the palm with a posterior striae and two additional striae between 1-2 and 2-3 striae. These striae are smooth or with minute spinules. Stridulating apparatus present with 11-12 parallel corneous crests. Ambulatory legs also with striae. Third pereopod with dactyls much longer than propodi; row of spines on the ventral margin of dactyls. Telson slightly asymmetrical, unarmed and rounded at terminal margin.

12. *Dardanus deformis* (Milne Edwards) (Plate 3, Fig. 18)

Description: Biscuit yellow with reddish tinge on legs, eyestalks and carapace. Carapace depressed and setose along margins. Ocular peduncles short and broadened distally. Antennal peduncles longer than ocular peduncles. Antennal acicles reach beyond base of ultimate segment. Ophthalmic acicles triangular and set widely apart. Chelipeds unequal with left larger than right. Chela longer than broad. Outer margin of merus with blunt spines and distal inner part with a sharp spine. Carpus with outer lower margin and surface smooth while spinose towards upper inner surface. Palm with a row of strong spines on upper margin and also with few more outer rows of smaller and less defined spines. A row of tubercles on lower margin of chela. Dactylus with crenulated crest along upper surface of dactylus. Finely crenulated overhanging crest seen on outer surface of propodus and dactylus.

13. *Dardanus pedunculatus* (Herbst, 1804) (Plate 4, Fig. 19)

Description: Shield cream to brown, ocular peduncles dark brown with white bands at the base of corneas and peduncles, ocular acicles brown and cream coloured. Antennular and antennal peduncles light brown and cream coloured.

Chelipeds with outer faces purple and inner faces light purple coloured, carpus tan-brown, meri cream coloured with brown shades. Ambulatory legs tan-brown with meri having tan-cream bands. Shield longer than broad with rostrum round. Ocular peduncles short and stout, corneas slightly dilated. Ocular acicles subtriangular to subquadrate with 8-12 marginal spines. Antennular and antennal peduncles overreaching corneas. Antennal acicle overreaching the proximal margin of the ultimate peduncular segment terminating in a single spine and with 1-3 spines laterally. Chelipeds unequal, left larger than right. Palm of left chelae with blunt spines or tubercles on ventral margin, upper half with longitudinal rows of tubercles separated by shallow furrows, upper margin with strong spinulose tubercles and lower half nearly smooth. Carpus with few spinulose tubercles on the upper margin and outer face. Merus smooth with a strong spinulose tubercle on the outer distal end. Right cheliped smooth with a row of blunt tubercles on upper margin and few tufts of setae on the outer face. Ambulatory legs smooth. Dactyls longer than propodi, Carpi of both pereopods with few strong tubercles on the outer distal end. Dactylus of third pereopod with dorsal and ventral margins armed with very small spinules, strong ridge present in proximal end of lateral face. Propodus with dorsolateral margin rounded and lateral face convex, ventral margin with row of small, closely spaced tubercles. Pleon with spur developed between second and third pleopods. Telson with narrow median cleft, distal margins with long setae, left lobe elongated having 2-4 spines and right lobe with 1-5.

14. *Dardanus hessi* (Miers, 1884) (Plate 4, Fig. 20)

Description: Shield, abdomen and legs cream with brown tinge. Reddish tinge on the lateral surface of ocular peduncles. Antennae and antennules are creamish. Fixed finger, ventral portion of palm and dactyli of cheliped brick red. Propodus of ambulatory legs with red colouration at the ventral margin. Shield longer than broad. Distally broadened ocular peduncles, nearly as long as antennal peduncles and overreached by antennular peduncles. Ocular acicles broadened distally with 3-7 spines. Antennal acicles overreaching the base of ultimate peduncular segment by 0.75 length. Chelipeds subequal, left slightly larger; similar armature in both chelipeds. Outer surface of palm and carpus with 3 longitudinal rows of spines. Palm and fingers with numerous small spines on outer surface and lateral surface, long bristles present on chelipeds and ambulatory legs not obscuring sculpture. Ambulatory legs similar with dorsal longitudinal row of prominent spines in carpi, propodi and dactyls. Third pereopod with dactyls longer than propodus. Telson asymmetrical with left lobe larger than right, separated by a shallow median cleft; terminal margins each with row of corneous spines.

15. *Dardanus lagopodes* (Forskål, 1775) (Plate 4, Fig. 21)

Description: Carapace mottled red and white, anterior portion with purplish-red patch. Ocular peduncles yellowish-brown with yellow band distally near corneas. Antennal and antennular peduncles light blue, with antennular flagellum orange. Chelipeds mottled red, brown, maroon and white; chelae reddish to maroon on fingers and palm, carpi red-brown with large purplish-blue patch dorsally, meri also red-brown and white. Ambulatory legs reddish-brown to maroon, mottled with patches of pale violet; carpi reddish-brown dorsally with purplish-blue patch on segments. Setae red with cream tips. Shield longer than broad with rostrum rounded; carapace depressed. Ocular peduncles long, slender, sub-cylindrical and broadened distally, overreaching both antennal and antennular peduncles. Ocular acicle subtriangular or subquadrate with 3-4 spines at distal margin. Antennular peduncle longer than antennal peduncle. Antennal acicle overreaching the proximal margin of the ultimate peduncular segment terminating in a single spine and with 3-4 spines mesially. Chelipeds subequal, left not appreciably longer than right. Upper and outer surface of palm of left chelae with acute spines. Right cheliped also with tubercles on upper surface of chela. Third pereopod with dactyls and propodus of nearly equal length, dorsal and ventral margin of each with row of strong corneous-tipped spines or tubercles. Dactyls with a median longitudinal groove on the lateral face while that of propodus is weakly concave. Carpi of both pereopods with a strong dorsodistal spine. Chelipeds and ambulatory legs are usually covered with long, stiff setae all over the segments. Telson asymmetrical; left lobe larger, each lobes with corneous ventrally directed 6-7 spines.

16. *Dardanus megistos* (Herbst, 1804) (Plate 3, Fig. 22)

Description: Carapace bright red with white spots bordered by black. Ocular peduncles bright reddish. Chelipeds and ambulatory legs bright reddish with numerous white spots bordered by black. Dark red setae all over the shield and legs. Shield longer than broad; rostrum rounded. Ocular peduncles long and slender; corneas slightly dilated; ocular acicles subtriangular, spinose. Antennular peduncles overreaching the distal margin of corneas. Antennal peduncles reaching at the base of corneas; antennal acicle with few spines on the dorsal margin interspersed by setae. Chelipeds and ambulatory legs covered with tufts of long bristles and corneous-tipped spines. Chelipeds unequal, left larger. Upper surface of left chela with 3-4 large spines. Palm of right cheliped with double row of prominent spines on upper margin; outer surface with 2 rows of smaller spines and rows of spinules in lower half. Dactyls of ambulatory legs longer than propodi. Propodus of left third pereopod subcylindrical, outer surface with densely-packed corneous-tipped spines. Telson asymmetrical with shallow median cleft; terminal margins with row of corneous spines.

17. *Dardanus setifer* (H. Milne Edwards, 1836) (Plate 5, Fig. 23)

Description: Carapace with patches of red and white. Ocular peduncels, antennular and antennal peduncles pinkish-brown. Chelipeds and ambulatory legs with patches of red and white. Carpi and propodi with dark red bands. Shield as long as broad; rostrum broadly rounded. Ocular peduncles long and slender, overreaching antennular and antennal peduncles; corneas slightly dilated. Ocular acicles subquadrate, with 3-5 terminal spines on each. Antennal peduncles reaching beyond the midpoint of ocular peduncle. Chelipeds unequal; left considerably larger than right. Left cheliped covered by thorn-like corneous spines accompanied by wreath bristles; lower margin with spines arranged one after another in palisade manner. Carpus with a row of 3-4 spines on the upper margin and thorn like corneous spines and stiff bristles on outer surface. Merus with row of spines on distal margin and many tuberculate spines on surface along with long bristles. Left third pereopod distinct in form and sculpture; propodus and dactyl with concave lateral faces with broad longitudinal spinose median carina; series of deep cut and regular transverse grooves seen on upper and lower surface of concavities, but more prominent on upper surface. Row of very long setae on dorsal and ventral margin. Telson asymmetrical with a median cleft; left lobe larger than right with few spines on terminal margin.

18. *Clibanarius infraspinatus* (Hilgendorf, 1869) (Plate 5, Fig. 24)

Description: Shield tan to brownish-orange, abdomen greyish-brown coloured, ocular peduncles dark brown with longitudinal reddish white stripes, chelipeds brownish orange with lighter coloured tubercles. Ambulatory legs brownish orange. Carpi, propodi, dactyli with two creamish tan stripes bordered with reddish brown and one median longitudinal brownish orange stripe on lateral face. Meri each with two longitudinal stripes laterally and one medial stripe. Shield longer than broad. Rostrum prominent, triangular. Ocular peduncles long, slender, ocular acicles 3-4 spines. Antennular peduncles slightly longer than ocular peduncles; antennal peduncles short and reaching beyond $3/4^{\text{th}}$ of ocular peduncles. Antennal acicle reaching beyond the proximal margin of ultimate peduncular segment, with about 6-8 spines in mesial margin. Chelipeds slightly subequal, left slightly larger, similar in armament. Dorsal surface of palm with numerous spiniform tubercles; carpi with numerous small spines on the dorsal surface and 3-4 strong spines on dorsomesial margin; ventromesial margin of merus with prominent blunt spine proximally. Ventral margin of dactyls in ambulatory legs with 7-9 corneous spines in distal half; carpi of second pereopod with row of spines on dorsal surface and third pereopod with a dorsodistal spine. Telson with asymmetrical posterior lobes

separated by very shallow median cleft; terminal margins with 5-7 prominent spines. Long stiff setae on the dorsal surface of shield, chelae and ambulatory legs.

19. *Clibanarius longitarsus* (De Haan, 1849) (Plate 5, Fig. 25)

Description: Shield and carapace greenish-brown with dark brown patches. Ocular peduncles yellowish-green. Chelipeds greenish-brown with golden bristles. Second and third pereopods bluish-green; propodus and dactyl with two longitudinal bluish-green stripes on lateral and mesial surfaces; carpi olive green. Meri with dorsal, lateral and ventrolateral olivebrown stripes. Shield longer than broad; rostrum triangular. Ocular peduncles slightly shorter than shield; ocular acicles with a simple spine terminally. Ocular peduncles slightly overreached by antennular peduncles; antennal peduncles reaching at the base of corneas. Antennal acicle not reaching at the base of ultimate peduncular segment; mesial face with 3-4 spines and a terminal single spine. Chelipeds subequal, robust; left slightly shorter than right, similar in armature; dorsal surface of palm with irregular row of corneous-tipped spines, dorsomesial margin with row of 5-6 spines; carpi with a prominent corneous-tipped spine distally at dorsomesial margin. Distal half of dactyls of ambulatory legs with 11-14 closely-spaced spinules at the ventral margin. Third pereopod with dactyls longer than propodus. Carpi with a dorsodistal spine. Telson with asymmetrical posterior lobes and shallow median cleft; terminal margins with few small spinules and 2-3 larger, corneous tipped spines.

20. *Clibanarius merguensis* De Man, 1888 (Plate 5, Fig. 26)

Description: Shield green with blue and cream tinge. Ocular peduncle orange with blue on dorsal side. Antennal and antennular peduncles dark blue, antennular flagellum orange. Chelipeds dark green with yellow or orange patches. Ambulatory legs dark bluish-green; dactyls with bluish stripe on lateral face, orange band on proximal half, tip with orange colouration. Propodi and carpi of third pereopod with bluish-white stripe on lateral face. Proximal half of merus with bluish-white stripe on the lateral face. Shield longer than broad. Ocular peduncles overreaching both antennal and antennular peduncles. Ocular acicles triangular with up to 6 spines on terminal margin. Antennular peduncle reaching at the base of corneas; antennal peduncles reaching beyond the midlength of ocular peduncular. Antennal acicle slightly reaching beyond the distal margin of fourth peduncular segment. Chelipeds slightly subequal; similar in armament. Dorsal surface of chela with spines, more abundant on dactyls and fixed finger; dorsomesial margin of carpi with a distal spine. Dactyls of ambulatory legs shorter than propodi, 5-6 corneous spines on ventral margin; dactyls and propodi with unarmed lateral faces, setae

arise from small pits on lateral face. Second and right third pereopod with propodi cylindrical, lateral faces smooth and convex; left third with lateral face flattened, with a ridge on dorsolateral margin; carpi with a dorsodistal spine. Telson asymmetrical with slender median cleft; 5-12 spines on terminal margin.

21. *Clibanarius arethusa* De Man, 1888 (Plate 6, Fig. 27)

Description: Shield light gray. Ocular and antennular peduncles brown. Antennular flagellum light brown. Antennal peduncle brown with light brown flagellum. Chelipeds and ambulatory legs reddish-brown. Shield longer than broad. Ocular peduncles slightly shorter than shield, overreaching both antennal and antennular peduncles; ocular acicles subtriangular with 3 terminal spines. Antennular peduncles nearly reaching base of corneas; antennal peduncles reaching beyond the midpoint of ocular peduncle. Antennal acicle reaching the distal margin of penultimate segment. Chelipeds subequal; similar in armature, right slightly longer and more robust. Dorsal surfaces of palm with irregularly scattered spines and tufts of stiff setae; row of 4 or 5 small spines on the dorsomesial margins. Distal portion of carpi with single prominent spine at dorsomesial margin. Ambulatory legs slightly robust; dactyls with row of 4-6 small corneous spines on the ventral margin; third pereopod with dactyl longer than propodi. Ambulatory legs with sparse tufts of stiff setae present entirely. Telson with asymmetrical lobes and a shallow median cleft; left lobe larger than right with 5-6 spinules and right with 2-4 spinules on the right.

22. *Clibanarius corallinus* (H. Milne Edwards, 1848) (Plate 6, Fig. 28)

Description: Reddish brown with dark brown bristles. Carapace longer than broad; rostrum pointed, reaching base of ocular acicles and are more prominent. Ocular peduncles long, ocular acicles broad with narrow distal end bearing 1-3 spinules at margin. Antennular peduncles shorter than ocular peduncle and slightly longer than antennal peduncles. Antennal acicles reach beyond the base of ultimate antennal segment. Chelipeds subequal; merus smooth with 2 spinules on lower margin distally. Upper surface of carpus, propodus and dactylus with dark tipped spines and tufts of bristles at its base. Fingers with spines on upper lateral margin and lower surface with tubercles, with or without bristles. Upper surface of chela, carpus and merus with long stiff bristles. Third pereopod with dactylus shorter than propodus. Second and third pereopods longer than chelipeds. Second extending beyond the third one. Propodus of third pereopod flat with thick bristles, claws sharp and black.

23. *Clibanarius padavensis* de Man 1888 (Plate 6, Fig. 29)

Description: Carapace yellowish brown. Ocular peduncle yellowish with a reddish or brown stripe on dorsal and another stripe on the inner angle. Antennal and antennular peduncles yellowish with red or brown bands, flagellum yellow. Chelipeds and ambulatory legs yellowish with 2-3 longitudinal reddish or brown bands. Setae light yellow coloured. Shield longer than broad with tubercles on dorsal surface. Rostrum acute, well developed, reaching base of ocular acicles. Ocular peduncle long; almost reaching the base of ultimate antennular joint. Ocular acicles are closely placed with 1-3 spines on the terminal margin. Antennal peduncle reaching upto the base of corneas; antennal acicle triangular with serrated margins, reaching base of ultimate peduncular joint. Chelipeds equal; palm with upper dorsal row of corneous-tipped spines extending upto the dactyls; outer and lower surface with tubercular spines, becoming strongly corneous at the fingers. Long setae sparsely arranged along palm. Carpus with a dorsodistal spine and many small spines or tubercles on the outer and lower margin. Merus with 2 spinules at the lower distal margin and many small tubercles on the outer surface. Both merus and carpus also with sparsely arranged long setae. Ambulatory legs with dactyls slightly longer than propodus; uniformly arranged setae on all segments. Telson slightly asymmetrical; left slightly larger than right; a shallow median cleft; terminal margin of lobes with spines.

24. *Diogenes alias* McLaughlin & Holthuis 2001 (Plate 6, Fig. 30)

Description: Shield cream coloured with brownish tinge. Ocular peduncle with light brown longitudinal stripe. Chelipeds, ambulatory legs, antennae, antennules are all coloured creamish-brown. Shield with rostral lobe weakly developed. Ocular peduncles 0.7 - 0.9 length of shield; corneas not dilated; ocular acicles with row of small spines over entire length of anterior margin, 2 or 4 frequently more prominent at inner angle. Intercalary rostral process usually reaching beyond anterior margins of ocular acicles, margins, most frequently, each with several prominent spines. Antennular peduncles when fully extended, overreaching corneas by approximately half length of ultimate segments. Antennal acicles usually prominently bifurcate; outer branches reaching to or beyond the proximal margin of ultimate peduncular segment; inner margins each with several small spines. Antennal flagella sparsely setose, every 2 or 3 articles with pair of moderate to long setae. Chelipeds unequal, left cheliped larger and with row of slender, acute spines near upper outer margin of dactyli and usually 2 smaller spines centrally in proximal half of outer surface; upper margin with 2 rows of acute spines. Fixed finger with outer

surface flattened, armed with row of prominent spines; lower margin with row of strong, acute spines, forming nearly straight line with lower, similarly armed margin of palm; convex outer surface of palm with 5 or 6 rows of acute, often slightly curved spines, irregular area devoid of spines or with only appreciably smaller, randomly set spines adjacent to upper margin and continuing proximally to articulation with carpus. Upper margin of palm with 2 or 3 irregular rows of smaller spines and tufts of moderately long setae. Carpus with row of moderate spines on the upper outer margin and adjacent to it on the upper margin row of strong spines, short row of spines is seen distally to the area devoid of spines or with very small spines proximally. Carpus with row of strong spines on upper margin, adjacent short row of spines distally, area devoid of spines or with only few small spinules or spinulose tubercles proximally; remainder of outer face with several rows of smaller spines and tufts of long setae. Right cheliped with 1 or 2 rows of acute spines on upper margin of dactyl, partially obscured by long setae. Ambulatory legs with dactyls longer than propodus. Dactyls longer than propodi with row of spines on the dorsal margin which is more prominent in third pereopod. Propodi with 3 row of prominent spine on dorsal surface, 2nd rows of small blunt tubercles but 3rd pereopod with 2 rows of strong tubercles. Carpus with dorsal row of spines lateral face with 3 rows of blunt tubercles. Merus also with row of tubercles on upper margin and irregular blunt tubercles on outer face. Telson without a median cleft. Lobes are asymmetrical each with 2-4 small spines centrally and 2-3 much larger spines laterally; lateral margins spinulose.

25. *Diogenes avarus* Heller 1865 (Plate 7, Fig. 31)

Description: Shield pale gray to grayish-brown. Ocular peduncle cream; antennal flagella cream with blue-green bands. Antennular peduncles cream with greenish gray spot on distal margin penultimate segment; antennular flagella cream. Chelipeds cream with dark brownish or blackish brown areas; especially on propodi. Ambulatory legs cream, scattered brown area on carpi and meri and midlength of propodi. Shield longer than broad, dorsal surface with few short transverse ridges and long setae; rostrum broadly rounded. Ocular peduncles short and stout, overreaching both antennular and antennal peduncles; ocular acicles 1-3 strong spines and several minute spinules on terminal margin. Rostrum slender, not reaching beyond innermost acicular spines. Antennal peduncles slightly shorter than antennular peduncles. Antennal acicle triangular not reaching to distal margin of fourth peduncular segment, with simple or bifid terminal spine, lateral margins with 1 or 2 spines distally, mesial margins with 3-8 small spines. Antennal flagellum long with ventrally placed paired setae. Chelipeds unequal; left larger than right.

Upper margin of palm with double row of irregular small spines, strongest on upper distal half. Outer surface convex with closely-spaced tubercles or spines; midpoint of proximal margin with strong tubercles forming prominent crest, not continued with dactyls. Lower margin of palm and fixed finger with irregular rows of small tubercles forming straight line. Upper surface of dactylus with 2-3 rows of spines. Upper surface of carpus with 2-3 rows of small acute spines becoming stronger on the distal angle; outer surface convex, armed with spinulose tubercles. Right cheliped with hiatus between dactyl and fixed finger; upper margins of carpus, palm and dactyl with 1-3 rows of small spines partially obscured by long plumose setae. Dactyli of ambulatory legs with two rows of widely-spaced, short setae on mesial faces. Propodi with irregular rows of small spines on second and third pereopod. Carpi of second pereopod with 1- 2 rows of small spines, third with a dorsodistal spine or a single row of small spinules. Telson asymmetrical with a median cleft; terminal margin with several small spines; 4-6 larger spines laterally on left lobe.

26. *Diogenes canaliculatus* Komai, Reshmi and Bijukumar, 2013 (Plate 7, Fig. 32)

Shield 1.1 times longer than broad, suboctagonal; anterior margin between rostrum and lateral projections slightly concave, smooth or bearing 1-4 tiny tubercles near each base of lateral projection; anterolateral margins sloping, slightly tuberculate; posterior margin roundly truncate; dorsal surface with some transverse spinulose ridges laterally. Rostrum obtuse. Ocular peduncles equal in length, about 0.7 times as long as shield, moderately stout, not inflated basally; cornea not dilated. Antennular peduncle overreaching distal corneal margin by 0.8-0.9 length of ultimate segment and extending as far as antennal peduncle. Antennal peduncle overreaching distal corneal margins by 0.8-0.9 length of fifth segment. Third maxilliped moderately slender. Carpus unarmed on dorsodistal margin. Ischium-basis fused segment with 4 strong, corneous-tipped spines (2 on ischium and 2 on basis) on mesial margin. Left cheliped (Figs. 51C, 52B) moderately large, not particularly elongate in male. Chela strongly compressed. Dactylus distinctly longer than palm; upper margin with double row of small tubercles or spines, becoming single row in distal half; outer surface usually with deep furrow medially and blunt ridge along cutting edge, having scattered granules (these granules larger on lower ridge); cutting edge sinuous, with single row of small blunt calcareous teeth increasing in size proximally; inner surface with median row of tiny tubercles in proximal half, row of small tubercles adjacent to upper margin, and with shallow sulcus proximally. Right cheliped moderately stout, with numerous tufts of long setae, particularly on

dorsal side; broad hiatus between fingers. Ambulatory legs generally similar, but third pair slightly longer than second pair. Shield light brown or tan generally; posterior carapace translucent. Ocular peduncles generally light brown, with tinge of darker brown proximal to base of cornea; no distinct markings otherwise. Named after the longitudinal furrows on the outer surface of the dactylus and palm of the left chela.

27. *Diogenes custos* (Fabricius, 1798) (Plate 7, Fig. 33)

Description: Light cream coloured body. Ocular peduncles, antennular and antennal peduncles with alternating cream and grey stripes. Chelipeds and ambulatory legs brown with brownish- grey patches. Shield as broad as long; rostral lobe rounded, rostrum reaching beyond the tip of ocular acicle, with 5-6 spines on the lateral margin. Ocular peduncle short, overreached by both antennal and antennular peduncles. Ocular acicle subtriangular with 7-8 smaller spines on the anterior margin. Antennal peduncle approximately equal to antennular peduncle. Antennular peduncle overreaching corneas by half the length of ultimate peduncular segment. Antennal acicle weakly bifurcate, outer branch not overreaching the distal margin of fourth peduncular segment. Outer branch with 7-8 spines on inner margin and inner branch with 1-2 spines. Chelipeds unequal; left larger than right. Dactyl of left cheliped with 2 rows of small subacute spines on the upper margin; closely packed conical spines on outer surface; inner face with 2 rows of subacute spines. Fixed finger with flattened outer face with numerous tubercles, lower margin with blunt spines forming straight line with that of palm. Palm with 2 prominent rows of subacute spines on the upper margin; outer face convex with closely set tubercles, strongest in upper proximal half. Upper margin of carpus with a row of strong spines and another inner row of smaller spines, Outer surface with several rows of smaller spines and a single longitudinal row of prominent spines at the centre. Merus with single row of spines on the upper margin and many tubercles on the outer face. Right cheliped with row of small spines on the upper margin of dactyls, palm and carpus, obscured by long setae; outer face with irregular rows of small spines. Ambulatory legs with dactyls longer than propodus; dactyls with row of small spines on dorsal margin; longitudinal sulcus present on the lateral face which is partially obscured by long stiff setae; ventral portion also with setae sparse at proximal half becoming dense at distal half. Dorsal surface of propodi flattened, with 2 rows of small spines, interspersed with sparse tuft of short setae; lateral face with weak tuberculate ridge dorsally; mesial face with tubercles; outface with spinulose tubercles. Dorsal surface of carpus and merus with spines, lateral face spinulose and with sparse setae. Telson asymmetrical with a deep median cleft; left lobe larger; left lobe with 8-10 large spines and right lobe with 6-8 larger spines both accompanied by few smaller spines.

28. *Diogenes dubius*(Herbst 1804) (Plate 7, Fig. 34)

Description: Light cream coloured body. Ocular peduncles, antennular and antennal peduncles with alternating cream and grey stripes. Rostrum and ocular acicles grey with red tinge. Chelipeds and ambulatory legs brown with brownish-grey patches. Shield with broadly rounded rostral lobe; rostrum well developed, reaching beyond the tips of ocular acicle, with 4-6 pairs of spines on margins. Ocular peduncles short, overreached by antennal and antennular peduncles. Ocular peduncles reaching about 0.7 length of antennular peduncle and 0.5 length of antennal peduncle. Ocular acicle with row of small spinules on anterior margin, 1-2 larger spines on the inner margin. Antennular peduncle nearly equal to antennal peduncle. Antennal acicle bifurcate, reaching at the distal joint of fourth peduncular segment. Inner branch reaching 0.5 length of fourth segment. Chelipeds unequal; left larger than right.

Dactyls with 2 rows of small tubercles on upper margin, outerface with closely packed tubercles; 2 rows of subacute tubercles on inner face. Outer face of fixed finger with numerous small tubercles, lower margin with closely packed conical tubercles, strongest in upper half proximally. Upper margin with 2 prominent rows of conical tubercles. Upper surface of carpus with 2 rows of small conical spines; outer surface spinulose with strongest spines in ventral half. Dactyls of right cheliped with row of small spines on upper margin obscured by long setae. Ambulatory legs with dactyli larger than propodi. Two rows of small spines on dorsal surface; shallow longitudinal sulcus on lateral face; mesial face with double row of setae on longitudinal sulcus; proximal half with row of tiny spines; proximal half of ventromesial margin with row of small spines and long dense setae in distal half. Dorsal surface of propodi with 2-4 rows of small spines; lateral face with vertical rows of bifid tubercles; dorsal margin of carpi with row of spines, lateral face with longitudinal row of bifid tubercles. Telson asymmetrical with indistinct median cleft; terminal margin with few large spines along with smaller spines.

29. *Diogenes klaasi* Rahayu and Forest, 1995 (Plate 8, Fig. 35)

Description: Shield reddish-orange. Ocular peduncles light greenish-orange with antennules and antennae pale yellow. Chelipeds dark brownish- green. Ambulatory legs pale yellow with irregular dark green spots seen in different segments. Shield longer than broad, rostrum bluntly triangular, not reaching up to ocular acicle projections. Ocular peduncles stout and cylindrical. Ocular acicle with 1-3 large spines and few smaller spinules. Antennular peduncle long, slender and overreaching corneas by about 0.5 length of ultimate peduncular segment. Antennal peduncle

slightly shorter or longer than ocular peduncles; antennal acicles overreaching the mid-length of fourth peduncular segment and with 3-4 marginal spines and an additional spine on dorsal surface. Antennal flagella with long setae. Chelipeds unequal, left larger than right. Upper and lower margins of left cheliped with irregular row of spines. Palm convex; outer surface with small spines or tubercles and median longitudinal row of spines. Carpus also spinulose on outer surface. Dactyls of right chela slender. Carpus with a dorsodistal spine. Ambulatory legs thin, slender and dactyls longer than propodus. Carpi of second and third pereopod with a dorsodistal spine and an additional spine at the proximal end of carpus of second pereopod. Chelipeds and ambulatory legs covered with long setae. Telson broad and asymmetrical with a small median cleft. Left lobe large than right with oblique terminal margin and about 2-5 large spines laterally and few spinules; right lobe is smaller than left and with 1-3 larger spines laterally and few smaller spinules on terminal margin.

30. *Diogenes mannarensis* Henderson, 1893 (Plate 8, Fig. 36)

Description: Shield, carapace and dorsal side of abdomen brick red with slightly bluish tinge and with scattered pale and dark spots; antennal, antennular and ocular peduncles light orange; antennular flagella white or cream in colour; antennal flagella bluish. Carapace, chelipeds and ambulatory legs all covered by gray muddy setae. Shield longer than broad with rugose outer surface. Dorsal margin of branchiostegites each with row of moderately small spines. Intercalary rostral process very small. Ocular peduncles long, slender but not overreaching the antennal and antennular peduncles; ocular acicles with 6-9 spines in distal outer margins, apical spine largest. Antennular peduncles overreaching distal margins of corneas by 0.60 length of ultimate segment. Antennal peduncles overreaching distal corneal margins by 0.50 length of ultimate segments; antennal acicles each with 5 or 6 spines on mesial margin; ventral margin of each article of antennal flagella with very long setae. Chelipeds unequal; left larger than right; carpus, palm and fingers spinose and pubescent on upper surfaces. Inner margin of palm and dactyls with spines, much smaller spines on the upper surface and outer margin of fixed finger; spines present on the inner and upper distal margins of carpus. Right cheliped with surfaces strongly pubescent but with fewer spines than on left. Ambulatory legs slender. Second pereopod with a dorsodistal spine on the carpus; meri with row of small spines on ventral margin; segments moderately pubescent. Telson weakly asymmetrical with very small median cleft; terminal margins each with row of spines, extending onto lateral margin.

31. *Diogenes merguiensis* de man 1888 (Plate 8, Fig. 37)

Description: Shield brown; rostrum brown; ocular peduncles, antennular acicles with stripes of dark brown and cream. Ambulatory legs and chelipeds orange with brown tinge and light shades near joints; meri and carpi with grey ting. Abdomen light coloured. Shield longer than broad, with many spinules or tubercles on the dorsal surface. Anterior end of shield with continuous row of spines on the anterior border. Rostrum long extending beyond the tip of ocular acicle, with 6-7 spines. Ocular peduncle short, reaching at the base of ultimate antennular segment and beyond the base of ultimate antennal peduncle. Ocular acicle oblique with 3-4 larger spines and many small spinules on the terminal margin. Antennular peduncle longer than antennal peduncle. Antennal acicle deeply bifurcate; outer fork reaching upto the middle of ultimate peduncular segment, inner fork reaching at the base of last antennal joint. Chelipeds unequal; left larger than right. Chela with upper margin and lower margin spinose; upper margin with double row of spines on upper margin; outer surface with sharp conical tubercles with werrth stiff radiating setae. Palm broader than long. Second and third pereopod with row of spines on the upper margin. Merus, carpus and propodus with granular outer surface. Dactyls with upper row of spinules; devoid of granules on the outer surface; lateral face with longitudinal grooves and ridges accompanied by long setae. Telson asymmetrical with left lobe larger than right; few spines on the terminal margin of lobes.

32. *Diogenes miles* Herbst, 1791 (Plate 8, Fig. 38)

Description: Bluish-violet in colour. Shield and carapace bluish with rose tinge. Ocular peduncles with ash coloured longitudinal stripes. Antennae and antennules bluish with white tinge. Chela and ambulatory legs light bluish-violet with rose or light coloured tinge. Carapace broader than long, dorsoventrally compressed, granular. Rostrum longer than ocular acicles, with 4-5 spines on either side. Ocular peduncle short, slender not overreaching the antennal and antennular peduncles. Ocular acicle oblique or straight with spines on the terminal margin. Antennal peduncle longer than antennular peduncle, antennal acicle weakly bifurcate, outer branch not reaching the base of ultimate peduncular segment. Inner border of antennal acicle with spinules. Chelipeds unequal, left larger than right. Chela flexed inward; merus also directed inwards. Palm with row of large spines on the upper and lower margin. Upper margin of dactylus with three rows of spines, separated by longitudinal grooves. Carpus with large spines arranged in two rows on upper margin and a row on lower margin; numerous tubercular spines on the outer face. Merus also with numerous spines on the distal margin and numerous spinular tubercles on the outer face. Chela, carpus, merus and ischium also with granular upper surface and tufts of setae on either side. Second and third pereopods with

spines on the upper margin and granules on merus, carpus and propodus. Dactylus with longitudinal grooves and ridges on lateral face with granules and setae on these ridges. Fleshy process present on ventral side of abdomen in between first and second pleopods. Telson asymmetrical with slightly visible median cleft; left lobe larger than right, with few spinules on either lobes.

33. *Diogenes planimanus* Henderson, 1893 (Plate 9, Fig. 39)

Description: Ocular peduncles, antennular and antennal peduncles with cream and grey longitudinal stripes, rostrum and ocular acicles grey. Shield, chelipeds and ambulatory legs with greybrown or brownish-grey patches. Shield as long as broad with denticulate anterior margin. Rostrum well developed, reaching slightly beyond the inner acicular spine; with single terminal spine and 4-7 marginal spines. Ocular peduncles slender, corneas not dilated; not overreaching antennal or antennular peduncles. Ocular acicles oblique with single large spine at the inner side and several small spines along the terminal margin. Antennal and antennular peduncles are of same length. Antennal acicles weakly bifurcate, outer processes not reaching upto the base of ultimate peduncular joint; both inner and outer processes with spines. Chelipeds unequal; left larger than right. Upper margin of dactylus with two rows of smaller tubercles on either side of single row of closely spaced spinulose tubercles. Upper margin of palm with 2 rows of small spines; row of large blunt or acute tubercles on the proximal margin strongest in upper half of palm. Lower half of palm flat and forming straight line with fixed finger. Upper margin of carpus with double row of spines, irregular row of spines on outer face, most prominent distally. Right cheliped with spinulose upper margin, obscured by long setae in dactyls; outer surface of palm granular or weakly tuberculate; upper margin with irregular row of small spines. Dorsal margin of carpus with row of strong spines; outer surface with row of smaller spines at the middle. Ambulatory legs with double row of small spines on dorsal margins of dactyls; longitudinal row of small spines partially obscured by row of long setae on mesial faces; double or triple rows of spines on dorsal margins of propodi, carpi and meri, lateral faces also spinulose or tuberculate; carpi with spinulose distal margin. Telson asymmetrical with shallow median cleft; left lobe larger than right, with several strong spines interspersed by small spinules on terminal and lateral margins.

34. *Diogenes violaceus* Henderson, 1893 (Plate 9, Fig. 40)

Description: Body parts generally violet coloured. Shield longer than broad with broader rostral lobe; many transverse, setose, spinulose ridges on the dorsal surface.

Intercalary rostriform process elongate, overreaching ocular acicles and terminating in a simple or bifid spine and 2-5 small marginal spines. Ocular peduncles overreached by both antennal and antennular peduncles. Ocular acicles oblique; terminal margin with spines, innermost spine largest. Antennular peduncles not overreaching the antennal peduncles. Antennal acicle weakly bifurcate, outer process not reaching at the base of ultimate peduncular segment; antennal flagellum short. Chelipeds unequal with left considerably larger than right. Left cheliped with carpus, palm and fingers elongate; upper margin of dactyls with row of conical spines and another row of smaller spines on the outer face; remaining outer surface usually granular. Fixed finger with granular outer surface and 1-2 rows of irregular, very small tubercles at the lower margin. Palm with row of more prominent tubercles on the upper margin; outer surface convex; granular, with small granules in the lower half. Lower proximal angle with row of large tubercles, arching upward to the middle of proximal margin and reaching the outer surface. Carpus with lower margin and outer lower surface subsulcate; row of acute spines on anterior upper margin becoming a continuous series of subquadrate tubercles in the proximal half; dorsally another row of subacute spines present on the mesial face. Outer surface with subacute or acute, small spines or tubercles. Right cheliped with prominent hiatus between dactyl and fixed finger; double row of conical spines on upper margins of dactyl and palm partially or completely obscured by tufts of long setae. Small spines or tubercles cover the surface of palm. Upper margin of carpus with row of spines partially obscured by tufts of long setae; irregular rows of small spines or tubercles on the outer surface. Ambulatory legs with dactyls longer than propodi; upper margin with row of small spinules at the proximal half; prominent longitudinal sulcus obscured by two converging rows of long setae on the mesial face; row of small spinules present at the dorsal and ventral margin, not extending to tip; ventral margin also with another row of small spines. Longitudinal sulcus present on the lateral faces, ventral surfaces with tufts of sparse short setae proximally becoming longer and dense row distally. Dorsal surface of propodi with double row of small spines, outer surface spinulose and covered tufts of moderately short setae. Dorsal surface of Carpi with row of spines accompanied by tufts of moderately long setae, lateral surface spinulose; ventral surface of right pair with 1 prominent longitudinal row of subacute spines. Merus with dorsal surface spinose and lateral faces spinulose. Telson asymmetrical with a shallow median cleft; terminal margins armed with row of small spines, left lobe with several large, strong spines interrupted by small spines on the lateral margin.

35. *Calcinus morgani* Rahayu and Forest, 1999 (Plate 9, Fig. 41)

Description: Shield gray; ocular peduncles dark brown at proximal end and blue distally, with black rings below corneas. Antennular peduncles dark brownish green and flagella light yellow. Antennal peduncle and flagella yellowish orange. Chelipeds reddish brown with white tips. Ambulatory legs reddish brown, with light brown propodi and dactyli; dactyls with white tips. Shield longer than broad with rostrum acutely triangular. Ocular peduncles long, slender, overreaching both antennal and antennular peduncles. Ocular acicle terminating in a single spine. Antennular peduncle longer than antennal peduncle. Antennal acicle overreaching the proximal margin of the ultimate peduncular segment terminating in a single spine and with 5-7 spines laterally. Fourth antennal segment with a small dorsodistal spine and first segment with dorsolateral outer margin with a bifid spine and inner margin with a simple spine. Chelipeds unequal, left larger than right. Outer surface of left chelae covered with closely-spaced tubercles becoming prominent on fixed finger and dactyls. Carpus with a dorsodistal spine and a prominent tubercle on the middle proximal end. Right cheliped also with tubercles on upper surface of chela. Ambulatory legs smooth. Meri of second and third pereopod with a spine at inner distal portion. Carpi of both pereopods with a strong dorsodistal spine sometimes a small spine present below the dorsodistal spine on second pereopod. Dactyls smaller than propodus. Brush of long plumose setae on ventral margins of dactyls and distal part of propodus of third pereopod. Telson with about 2-10 spines on left lobe and 1-4 on right lobe.

36. *Calcinus laevimanus* (Randall, 1840) (Plate 9, Fig. 42)

Description: Shield grayish-green. Ocular peduncle with thin orange proximal band followed by blue colour at 0.5-0.3, and orange at remaining distal portion. Ocular acicles, antennae and antennular flagellum orange or tan. Antennular peduncle blue. Chelipeds dark bluish-black. Left cheliped with tip of dactyl, fixed finger and cutting edge white or cream. Ventral margin of palm and most of outer surface of palm white colour. Right cheliped with distal halves of fingers and cutting edge white. Dactyls of ambulatory legs white with dark green band on subdistal margin; dark spot on the lateral and mesial side. Propodi blackish-brown; carpi brownish-orange, with bluish-black stripe; meri with distolateral longitudinal bluish-black stripe. Shield as broad as long; rostrum acutely triangular. Ocular peduncles slender, nearly as long as shield; overreaching both antennal and antennular peduncles. Ocular acicles triangular, with a single terminal spine. Antennal peduncles shorter than antennular peduncles, reaching upto $\frac{3}{4}$ length of ocular peduncle. Antennal acicle reaching nearly the base of ultimate peduncular segment; with 4-5 spines on lateral margin. Chelipeds unequal with left considerably larger

than right. Palm of left cheliped with rounded and smooth outer face, upper margin similar. Outer face of carpus and merus smooth or slightly granular. Proximal margin of carpus with a deep depression extending from upper to lower margin. Dorsal surface right chela smooth or slightly granular. Ambulatory legs granular outer surface; dactylus distinctly shorter than propodus. Carpus with a dorsodistal spine. Telson with asymmetrical posterior lobes, left larger; terminal margins unarmed.

37. *Paguropsis typica* Henderson, 1888 (Plate 10, Fig. 43)

Description: Carapace and legs reddish orange with white tinge at the joints and extremities. Ocular peduncle, antennae and antennules all brownish orange. Abdomen creamish orange. Carapace soft and membranous except for the calcification at the cervical groove and region anterior to cardiac region. Well developed rostrum reaching $1/3^{\text{rd}}$ length of eyestalk. Ocular peduncles broadened at the distal end, corneas reniform. Antennular peduncles overreaching distal portion of corneas by their ultimate segment. Antennular peduncle overreaching antennal peduncle. Antennal acicle reaching the middle of the ultimate peduncular segment, as long as eyestalks without cornea. Chelipeds equal and massive in size, slightly longer than entire body. Dorsal upper portion of chela, carpus and merus with squamiform tubercles covered with thick, long, golden-yellow bristles. Long bristles present on the lower portion of merus. Second ambulatory legs stout and compressed with thick bristles at lower surface of all segments and on the sides except merus. Third ambulatory legs longer than second with longitudinal depression on either side near proximal end. Fourth and fifth legs chelate and flattened. Fourth extending beyond the anterior border of carapace. Abdomen membranous and bag-like. Telson slender and symmetrical. Telson and uropods slender, narrow and symmetrical inner rami of uropod ending in a spine.

III. FAMILY: PAGURIDAE (Right-handed Hermit Crabs)

Description: Carapace cylindrical or subcylindrical or dorsoventrally flattened, carapace longer than wide or as long as or wider than long; carapace with linea anomurica; outer orbital spines absent; rostrum reduced, or absent. Eye cornea well developed, or reduced, or absent; ocular acicles present. Antenna 1 flagellum biramous. Maxilliped 3 bases widely separated; crista dentata present, or absent; accessory tooth present, or absent; dactylus simple. Pereopod 1 chelate; cheliped equal or subequal, or right largest. Pereopods 2 to 4 pereopods 2 and 3 similar, pereopod 4 greatly reduced; 2-4 with basis and ischium fused; dactyli of pereopods 2 to 3 simple. Pereopod 3 about the same length as pereopod 2, or noticeably

longer than pereopod 2, or shorter than pereopod 2; pereopods 3 dactyli and propodi of right and left similar, or dactyli and propodi of right and left dissimilar. Pereopod 4 simple, or chelate. Sternum partially divided; sternite of pereopod 5 reduced, widely separated from preceding sternite; somite of pereopod 5 not fused with first abdominal somite, or somite of pereopod 5 fused with first abdominal somite. Abdomen well developed, carried posteriorly or reduced, carried posteriorly or reduced, carried under thorax, abdomen with distinct somites or with indistinct somites. Epimera (pleura) absent. Male pleopods 3-5 unpaired; none modified as gonopods, or pleopod 1 with one or both modified as gonopods, or pleopod 2 with one or both modified as gonopods, or pleopods 1 and 2 modified as gonopods. Male with no other sexual modifications, or with sexual tube(s), or with gonopores masked by tuft(s) of setae, or with single gonopore, or with indications of female gonopores; female with no sexual modifications, or with single gonopore, or with first pleopods paired and modified as gonopods. Uropods present, uropods positioned ventrolaterally, not forming tailfan; rami with propodal rasps. Telson present, entire or partially divided longitudinally (Ahyong and Lowry, 2002). *Nematopagurus*, *Pagurus* and *Phylopaguropsis* are the common genera in this family represented in India.

38. *Nematopagurus squamichelis* Alcock, 1905 (Plate 10, Fig. 44)

Description: Carapace brown with red tinge; ocular peduncles with orange and white transverse stripes. Cheliped and legs white with orange-red spot like markings. Shield as long as broad; rostrum broad, rounded, ocular peduncles short, depressed, broadened distally, not overreaching antennal and antennular peduncles. Eyes large and reniform, ocular acicles small ending in a bifid spine. Antennal peduncles are nearly as long as antennular peduncles. Antennal acicle curved, sparsely setose, reach the middle of the ultimate peduncular segment; very long flagellum. Chelipeds subequal and similar, right larger than left; carpus is longer than palm and as long as merus. Palm is longer than broad with little long finger on the left hand than on the right. Merus with 1-2 spinules on lower border; outer surface of carpus and palm with closed arranged flat, squamiform, imbricationg tubercles with setae at the free edge. Scales on the palm are arranged closely forming several series; inner border of carpus spinulose. Inner and outer border of -palm also spinulose and it extend up to the outer surface of fixed finger. Fingertips are corneous. Ambulatory legs long, slender; 2nd and 3rd pair overreaches the chelipeds by half the length of dactylus. Dactylus is stout, curved and that of 3rd is longer than 2nd. Upper dorsal margin of the 2nd and 3rd ambulatory legs covered with transverse subsquamiform marking bearing setae. Carpus with a dorsodistal spine. Telson slightly asymmetrical.

39. *Pagurus kulkarni* Sankoli, 1962 (Plate 10, Fig. 45)

Description: Shield light pinkish tan with few darker patches. Ocular peduncles orange proximally and distally separated by broad gray or light brown band. Ocular acicles reddish-brown proximally. Antennal flagella banded with gray and reddish brown. General colour of chelipeds and ambulatory legs white to light brown or brownish rose with small longitudinal stripes. Shield slightly longer than broad with a rounded rostrum. Moderately elongated ocular peduncles overreach both antennular and antennal peduncles; corneas not dilated. Ocular acicles each with terminal spinule. Antennal acicle long, curved and reaching beyond the proximal margin of ultimate peduncular segment. Shield with numerous granules. Chelipeds unequal with right longer and stouter; upper surface of right cheliped with small tubercles. Palm with granular upper surface, row of small tubercles on the dorsomesial and dorsolateral margins. Carpus with few tubercles on the dorsal surface, row of spines on dorsomesial margin, dorsolateral margin generally spinulose. Ventromesial margin of carpus and merus and distomesial margin of merus produced into wing like projections. Left cheliped smaller than right with spinulose dorsomesial margin, dorsal surface of palm granular; carpus with a dorsodistal spine. Second and third ambulatory legs almost similar; dactyls shorter than propodi, with 5 or 6 corneous spines on ventral margin. Dorsal margin of propodi with transverse rows of minute ridges, 2-5 corneous spinules on ventrodistal margin; carpi each with dorsodistal spine. Telson asymmetrical with a moderately deep median cleft. Left lobe slightly larger than right. Each with irregularly sized blunt spines.

40. *Pagurus spinossior* Komai, Reshmi and Biju Kumar 2013 (Plate 10, Fig. 46)

Shield, antennae, chelipeds and ambulatory legs generally light tan. Ocular peduncles with purple tint distally. Ambulatory legs with tinge of pale brown on distal and proximal parts of propodi and meri and ventral parts of carpi. Shield slightly wider than long; anterior margin between rostrum and lateral projections slightly concave; anterolateral margins sloping; posterior margin truncate; dorsal surface slightly convex transversely, with tufts of short setae on either side of midline; paragastric grooves faint. Rostrum broadly rounded, reaching level of lateral projections. Lateral projections roundly triangular, with conspicuous marginal spine directed outward. Posterior carapace approximately as long as shield; posteromedian plate narrow, well calcified. Ocular peduncles (including cornea) stout, increasing in width distally. Antennular peduncles, when fully extended, overreaching distal corneal margins by 0.7 of ultimate segment. Antennal peduncles

slightly overreaching distal corneal margins, with supernumerary segmentation. Antennal flagellum about 4 times as long as shield; each article with 3 long setae (about 8 articles length) every 12–15 articles. Right cheliped moderately stout, not particularly elongate. Chela subovate in dorsal view, about 2.0 times as long as wide; no hiatus between fingers; spines on dorsal surface subconical, usually corneous-tipped. Dactylus subequal in length to palm, nearly straight, overlapped by fixed finger distally; dorsal surface with longitudinal row of small spines on midline, dorsomesial margin delimited by double row of small to moderately large spines; all surfaces with scattered tufts of short to long setae, mesial surface with row of small spines becoming double row proximally. Merus with irregular rows of short transverse ridges (sometimes marginally multidenticulate) becoming weak proximally, each ridge bearing tuft of short to long stiff setae; dorsodistal margin with 4 prominent spines decreasing in size laterally. Left cheliped moderately slender. Chela about 2.4 times as long as wide (greatest width at base of dactylus), with numerous tufts of short to long setae on surfaces; no hiatus between fingers. Ambulatory legs moderately long and slender, right second pereopod overreaching tip of extended right cheliped by half length of dactylus. Fifth pereopods chelate. Uropods markedly asymmetrical; protopods unarmed. Telson with distinct lateral indentations; posterior lobes rounded, slightly unequal, median cleft V-shaped, each terminal margin with row of small corneous spines extending onto lateral margin. The specific epithet “spinossior” (= most spinose) refers to the strong armature on the chelipeds of this species.

41. *Pylopaguropsis magnimanus* (Henderson, 1896) (Plate 11, Fig. 47)

Description: Shield and carapace biscuit yellow. Ocular peduncles, antennae and antennules all yellowish orange. Legs yellowish white with crimson patches, joints with white under surface. Shield as long as broad, well calcified; hepatic region and the posterior branchial regions also with strong calcified stripes. Rostrum broadly triangular, acute, reaching beyond the antennal angles. Eystalks moderately stout and slender with slightly expanded distal end; corneas not dilated. Ocular acicles triangular and acute. Corneas overreached by antennular peduncles by half length of ultimate peduncular segment. Antennal peduncle reaching slightly beyond corneal margins. Antennal acicle is strongly curved; convex inner border is strongly setose. Flagellum as long as the body. Right chelae larger than the left; dorso-ventrally compressed dactyli, row of spines on the expanded dorsomesial margin. Outer surface of the palm and fingers is covered with tubercular granules. Ventromesial margin concave. Irregular rows of spinulose tubercles on dorsomesial margin of palm. ventro mesial inner portion of merus extended and with 4-5 large spines. Carpus with conical spines on the dorsal surface and strong spines on the

dorsodistal margin. Dorsomesial margin of palm of left chela with low protrubences and a row of acute spines. Ventromesial margin of merus with 4-5 spines. Second and third ambulatory legs with dactyls longer than propodi. Dactylus is stout, strongly curved and plumose on the convex upper border, ambulatory legs are unarmed except a spinule or two on the anterior border of the carpus. Telson asymmetrical, rather elongate, distinctly constricted laterally with a narrow median cleft. Left lobe larger than right with 13-18 spines; right lobe smaller with 3-4 spines.

42. *Pylopaguropsis zebra* (Henderson, 1893) (Plate 11, Fig. 48)

Description: Yellowish in colour with fine blood-red longitudinal stripes along the body. Length of carapace nearly 8 mm. Rostrum acute, broad and triangular reaching beyond the antennal angles of the carapace. Ocular peduncles slender and slightly longer than the anterior margin of the carapace, reaching to middle of ultimate segment of antennular peduncles and nearly entire antennal peduncles. Corneas expanded; ocular acicles acute. Antennal acicle curved, setose. Antenna twice as length of carapace, sparsely setose. Chelipeds unequal, right larger than left (twice the length of the carapace) with sparse setae. Merus smooth and unarmed with inner lower margin hirsute. Carpus slender and shorter than palm with few spinules on inner border and on distal border. Palm with lower border sharply defined, curved and granular; fingers are compressed. Left cheliped slender; lower border of merus and upper border of carpus spinose; Second and third pereopods slender, smooth and slightly reaching beyond the right cheliped; dactyli twice as long carpus and propodus, distal half of concave border with long capillary spinelets.

IV. FAMILY: PARAPAGURIDAE (Deep-water Hermit Crabs)

Carapace cylindrical or subcylindrical, carapace longer than wide or as long as or wider than long; carapace with linea anomurica; outer orbital spines absent; rostrum reduced. Eye cornea well developed, or reduced, or absent; ocular acicles present. Antenna 1 flagellum biramous. Maxilliped 3 bases widely separated; crista dentata present; accessory tooth present; dactylus simple. Pereopod 1 chelate; cheliped right largest. Pereopods 2 to 4 pereopods 2 to 4 all of similar form; 2-4 with basis and ischium fused; dactyli of pereopods 2 to 3 simple. Pereopod 3 about the same length as pereopod 2, or noticeably longer than pereopod 2; pereopods 3 dactyli and propodi of right and left similar. Pereopod 4 semichelate. Sternum partially divided; sternite of pereopod 5 reduced, widely separated from preceding sternite; somite of pereopod 5 not fused with first abdominal somite. Abdomen reduced, carried posteriorly, abdomen with indistinct somites. Epimera (pleura) absent. Male pleopods

PLATE-1



Fig. 7. *Birgus latro*



Fig. 8. *Coenobita brevimanus*



Fig. 9. *Coenobita perlatus*



Fig. 10. *Coenobita rugosus*

PLATE-2



Fig. 11. *Paguristes longirostris*



Fig. 13. *Paguristes puniceus*



Fig. 12. *Paguristes luculentus*



Fig. 14. *Ciliopagurus grandis*

PLATE-3



Fig. 15. *Ciliopagurus krempfi*



Fig. 16. *Ciliopagurus liui*



Fig. 17. *Ciliopagurus tricolor*



Fig. 18. *Dardanus deformis*

PLATE-4



Fig. 19. *Dardanus pedunculatus*



Fig. 20. *Dardanus hessi*



Fig. 21. *Dardanus lagopodes*

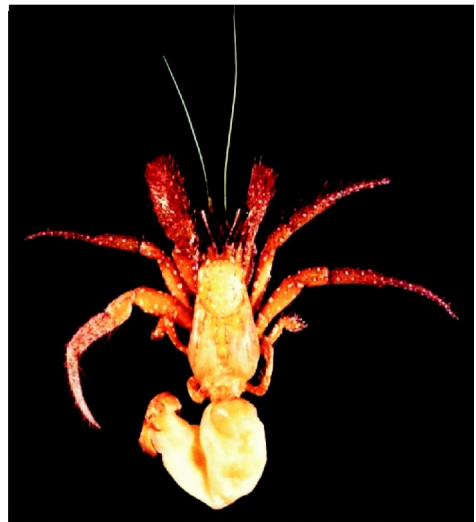


Fig. 22. *Dardanus megistos*

PLATE-5



Fig. 23. *Dardanus setifer*



Fig. 24. *Clibanarius infraspinus*



Fig. 25. *Clibanarius longitarsus*



Fig. 26. *Clibanarius merguensis*

PLATE-6



Fig. 27. *Clibanarius arethusa*



Fig. 28. *Clibanarius corallines*



Fig. 29. *Clibanarius padavensis*



Fig. 30. *Diogenes alias*

PLATE-7



Fig. 31. *Diogenes avarus*



Fig. 32. *Diogenes canaliculatus*



Fig. 33. *Diogenes custos*



Fig. 34 *Diogenes dubius*

PLATE-8



Fig. 35. *Diogenes klaasi*



Fig. 36. *Diogenes mannarensis*



Fig. 37. *Diogenes merguiensis*



Fig. 38. *Diogenes miles*

PLATE-9



Fig. 39. *Diogenes planimanus*



Fig. 40. *Diogenes violaceus*



Fig. 41. *Calcinus morgani*



Fig. 42. *Calcinus laevimanus*

PLATE-10



Fig. 43. *Paguropsis typica*



Fig. 44. *Nematopagurus squamichelis*



Fig. 45. *Pagurus kulkarni*



Fig. 46. *Pagurus spinossior*

PLATE-11



Fig. 47. *Pylopaguropsis magnimanus*



Fig. 48. *Pylopaguropsis zebra*



Fig. 49. *Oncopagurus monstrosus*

3-5 unpaired; none modified as gonopods, or pleopod 1 with one or both modified as gonopods, or pleopod 2 with one or both modified as gonopods, or pleopods 1 and 2 modified as gonopods. Male with no other sexual modifications; female with single gonopore. Uropods present, uropods positioned ventrolaterally, not forming tailfan; rami with propodal rasps. Telson present, entire.

In Indian waters this family is represented commonly by a single genus *Oncopagurus*.

43. *Oncopagurus monstrosus* (Alcock, 1894) (Plate 11, Fig. 49)

Description: Carapace creamish-orange. Right cheliped creamy-white with proximal portion of merus and carpus reddish-orange. Left cheliped and ambulatory legs light pink. Lateral faces of merus, carpus and propodus with one or two reddish-orange patches. Shield as long as broad with weakly calcified dorsal surface; rostrum broadly rounded, with short median ridge. Ocular peduncles broadened distally, reaching more than half shield length, corneas slightly dilated; ocular acicles terminating in prominent spine. Corneas overreached by both antennular and antennal peduncles, antennular peduncles longer than antennal peduncle. Antennal acicle moderately long, reaching upto or beyond the distal margin of ultimate peduncular segment, mesial margin with 8-17 spines. Epistomal spine prominently curved upward. Chelipeds unequal and somewhat iridescent with moderately dense setation; ventromesial margin of right cheliped concave bordered by upper and lower rows of spines, dorsolateral margins of palm each with row of spines, irregular rows of small spines on dorsal surface; carpus spinulose, dorsolateral margin with a row of 6-8 moderately large spine. Palm of left cheliped unarmed; carpus with dorsodistal spine. Ambulatory legs similar with dactyls longer than propodi, a row of 5-15 small corneous spines on the ventromesial face, dorsal and dorsomesial faces obscured by rows of long setae; carpi each with a dorsodistal spine; merus of third right pereopod unarmed. Telson with posterior lobes separated by moderately deep median cleft, irregular single or double row of corneous spines on terminal margin of each lobe.

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