The Fauna and Geography of the Maldive and Laccadive Archipelagoes

Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900

Edited by

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MARINE CRUSTACEANS.

PARTS IV.—VII.

By L. A. Borradaile, M.A., *Lecturer in Natural Sciences at Selwyn College, Cambridge.*

(With Plate XXII. and Text-figures 110—119.)

IV. SOME REMARKS ON THE CLASSIFICATION OF THE CRABS.

When Boas, in 1880[1], reorganised the classification of the Decapoda, abolishing the distinction established by Fabricius between the *Macrura* and *Brachyura*, and dividing the order anew into *Natantia* (Prawns and Shrimps) and *Reptantia* (Lobsters and Crabs), he left the crabs (*Brachyura*) untouched, as a single tribe of the Reptantia. Within this tribe he recognised two subtribes, one comprising the primitive *Dromia*-like forms, in which the orbits, the abdominal limbs, the gills and other features recall the Macrurous tribes, and the other containing all the rest of the true crabs. These subtribes he called respectively *Dromiacea* and *Brachyura genuina*. Ortmann, however, elaborating Boas' scheme in 1896[2], took the step of dividing the Brachyura into three groups, each of which he made equal in rank to the other subdivisions of the Reptantia (*Astacidea*, *Loricata*, etc.). These groups were: (1) Boas' Dromiacea, under the name of *Dromiidea*, (2) the old division *Oxystomata* established by Milne-Edwards for the crabs like *Calappa* and *Leucosia* which are modified for life in sand, and (3) the *Brachyura*, comprising the remainder of the crabs. In the *Brachyura* he recognised, with some alterations, Milne-Edwards' divisions *Oxyrhyncha* (Spider Crabs), *Cyclometopa*[3] (Round-fronted Crabs, including *Cancer*-like genera), and *Catometopa* (Square Crabs).

It may be admitted that Ortmann was well-advised in establishing his three main groups of Crabs. If he be right—as, in the opinion of the writer of this paper, he is right—in regarding the Oxystomata as derived from the Dromiacea independently of the Brachyura genuina, then it is clearly misleading to retain Boas' arrangement, in which the Dromiacea

[1] Boas, J. V., *Kong. Danske Vidensk. Selsk. Skriften* (6), I. p. 23.

[2] Ortmann, A. E., *Zool. Jahrb. Syst.* IX. p. 409.

[3] Ortmann at first applied the name *Cancroidea* to this group, his *Cyclometopa* forming only a part of Milne-Edwards' group of the same name. Later (Bronn's *Thierreich*, Crust. II. p. 1165) he returned to the use of the term Cyclometopa as including all its former genera, making it thus synonymous with Cancroidea.

are opposed to a group containing the Oxystomes together with the rest of the crabs. But quite apart from this consideration is the fact that the Oxystomata have certain well-defined features which give them a unity such that it would in any case be necessary to oppose them to the rest of the Genuina; and, if this be not done by raising them to the rank of the Dromiacea, then a new grade of classification must be introduced within the Genuina, which must be separated into Oxystomes and non-Oxystomes. Such a step would be most undesirable in view of the already complicated system of the Decapoda.

At the same time I am unable to follow Ortmann in raising the three groups of crabs to the same rank as the Astacidea or Paguridea. The crabs are a true group with a common phylogenetic origin from Macrurous forms of the Reptantia through the Dromiacea. Moreover, besides the shape of the body, there are three features which are almost absolutely diagnostic of the Brachyura in the old sense of the word: (1) the loss of the last pair of abdominal limbs, (2) the fusion of the shield of the cephalothorax with the epistome in such a way as to form two sockets for the sense organs of the two sides, and (3) the broad, unjointed endopodite of the first maxilliped, with its marked outer angle (Fig. 110). In these circumstances I follow Boas in keeping all the crabs together as a single tribe, *Brachyura*, of the Reptantia. If we thus use the word in its old, full sense, it becomes needful to find another name for Ortmann's Brachyura (= Boas' Brachyura genuina without the Oxystomata). For this group I have already proposed[1] to use de Haan's name *Brachygnatha*.

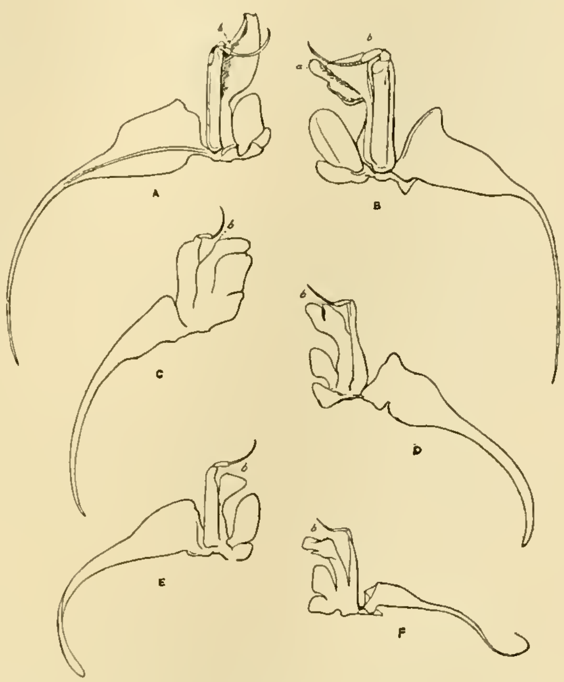


Fig. 110. The first maxillipeds. A. *Calappa*, B. *Portunus*, C. *Dromia*, D. *Cardiosoma*, E. *Cancer*, F. *Uca* (= *Gelasimus*), *a*. the inner lobe characteristic of the Portunidae, *b*. the outer angle, well-marked in crabs.

I now pass to the consideration of the subdivisions of the Brachygnatha. The Oxyrhyncha form a natural and, on the whole, well-defined group, but a boundary between the Cyclometopa and the Catometopa is absolutely wanting. This is especially the case between the Gonoplacidae and the Xanthidae, where the transition is made complete by such genera as *Pilumnoplax* and *Platypilumnus*. The Potamonidae also are far from presenting an easy problem in their affinities. And the genus *Catoptrus*, while it seems clearly allied with the Carcinoplacinae, is extraordinarily like the Portunidae, this likeness extending even to the form of the first maxilliped, which is peculiar to the latter family (B. Fig. 110). In view of these facts I propose to unite the Cyclometopa and Catometopa into a single group, for which I propose the alternative titles *Brachyrhyncha* and *Cancroidea*[2], corresponding

[1] *Proc. Zool. Soc.* 1900, p. 568. This term in its original meaning included the Dromiacea as well as the Cancroid forms, but it has so long been in disuse that its revival in a somewhat altered sense would cause no inconvenience.

[2] This word was used by de Haan (in von Siebold's "Fauna Japonica") with practically the same meaning as that given to it here.

to those applied to the spider crabs, *Oxyrhyncha* and *Maioidea*. The group thus formed presents a series of families, long and varied indeed, but neither more numerous nor more diverse than, for instance, those included in the Caridea (Eukyphotes).

With regard to the position of the remarkable family Hymenosomidae I am in agreement with Ortmann in provisionally placing them among the Oxyrhyncha. The genus *Catoptrus* A. M.-Edw., 1870 (= *Goniocaphyra* de Man, 1887), which I have already[1] proposed to make the type of a subfamily of the Portunidae, I shall for the present continue to keep in that position, in spite of the fact that, if *Catoptrus* seems clearly related to *Carupa* and perhaps also to *Caphyra* among the swimming crabs, it has hardly less clear resemblances to *Libystes* and *Carcinoplax* among the Gonoplacidae. The Hapalocarcinidae should, I believe, be placed somewhere among the Brachyrhyncha but, in view of their exceedingly doubtful affinities, are not included in the key given below. For the same reason the family Trichiidae, which should probably be established for *Trichia* de Haan is also left unmentioned. Lastly, I have followed Alcock in placing *Palicus* near the Catometope families. The accompanying table gives the classification of the Brachyura, as it will stand with the changes proposed above, and the characters on which it depends are summarised by means of a series of keys.

Subtribes of the Brachyura.

I. Fore edge of the mouth-field (endostome) prolonged forwards to form a gutter. [Last pair of legs normal or abnormal. Female opening generally sternal. First abdominal limb of female wanting. Gills few.] *Oxystomata*[2].

II. Mouth-field roughly square.

A. Last pair of legs abnormal, dorsal. Female genital opening coxal. First abdominal limb of female present. Gills usually many. *Dromiacea*[2].

B. Last pair of legs normal, rarely reduced, not dorsal, except in *Palicus* and *Ptenoplax*. Female genital opening sternal. First abdominal limb of female wanting. Gills few. *Brachygnatha*.

Legions of the Brachygnatha.

I. Fore part of body narrow, usually forming a distinct rostrum. Body more or less triangular. Orbits generally incomplete. *Oxyrhyncha*[2].

II. Fore part of body broad. Rostrum usually reduced or wanting. Body oval, round or square. Orbits nearly always well enclosed. *Brachyrhyncha*.

Families of the Brachyrhyncha.

I. Orbits formed but more or less incomplete. [Antennal flagella, when present, long and hairy. Rostrum present. Body elongate-oval. Fore edge of the mouth indistinct.] *Corystidae*.

II. Orbits complete (though fissures may remain), except in the Mictyrinae, where the eyes are almost or quite unprotected. [Body rarely elongate-oval. Rostrum often wanting. Antennal flagella usually short, not hairy.]

[1] *Proc. Zool. Soc.* 1900, pp. 578, 799.

[2] For key see the article on the group.

TABLE SHOWING THE DIVISIONS OF THE BRACHYURA.

Tribe	*Sub-tribes*	*Legions*	*Families*	*Subfamilies*
Brachyura	Oxystomata		Calappidae	Calappinae
				Orithyinae
				Matutinae
			Leucosiidae	Leucosiinae
				Iliinae
			Raninidae	
			Dorippidae	Dorippinae
				Tymolinae
	Dromiacea	Dromiidea	Homolodromiidae	
			Dromiidae	
			Dynomenidae	
		Homolidea	Homolidæ	
			Latreillidae	
	Brachygnatha	Brachyrhyncha	Corystidae	
			Atelecyclidae	Thininae
				Acanthocyclinae
				Atelecyclinae
			? Trichiidae	
			Cancridae	Pirimelinae
				Cancrinae
			Portunidae	Carcinidinae
				Portumninae
				Catoptrinae
				Carupinae
				Portuninae
				Caphyrinae
				Thalamitinae
				Podophthalminae
			Potamonidae	
			Xanthidae	Xanthinae
				Carpilinae
				Etisinae
				Menippinae
				Trapeziinae
				Eriphiinae
				Oziinae
			Gonoplacidae	Carcinoplacinae
				Gonoplacinae
				Prionoplacinae
				Rhizopinae
				Hexapodinae
			Pinnotheridae	(subfamilies ?)
			Grapsidae	Grapsinae
				Varuninae
				Sesarminae
				Plagusiinae
			Gecarcinidae	
			Ocypodidae	Ocypodinae
				Macrophthalminae
				Mictyrinae
			Palicidae	
			Ptenoplacidae	
			? Hapalocarcinidae	
		Oxyrhyncha	Parthenopidae	Parthenopinae
				Eumedoninae
			Maiidae	Inachinae
				Acanthonychinae
				Pisinae
				Maiinae
			Hymenosomidae	

A. Carpopodite of 3rd maxilliped articulates at or near the antero-internal angle of the meropodite. [Body usually round or transversely oval. Male opening nearly always coxal.]

1. Legs more or less distinctly adapted for swimming. [Antennules fold slanting or transverse. Usually a small lobe on the inner angle of the endopodite of the 1st maxilliped[1].] *Portunidae.*

2. Legs not adapted for swimming. Or, if so modified, then the vas deferens opens sternally or runs in a sternal groove (certain *Macrophthalmus* and *Libystes*). Inner lobe on the endopodite of the first maxilliped wanting[2].

a. Freshwater crabs with the branchial region much developed and swollen. [Body often squarish, but male opening coxal.] *Potamonidae.*

b. Marine crabs, with the branchial region not greatly swollen.

i. Antennules fold lengthwise.

α. Carapace subcircular. Antennal flagella either long and hairy or wanting. *Atelecyclidae*[3].

β. Carapace broadly oval or hexagonal. Antennal flagella present, short, not hairy. *Cancridae*[3].

ii. Antennules fold slanting or transversely.

α. Body usually transversely oval. Malê openings rarely sternal. Not sharply separated from the following family. *Xanthidae*[4].

β. Body usually square or squarish. Male ducts open on the sternum or, if coxal, pass along a groove in the sternum. Not sharply separated from the foregoing family. *Gonoplacidae.*

B. Carpopodite of 3rd maxilliped does not articulate at or near the inner angle of the meropodite. [Body usually square or squarish. Male opening sternal, except in *Ptenoplax*, where the duct passes along a sternal groove to the coxopodite.]

1. Small symbiotic crabs with very small eyes and orbits. Body usually more or less rounded. *Pinnotheridae.*

2. Free-living crabs with eyes not specially reduced and usually a square body.

a. Last pair of legs dorsally placed and weaker than the others. [Interantennular septum very thin. No distinct epistome. Exopodite of 3rd maxilliped not hidden.]

i. Front narrow. Female opening in normal position, 3rd maxillipeds subpediform, not covering the mouth. *Ptenoplacidae.*

ii. Front moderately broad. Female openings on the sternal segment corresponding to 1st pair of walking legs. 3rd maxillipeds cover the mouth ventrally and have a very small meropodite. *Palicidae.*

[1] A key to the subfamilies of the Portunidae will be found in the *Proc. Zool. Soc.* 1900, p. 577. The name *Catoptrinae* should be substituted for *Goniocaphyrinae*, Milne-Edwards' name *Catoptrus* having priority of *Goniocaphyra* de Man.

[2] I make this statement on the authority of Ortmann (*Zool. Jahrb.* IX. *loc. cit.*). *Uca* (= *Gelasimus*) and many other genera have a small lobe on the inner side of the endopodite, but this is not at the angle and is a different structure. In *Cardiosoma* the outer angle is divided from the main part of the plate, thus leaving a *large* inner lobe. This again is probably not the same structure as that in the Portunidae (Fig. 110 B).

[3] For key to subfamilies see below.

[4] A key to the subfamilies of the Xanthidae will be found above on p. 238 of Pt. III. in the article on that family.

β. Last pair of legs not dorsally placed nor markedly weaker than the rest. [Inter-antennular septum not very thin except in Macrophthalminae.]

i. A gap of greater or less size is left between the 3rd pair of maxillipeds. Front broad, or moderately so.

a. Sides of the body either straight or very slightly arched. Shape square. Rarely true land-crabs. *Grapsidae*[1].

β. Sides of the body arched. Shape transversely oval. Land crabs. *Gecarcinidae.*

ii. 3rd pair of maxillipeds almost or quite close to the mouth. Front moderately or very narrow. *Ocypodidae.*

Subfamilies of the Atelecyclidae.

I. Antennal flagella absent. [Mouth covered by 3rd maxillipeds. Front uncleft.] *Acanthocyclinae.*

II. Antennal flagella present.

A. Regions not defined. 3rd maxillipeds cover the mouth. Front entire or lobed. *Thiinae.*

B. Regions more or less clearly marked out. 3rd maxillipeds do not cover the mouth. Front toothed. *Atelecyclinae.*

Subfamilies of the Cancridae.

I. Carapace broadly oval. Epistome not sunken. *Cancrinae.*

II. Carapace hexagonal. Epistome sunken. *Pirimelinae.*

V. THE CRABS OF THE CATOMETOPE FAMILIES.

The group Catometopa was as hard to characterise bionomically as it was to separate morphologically from the Cyclometopa. The one thing that could be said about it in this respect was that the bulk of its members lived, not in the sea, but on land, in fresh water or between tidemarks. At the same time a considerable number were strictly marine, especially the Xanthid-like family Gonoplacidae and the Mussel-Crabs of the Pinnotheridae. The land forms have been already enumerated above (Pt. I. p. 64) where some remarks on their habits will be found. Of the others, the only genera to which any striking bionomic interest attaches are *Plagusia* and *Leiolophus*, which live between tidemarks and are very active (see p. 432), *Pinnotheres*, which inhabits bivalve shells, and *Planes*, found on floating objects at sea. *Caecopilumnus* described with the Xanthidae, etc. (p. 267), belongs, I think, to the Gonoplacidae. *Platyozius* described in the same paper is more nearly related to *Pilumnoplax* than to *Pseudozius* but is a Xanthid, as is also *Pilumnoplax*.

All the species which are not new have already been described from the Indo-Pacific region, most of them being Indian. The following list enumerates the species:

[1] A key to the subfamilies and genera of the Grapsidae is given by Kingsley (*Proc. Ac. Philad.* 1880), and the members of most other groups of the old Catometopa can be fairly easily recognised by means of the diagnoses in Major Alcock's paper (*Journ. As. Soc. Bengal*, LXIX. ii. 1900). The points in which the arrangement in this paper differs from Major Alcock's are mostly small and will cause no confusion.

Family **Gonoplacidae.**

Subfamily **Carcinoplacinae.** Genus *Litocheira* Kinahan, 1858.

1. *Litocheira angustifrons* Alc., 1902. Alcock, VI. p. 315[1].

Taken on the reef at Hulule, Male Atoll.

2. *Litocheira integra* (Miers), 1884. Alcock, VI. p. 314.

Taken on the reef at Hulule, Male Atoll. *L. subinteger* (Lanchester), 1900 [= *Carcinoplax integer* de Man, 1887] seems to differ from this species in that: (1) There are three, instead of two, notches on the anterolateral edge. (2) The shape of the anterolateral edge is different, making almost a right angle. (3) The front is narrower.

3. *Litocheira inermis* n. sp. (Fig. 111).

Diagnosis: "A *Litocheira* whose cephalothorax is almost square, smooth, hairless and microscopically pitted; the front arched gently, but with a shallow bay in the middle; the anterolateral edges without teeth but showing traces of two faint notches; the chelipeds short and stout, with one sharp tooth at the inner angle of the wrist and a faint ridge along the lower part of the outside of the hand; and the walking legs stout, with broad end-joints and a beard of hairs on the hinder edge of the last two joints."

Length of the only specimen (a female): 8·5 mm. Breadth: 9·5 mm. Colour in spirit: yellowish-white.

One female was taken at Hulule, Male Atoll.

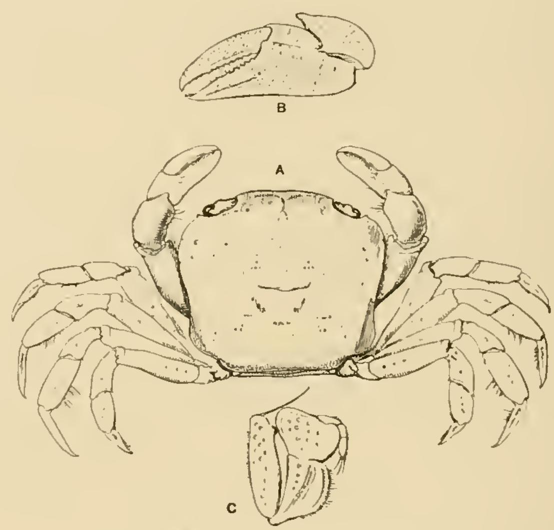


FIG. 111. *Litocheira inermis*; A. whole animal, B. outside of hand, C. third maxilliped.

Subfamily **Rhizopinae.** Genus *Selwynia* n.

Among the crabs collected on the reef at Hulule, Male Atoll, was one which by its diagnostic features should belong to the Rhizopinae, but for which I am unable to find a place in any of the known genera of that subfamily. In proposing a new genus for it I have commemorated my College and its patron saint.

Characters of *Selwynia* n. gen.: (1) *Carapace* broadly oval, without teeth or notches on the anterolateral edge, flat, but falling away in front. Body rather deep. (2) *Front* narrow, bent downwards, bilobed owing to a deep groove in the middle, continued into the interantennular septum. (3) *Eyes* well formed and well pigmented, small, stout, not fixed into the small, close-fitting orbits. (4) *Antennules* fold almost, but not quite, transversely. (5) *Antennae* short, the flagellum standing in the orbital gap. (6) *Third maxillipeds* with meropodite roughly square, a little smaller than the ischiopodite; palp strong, arising nearly

[1] For the principle upon which references are given in this paper see p. 192 of Pt. II. of this publication. Major Alcock's paper on the Indian Catometopes appeared in *Journ. Roy. As. Soc. Bengal*, LXIX. ii. (1900).

in the middle of the fore edge of the meropodite; and exopodite well developed. (7) All the *legs* present and stout. (8) *Abdomen* not nearly covering the last thoracic sternite.

4. *Selwynia laevis* n. sp. (Fig. 112).

Diagnosis: "A *Selwynia* with the body smooth and naked except for some hairs on the underside and on the last three joints of the walking legs, microscopically pitted all over; the regions of the back barely to be made out, the chelipeds very large and stout, their fingers nearly as long as the palm, gaping slightly, finely toothed on their opposed edges, and not furrowed; no thorns or teeth on any of the joints of any leg, save a small tooth underneath the meropodites of the walking legs; and the walking legs very stout, with very small end-joints, the last pair being a good deal smaller than the rest."

Length of the only specimen (a male): 6 mm. Breadth: 8 mm. Colour in spirit: white.

One male specimen was taken at Hulule, Male Atoll.

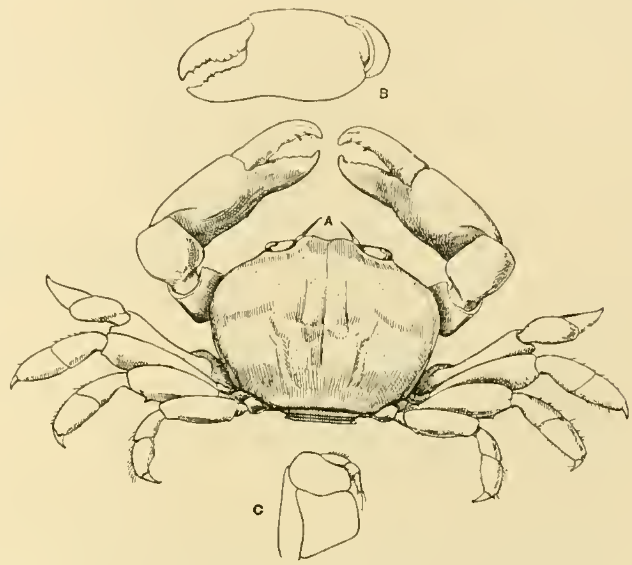


FIG. 112. *Selwynia laevis*; A. whole animal, B. outside of hand, C. third maxilliped.

[Genus *Caecopilumnus* Borradaile, 1902.]

[*Caecopilumnus hirsutus* Borradaile, 1902.] See above, Pt. III. p. 267.

This genus is at least allied to, if not identical with, *Typhlocarcinodes* Alc., 1900. I formerly regarded it as *incertae sedis*, but now believe that its proper place is in this subfamily.

Family **Pinnotheridae**. Genus *Pinnotheres* Latr., 1802.

5. *Pinnotheres purpureus* Alc., 1900. Alcock, VI. p. 339.

Dredged from 30 fathoms, Felidu Atoll.

6. *Pinnotheres tenuipes* n. sp. (Fig. 113).

Diagnosis: "A *Pinnotheres* with the carapace subcircular, smooth, moderately convex; the front rounded and hood-like; the eyes small, well pigmented; the end-joint of the third maxilliped slender, set far back on the inner edge of the joint before it, nearly reaching the tip of that joint; the chelipeds short, moderately stout, with fingers about $\frac{2}{3}$ the length of the palm, and a strong, rounded tooth on the moveable one about $\frac{1}{3}$ of its length from the articulation; the walking legs slender, the second the longest, the second and third nearly equal, and the fourth much the shortest, the last two joints of the walking legs hairy and their end-joints about equal in length, except for those of the fourth pair, which are much longer and more slender than the rest."

Length of the only specimen (a female): 12 cm. Breadth: 13 cm. Colour in spirit: mottled brown.

One female was taken from within the shell of a *Mya* (?) in Minikoi.

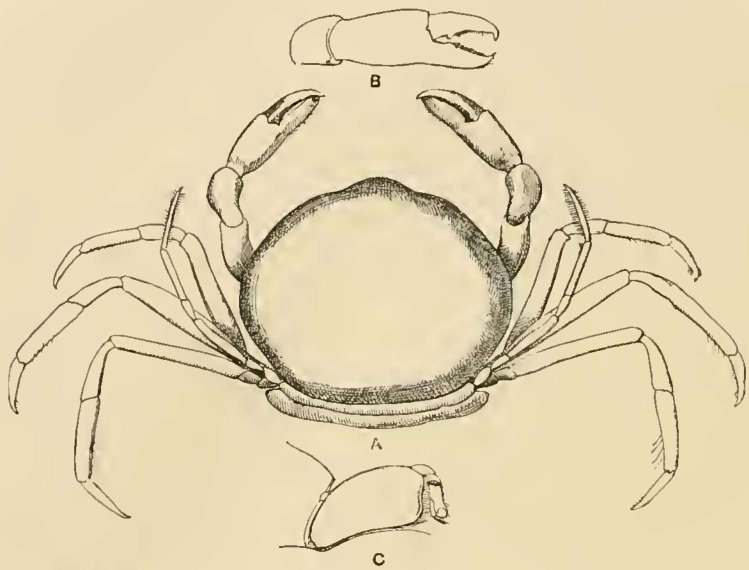


FIG. 113. *Pinnotheres tenuipes*; A. whole animal, B. outside of hand, C. third maxilliped.

Family **Grapsidae.**

Subfamily **Grapsinae.** Genus *Pachygrapsus* Randall, 1839.

7. *Pachygrapsus minutus* (A. M.-Edw.), 1873. Alcock, VI. p. 379.

Taken at Minikoi, and dredged in Fadifolu and Mahlos Atolls down to 25 fathoms.

8. *Pachygrapsus plicatus* (H. M.-Edw.), 1837.

Pachygrapsus plicatus, Kingsley, *Proc. Ac. Philad.* 1880, p. 200.

Taken at Hulule, Male Atoll and Goidu, Goifurfehendu Atoll.

9. *Pachygrapsus planifrons* de Man, 1887.

Pachygrapsus planifrons de Man, *Arch. Naturges.* LIII. i. p. 368, Pl. XVI. Fig. 2 (1887).

Taken in a coral mass on the outer reef at Minikoi.

Subfamily **Varuninae.** Genus *Planes* Leach, 1815.

10. *Planes minutus* (Linn.), 1750.

Nautilograpsus minutus, Kingsley, *Proc. Ac. Philad.*, 1830, p. 202.

Taken at Male on a floating cuttle-bone.

Subfamily **Plagusiinae.** Genus *Plagusia* Latr., 1806.

11. *Plagusia depressa* (Hbst.), 1793, var. *squamosa* (Hbst.), 1790. Alcock, VI. p. 437.

Common all over the Archipelagoes, scrambling actively over the rocks at low tide.

Genus *Leiolophus* Miers, 1876.

12. *Leiolophus planissimus* (Hbst.), 1804. Alcock, VI. p. 439.

Common all over the Archipelagoes. Hides under stones, clinging with its flat body close against them. When the stone is turned, the crab slips away, and is hard to secure.

Family **Ocypodidae.**

Subfamily **Macrophthalminae.** Genus *Macrophthalmus* Latr., 1829.

13. *Macrophthalmus verreauxi* H. M.-Edw., 1848. Alcock, IV. p. 377.

Taken in Felidu Atoll, 30 *f.*

14. *Macrophthalmus latipes* n. sp. (Fig. 114).

Diagnosis, "A *Macrophthalmus* whose length is to its breadth as 5 : 8; with the front very strongly bent downwards; the upper edge of the orbit slightly sinuous, slanting so much backwards that the sharp thorn at its outer angle lies far behind the level of the front; no stridulating organ; the antero-lateral edge with one blunt tooth behind the orbital angle and faint traces of two mounds behind this tooth; eyes outreaching the orbital angle by more than a third of their length; chelipeds small, simple in shape, with one blunt tooth on the moveable finger and no thorn on the inside of the palm; and walking legs with a spine near the end of the upper edge of the meropodites and long slender end-joints, except in the case of the hindermost pair, where the last three joints are broad and flattened."

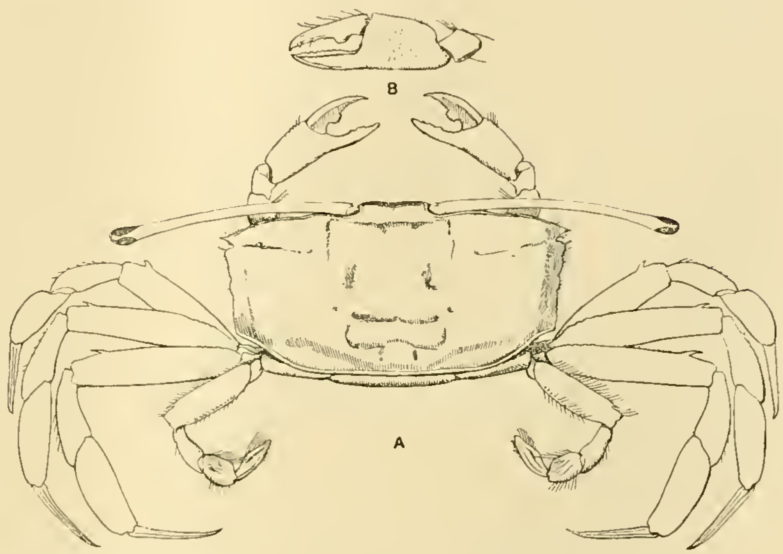


Fig. 114. *Macrophthalmus latipes*; A. whole animal, B. outside of hand.

Length of only specimen (a male): 5 mm. Breadth: 8 mm. Colour in spirit, white. In the flattened shape of its last pair of legs, this species recalls the Portunid genus *Podophthalmus,* already curiously like *Macrophthalmus* in the length of its eyestalks and its broad body.

Dredged from 36 *f.* South Nilandu Atoll.

Family **Palicidae.** Genus *Palicus* Philippi, 1838.

15. *Palicus jukesi* (White), 1847. Alcock, VI. p. 451.

According to Alcock, "the Indian species of *Palicus* live among coral shingle at a depth of from 10 to 40 fathoms, where their mottled coloration and granular rugose carapace afford a good concealment." The majority of the specimens of this species taken by the expedition were dredged on a bottom which contained coral shingle, but several were obtained from foraminiferal mud, quite unlike and unmixed with coral shingle. The species was taken from 25 to 45 fathoms in Suvadiva, Haddumati, South Nilandu, and Kolumadulu Atolls.

VI. THE SAND CRABS (OXYSTOMATA).

The morphological feature by which the Oxystomata are distinguished from other crabs is, at the same time, an indication of their most marked binomic peculiarity. This feature is to be found in the shape of the mouth and foot-jaws. The epistome is small or wanting, and the endostome is lengthened forwards, so that it is of a triangular shape. The channels for the outward stream from the gill-chamber, running on this endostome, are covered in by the long, leaf-like endopodites of the first pair of maxillipeds (*A* Fig. 110), and in this way are prolonged as closed tubes to the front of the body. The whole apparatus is neither more nor less than an adaptation to breathing under the special circumstances that present themselves in the sand-beds which form the characteristic habitat of the group.

The Oxystomata are singularly unanimous in their habits. Nearly all of them are crabs whose strength is to sit still, trusting to concealment rather than to agility or offensive tactics for protection against predaceous animals. Most of them find their concealment in the sand, where they lie buried with only the eyes exposed, and can often only be detected by the little whirlpool which they make in breathing. In such circumstances the advantage of having the breathing channels carried right up to the surface of the sand is obvious, and we have seen how this is done in the case of the outgoing stream. The incoming stream is ordered differently in different families. The Calappidae[1] (Pl. XXII. fig. 6) draw in water, like many other crabs, down a passage formed, so to speak, by "holding the hands against the breast," and so into the gill-chamber through an opening in front of the chelipeds, guarded by the wide base of the epipodites of the third pair of maxillipeds. But their hands (chelae) are peculiarly shaped for this purpose, being very broad and flat, and usually having a toothed crest, which is held against the forepart of the body. Through

[1] *Key to the families of the Oxystomata.*

I. Body of the shape usual in crabs. Abdomen hidden under thorax. Antennae small. Legs normal in position.
   - A. Afferent openings to gill-chambers lie in front of first pair of legs (chelipeds). Gills 9 on each side. Male openings coxal. *Calappidae.*
   - B. Afferent openings to gill-chambers lie on either side of the mouth at the base of the third maxillipeds. Gills less than 9 a side. Male openings sternal. *Leucosiidae.*

II. Body more or less abnormal in shape. Abdomen not hidden under thorax. Antennae large. Last one or two pairs of legs in a more dorsal position than the rest.
   - A. Carapace short. Last two pairs of legs subprehensile, with hook-like end-joints. *Dorippidae.*
   - B. Carapace long. Legs usually have the last two joints very broad. *Raninidae.*

Key to the subfamilies of the Calappidae.

I. Last three joints of 3rd maxilliped not hidden by the meropodite. Orbits not separated from the antennular sockets.
   - A. Meropodite of 3rd maxilliped not elongate nor acute. Exopodite of same limb with flagellum. Legs not adapted for swimming. *Calappinae.*
   - B. Meropodite of 3rd maxilliped elongate and acute. Exopodite of same limb without flagellum. Legs adapted for swimming. *Orithyinae.*

II. Last three joints of 3rd maxilliped hidden by the meropodite. Orbits more or less separated from the antennular sockets. [Exopodite of 3rd maxilliped with flagellum. Meropodite of same limb elongate and acute. Legs may be adapted for swimming or not.] *Matutinae.*

Key to the subfamilies of the Leucosiidae.

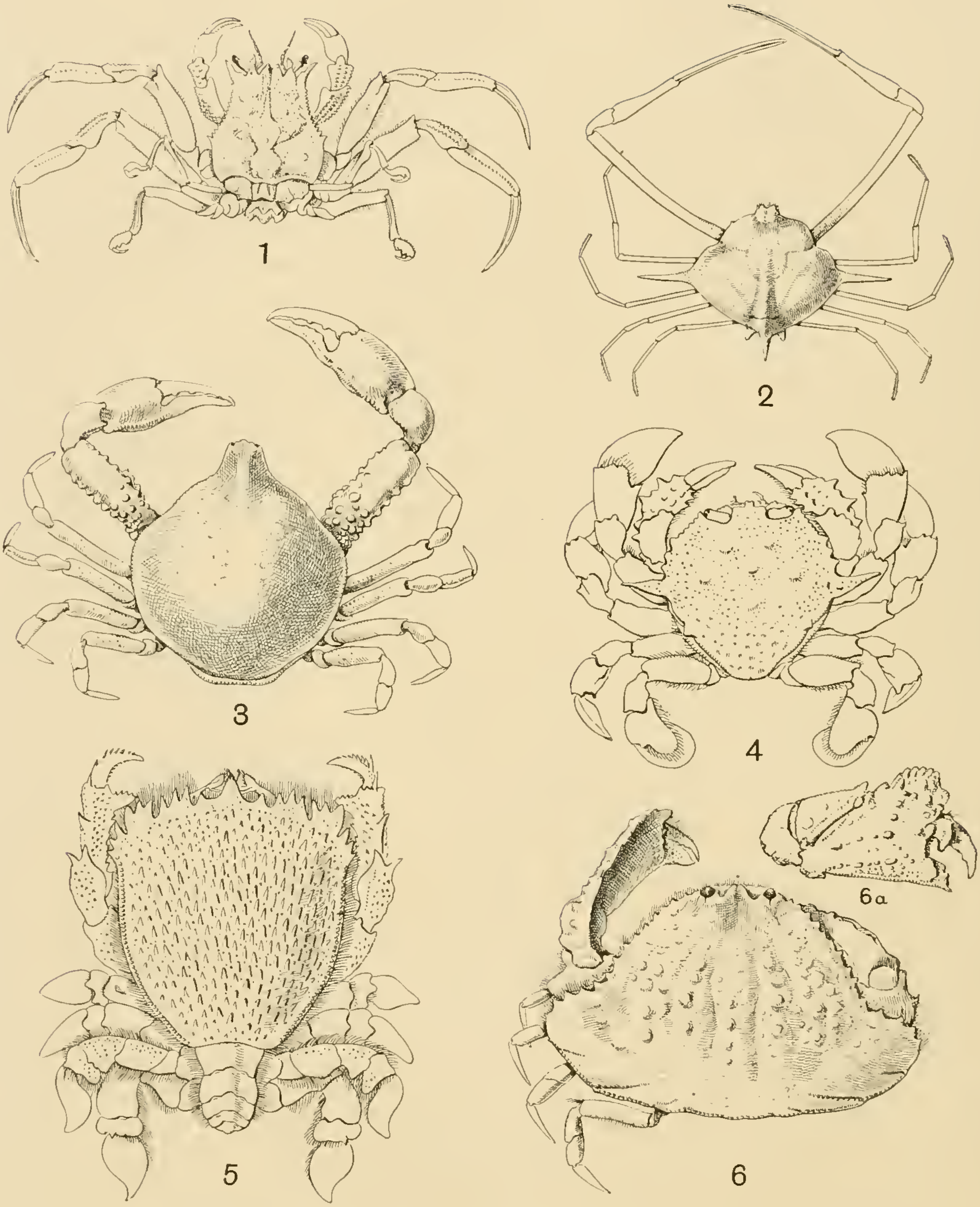
I. Meropodite of 3rd maxilliped more than half the length of the ischiopodite. Fingers stout, gradually narrowing from base to tip, usually shorter than the palm. *Leucosiinae.*

II. Meropodite of 3rd maxilliped never more than half the length of the ischiopodite. Fingers slender, of even width from the base to near the tip, usually longer than palm. *Iliinae.*

Key to the subfamilies of the Dorippidae.

I. 3rd maxillipeds leave a good part of the mouth uncovered. Inward openings to the gills near the base of the chelipeds. *Dorippinae.*

II. 3rd maxillipeds almost completely cover the mouth. Inward openings to the gills may or may not be near the base of the chelipeds. *Tymolinae.*



BORRADAILE—OXYSTOMATA.

To face p. 435.

the notches between the teeth water can enter, while at least the coarser sand-grains are kept out. *Matuta* (Pl. XXII. fig. 4) replaces these teeth, functionally, by a sieve of hairs. In the Leucosiidae, on the other hand, the openings for the ingoing stream are situated at the base of the maxillipeds of the third pair, and the water is led thither by a groove on the body, outside the efferent channel and parallel with it, covered by the third pair of maxillipeds. The Dorippidae (Pl. XXII. fig. 1) are probably divided in this respect, some breathing like the Leucosiidae, while others do not. In the Raninidae (Pl. XXII. fig. 5) a third method seems to be adopted. There are no obvious afferent openings in the forepart of the thorax, but spaces can clearly be seen between the hind edge of the carapace and the bases of the last pair of legs, and it is through these that the water probably enters.

Besides the conformation of the breathing organs just described we can trace other adaptations of the structure of Oxystomes to a sandy habitat. The comparatively simple egg- or pear-shaped body of some Leucosiidae is eminently suitable to a life spent buried in the sand, and the hard carapace found in most of these crabs is no doubt a last resource of the defenceless. *Calappa*, when seized, often draws up its legs under the broad shields formed by the overlapping edges of the carapace, thus seeming to sham death (Pl. XXII. fig. 6, right side). No doubt it is more difficult to dismember in this attitude, but it is quite possible that the action has no such special significance in this case, being instinctively adopted whenever the animal is moved against its will[1]. The colouring of many Calappidae is another feature in which they are adapted to their environment, being sand-like, and clearly protective.

Notwithstanding these generalisations, it is by no means likely that all Oxystomes hide in sand. *Dorippe* (Pl. XXII. fig. 1) conceals itself by holding a sponge or some other object over its back with its two hinder pairs of legs, which are dorsally placed and subchelate with hooked end-joints. Many of the Leucosiid genera show so strong a likeness to the Spider crabs (Oxyrhyncha) in their form of body and limbs (Fig. 117, and Pl. XXII. fig. 2) that they probably have a similar habit of weed-haunting, a view confirmed by the fact that several were taken in weed by the Expedition[2]. Another habitat is taken up by *Oreophorus* and *Tlos* (Fig. 115), which closely resemble water-worn coral pebbles, and live on shingle made up of such pebbles.

As a whole the Oxystomata are of distinctly sluggish habits, and this peculiarity reaches its height in the Leucosiidae. *Calappa* is perhaps somewhat more active. *Matuta* is not only a good swimmer, by means of paddle-like feet (Pl. XXII. fig. 4), but also an excellent digger, burying itself with wonderful rapidity in the sand. *Dorippe* is said to be able to run rapidly by means of its two pairs of very long walking-legs (Pl. XXII. fig. 1). And, lastly, the

EXPLANATION OF PLATE XXII.

FIG. 1. *Dorippe dorsipes*. FIG. 2. *Arcania quinquespinosa*. FIG. 3. *Leucosia marmorea*. FIG. 4. *Matuta banksi*. FIG. 5. *Ranina serrata*. FIG. 6. *Calappa hepatica*, legs on right side withdrawn under the shield. 6 *a*, outside of hand, showing crest. The figures are not drawn to one scale.

[1] *Calappa* is generally to be found in spots where deep sand is freely exposed to currents or wave motion, and in this compact form would probably undergo rolling about on a soft bottom without much injury.

[2] In considering the habitat of Oxystomes, as of other crabs, it should always be remembered that actual observation in shallow water is far more convincing proof than dredging on any particular bottom. For instance, a large crab dredged on a bottom of coral blocks may fairly be concluded not to be a sand-haunting one, but a small species may well make use of the hollows in the blocks, often as large as a man's fist, which are found to be filled with sand, and may have been dislodged in the dredge; and, again, the presence of weed or coral in a dredging always opens the possibility that some of the crabs found free may have belonged to them.

Raninidae are probably swimming sand-crabs, somewhat like *Matuta* in habits, as they are in the shape of the legs, and moving with jerks like the Galatheidae.

Judging from the contents of their stomachs, de Haan came to the conclusion that *Calappa*, *Matuta* and *Dorippe* feed on other crabs, *Leucosia* on prawns, and *Ranina* on fish and starfish. The following systematic list includes the forms taken by the expedition. All those not now described for the first time are of Indian or Indo-pacific distribution.

Family **Calappidae.**

Subfamily **Calappinae.** Genus *Calappa* Fabr., 1798.

1. *Calappa hepatica* (Linn.), 1764. Alcock, II. p. 142. (Pl. XXII. fig. 6.)

Taken at Hulule, Male Atoll and in Minikoi lagoon down to 5 fathoms.

2. *Calappa gallus* (Hbst.), 1803. Alcock, II. p. 146.

Dredged in Felidu, Haddumati and Suvadiva Atolls in 25—43 fathoms.

3. *Calappa depressa* Miers, 1886.

Miers, Challenger Brachyura, p. 287, Pl. XXIII. Fig. 2 (1886).

Dredged in Suvadiva Atoll in 43 fathoms.

4. *Calappa pustulosa* Alc., 1896, var. See Alcock, II. p. 147.

The specimens differ from the type in that: (1) the shields at the sides of the carapace are better developed, resembling those of *C. depressa* Miers; (2) the endostomial septum is complete in its hinder half and hollowed out in its anterior half only; (3) the whole antero-lateral edge is toothed (as in Alcock's figure. In his description he says that the anterior half is smooth). The name *clypeata* would be a suitable one to apply to this variety.

Dredged in Haddumati and Mulaku Atolls, in 30—39 fathoms.

Genus *Cryptosoma* Brullé, 1837.

5. *Cryptosoma granulosum* (de Haan), 1835. Alcock, II. p. 182.

Dredged in Suvadiva and South Nilandu Atolls, in 30—43 fathoms.

Subfamily **Matutinae.** Genus *Matuta* Fabr., 1798.

6. *Matuta banksi* Leach 1817. Alcock, II. p. 158. (Pl. XXII. fig. 4.)

Taken in Hulule, Male Atoll.

Family **Leucosiidae.**

Subfamily **Leucosiinae.** Genus *Oreophorus* Rüppell, 1830.

7. *Oreophorus reticulatus* Ad. and Wh., 1850. Alcock, II. p. 174.

Besides a full-grown male, there is in the collection a very small one which closely resembles the adult, and is not at all like the specimen figured by Adams and White as the young of this species ["Samarang" Crustacea, Pl. VI. Fig. 2].

Dredged in Kolumadulu and Fadifolu Atolls in 38 and 23 fathoms.

Genus *Tlos* Ad. and Wh., 1850.

8. *Tlos latus* n. sp. (Fig. 115).

Diagnosis: "A Tlos with the carapace broad and finely granulated all over, roughened by small pits and minute linear grooves among the granules; in the hinder part a mound, consisting of two large humps, one on each side of the cardiac region, and the latter region itself somewhat swollen, and connected with the front by a broad ridge, on each side of which is a deep pit; the front well developed, notched at the tip, not quite hiding the eyes; the anterolateral edge with one peak, the posterolateral irregular; the chelipeds about a third longer than the carapace in the female, irregularly nodular all over; the walking-legs short and nodular."

Length: 6 mm. Breadth: 9 mm. Colour in spirit, white.

Taken at Hulule, Male Atoll, and dredged in 35 fathoms in North Male Atoll.

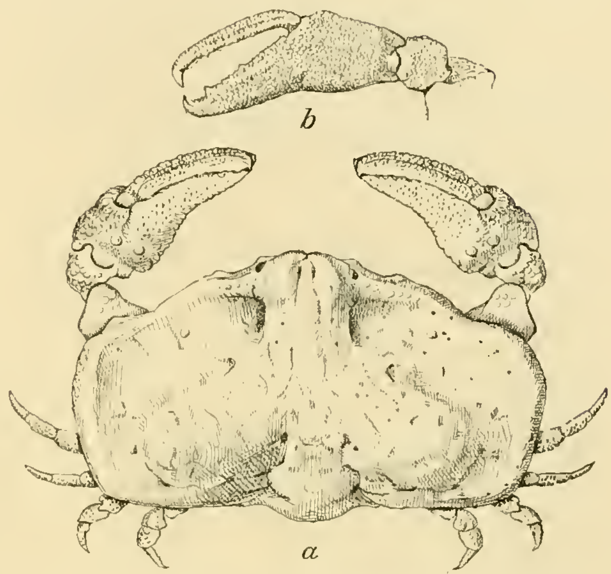


FIG. 115. *Tlos latus*; *a*. whole animal, *b*. outside of hand.

Genus *Ebalia* Leach, 1817.

9. *Ebalia erosa* (A. M.-Edw.), 1873. Alcock, II. p. 189.

Taken in Minikoi lagoon down to 9 fathoms and in Fadifolu Atoll in 22 fathoms.

10. *Ebalia maldivensis* n. sp. (Fig. 116).

Diagnosis: "An *Ebalia* with the carapace somewhat broader than long; the front prominent, rather deeply bilobed; the anterolateral edge with three projections, of which the hindermost is the smallest; the middle region of the carapace raised above the rest, bearing a large mound in the hinder part and a horseshoe of 8 smaller mounds in front, the smaller mounds varying greatly in distinctness in different specimens; the hind edge evenly arched; the body and limbs granular all over; the chelipeds of simple shape, without thorns or teeth, the fingers slender, grooved, as long as the somewhat swollen palm."

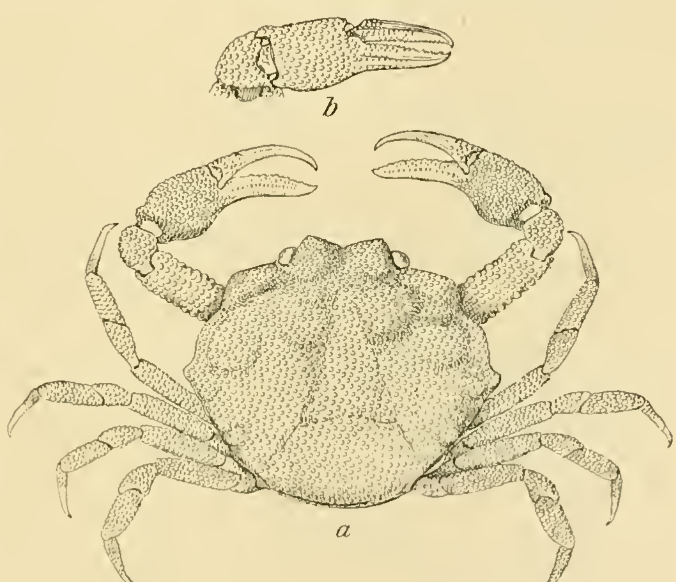


FIG. 116. *Ebalia maldivensis*; *a*. whole animal, *b*. outside of hand.

Length: 4·5 mm. Breadth: 5 mm. Colour in spirit, white, tinged in places with yellow. Dredged in Suvadiva and Fadifolu Atolls in 43 and 23 fathoms.

Genus *Leucosilia* Bell, 1855.

11. *Leucosilia maldivensis* n. sp. (Fig. 117).

Diagnosis: "A *Leucosilia* with the carapace subcircular, covered with flattened granules which in the branchial regions pass into minute, flat-topped spines; the front short, barely hiding the epistome; a large hollow in the carapace on each side just behind the front and a ridge separating these hollows and running back to the gastric region, where it bears 5 knobs, 2 knobs one behind another on the cardiac region, and a blunt knob at each end of the hind margin; the chelipeds about $\frac{1}{2}$ as long again as the carapace, granular, the granules being smallest on the hands, the fingers longer than the palms, furrowed, slender, and set with slender teeth of various sizes; the walking-legs short and slender, with long end-joints."

Length: 12 mm. Breadth: 11 mm. Colour in spirit, white.

Dredged in Suvadiva Atoll, in 43 fathoms.

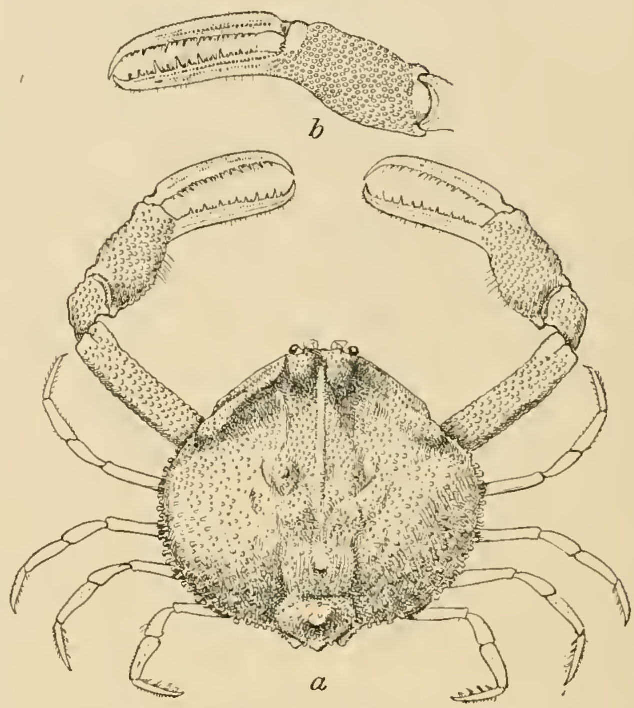


FIG. 117. *Leucosilia maldivensis*; *a*. whole animal, *b*. outside of hand.

Genus *Myra* Leach, 1817.

12. *Myra brevimana* Alc., 1896. Alcock, II. p. 206.

Dredged in Kolumadulu and South Nilandu Atolls, in 35 and 36 fathoms.

13. *Myra darnleyensis* Hasw., 1879. Alcock, II. p. 207.

Dredged in Suvadiva, South Nilandu and Mulaku Atolls in 28—43 fathoms.

14. *Myra intermedia* n. sp.

A specimen of a new form of *Myra* in the collection shows a combination of characters which tend to unite the species *M. fugax* (Fabr.), *M. affinis* Bell, and *M. brevimanus* Alc.

The following are the diagnostic features of the new form: (1) Carapace rather sparsely covered with granules, which are smaller than in *M. brevimana* except on the intestinal region and the base of the large hinder spine, where they are coarse and close set. (2) A keel is present in the middle of the back and is more closely granular than the field on either side of it. (3) The tooth on the hinder part of the upper of the two lines which define the hepatic facet is almost lost. (4) The front hardly projects to the same level as the outer tooth of the breathing channel; it is widely, but not very deeply, notched. (5) All the three spines at the hinder end are sharp. The middle one is much the longest and is somewhat upcurved at the tip, which is free from granules. (6) There is no tooth at the end of the long segment of the male abdomen. (7) The length of the male cheliped : length of carapace (without spine) :: 5 : 3. The palm is short, and the moveable finger almost exactly equals the outer edge of the palm in length.

The specimen is a male 15 mm. long without the spine and is probably full-grown. The colour in spirit is dirty white. It was dredged in 30 fathoms in Mulaku Atoll and probably taken from a sponge.

Genus *Leucosia* Fabr., 1798.

15. *Leucosia marmorea* Bell, 1858. Alcock, II. p. 221. (Pl. XXII. fig. 3.)

Dredged in Felidu and Mulaku Atolls in 25 and 40 fathoms.

16. *Leucosia* sp. aff. *pallida* Bell, 1855. See Alcock, II. p. 222.

A damaged male specimen of a *Leucosia* from Hulule resembles *L. pallida* in the shape of the carapace, but differs in that: (1) the front has the middle tooth broad and slightly emarginate at the tip. (2) The crenulation of the anterolateral edge is almost obsolete. (3) The outer limb of the V-shaped thoracic hollow is obsolete.

Genus *Pseudophilyra* Miers, 1879.

17. *Pseudophilyra pusilla* Hend., 1893. Alcock, II. p. 281.

The markings on the carapace are irregular and do not agree with Alcock's description. In particular the brown band across the tip of the front is wanting. The palms are somewhat longer and flatter than in Henderson's figure [*Tr. Linn. Soc.* (2) v. *Zool.*].

Dredged in Minikoi, South Nilandu and Suvadiva Atolls in from 2 to 43 fathoms.

Subfamily **Iliinae.** Genus *Nursilia* Bell, 1855.

18. *Nursilia dentata* Bell, 1855. Alcock, II. p. 260.

Dredged in South Nilandu, Kolumadulu, Suvadiva and Mulaku Atolls in various depths down to 40 fathoms.

Genus *Arcania* Leach 1817.

19. *Arcania tuberculata* Bell, 1855. Alcock, II. p. 268.

Dredged in South Nilandu Atoll in 30 fathoms.

20. *Arcania quinquespinosa* Alc. and And., 1894. Alcock, II. p. 266. (Pl. XXII. fig. 2.)

Dredged in Haddumati, Kolumadulu and Suvadiva Atolls in various depths down to 44 fathoms.

Family **Dorippidae.** Genus *Dorippe* Fabr., 1798.

21. *Dorippe dorsipes* (Linn.), 1764. Alcock, II. p. 277. (Pl. XXII. fig. 1.)

The specimen carried a sponge when taken. It was dredged in Haddumati Atoll in 40 fathoms.

VII. THE BARNACLES (CIRRIPEDIA).

Seeing that the Barnacles are sessile animals, and need to attach themselves to a firm holdfast, it might be expected that they would be numerous and characteristic inhabitants of coral reefs, which give so many opportunities of settlement on fixed bodies, under conditions so diverse both biologically and physically. But, curiously enough, as Darwin has remarked[1], coral reefs are, for some reason, not favourable to them. Yet a number of species may be taken there, and some are even characteristic and specially modified for the habitat. Among these may be included the *Lithotryas* which bore into coral rock, those species of *Pyrgoma* which live imbedded in reef corals, and several of the *allium*-group of *Balanus*, besides common species such as *B. tintinnabulum* and *B. amphitrite.* Of course those which live on animals such as sea-snakes or turtles and on floating objects as cuttle-bones or pieces of wood, are also found.

The collection contains 16 species, including members of all the groups mentioned above. Of these species two are new. Most of the others have already been recorded from some part of the Indo-Pacific region, but one form can only be classed as a variety of the West Indian *Lithotrya dorsalis*, and another, whose locality has hitherto been unknown, was formerly supposed to be (and still may be) West Indian.

Family **Lepadidae.**

Genus *Lepas* Linn., 1758.

1. *Lepas ansifera* Linn., 1767. Darwin, I. p. 81[1].

Taken on floating objects in various localities throughout the Archipelagoes, a number of the younger individuals being on cuttle-bones.

Genus *Dichelaspis* Darw., 1851.

2. *Dichelaspis warwicki* (Gray), 1825. Darwin, I. p. 120.

The specimens differ from that figured by Darwin in that the upper end of the occludent segment of the scutum is considerably wider than the base of this segment, leaving only a narrow strip of soft skin between itself and the basal segment. But Darwin says that this segment may be wider in the upper part. The plate at the base of the carina is an independent ossicle, joined by a suture to the true keel.

Taken in Suvadiva Atoll.

3. ? *Dichelaspis grayi* Darw., 1851. Darwin, I. p. 123.

A specimen which I believe to belong either to this species or to *D. pellucida* Darw., 1851, is attached to a sea-snake (*Hydrus platurus*) taken by the expedition in the Maldives.

Unfortunately, the shells are so badly preserved, owing to their having been kept in formalin, that it is impossible to be certain of the species. It is the habit of both species to live on sea-snakes.

[1] All the references to Darwin's work in this paper are to his "Monograph of the Cirripedia," London, 1851–4.

Genus *Conchoderma* Olfers, 1814.

4. *Conchoderma hunteri* Darw., 1851. Darwin, I. p. 153.

Hoek ("Challenger" Cirripedes) regards this form as a variety of *C. virgata* (Spengler), 1790, but the latter has not been found on sea-snakes, while *C. hunteri* appears to have that habitat, Darwin's specimen and the present both so occurring. The only others recorded (Stebbing, Willey's *Zool. Results*, vol. v. p. 676) made the pardonable mistake of attaching themselves to submarine cables. This fact lends support to the presumption that the species are distinct.

Genus *Lithotrya* Sowerby, 1822.

5. *Lithotrya dorsalis* (Ellis), 1786. Darwin, I. p. 351.

I am unable to regard the Maldive specimens of this genus otherwise than as belonging to varieties of this West Indian species. Two forms may be recognised, the type (var. A) not being present.

B. Var. *maldivensis* n.

Differs from the type in the following points: (1) There is a very faint ridge within the carina. (2) The caudal appendages are rather less than half as long again as the last pedicel. (3) There is a shallow notch on the maxilla of the right side, though none on the left. (4) The tergal edge of the scutum is slightly concave. (5) The scuta are longer than in *L. dorsalis*. (6) The *carina* is shorter.

These latter two features, however, may well be due to a difference in the manner in which the specimens have become worn by the sea.

C. Var. *rugata* n.

Differs from the preceding variety in the following points: (1) The carina has a fairly strong ridge. (2) The caudal appendages are only very slightly longer than the pedicel of the last limb. (3) The rostrum is bordered by 6 scales instead of 3.

This species lives on the under side of overhanging coral rocks and is always so placed that its capitulum is at the opening of the hole. I am at a loss to understand how some of Darwin's specimens came to be reversed. For some remarks on its importance in the disintegration of coral rock, see Mr Gardiner's Paper in Part III. of this publication (p. 337).

Family **Balanidae.** Genus *Balanus* Da Costa, 1778.

6. *Balanus tintinnabulum* (Linn.), 1758. Darwin, II. p. 194.

The specimens, which were taken in various localities, are all small and belong to the var. *communis*.

7. *Balanus amphitrite* Darw., 1854. Darwin, II. p. 240.

The specimens are coloured pink and much resemble *B. tintinnabulum*. They are small and have given me much trouble, but I have finally placed them here on account of the undoubted absence of pores from the radii, and because the mandibles agree best with Darwin's description for this species. They were taken in Fadifolu Atoll.

8. *Balanus quadrivittatus* Darw., 1854. Darwin, II. p. 284.

Taken in Miladumadulu Atoll.

9. ?*Balanus terebratus* Darw., 1854. Darwin, II. p. 288.

I am unable to find in my specimens the rows of holes between the ridges of the basis as described by Darwin. Possibly the species is distinct. The scuta and terga, which were wanting in Darwin's specimens, have the following characters in mine:

Scuta. Shape that of a right-angled triangle with convex base. Growth ridges on the outside curved. Adductor ridge strong and articular moderate.

Terga. Spur very short and fairly broad. Growth ridges on the outside curved. Spur groove wide, shallow. Apical tooth present, but broken in the specimen.

Taken on the reef at Naifaro, Fadifolu Atoll.

10. *Balanus maldivensis* n. sp. (Fig. 118).

Diagnosis: "A *Balanus* with solid walls, the basis, radii and parietes being without canals, though indications of these are seen in the parietes when the latter are broken; the opening rhomboidal, and toothed owing to the projection of the tips of the parietes, the walls gnarled and often ringed, but not regularly ribbed; the scutum of simple, obtuse-angled triangular shape, with slight articular and no adductor ridge; the tergum very broad with a rounded tip, a short, broad spur, which is also rounded at the end, a sharp tooth at the end of the scutal edge next the spur, and a sharp, though not very deep, spur groove; the outside of both scutum and tergum moderately strongly ridged; the mandible with seven teeth, which grow smaller in succession from above downwards, and of which numbers 1—5 are blunt and often subdivided, while 6 and 7 are sharp, a row of stiff bristles along the lower edge and the sides and upper edge hairy; and the edge of the maxilla almost straight, without notch or projection."

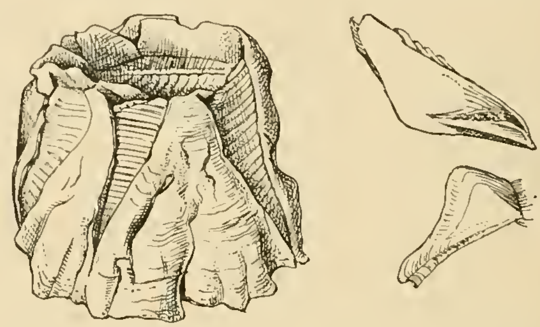


FIG. 118. *Balanus maldivensis*; whole animal, with scutum and tergum detached and seen from the inside.

Length of longest specimen: 7 mm. Height: 6 mm.

Taken in S. Nilandu Atoll, on a twig of wood.

The peculiarities of the shell of this species would appear to necessitate the founding for it of a new section [H] of the genus, with the characters: "All parts of the shell present, heavy, and without pores."

Genus *Acasta* Leach, 1817.

11. *Acasta sulcata* Lam., 1818. Darwin, II. p. 310.

Dredged in two fathoms in Fadifolu Atoll.

Genus *Pyrgoma* Leach, 1817.

12. *Pyrgoma cancellatum* Leach, 1824. Darwin, II. p. 362.

Darwin did not know from what locality his specimens of this species had been brought, but supposed it to be the West Indies. The present specimens were dredged in Suvadiva Atoll in 26 fathoms.

13. *Pyrgoma grande* (Sowerby), 1839. Darwin, II. p. 365.

This species lives inside the polyps of *Euphyllia.* The outside of the basal cup of the cirripede often shows septa formed by the polyp, so that it would appear that the soft parts of the polyp adapt themselves to the invasion by growing over the foreign body. [The same or another species lives commonly in the Maldives on *Galaxea.* ED.]

Darwin reports *P. grande* from "two sorts of corals," and it is evident from his figure that in at least one of these the same relation between the barnacle and the coral is found as in our specimens.

14. *Pyrgoma madreporae* n. sp. (Fig. 119).

Diagnosis: "A *Pyrgoma* with the shell flat, oval, the opening keyhole-shaped; the ridges well developed, alternately long and short, rather wide apart, about 11 in a quadrant, projecting somewhat at their outer ends; basal cup very strongly ribbed inside; scutum of simple, triangular shape, with a rounded basal edge and a well-developed adductor ridge; tergum also triangular, with a short spur; cirri delicate, the series growing longer from before backwards; mandible with 5 teeth, exclusive of the lower angle, which bears a number of bristles, the teeth growing smaller from above downwards."

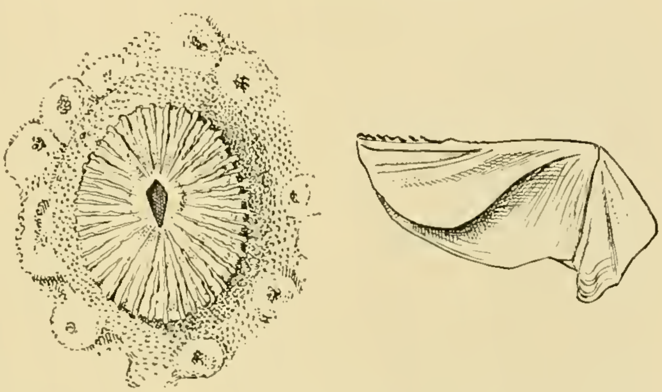


FIG. 119. *Pyrgoma madreporae*; whole animal imbedded in coral, with detached scutum and tergum seen from the inside.

Breadth of largest specimen: 8 mm. Colour in spirit, white.

Found in a *Madrepora* at Hulule, Male Atoll.

Genus *Chelonobia* Leach, 1817.

15. *Chelonobia testudinaria* (Linn.), 1758. Darwin, II. p. 392.

Two specimens were taken on the carapace of the turtle *Chelone midas* in Minikoi.

16. *Chelonobia caretta* (Spengler), 1790. Darwin, II. p. 394.

Several specimens were found in the skin on the legs of the turtle *Chelone imbricata* in Minikoi.