BULLETIN
OF THE
MADRAS GOVERNMENT MUSEUM

Edited by the Superintendent

THE LITTORAL FAUNA OF KRUSADAI ISLAND IN THE GULF OF MANAAR

WITH APPENDICES ON THE VERTEBRATES AND PLANTS

by Various Authors

New Series - *Natural History Section, Vol. I, No. I*
1927

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FOREWORD

The Government Museum, Chennai (then Madras) was the Central Museum for the then Madras Presidency, which extended over almost the whole of South India. "The Littoral Fauna of Krusadai Island in the Gulf of Manaar with appendices on the vertebrates and Plants, (by various authors) is an interesting publication that marks the revival of a serial publication - Bulletin of Government Museum, Chennai. This book deals with the systematic account of practically all groups of Invertebrates excluding Protozoa, Porifera, flatworms and some of the smaller groups.

The volume has been prepared primarily for the use of the students and would serve as a very valuable handbook. The chapters dealing with the various groups have been written by different authors, but the greater part of the volume is the work of Dr. F.H. Gravely, former Superintendent of the Madras Museum, who had also acted as the editor for the remaining contributions and Dr. B. Sundara Raj, former Director of Fisheries, Madras.

This book was out of stock for several years. It has been felt that there is a need for a reprint and it is hoped that this reprint will stimulate detailed research on Indian Marine Fauna of the region.

M.A. SIDDIUQE

Chennai - 600 008.
7.3.2005.

EDITOR'S FOREWORD TO THE NEW SERIES OF BULLETINS.

The results of work done in the Madras Government Museum were first published in a series of catalogues, notes and guides, commencing with a catalogue of coins published by Major Bidie in 1874. The Bulletin was started in 1894 by Mr. Thurston, as a convenient means of publishing miscellaneous information, mostly anthropological, resulting from his work. But the publication of special catalogues was not discontinued. The last number of the Bulletin that has been issued appeared in 1907, catalogues alone having been published since then.

In order to put our publications on to a more convenient and definite basis it is proposed in future that all shall be issued as parts of a new series of the Bulletin, of which the present number forms the first. It is hoped to publish in this way, as opportunity arises, a series of works dealing with the Arts and Sciences of Southern India, especially such as are illustrated in the collections of the Madras Government Museum. For the convenience of those who may be interested only in the parts dealing with either Natural History or with Archaeology, Anthropology and allied subjects, and who do not wish to fill their shelves with the other parts, this new series of the Bulletin will be issued in two sections which may be termed the Natural History and General Sections, respectively. It will be issued in larger form than the old Bulletins, for the sake of the illustrations.

The following is a list of the publications hitherto issued by the Museum. Many of them are out of print.

I. Catalogues, etc.—

Catalogue of Coins in the Collection of the Government Museum, Madras, 1874.

Catalogue of Mammals in the Government Central Museum, Madras, with a brief sketch of the Anatomy of Vertebrates, etc. By G. BIDIE, 1877.

Preliminary Report on the Marine Fauna of Rameswaram, and the neighbouring Islands. By E. THURSTON, 1887.

Coins. Catalogue No. 1. Mysore. By E. THURSTON, 1888.

Catalogue of the Batrachia Salientia and Apoda of Southern India. By E. THURSTON, 1888.

Coins. Catalogue No. 2. Roman, Indo-Portuguese, and Ceylon. By E. THURSTON, 1888 (revised with additions, 1894).

Catalogue of Minerals, Ores and Rocks; with a note on Meteorites, of which the fall in Southern India has been recorded. 1890.

History of the Coinage of the Territories of the East India Company in the Indian Peninsula: and Catalogue of the Coins in the Madras Museum. By E. THURSTON, 1890.

Pearl and Chank Fisheries and Marine Fauna of the Gulf of Manaar. Notes. By E. THURSTON, 1890.

Coins. Catalogue No. 3. Sultans of Delhi. By E. THURSTON, 1893.

Coins. Catalogue No. 2. Roman, Indo-Portuguese, and Ceylon. 2nd Ed., revised with additions. By E. THURSTON, 1894.

Guide to the Natural History and Mineral Galleries. 2nd Ed., revised with additions. 1894. [1st Ed. cannot be traced.]

Catalogue of the Prehistoric Antiquities. By R. BRUCE FOOTE, 1901.

Ethnographic Notes in Southern India. By E. THURSTON, 1906.

The Foote Collection of Indian Prehistoric and Protohistoric Antiquities. Catalogue Raisonné. By R. BRUCE FOOTE, 1914.

Catalogue of the Prehistoric Antiquities from Adichanallur and Perumbair. By A. REA, 1915.

The Foote Collection of Indian Prehistoric and Protohistoric Antiquities. Notes on their Ages and Distribution. By R. BRUCE FOOTE, 1916.

Catalogue of the Wood Specimens exhibited in the Economic Section, 1916.

Catalogue of Copper-Plate Grants in the Government Museum, Madras, 1918.

Catalogue of the Exhibits in the Economic Products Section, except Wood Specimens. By S. N. CHANDRASEKARA AYYAR, 1921.

Catalogue of the Coins of Haider Ali and Tipu Sultan. By J. R. HENDERSON, 1921.

Gramophone Records of the Languages and Dialects of the Madras Presidency: Text of Passages. (In the press.)

II. Bulletins—

Vol. I. No. 1. Pearl and Chank Fisheries of the Gulf of Manaar. By E. THURSTON, 1894.

" " 2. Notes on Tours along the Malabar Coast. By E. THURSTON, 1894.

" " 3. Rameswaram Island and Fauna of the Gulf of Manaar. 2nd Ed., revised with additions. By E. THURSTON, 1895. [1st Ed. cannot be traced.]

" " 4. Anthropology of the Todas and Kotas of the Nilgiri Hills; and of the Brahmans, Kammalans, Pallis, and Pariahs of Madras City. By E. THURSTON, 1896.

Vol. II. " 1. Anthropology. Badagas and Irulas of the Nilgiris; Paniyans of Malabar; A Chinese-Tamil Cross; A Cheruman Skull; Kuruba or Kurumba; Summary of Results. By E. THURSTON, 1897.

Vol. II. No. 2. Anthropology. Eurasians of Madras and Malabar; Note on Tattooing; Malagasy-Nias-Dravidians; Toda Petition. By E. THURSTON, 1898.

" " 3. Anthropology. Kadirs of the Anaimalais; Malaialis of the Shevaroys; Syllabus of Demonstrations on Anthropology; The Dravidian Head; The Dravidian Problem. By E. THURSTON, 1899.

Vol. III. " 1. Anthropology. Notes on some of the People of Malabar, by F. FAWCETT; Mala Vedars of Travancore, by F. EVANS; Miscellanea, by E. THURSTON, 1900.

" " 2. Sea Fisheries of Malabar and South Kanara. By E. THURSTON, 1900.

" " 3. Anthropology. Nayars of Malabar. By F. FAWCETT, 1901.

Vol. IV. " 1. Anthropology. Todas of the Nilgiris; Eurasian Schoolboys; Meriah Sacrifice Post; Walking through Fire; Malaialis of the Shevaroys; Scissors People; Sorcery in Coimbatore; Nayadis of Malabar, 1901.

" " 2. Anthropology. The Dravidian Head; Yanadis of Nellore; Miscellanea, 1901.

" " 3. Anthropology. Some Marriage Customs in Southern India; Deformity and Mutilation; Uralis, Sholagas and Irulas; Fire-walking in Ganjam; Corporal Punishment in Vernacular Schools, 1903.

Vol. V. " 1. Anthropology. Vision of the Uralis and Sholagas; More marriage customs in Southern India; Hook-swinging; Paliyans, 1903.

" " 2. Anthropology. The Paraiyan and the Legend of Nandan, by the REV. A. C. CLAYTON; Some Agricultural Ceremonies in Malabar, by C. KARUNAKARA MENON, 1906.

" " 3. Anthropology. The Village Deities of South India. By H. WHITEHEAD, 1907.

THE LITTORAL FAUNA OF KRUSADAI ISLAND AND NEIGHBOURING LOCALITIES.

INTRODUCTION.

The following account of the littoral fauna and flora of Krusadai Island in the Gulf of Manaar has been prepared primarily as an aid to students visiting the marine biological station, which it is hoped will shortly be established there. These visits can as a rule only be of short duration, and if full value is to be obtained from them some ready means, by which at least the commoner organisms that will be met with can be identified, must be provided. In Europe this can to a great extent be done with the aid of the many excellent monographs that have been published on various groups. But in India, few such monographs have yet been written.

To prepare a complete and self-sufficient monograph of the fauna and flora even of so small an area as that under consideration, with a full account of the classification of every group, would swell the work to an inordinate size with matter which would be largely a repetition of the work of others already published elsewhere. And, however convenient it might be, it would be undesirable; inasmuch as it would help to confirm the impression which students so often get that all knowledge is to be found between the covers of their text-books. On the other hand, to write an account which could only be followed by specialists or with the aid of books that cannot, for some time at least, be available on the island, would be to defeat the object of the work.

We have therefore followed as far as possible the classification set forth in some standard text-book, such as the Oxford and Cambridge Natural Histories. The particular book followed has been mentioned under each group and should be consulted for details. As, however, only the broad outlines of classification are dealt with in such books, reference is given to other works that have been found helpful in connexion with more detailed classification, and it has usually been necessary to insert a brief account of the distinctive characters of such of the smaller subdivisions as are represented in the collections. These have been kept as short and clear as possible, only the most useful characters being included. But keys have as a rule been avoided on account of the sense of completeness and finality which they are apt, often falsely, to convey. Descriptions of species have also been kept as brief as possible, especially in the case of those already described in the publications of the Indian Museum, in Alcock's "Materials for a Carcinological Fauna of India" (*Journ., Asiatic Soc., Bengal*, 1895–1900), in Stanley Gardiner's "Fauna and Geography of the Maldive and Laccadive Archipelagoes," in the reports of the Percy Sladen Trust Expedition to the Indian Ocean (*Trans. Linn. Soc., London*, 1907 onwards) and in Herdman's "Report on the Pearl Oyster Fisheries of the Gulf of Manaar," works bearing in so definite a manner on the fauna under consideration that they must obviously be available for reference along with the standard text-books already mentioned in the library of the Krusadai biological station.

It must of course be clearly understood that we have dealt almost exclusively with the forms actually collected in the locality under consideration, that little or no reference has been made to other species, genera or larger groups that may yet be found to occur there and that the present work is intended simply as a preliminary guide. No collection of Protozoa has been made, and very few have been seen. The Sponges, Flatworms, Alphaeids, Hemichorda and some other groups have also had to be omitted, as the authors have found themselves unable to deal with them and have been unable as yet to obtain the necessary help for them from specialists. It is hoped that it may be possible to deal with them later and that all groups will be revised by specialists when more exhaustive collecting has been done. If the present work helps to stimulate such collecting, its authors will feel that their efforts have been rewarded.

Much of the collecting has been done at low tide in more or less extensive areas of shallow water. In order that the present paper may fulfil its purpose, specimens collected from such places have had to be included, though they are not strictly littoral in the sense of occurring between tidemarks. But everything has, unless otherwise stated, been collected by hand, without the help of the dredges or divers. The greatest depth from which specimens have been obtained can therefore hardly exceed three or four feet. This does not, however, apply to the few specimens recorded from Rameswaram, some of which were brought up by divers from the chank beds.

Except for a few specimens collected in previous years and preserved in the Madras Museum, all the material was collected by Professor Parthasarathy Iyengar and Dr. Sampathkumaran in October 1920, by Dr. Gravely and Professor Parthasarathy Iyengar in September 1922, by Dr. Sundara Raj, Professor Parthasarathy Iyengar and Dr. Gravely in April–May 1924, by Professor Parthasarathy Iyengar in September of the same year (plants only) and by Professor Ramunni Menon, Professor Parthasarathy Iyengar and Dr. Gravely in September–October 1925 or by students who accompanied them. The zoological material is preserved in the Government Museum, Madras, with the exception of the types of new species, which have been added to the collections of the Zoological Survey of India in the Indian Museum, Calcutta. The botanical specimens collected by Professor Parthasarathy Iyengar are preserved in the Botanical Laboratory of the Madras Presidency College.

As most of the work of identification has been done by those who collected the material, and as they obviously cannot have complete knowledge of the literature of so many groups, a number of species which may prove to be new have had to be left unnamed for the present. New species have, however, for the sake of convenience of reference, been described in groups of which the author had or could readily obtain special knowledge, or in which a recent monograph has made it easy to achieve a reasonable degree of certainty. This course seemed better than postponing publication till it was possible to obtain the opinion of specialists; for, as already pointed out, the work is intended to meet what is likely to be an immediate need rather than to be an exhaustive treatise. Specialists have, however, been consulted in a number of groups and we take

this opportunity of thanking them for the invaluable help which they have so readily given. Acknowledgment by name is made under each group separately.

No attempt has, for similar reasons, been made to give exhaustive bibliographies. References are of course given to all works cited; and to these have been added the titles of such other papers as we have seen, which seem specially likely to have a bearing on the fauna of the area under consideration—especially such as are available for reference in Madras.

General Description of the Island.

Krusadai is one of a string of islands running approximately east and west, parallel to, and on the south side of, the eastern end of Mandapam Peninsula and the western end of Rameswaram Island (see pl. i). The southern side and the eastern part of the northern side are entirely sandy; but the western part of the northern shore is very muddy and fringed with mangroves. Hence the eastern and western ends of the island are known as Sandy Point and Bushy Point, respectively.

The Fisheries Department bungalow is situated not far from Sandy Point. A little to the east of it is a pit, apparently the remains of the quarry from which the coral rock of which it is built was obtained. Such rock presumably underlies the whole island, but it is nowhere exposed.

Tolerably fresh water can be obtained from shallow pits dug in the sand. In one of these, in the central coconut plantation, swarms of Anopheline larvae are sometimes to be found, together with decaying palm fronds. None, however, have been found in the cleaner and more exposed pits near the bungalow. No mosquitoes were seen either in September or in April-May, but they are said to be troublesome during the north-east monsoon.

A salt marsh, bounded on its southern and eastern sides by high sand dunes, extends from the northern shore across almost the whole width of the island a little to the east of the middle. The rest of the island is flat and sandy. There is a small pond of brackish water close to the shore in Porites Bay.

Sandy Point is broadly truncate with a short stretch of sandy beach between its two angles, which point roughly north-east and south-east, respectively. From these angles shallow banks, partially exposed at low tide, extend outwards for some distance into the sea. Their outer ends are united by a reef of dead and largely decomposed coral which gives shelter to an interesting assemblage of rock-loving forms. The outer side of this reef is covered with seaweed and slopes away somewhat steeply into the sea, especially towards the south where it bends westward and extends roughly parallel to the main axis of the island, becoming much broken, however, towards the western end. On the south side of the island the reef is in places of considerable breadth and a veritable garden of luxuriant seaweeds is exposed on its surface at low tide. The number of species represented, however, does not appear to be very great. *Sargassum*, *Caulerpa*, *Turbinaria*, *Gelidium*, *Spatoglossum*, *Gracilaria*, *Ulva*, *Enteromorpha*, *Ceramium*, *Chaetomorpha* and *Polysiphonia* are among the commonest genera.

The waves break on the outer side of this reef, where the water becomes suddenly deep. Between it and the island the water is smooth and comparatively shallow. Over a large part of this area one can wade with ease; but there are some parts where a non-swimmer, or even a swimmer when loaded with collecting materials, may easily get into difficulties if not very careful. Only one really troublesome area has, however, been found. This is situated opposite or a little to the west of the big sand dunes and is a place where one may lose touch with the bottom and find it difficult to regain for considerable distances. Another, but smaller, deep area exists just behind the reef about opposite the bungalow.

The reef itself is composed of dead coral rock, full of holes, and in places apt to collapse beneath one's weight, making progress over it extremely slow and at times somewhat painful. Inside the reef the bottom is sandy with an admixture of mud in places. Moderately large sponges are common here, as are also the corals *Pocillopora*, *Madrepora*, *Montipora*, and *Porites*; but corals seem to be confined to the shallower parts and consequently cannot grow as large as they do in Porites Bay on the north side of the island, or at the south end of Shingle Island. These corals, both alive and dead, afford shelter or support for a variety of sponges, coelenterates, planarians, polychaets, crustacea, polyzoa, molluscs, tunicates, etc. Towards the western part of the south side of the island, where the reef is so much broken as to be almost obliterated, banks extend obliquely inwards towards the shore, though at a very considerable distance from it. These banks consist of dead and broken coral, and the most easterly one is a particularly good collecting ground. The marine spider, *Desis inermis*, is very abundant here.

On the north side of Sandy Point the reef disappears into the sea and the shore is sandy and open and comparatively straight for about half a mile. Then it bends abruptly inwards, curving round to form a well-marked bay. Here the reef begins again but in somewhat deep and very muddy water. Its character, consequently, is quite different from that of the reef off Sandy Point and the south shore. It consists chiefly of immense masses of *Porites*, attached to which other species of coral and seaweeds are found. Here and there the *Porites*, from which the name of the bay is taken, is replaced by colonies of the fragile *Echinopora lamellosa*, especially where the bottom is of exceptionally soft mud. *Madrepora* is abundant and immense masses of *Favia abdita* are not uncommon. A beacon for the guidance of ships has been erected on the edge of the reef in this bay.

On the west of Porites Bay the shore again curves inwards forming a large bay, with a muddy bottom which is almost completely exposed at low tide. Worms are abundant in the mud and hermit-crabs on its surface. The watchman and his family have their huts among the bushes on the shore of this bay, which may conveniently be referred to as Watchman's Bay.

From the point to the west of the watchman's huts to Bushy Point at the western end of the island the shore is fringed with mangroves and its lower levels are uniformly muddy.

Other collecting grounds in the neighbourhood.

Varied though the collecting grounds on Krusadai Island are, still greater variety can be found within easy reach of it. We have not been able to make any systematic survey of such grounds, and the islands west of Krusadai have not been visited at all. The following notes may, however, be useful :—

SHINGLE ISLAND, the island to the east of Krusadai and the last of the line in this direction, is small and covered for the most part with bushes. In old maps it is shown as two islands, shaped somewhat like two L's facing each other, almost in contact on the south-east side, but with the northern parts separated by a wide bay (see pl. i). The south-eastern shores of the two islands are now continuous and an extensive bank of sand, covered with bushes, closes the old bay on the north-west, reducing it to a completely land-locked lagoon in the middle of the single island thus formed. This island is roughly quadrangular in shape. The north-western shore is sandy and slopes rapidly down into moderately deep water. The north-eastern shore is also sandy, but runs out to shallower water in which living coral is abundant. The south-eastern shore is thickly strewn with masses of dead coral and supports a fauna very like that of the dead reef off Sandy Point on Krusadai Island, but in some respects apparently somewhat richer. The south-western shore forms a small bay sheltered by dead reefs on the seaward side, in which luxuriant masses of *Montipora foliosa*, *Echinopora lamellosa* and a few other corals grow in calm and moderately shallow water of absolute clearness, in which one can wade among them on a firm soft bottom.. This is the best place we know for seeing these corals in their natural surroundings.

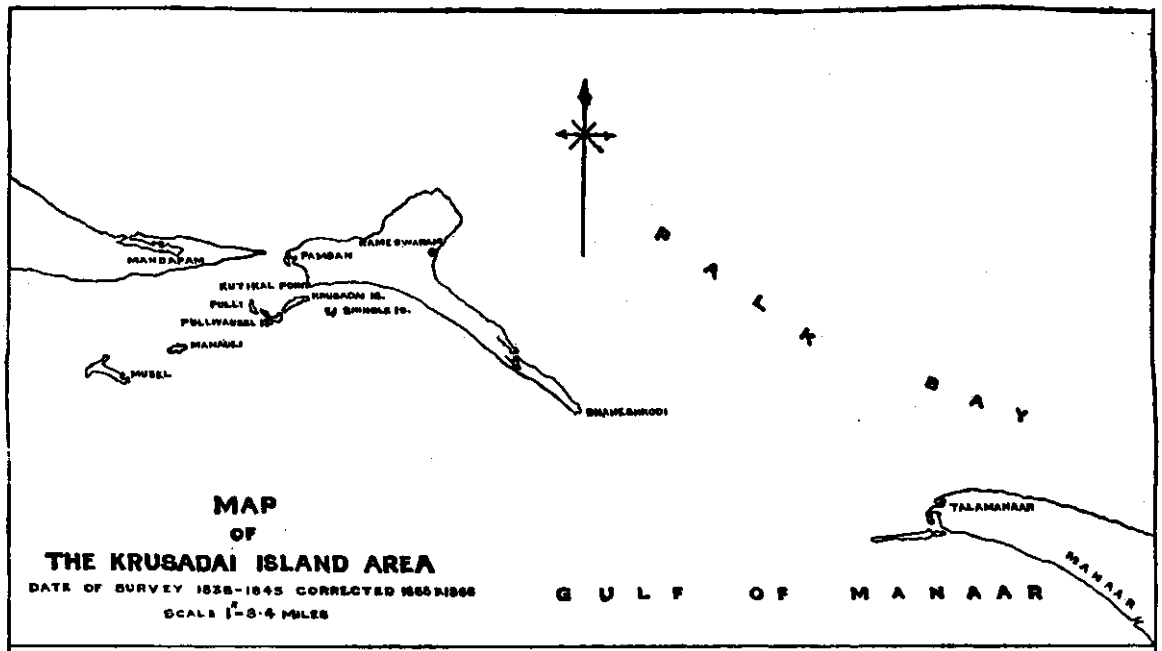
KUTIKĀL POINT on Rāmēswaram Island, opposite the eastern end of Krusadai Island, is sandy on its southern, muddy on its western, side. The sandy shore is frequented by large numbers of the Leucosiid crab, *Philyra scabriuscula*, and the burrowing snail, *Leiodomus vittatus*. It also seems to be a particularly good place for collecting medusae and other objects washed up by the tide.

The muddy shore likewise provides good collecting and several things have been found on it which have not yet been seen on Krusadai Island. *Pinna* is abundant in the neighbourhood of the channels that connect a small backwater with the sea at low tide; and there are special sponges, hydroids, etc., to be found among the marine phanerogams that grow luxuriantly in a bay, beyond these channels, which contains shallow water even at low tide.

PĀMBAN CHANNEL is extraordinarily rich in hydroids, polyzoa, ascidians, etc., doubtless on account of the strong tidal currents that sweep through it. The piers of the bridge, and the rocks and stones around them, are covered with a luxuriant growth of *Thyroscyphus*, *Sertularia*, *Lytocarpus* (one species of which stings like a nettle), *Pennaria*, etc., together with the Alcyonarian *Telesto*; and these support innumerable Caprellids and other small Crustacea, Pycnogonids, Nudibranchs, etc. Thurston records the occurrence of young Fungiae on the muddy bottom, where he took them in the dredge.

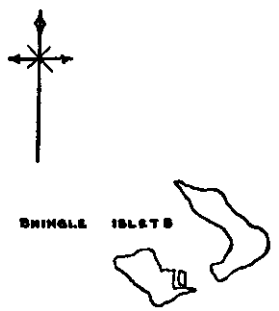
RĀMĒSWARAM, though outside the area under consideration, is usually visited by any one going to Krusadai Island, and is worthy of mention as its fauna is very different

from anything yet found in the immediate neighbourhood. The sea, opposite the Fisheries Department office, is comparatively shallow with firm but somewhat muddy bottom, on which the Alcyonarians *Sarcophytum*, *Lobophytum* and *Sclerophytum* flourish along with sponges, the Pennatulid *Virgularia*, several Echinoderms (including two Holothurians not commonly met with elsewhere, and the cake-urchin *Laganum*), and other things. This area is bounded on the seaward side by an extensive reef of *Madrepora*, beyond which the water becomes deeper. Further out the chank beds, in much deeper water, support yet another type of fauna including several species of Gorgonacea, a group which we have not so far found in shallow water in this region.

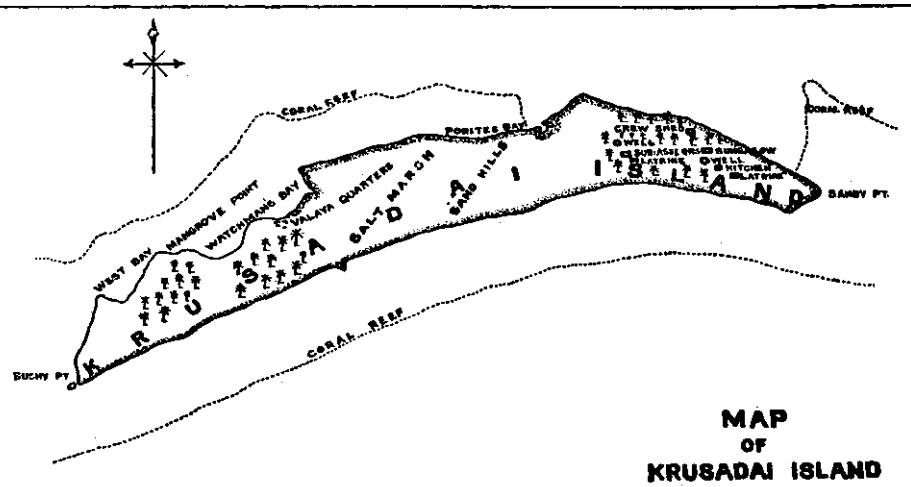


MAP
OF
THE KRUSADAI ISLAND AREA
DATE OF SURVEY 1838-1845 CORRECTED 1865 & 1868
SCALE 1"-8·4 MILES

SHINGLE ISLETS AS SURVEYED IN 1878
THE TWO ISLETS ARE NOW (1920-1927) UNITED ON THE N.W.
& S.E. TO FORM A SINGLE ISLAND WITH A LAGOON IN THE MIDDLE
COMPLETELY CUT OFF FROM THE SEA.



MAP
OF
SHINGLE ISLETS
DATE OF SURVEY 1878
SCALE 4" = 1 MILE



MAP
OF
KRUSADAI ISLAND
DATE OF SURVEY BY FISHERIES 22-7-1924
SCALE 1 CM. = 200 FT.

PLATE I.

COELENTERATA.

Class Hydrozoa.

Orders Gymnoblastea and Calyptoblastea.

By F. H. GRAVELY, *D.Sc.*

Order Gymnoblastea.

The classification followed is that of the Cambridge Natural History, except that the Eucopidae are merged in the Campanulariidae, from which they differ only in having free-swimming medusoid gonophores. This can no longer be considered a sufficient character for the separation of families, as various stages in their reduction occur in this Calyptoblastic as well as in several Gymnoblastic groups.

Family TURRIDAE.

(Turridae + Clavidae.)

Gymnoblastic hydroids in which the tentacles, all of which are filiform, are scattered over the surface of the polyps without any definite arrangement.

Genus Corydendrium, Van Beneden.

Branches originating by division into strands which remain in close contact for a considerable distance, the outermost ultimately bending outwards and becoming a free branch. Gonophores in the form of blind sacs arising some distance below the hydranth and lying within the perisarcal tube from which the hydranth projects.

Corydendrium dendriforme, Ritchie.

Pl. II, fig. 2.

Soleniopsis dendriformis, Ritchie, 1907, pp. 494–498, pl. xxvi, fig. 1, text figs. 142–3.
Corydendrium dendriformis, Ritchie, 1910, p. 803.

A stout, orange coloured hydroid with branches arising more or less definitely in one plane. It sometimes reaches a height of several inches, but is more often stunted and is frequently less than an inch high. A single tall colony was obtained at Rameswaram, about as tall as the type but of much more straggly and irregular growth. Small colonies were found on the under sides of stones at Pamban and on Shingle Island. It has also been found on a worm tube at the entrance to Madras harbour. The type came from the Cape Verde Islands.

Family CORYNIDAE.

This family differs from the Turridae chiefly in having all the tentacles capitate instead of filiform. The tentacles are usually scattered, but are occasionally concentrated into two or more whorls.

Genus Syncoryne, Ehrenberg.

Tentacles more or less scattered. Gonophores in the form of free medusae.

Syncoryne sp.

Pl. II, fig. 3.

This curious form of *Syncoryne* was found growing among *Sertularia gracilis* and other hydroids on concrete at the base of one of the piers of the bridge over Pamban Channel. A few specimens have also been found on stones on the western part of the reef south of Krusadai Island. It is very inconspicuous.

The hydrocaulus is unbranched and extremely slender. It is always, however, well developed and often a centimetre in length or even a little more. In well expanded specimens the tentacles are found to be concentrated round the middle of the hydranth, where they seem to be arranged in three closely approximated whorls. The gonophores are borne at the base of the hypostome immediately above the tentacles. None that have been seen are mature, but they resemble the early stages of free medusae.

A similar arrangement of the tentacles is recorded by Hartlaub (1905, p. 526) as of frequent occurrence in the hydranths of *S. mirabilis*, Agassiz.

Clavatella multitentaculata, Warren (1908, pp. 278–280, pl. xv figs. 7–9) is evidently closely related to the present species and should, I think, be transferred to the genus *Syncoryne* in view of the position in which the gonophores arise.

Family BOUGAINVILLIIDAE.

A single circlet of filiform tentacles; no capitate tentacles; hypostome conical.

Genus Bimeria, Wright.

Branched colonies with the body and lower part of each tentacle of the hydranths protected by a membrane. Gonophores in the form of sporosacs on the stem and branches.

Bimeria vestita, Wright.

Pl. II, fig. 5.

Bimeria vestita, Allman, 1871-2, pp. 297–8, pl. xii figs. 1–3.

A widely distributed species abundant under stones on Krusadai and Shingle Islands, where its small dirt-encrusted colonies often form a dense growth. It also occurs on seaweed on Krusadai Island and under the bridge at Pamban.

A closely allied species, *B. fluminâlis*, has been described by Annandale (1915, pp. 111–114, pl. ix figs. 3–3*a*, text fig. 10) from the Chilka Lake, differing in the thinner and

less conspicuous covering of the base of the hydranth and tentacles, and in the spadix of the gonophores which is median but unbranched in the male and lateral instead of basal in the female. In the Krusadai specimens all these characters except that of the female gonophore are found to be variable, which throws some doubt on the distinctness of the two species.

Family EUDENDRIIDAE.

Tentacles as in the Bougainvilliidae; hypostome trumpet-shaped.

Genus Eudendrium, Ehrenberg.

Gonophore in the form of sporosacs, borne on the body of the hydranth below the tentacles, or on the stem.

Eudendrium album, Nutting.

Pl. II, fig. 4.

Eudendrium album, Nutting, 1898, pp. 362–363, pl. xiv fig. 1.
Eudendrium album, Fraser, 1912, p. 348, text fig. 5.

A small species of *Eudendrium* found at the base of a tuft of brown seaweed in the western part of the south shore of Krusadai Island, on stones on Shingle Island, among *Tubularia* stems at Pamban and on a *Thuiaria* stem at the entrance to Madras harbour, has the characteristic manner of growth and general structure of this species, the low irregular and almost unbranched habit of which gives it a superficial resemblance to *Perigonimus*. It was first described from the south of England and has since been recorded from the east coast of the United States.

Like *E. parvum*, Warren (1908, p. 272, pl. xlv figs. 1–4, text fig. 1) from Natal it is less definitely branched than the allied *E. capillare*, Alder (see Allman, 1871–2, pp. 335–336, pl. xiv figs. 1–3). *E. parvum* was described from a male colony only, in which the hydranths of the blastostyles were aborted and the gonophores three-chambered. In *E. album* the hydranths of the blastostyles are little if at all aborted, and the male gonophores are two or three-chambered (Fraser). Practically all our specimens are female and I have only succeeded in finding a single male polyp among them for examination. Its hydranth is well-developed and its gonophores two-chambered. The female gonophores appear always to arise on the hydranths, as those containing ova are all situated in this position; but those containing developing planulae are found thickly scattered along the stems.

?Eudendrium sp.

Pl. III, fig. 22.

It is with some hesitation that a hydroid is provisionally referred to this genus which was found growing in luxuriant masses on the stems and leaves of a phanerogamic seaweed in the shallow bay north of the channels connecting Kutikal backwater with the sea. Its large polyps and dense but irregular growth give it a superficial resemblance

to *Tubularia*; but the tentacles, though extremely numerous, form a single dense girdle round the widest part of the polyp, and the gonophores arise immediately below them. All the mature gonophores which have been examined have been male. The narrowest part of the polyp is at the base of the hypostome, which swells out to some extent beyond it. Whether in a fully expanded condition it would assume the trumpet-shaped form characteristic of the Eudendriidae was unfortunately not observed. The living polyps are of a rich brown colour.

Family PENNARIIDAE.

Hydranths with a circlet of filiform tentacles near the base and scattered or whorled capitate tentacles between these and the mouth.

Genus Pennaria, Goldfuss.

(Pennaria + Halocordyle.)

Symmetrically branched colonies with well-developed perisarc; gonophores, in the form of free medusae, developed immediately above the filiform tentacles.

Pennaria disticha, Goldfuss.

Pl. II, fig. 1.

Pennaria cavolinii, Auct.
Pennaria australis, Bale, 1884, pp. 45–46.
Pennaria australis var. *cooperi*, Warren, 1908, pp. 282–284.
Pennaria disticha var. *australis*, Ritchie, 1910, pp. 806–807 and 829.

This beautiful and widely distributed hydroid is abundant under the bridge at Pamban and to a less extent on Shingle Island. It is also found on Krusadai Island and at the entrance to Madras harbour. The colonies vary greatly in size and robustness according to the situation in which they grow and may attain a height of about 3 inches. In detail they agree better with Bale's description of *P. australis* than with Allman's description of *P. cavolinii*, especially as regards the ringing of the pedicels of the hydranths; but as a specimen, almost certainly from Naples, with which I have compared them, also has the pedicels ringed at the base only, I am unable to follow Ritchie in regarding *australis* as a distinct variety. Stechow (1920, pp. 7–8) describes the variability in the ringing of the pedicels in specimens from Naples even in single colonies. Hargitt (1924, pp. 476–477) disagrees with Stechow, but does not controvert his facts.

Family TUBULARIIDAE.

Hydranths with two circlets of filiform tentacles, one near the base and the other round the mouth.

Genus Tubularia, Linnaeus.

Gonophores borne in clusters on blastostyles arising immediately above the proximal tentacles.

Tubularia sp.

Tubularia gracilis, Thornely (*nec* von Lendenfeld), 1924, p. 111.

Two small colonies, apparently identical with the species doubtfully referred by Miss Thornely to the Australian *T. gracilis*, von Lendenfeld, were found under Pamban bridge in 1922 and 1925 respectively. The blastostyles are very short and erect; they appear to be slightly more numerous than in Miss Thornely's specimens. In none of the gonophores are gonads distinct, though many show the four lobes very clearly and in one or two a single tentacle is developing. Probably, therefore, the gonophores are destined to be liberated as monotentaculate medusae. In *T. gracilis*, on the other hand, "The medusostyles are highly rudimentary and small. They appear to be simple ovoid sacs" from which von Lendenfeld obtained well-developed actinulae (von Lendenfeld 1884, pp. 597-598).

Order Calyptoblastea.

The classification of this group is based on that adopted by Hincks (1868). The greater part of it has been revised and brought up to date by Nutting (1900, 1904 and 1915), but the Haleciidae, Campanulinidae, Lafoeidae, and one or two smaller families still remain to be dealt with. The system adopted here, as already indicated, is that of the Cambridge Natural History, except that the Eucopidae are merged in the Campanulariidae.

Family CAMPANULARIIDAE.

Hydrothecae pedunculate, campanulate or tubular, without operculum. Hydranths with trumpet-shaped proboscis. See also Nutting, 1915.

Genus Orthopyxis, Agassiz.

Colony consisting of unbranched pedicels springing from a creeping hydrorhiza; perisarc of most or all of the zooids greatly thickened, decreasing the cavities of the hydrothecae; gonothecae ovoid or compressed, not greatly lengthened or attenuated; gonophores not liberated.

Orthopyxis everta (Clark).

Pl. II, fig. 10.

Orthopyxis everta, Nutting, 1915, pp. 67-68, pl. xvi figs. 6-8.

An inconspicuous little hydroid not uncommon on the stems of seaweeds both on Krusadai and Shingle Islands and under Pamban bridge. It has also been found on *Lytocarpus* stems. It has previously been recorded from the Pacific coast of America and the Antarctic. The hydrothecae in our specimens, as in those recorded by Nutting and others, are extremely variable, their more or less strongly denticulate margin being their most distinctive feature. The gonothecae are relatively larger than are those described by Nutting. They are more or less smooth, not distinctly ringed as in so many other species.

Family SERTULARIIDAE.

Hydranths with conical or dome-shaped hypostome and a single verticil of filiform tentacles. Hydrothecae almost always sessile, adnate or more or less embedded in the hydrocaulus, definitely arranged in more than a single row. An operculum composed of from one to four parts almost always present. Nematophores wanting. Gonophores never liberated. See also Nutting, 1904.

Genus Calamphora, Allman.

Hydrothecae arising from a creeping stolon, usually more or less distinctly pediculate, closed by an operculum of four flaps.[1]

Calamphora campanulata (Warren).

Pl. II, fig. 9.

Sertularella campanulata, Warren, 1908, pp. 300–392, pl. xlvii figs. 21–22.
Calamphora campanulata, Stechow, 1920, p. 83.

A minute hydroid found creeping on the stems of seaweeds and on the stones to which they are attached. The species was originally described from Natal. The transversely corrugate, barrel-shaped hydrothecae are supported on short (almost rudimentary) unbranched and more or less distinctly ringed pedicels which spring directly from the hydrorhiza, usually at an angle of about 45°. The mouth of the hydrotheca bears four strong denticles situated at the points where the flaps of the operculum meet. The gonosome is unknown. *C. campanulata* differs from *C. parvula* (Allman, 1888, p. 29, pl. x figs. 3-3*a*) in the presence of short but distinct and more or less clearly annulated pedicels below the hydrothecae. In *C. solitaria* (Nutting, 1904, pp. 89–90, pl. xx figs. 10–11) the pedicels are nearly as long as the hydrothecae and are not ringed. *Thyroscyphus intermedius*, Congdon, is also referred to this genus by Stechow, but I have not seen a description of it.

Genus Thyroscyphus, Allman.

Colonies erect, branching. Hydrothecae more or less distinctly pediculate and with an operculum of four flaps, as in the preceding genus.

Thyroscyphus juncea (Allman).

Pl. II, fig. 8.

Campanularia juncea, Allman, 1876, pp. 260–261, pl. xi figs. 3–4.
Campanularia juncea, Thornely, 1904, pp. 113–114, pl. i figs. 1–1*b*, text figs. 1–3.
Thyroscyphus vitiensis (Marktanner-Turneretscher) Ritchie, 1910, pp. 7–8.

Large colonies of this fine hydroid are abundant under the bridge at Pamban and at greater depths on the chank beds at Rameswaram. Allman's description and figures of the type specimen of *Campanularia juncea* from Ceylon fit this species so perfectly that, like Miss Thornely, I am convinced they must really apply to it although, as in

[1] Allman describes it as "inoperculate" but was apparently mistaken in this. See Nutting, 1904, p. 89.

the type of the preceding genus, he overlooked the operculum and so failed to recognize it as a *Thyroscyphus.*

Genus Sertularella, Gray.

Hydrothecae biserial, strictly alternate, with a well-marked operculum of three or four flaps and usually three or four marginal teeth. When the teeth are absent the operculum, though always present, is less easy to detect.

Sertularella spp.

Two species of *Sertularella* have been found at Pamban, a minute one on slender seaweed and a much larger one on the stems of *Lytocarpus spectabilis.* In both the operculum is four-flapped and the teeth on the margin of the hydrotheca are somewhat obscure.

Genus Thuiaria, Flemming.

Hydrothecae normally sub-opposite to alternate, more than two to each internode, more or less immersed in the hydrocaulus; margin never with more than two teeth, always with operculum of one abcauline or two flaps. Internodes varying greatly in length.

Thuiaria interrupta, Allman.

Pl. II, figs. 7 and 12.

Thuiaria interrupta, Allman, 1886, p. 145, pl. xvi figs. 8–10.
Thuiaria tubuliformis (Marktanner-Turneretscher, 1890), Nutting, 1904, p. 70, pl. xi figs. 1–8.
Thuiaria tubuliformis, Warren, 1908, pp. 314–316, text fig. 12.

A somewhat variable species, of which the most compact and robust form was first described by Allman from Australia, the looser forms having since been recorded by various authors under the name *tubuliformis* from America, Natal and the Red Sea.

Robust colonies with straight main stem, from about two to three inches in height, were collected under Pamban bridge in 1922. They agree with Allman's description, and differ from his figure only in having two hydrothecae to each internode of the main stem on the side opposite to the branch, instead of three on both sides. To have one hydrotheca more on the branch side than on the other is, however, the rule in the genus; and as Allman's material was dried it is not unlikely that his figure may be inaccurate in this respect. On the same occasion smaller colonies about one inch high were found on a worm-tube. In these, as in the others, the branches are robust with overlapping hydrothecae; but the main stem is thinner and more geniculate, being scarcely distinguishable from the branches in general appearance. Specimens found on stones in 1924 on Krusadai Island are slightly more slender still and the nodes of the main stems usually have 2+1 hydrothecae as described for *tubuliformis* instead of 3+2; the hydrothecae still overlap, but little or no more than in Nutting's fig. 3. Still more slender colonies were obtained from Shingle Island in 1924 and similar ones obtained there

in 1914 are in the Madras Museum collection. In these the hydrothecae are separated as is apparently usual in *tubuliformis*.

Another point of considerable interest in connexion with this species is that in a single colony gonothecae may be found arising both direct from the stem as is usual in the genus or, quite as frequently, from the mouth of a hydrotheca as in the genus *Synthecium*.

Genus Diphasia, Agassiz.

Hydrothecae biserial, opposite or alternate, aperture broad, operculum evident, of a single adcauline flap. Gonangia usually differing in the sexes and with marked spines or lobes; an internal marsupium usually present in the female.

Diphasia digitalis (Busk).

Pl. III, fig. 15.

Desmoscyphus acanthocarpus, Allman, 1888, pp. 73-74, pl. xxxv figs. 2-2c.
Diphasia digitalis (Busk) Nutting, 1904, pp. 110-111, pl. xxx figs. 2-7.

Colonies of this species an inch or two in height were found among *Telesto* at Pamban in 1925. They are of a bluish grey colour and are without gonangia. The long tubular hydrothecae are strictly opposite, the two members of a pair being separated on the main stems where they are borne laterally, and in contact on the branches where they are borne on the front. They are somewhat more definitely turned outwards distally than is usual in American specimens, judging from Nutting's figure.

For records of the occurrence of this widely distributed species see Nutting (1904, p. 111) supplemented by Billard (1925, p. 209).

Genus Pasythea, Lamouroux.

Hydrothecae biserial, strictly opposite, arranged in groups of pairs, a group to an internode, the upper pairs of each group being smaller than the lower and differing from them in shape.

Pasythea quadridentata (Ellis and Solander).

Pl. II, fig. 6.

Pasythea quadridentata (Ellis and Solander, 1786), Bale, 1884, pp. 112-113, pl. vii fig. 3.
Pasythea quadridentata, Nutting, 1904, p. 75, pl. xiii figs. 4-7.
Pasythea quadridentata, Warren, 1908, pp. 312-314, text fig. 11.

A widely distributed species, found under Pamban bridge and on Krusadai Island on stems of seaweeds and *Lytocarpus*. Though never more than about half an inch high this hydroid is easily recognized on account of its very compact and sharply separated groups of hydrothecae, usually two or three pairs in each group. The mouth of each hydrotheca is closed with a two-flapped operculum, and has a distinct tooth on either side and a smaller one above. The hydrorhiza is provided with internal ribs of perisarc as described by Warren.

Genus Sertularia, Linnaeus.

Hydrothecae in strictly opposite or (rarely) sub-opposite pairs. Stem and branches normally divided into regular internodes, each of which bears a pair of hydrothecae, but sometimes more than one pair to an internode, in which case the hydrothecae are always strictly opposite. Operculum normally of two flaps.

Sertularia gracilis, Hincks.

Pl. II, figs. 13–14.

Sertularia gracilis (Hassal, MS.) Hincks, 1868, pp. 262–263, pl. liii figs. 2–2*b*.
Sertularia gracilis, Nutting, 1904, p. 59, pl. iii fig. 10.
Sertularia gracilis, Thornely, 1904, p. 116, pl. ii fig. 3.

Abundant on the stems of seaweeds and *Lytocarpus* under Pamban bridge; also found on Krusadai Island.

Hincks' two figures of the hydrosome of this species from Britain indicate considerable variation. Our specimens agree with the less attenuated of his two figures. Miss Thornely's Ceylon specimens, on the other hand, were even more attenuated than his other figure. Miss Thornely does not mention the gonosome, which is absent in our specimens also. In our specimens many of the stems end in tendrils terminated in the curious discs recorded by Miss Thornely in *S. ligulata*. The species is also recorded from America.

Genus Idia, Lamouroux.

Hydrothecae adnate to the hydrocaulus, encroaching on each other in the terminal branches. Operculum adcauline.

Allman (1888, pp. lii and 82-83) regarded the unusual structure of the coenosarc as necessitating the establishment of a distinct family Idiidae for this genus. I prefer to follow Bale (1884, p. 113) who placed it among the Sertulariidae.

Idia pristis, Lamouroux.

Pl. III, fig. 21.

Idia pristis, Bale, 1884, pp. 113–4, pl. vii figs. 1–2 xix 33.
Idia pristis, Allman, 1888, pp. 83–87, pl. xxx x figs. 1–10.
Idia pristis, Billard, 1907, pp. 351–352; 1925, pp. 219–222, text fig. lviii, pl. vii fig. 33.

Small colonies of this stout Sertularian were collected under Pamban bridge in 1925, and much larger ones were found in deeper water on the chank beds at Rameswaram in 1924. In both cases the characteristic gonothecae were present.

The hydrothecae of opposite sides are in contact with one another on the branches, but are separated on the main stems.

The species has already been recorded from many localities extending from New Zealand, Australia and Japan, to Katiawar in Western India and Pemba of the east coast of Africa.

Family PLUMULARIIDAE.

Hydrothecae developed on one side only of their supporting branches (hydrocladia) and more or less adnate to it. Nematophores always present. See also Nutting, 1900.

Genus Plumularia, Lamarck.

Colonies pinnate, each hydrocladium bearing more than one hydrotheca. Hydrothecae with smooth margins. All the nematophores movable. Gonangia not protected by special branchlets or by modifications of the hydrocladia.

Plumularia tenuis, Warren, var. pambanensis, n. var.

Pl. II, fig. 11.

Plumularia tenuis, Warren, 1908, pp. 316-318, text fig. 13.

This delicate little hydroid is common on seaweed under Pamban bridge and also occurs on Krusadai Island. It is closely allied to the widely distributed *P. setacea* (Ellis) from which it differs chiefly in the larger male gonothecae and more broadly ovate female gonothecae, and in the formation at the mouth of the latter, when the ova are extruded, of an external marsupium in which they develop into planulae. All the gonothecae I have examined have been female. They are broad in one direction but much flattened in the other, being oval in section. Though flattened distally when immature, as described by Warren, they become pointed with subterminal aperture before maturing; and the ova in most if not all cases develop on two sides of the spadix instead of on one only. It must therefore be regarded as a distinct variety of the Natal form.

Plumularia sp. nr. alternata, Nutting.

Pl. III, figs. 19-20.

A somewhat taller and more sparsely branched species than the last was found attached to stones on Shingle Island and has also been found at Pamban; but in the absence of the gonosome it is impossible to determine the genus with certainty. If it is a *Plumularia* it must be very near *P. alternata* Nutting (1900, p. 62, pl. iv figs. 1-2), from which it differs in the absence of athecate internodes from the hydrocaulus (though not from the hydrocladia), these being represented, however, by the single nematophore which they bear in that species. The supracalycal nematophores are, moreover, somewhat shorter, not quite reaching the margins of the hydrothecae.

A smaller form, very like *P. tenuis* var. *pambanensis* in size, occurs on seaweed at Pamban. It differs from the Shingle Island form in having the hydrothecae much larger and closer together.

Hydroids of this group are distinguished from those of the *setacea* group by the presence of hydrothecae on the hydrocaulus as well as on the hydrocladia.

Genus Lytocarpus (Kirchenpauer) Allman.

Stem usually fascicled; hydrothecal margin strongly toothed or sinuous; a prominent perforated process at the base of each hydrocladium; nematophores not movable; gonosome borne on protective branchlets, each of which is a modified hydrocladium; these may be aggregated into a pseudocorbicula, but true corbiculae (each formed by the growth of leaf-like processes from a single hydrocladium) are not present.

Lytocarpus sp. nr. graeffei (Kirchenpauer).

Pl. III, fig. 17.

A group of plumose but otherwise simple and unbranched colonies, none of them more than 15 mm. in height, was found growing on a stone on Shingle Island, mixed with colonies of the still smaller and slenderer *Plumularia sp.* nr. *alternata.*

The small size and unbranched monosiphonic stems of these colonies suggest affinity with *L. graeffei* (Kirchenpauer, see Stechow, 1920, pp. 128–130 fig. x), a species which it further resembles in having the hydrocladial nematophores practically straight and reaching about to the margin of the hydrotheca with which they are associated, and in having two cauline nematophores on the front of each internode of the stem and none on the back. It differs, however, in having a much thicker (though somewhat short and rounded and consequently inconspicuous) intrathecal ridge, and a strongly developed median tooth to the margin of the hydrotheca, which is more strongly elevated laterally. The intrathecal ridge closely resembles that of *Halicornaria intermedia,* Billard (1913, p. 65, text fig. 53, pl. iv fig. 37) of which the genus is uncertain, the gonophores being unknown. The stems of that species are, however, polysiphonic, and the manner of growth somewhat different.

A single colony may bear both male and female gonothecae, one to each of the modified hydrocladia. These hydrocladia are very like those of *Lytocarpus spectabilis* in form, but are much smaller, scarcely reaching the top of the gonotheca instead of far beyond it. There is a single hydrotheca on the proximal segment of each hydrocladium, the gonotheca being borne on the next segment. The usual three nematophores are present on these two segments; on subsequent segments the median one is (? always) absent.

Lytocarpus spectabilis, Allman.

Pl. III, fig. 16.

Lytocarpus spectabilis, Allman, 1883, pp. 43–45, pl. xv, text fig. 2.

A number of colonies of this handsome species were found growing on the piers of Pamban bridge. Though not met with at more than one or two places, it was very abundant wherever it was found at all. It was originally described from the Philippine Islands and Torres Straits.

The colonies attain a height of about 17 cm. They are compoundly pinnate and of brownish colour. They do not sting. The mesial nematophore is very prominent. The

margin of the hydrotheca has a very weak median tooth but has two very strong teeth on each side; the intrathecal ridge, though thin and laminar, is very long.

The gonangia are of the same type as those of the preceding species, but a single modified hydrocladium sometimes bears more than one gonotheca. The mesial nematophore may be present on some of the distal segments of these hydrocladia.

Lytocarpus philippinus (Kirchenpauer).

Pl. III, fig. 18.

Lytocarpus philippinus, Nutting, 1900, pp. 122–123, pl. xxxi, figs. 4–7.
Lytocarpus philippinus, Ritchie, 1910, pp. 20–21.
Lytocarpia philippina; Stechow, 1920, pp. 132–134, text fig. Z.

A widely distributed species which is abundant under the bridge at Pamban and also occurs on Krusadai Island and at the entrance to Madras harbour. It forms arborescent colonies with dark stems and white hydrocladia. It stings like a nettle when touched. The intrathecal ridge is strongly developed, thick and somewhat acute. The median tooth and broad lateral lobes of the hydrothecal margin, though distinct, are very low.

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PLATE II.

Gymnoblastea and Calyptoblastea.

Fig. 1. *Pennaria disticha.*
„ 2. *Corydendrium dendriforme.*
„ 3. *Syncoryne sp.*, two polyps contracted to different extents.
„ 4. *Eudendrium album.*
„ 5. *Bimeria vestita*, female colony with a pycnogonid gall.
„ 6. *Pasythea quadridentata.*
„ 7. *Thuiaria interrupta*, robust form.
„ 8. *Thyroscyphus juncea.*
„ 9. *Calamphora campanulata.*
„ 10. *Orthopyxis everta.*
„ 11. *Plumularia tenuis* var. *pambanensis.*
„ 12. *Thuiaria interrupta*, slender form showing gonophores arising (1) direct from the stem and (2) from the mouth of a hydrotheca.
„ 13. *Sertularia gracilis*, showing tendril.
„ 14. *Do.* from in front.

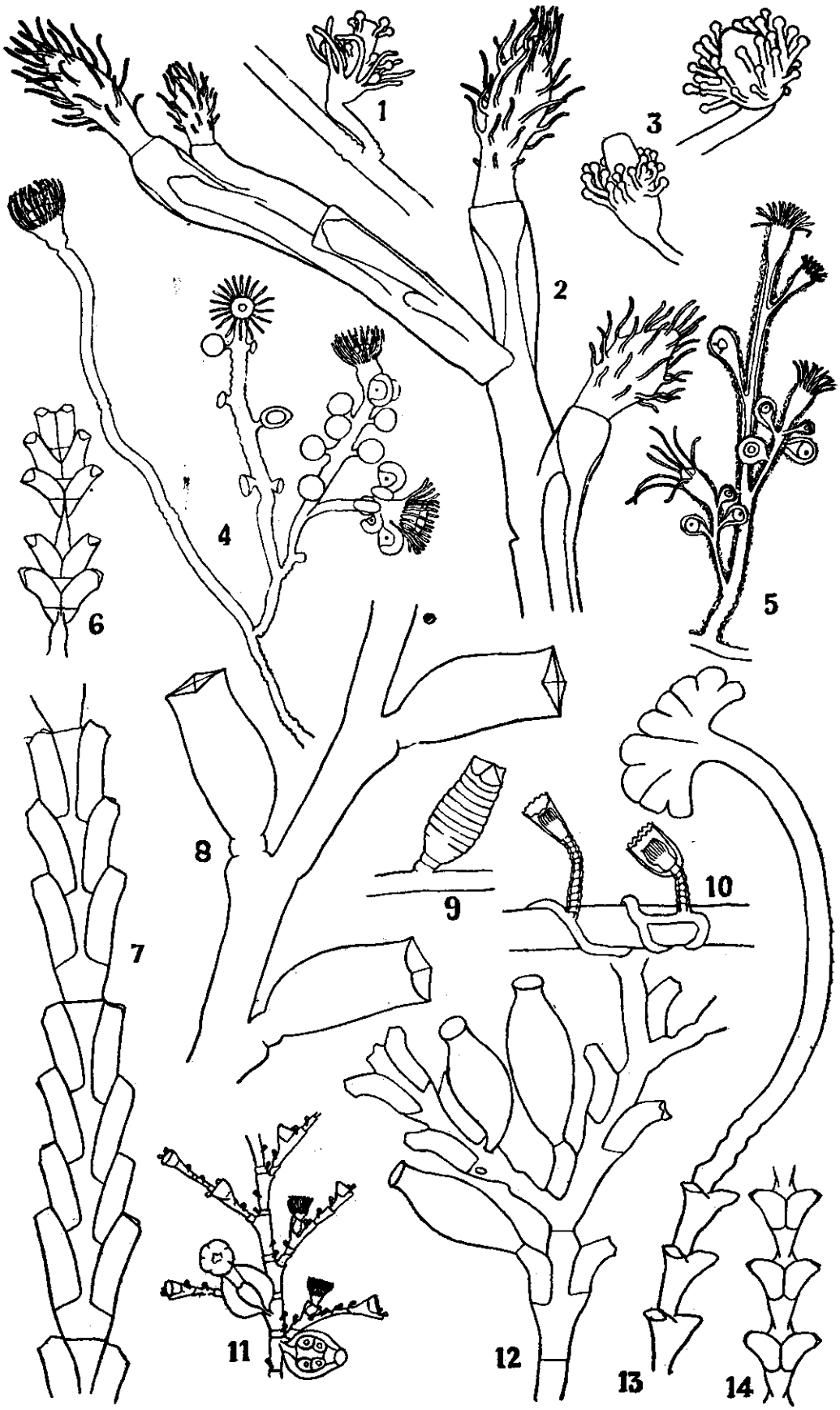

PLATE II.—KRUSADAI HYDROIDS.

PLATE III.

Gymnoblastea and Calyptoblastea.

Fig. 15. *Diphasia digitalis.*
„ 16. *Lytocarpus spectabilis.*
„ 17. *Lytocarpus sp.* nr. *graeffei.*
„ 18. *Lytocarpus philippinus.*
„ 19. *Plumularia sp.* nr. *alternata.*
„ 20. *Do.* var.
„ 21. *Iaia pristis*, main stem with gonothecae (from Allman).
„ 22. *Eudendrium sp.* (× 6).

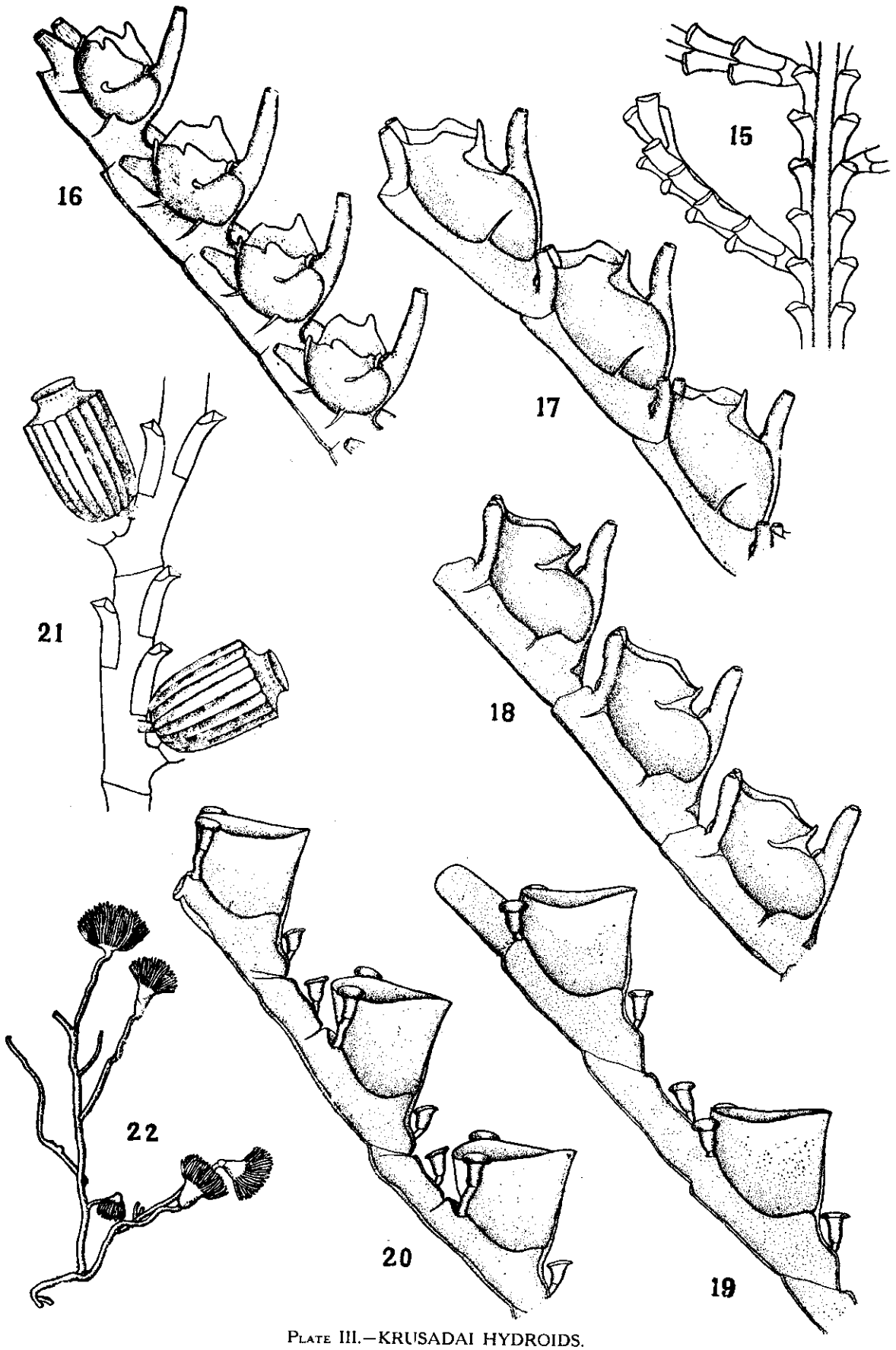

PLATE III.—KRUSADAI HYDROIDS.

Order Siphonophora.

By B. SUNDARA RAJ, *M.A., Ph.D.*

The classification adopted is that in the Cambridge Natural History.

Suborder Physophorae.

Family RHIZOPHYSALIIDAE.

Genus Physalia, Lamarck, 1801.

In the "Portuguese Man-of-War" the pneumatophore is a large bladder-like vesicle. Zooids are arranged in horizontal rows on the under side of the pneumatophore.

Physalia utriculus (La Martiniere), 1787.

Pl. IV, figs. 2-2B.

The literature on *Physalia* is very extensive and confusing. The Indo-Pacific forms have been assigned to a single species, *Physalia utriculus*, by recent writers (Chun, Lens and Bigelow). The most important difference between the Atlantic and Indo-Pacific species is that only one large tentacle is developed in the latter and no "Haupttentakel" is developed in the distal region as in the Atlantic species. For detailed anatomy of the species reference should be made to the following papers:—Huxley, "The Oceanic Hydrozoa," *Roy. Soc., London*, p. 101, pl. x & xii (1859), and Lens and Van Riemadijk, "The Siphonophora of the Siboga Expedition," Monograph 38 (1908).

Family CHONDROPHORIDAE.

A large polythalmic pneumatophore and a single large central gastrozooid are the distinguishing characters of the family.

Genus Porpita, Lamarck, 1801.

Colony disc-shaped and circular without a sail or crest.

Porpita pacifica, Lesson, 1826.

Pl. IV, figs. 1-1A.

The *Porpitae* of the Indo-Pacific and Atlantic oceans have been described under many names. There seem however to be only two species *P. pacifica*, Lesson; and *P. umbella*, O. F. Müller. The characters which distinguish *P. pacifica* from *P. umbella* according to Bigelow are (1) the tubercles on the upper surface of the disc, (2) the greater number of stalked nematocyst knobs (cnidospheres) on the marginal tentacles, (3) the more completely branched limbar canals, and (4) the fewer open stigmata on the disc.

The specimens collected at Krusadai Island range in size from 24 mm. to 33 mm. in the diameter of the disc, including the soft marginal rim. The surface is tuberculate in all, but specially so in the larger ones. The following is the number of cnidospheres on the tentacles :—

24 mm. specimen ... ... 20, 11, 11, 4 terminal knobs.
33 mm. specimen ... ... 24, 11, 12, 4 terminal knobs.

Only 4 or 5 concentric rows of tentacles are present. There are no open stigmata in the central part of the disc in the larger specimens. I therefore refer them to the species *P. pacifica*, Lesson.

Genus Velella, Lamarck.

Disc elliptical, often quadrangular, with a polythalamous pneumatocyst composed of concentric rings and usually bearing diagonally a vertical crest. Marginal tentacles simple without cnidospheres.

Velella sp. is reported to occur in the Gulf of Manaar but no specimens were collected at Krusadai.

LITERATURE FOR SIPHONOPHORA.

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PLATE IV.

Siphonophora.

Porpita pacifica, Lesson.

1. *Dorsal view of the disc—*
   - (*a*) Rows of stigmata or dorsal pores.
   - (*b*) The margin of the disc.

1A. *A vertical section—*
   - (*a*) Concentric chambers of the polythalamic pneumatophore.
   - (*b*) Single central gastrozooid.
   - (*c*) Horizontal rows of gonozooids bearing medusiform gonophores.
   - (*d*) Dactylozooids or marginal tentacles.
   - (*e*) Cnidophores.
   - (*f*) "Liver" with tracheae.

Physalia utriculus (La Martiniere).

2. *Complete colony—*
   - (*a*) Pneumatophore.
   - (*b*) The single long tentacle.
   - (*c*) Dactylozooids.
   - (*d*) Other tentacles.

2A. *A typical group of dactylozooids from the narrow end of pneumatophore.*

2B. *A gonodendron—*
   - (*a*) Gonophore.
   - (*b*) Gonocalyx.
   - (*c*) Dactylozooid or gonopalpon.
   - (*d*) Gastrozooid.

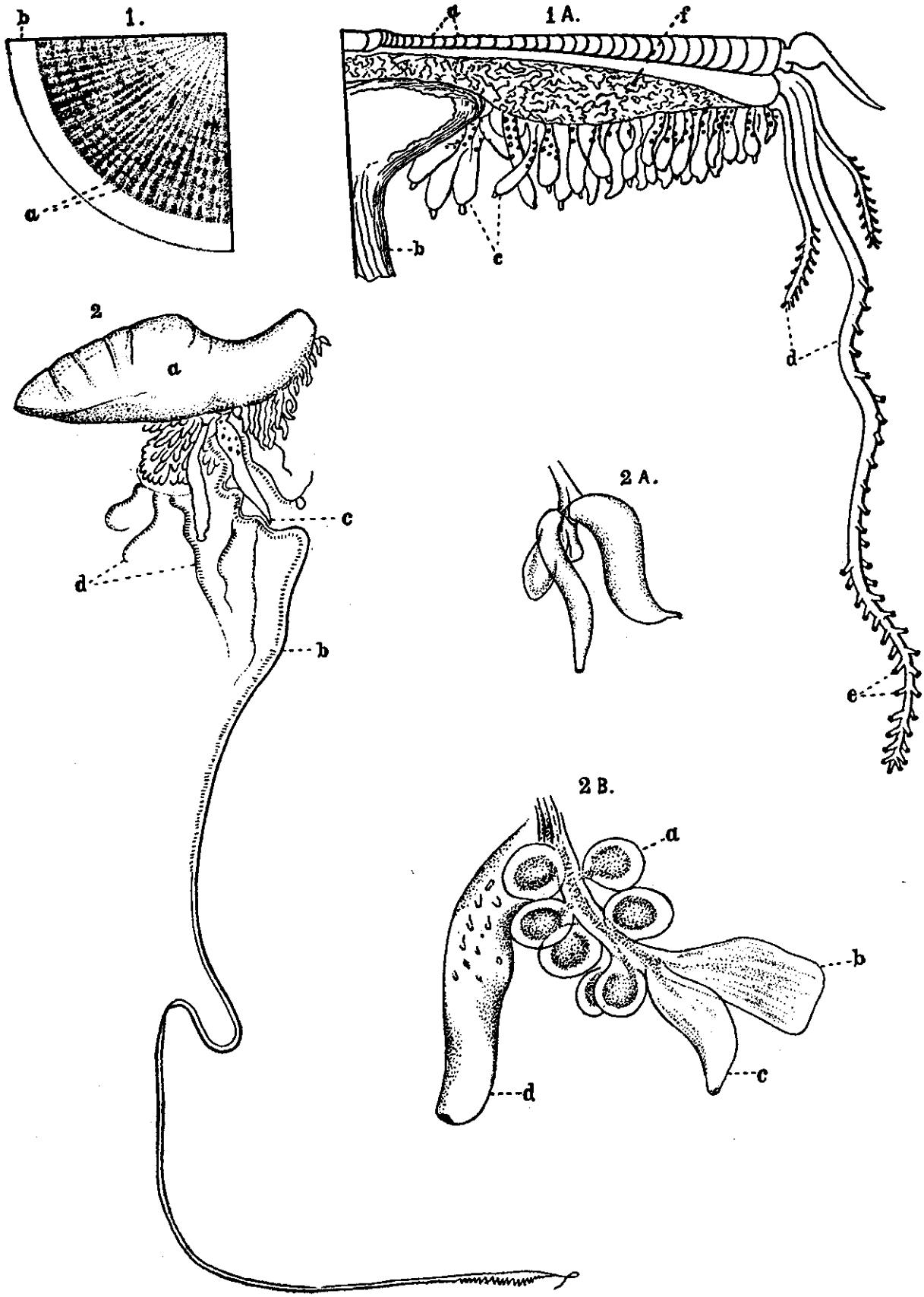

PLATE IV.—KRUSADAI SIPHONOPHORA.

Class Anthozoa.

Subclass Alcyonaria.

By F. H. GRAVELY, *D.Sc.*

The classification followed is that adopted by Bourne in Lankester's Treatise on Zoology.

Order Stolonifera.

Family CORNULARIIDAE.

Clavularia ? crassa (Milne-Edwards).

Pl. V, fig. 1.

Cornularia crassa, Milne-Edwards, in Cuvier 1836-1849, X, Zoophytes, pl. lxv figs. 3-3*b*.
Cornularia crassa, Milne Edwards, 1857, p. 106, pl. B1 fig. 4.
Clavularia crassa, Kowalevsky and Marion, 1883, pp. 8-14, pl. I figs. 1-1*d*, II 1-11.

A species of *Clavularia* is abundant on the under sides of stones on the south-eastern shore of Shingle Island, and is more rarely found in similar situations on Krusadai Island. But its zooids, which are scarcely a centimeter high when expanded, faintly tinted with orange pink and to a large extent transparent, are somewhat inconspicuous. It agrees closely with Milne-Edwards' figures and description of *C. crassa* from Algeria. Kowalevsky and Marion, however, distinguish two species which are apparently identical in appearance. The name *crassa* they confine to an oviparous form which is found only on the plant *Posidonia caulini* (though it seems to me more likely that fig. 3 of Milne-Edwards, 1836-49, represents a stone) introducing the name *petricola* for a viviparous form found only on stones. The present species lives exclusively on stones so far as I have seen: but as fully developed eggs and no planulae have been in the polyps it is almost certainly oviparous. Its specific identity is therefore open to some doubt. The differences in spicules indicated by Kowalevsky and Marion are not sufficiently definite to settle the matter.

Anthelia sp.

Pl. V, fig. 2.

The genus *Anthelia*, which is not included among the genera defined by Bourne, resembles *Sympodium* in having an expanded membraneous base in which the proximal portions of the zooid cavities are sunk, but has non-retractile polyps (see Milne-Edwards, 1857, p. 104).

An extensive colony was found encrusting a mass of dead coral that was raised from two or three feet of water in Porites Bay, and another on rock just covered at low tide in the same bay. They were of a dark purplish brown colour, the back of each tentacle contrasting with the rest as a creamy white stripe on account of the densely packed minute spicules which there form a superficial protective layer. These spicules are smooth flattened discs, usually two or three times as long as broad and oval in outline with a more or less distinct constriction in the middle; more rarely they are as long as broad, with two constrictions at right angles to each other. The greater part of the spicule is finely granular, but the middle is clear. Such spicules are also found in other parts of the colony, but are very sparsely scattered there. No warted or other kind of spicule is present.

The polyps in the first colony are very small, scarcely attaining a height of 2 mm. and are aggregated into dense clusters which thickly cover the basal expansion. The tentacles are short and thick with short lateral pinnules. In the second colony, from which the figure was prepared, they were larger and more elongate, and were united in their basal portions to form a small fleshy stem, thus affording a transition to the genus *Xenia*. In spite of this difference, which may well have been due to the different conditions under which they lived, the two colonies probably, I think, belong to a single species.

A useful synopsis of the chief characters of a number of species of *Anthelia* is given by Thomson and Henderson, who include them in the genus *Clavularia* (1906, facing p. 408).

Order Alcyonacea.

Family ALCYONIIDAE.

Four genera have been found on Krusadai Island, and as they are often somewhat difficult to distinguish from each other the following key is given. For further details regarding *Sarcophytum*, *Lobophytum* and *Sclerophytum*, see Pratt, 1906, p. 533.

1. Siphonozooids and large superficial canal system absent ... ... *Alcyonium.*
— Siphonozooids or large superficial canal system present ... ... 2.

2. Siphonozooids minute or absent, large superficial canal system present ... ... *Sclerophytum.*
— Siphonozooids present, large superficial canal system absent ... 3.

3. Young colonies often mushroom-shaped, older ones with lobed surface as in preceding genera; autozooids least, siphonozooids usually most, numerous on the margin ... ... *Lobophytum.*
— Colonies usually mushroom-shaped throughout life, autozooids most, siphonozooids least, numerous on the margin ... ... *Sarcophytum.*

Alcyonium pachyclados, Klunzinger.

Pl. V, fig. 3.

Alcyonium pachyclados, Klunzinger, 1877, pp. 24–25, pl. i figs. 5–5*b*.
Alcyonium pachyclados, Pratt, 1906, pp. 534–535.
Alcyonium pachyclados, Thomson and Henderson, 1906, p. 416.

Dead and dying colonies were washed up on Krusadai Island by the tide in large numbers in September 1922; living ones have been found in Porites Bay.

The colonies are tough and leathery, often very extensive, with a distinct basal portion devoid of zooids, surmounted by numerous short, thick lobes, set close together and themselves usually divided into more or less numerous subsidiary lobes. The polyps are extremely small; their tentacles contain minute opaque constricted-oval spicules very like those found in the tentacles of the above described species of *Anthelia*. In the general tissues of the colony the spicules have the form of short, thick, double clubs with both ends covered with short, thick, spines.

The species has previously been recorded from the Red Sea, Zanzibar, the Maldives, Luzon and (perhaps more doubtfully) from the Cape of Good Hope.

Sarcophytum ehrenbergi, Marenzeller.

Sarcophytum ehrenbergi, Marenzeller, 1886, pp. 356–359, pl. ix figs. 3–4.
Sarcophytum ehrenbergi, Pratt, 1905, p. 252.
Sarcophytum ehrenbergi, Pratt, 1906, p. 508, pl. xxviii figs. 1–2.

A single mushroom-shaped colony from the southern shore of Krusadai Island. The upper surface is concave, not convex as in the much younger colony figured by Pratt; and spicules identical with those figured by Marenzeller are abundant in the coenenchym, though those close to the surface are less slender. In other respects it agrees closely with the description.

The species has already been recorded from the Red Sea, Maldives, Ceylon, Malay Archipelago, Australia and Polynesia.

Lobophytum pauciflorum (Ehrenberg).

Pl. V, fig. 4.

Sarcophytum pauciflorum, Klunzinger, 1877, p. 29, pl. ii figs. 2–2*d*.
Lobophytum pauciflorum, Pratt, 1906, pp. 515–516, pl. xxviii fig. 7, xxix 12–14.

A single specimen of this species was found on Krusadai Island. The upper surface forms a number of flattened lobes about an inch in height. The spicules are identical with those figured by Klunzinger. The species is known to occur from New Zealand to the Red Sea.

Genus Sclerophytum, Pratt.

Pl. V, figs. 5 and 6.

Three species of this genus have been found on Krusadai Island and another at Rameswaram. The one which has been found at Rameswaram only is divided above into numerous parallel, slender, fleshy lobes. It is probably identical with *S. palmatum*, Pratt, from Ceylon and the Maldives (1906, pp. 525–527, pl. xxx fig. 26, xxxi 27), though in our specimens the tentacles are not well enough preserved to show the double row of rudimentary pinnules on each side, characteristic of the species.

S. querciforme, Pratt, from the Maldives and Gulf of Manaar (1906, pp. 530 and 532, pl. xxxi fig. 33) has been found both on Krusadai Island and at Rameswaram (see pl. v fig. 6). It may be recognized by its arborescent growth, looser and less regular than in *S. palmatum*.

The other two species found on Krusadai Island form somewhat thin but extensive and rather hard incrustations. In one of them, which occurs in Porites Bay, the upper surface bears numerous small, rounded or irregular lobes crowded with zooids (see pl. v fig. 5). This species is perhaps an encrusting form of *S. herdmani*, Pratt, from Ceylon (1905, pp. 253–254, pl. ii figs. 8–9), with which the spicules seem to agree. The lobes are, however, less crowded than appears to be indicated by Miss Pratt's figure. The last species is very hard indeed but has slightly smaller spindles. In other respects its spicules resemble those of the preceding. The zooids are, however, so small as to be scarcely visible to the naked eye; and the lobes are more widely separated and are compressed into ridges. I have been unable to find an account of any species with which to identify it. It is certainly distinct from all those in Miss Pratt's table (1906, p. 531).

Order Stelechotokea.

Of the two suborders into which this order is divided, only one, the Asiphonacea, is yet known to occur in the area under consideration. The other suborder, Pennatulacea, is, however, represented by a fine species of *Virgularia* in shallow water at Rameswaram, though the startling rapidity with which it disappears into the mud when in any way disturbed makes it somewhat difficult to capture.

Suborder Asiphonacea.

Family TELESTIDAE.

Telesto trichostemma (Dana).

Gorgonia trichostemma, Dana, 1848, pp. 665–666, pl. lix figs. 3–3*b*.
Telesto trichostemma, Wright and Studer, 1889, pp. 264–265.
Telesto (*Carijoa*) *trichostemma*, Thompson and Henderson, 1905, p. 319.

This is evidently a common and widely distributed form, having been recorded from Fiji, Torres Straits and the Gulf of Siam. It is very abundant in dark places under stones

beneath Pamban bridge. It also occurs at the entrance to Madras harbour. It forms somewhat slender, flexible colonies up to about 10 cm. in length. The stolons and stems are usually more or less covered with silt, but the comparatively large white polyps when expanded make it the most beautiful of all the littoral Alcyonaria of the district.

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PLATE V.

Fig. 1. *Clavularia ? crassa* × 4.

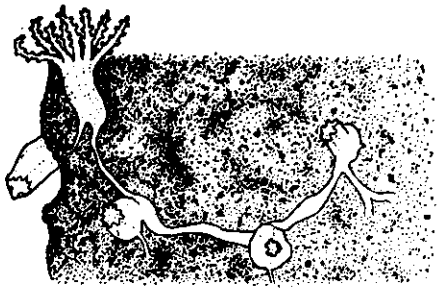
„ 2. *Anthelia sp.* × 6.

„ 3. *Alcyonium pachyclados* × 1.

„ 4. *Lobophytum pauciflorum* × 1.

„ 5. *Sclerophytum ? herdmani* × 1.

„ 6. *Do. querciforme* × 1.



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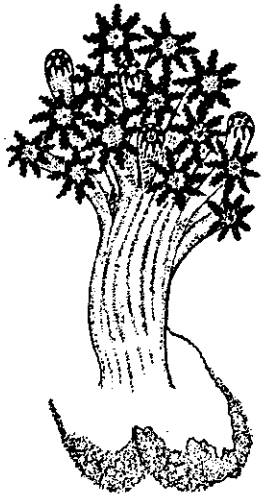

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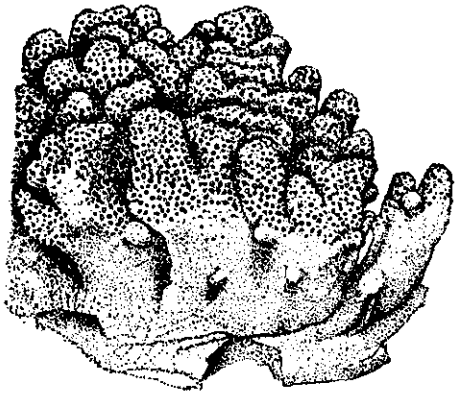

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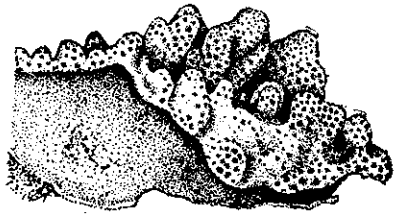

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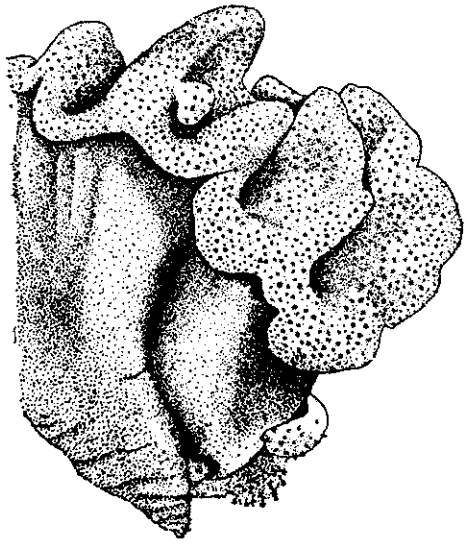

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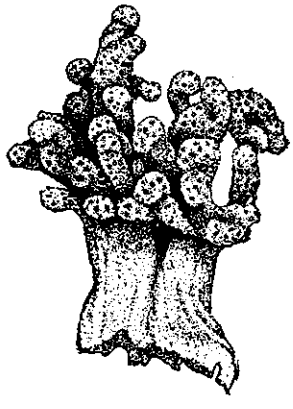

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PLATE V.—KRUSADAI ALCYONARIA.

Subclass Zoantharia (except Scleractiniae).

By Prof. K. RAMUNNI MENON, *M.A.*

Sea-anemones, as the animals dealt with in this section are called, were included in the old group Actiniaria, but are at the present day arranged in three independent orders in the sub-class Zoantharia (Hexacorallia) in the class Anthozoa. These orders are called Cerianthidea, Actiniidea and Zoanthidea. The popular term sea-anemones, though strictly applicable to the first two, may without undue strain be extended to the Zoanthidea also. The sea-anemones are soft-bodied and solitary animals though examples of colonial and hard-bodied forms are not unknown in the group. For the general structure and classification of the Zoantharia the student is referred to the ordinary text books.

Though the sea-anemones hitherto obtained from Krusadai Island and the neighbourhood form but a small collection, there is every reason to think that the Gulf of Manaar will be found to harbour a very rich and varied Actinian fauna. All the three orders mentioned above are represented in the Krusadai collection.

It has not yet been possible to study the material in the collection with that thoroughness which is necessary before exact identification is possible; the specific identity of many of the following forms has therefore been left undetermined and, even in those cases in which it is stated with some degree of confidence, it would be wise to regard the identification as provisional till a fuller examination has been made.

Order Cerianthidea.

About fifty species of this order have been recorded from various parts of the world. The Cerianthidea are soft-bodied, solitary animals living in a leathery tube buried in the sand or mud, with the tentacles exposed. A foot or pedal disc is absent and the animal is not attached. The aboral end of the body is rounded and there is a very distinct pore at its extremity. The tentacles are arranged in two sets, one at the margin in four cycles and the other round the mouth.

A fine specimen of *Cerianthus sp.* (pl. vi, fig. 1) has been obtained from Kutikal Point. The preserved specimen is 125 mm. long without the tentacles, and is about 25 mm. thick at the margin without the tentacles; the long marginal tentacles are about 10 mm. in length, the oral about 18 mm. The tentacles are numerous; about 150 marginals and 162 orals were counted. The column has a deep violet colour, the inner marginals have cross bands of violet and the orals are light red in colour.

Arachnactis, the pelagic larva of *Cerianthus*, is commonly met with in the Madras plankton. Colonies of *Phoronis* are often found growing on *Cerianthus* tubes. Sea-anemones are well known for their longevity. One of the best recorded cases is that of *Cerianthus membranaceus* which lives in the Naples Aquarium. This fine specimen which

is figured in Andres' classical monograph written in 1883 was recorded as flourishing in the Aquarium in 1924 and, for aught one knows, is still one of the favourites of the Aquarium.

Order Zoanthidea.

This order contains about 300 living species. They are solitary or colonial forms, generally attached, but sometimes free and unattached, and generally with an incrusted body-wall. The tentacles are simple, unbranched and arranged in two alternating cycles at the margin of the disc. The littoral forms comprise the genera *Zoanthus*, *Gemmaria*, *Palythoa*, *Sphenopus*, *Epizoanthus* and *Parazoanthus*.

Genus Zoanthus, Cuvier.

Zoanthus.—Soft unincrusted colonial forms with a double mesogloeal sphincter. *Z. shackletoni* (pl. viii, fig. 14), a small species with the coenenchyme in the form of stolons and with a brown cuticle occurs at Pamban Bridge and in Porites Bay. Polyps with a long stalk or short and sessile, widely separated or close-set. Colour varied: column yellowish grey, with the upper part in closed polyps pinkish brown, pinkish yellow, violet, green or dark blue; disc pinkish brown, violet or warm brown, with white or green radiating lines, often with a metallic green area round mouth and in some specimens a circle of eight or more white dots; tentacles green, yellowish green, warm-brown, violet-brown or bluish green, with cross bands of contrasting colours.

Genus Palythoa, Lamouroux (incl. Gemmaria, D. & M.)

Gemmaria is a sand-encrusted genus. *G.* (*? multisulcata*) is very common at Pamban bridge and on the reefs. Forms colonies, individuals connected together by broad stolons or by flat lamellar coenenchyme. Colonies often very extensive, being spread over a few square feet of rock surface and consisting of many hundreds of polyps. Polyps may be short and cylindrical or rather long with the upper portion narrowing into the stalk; oral disc broader than the column. Column brown, whitish towards base; disc green or dark-brown; tentacles brown; capitular ridges light-brown. On the disc there is often a white line running from the siphonoglyph to the margin and the corresponding marginal tubercle is slightly enlarged. Length of polyps 18-25 mm., disc 10–12 mm. Over sixty tentacles in larger individuals. Locality Pamban, Shingle Island and reefs round Krusadai.

The genus *Palythoa* (old) consists of forms with a very thick coenenchyme. As the difference in the thickness or development of coenenchyme cannot be made a sufficiently important generic character, *Gemmaria*, Duchassaing & Michalotti, and *Palythoa*, Lamouroux, are now fused into one genus *Palythoa*. The above species should therefore be regarded as a species of *Palythoa*. No species of *Palythoa* in the old sense, i.e., with thick coenenchyme in which the basal parts of the polyps are embedded, has been obtained from Krusadai.

Genus Isaurus Gray.

This genus is not represented in the present collection. *I. spongiosus* has however been recorded from the Gulf of Manaar and the author has seen specimens of a species of *Isaurus* from Cape Comorin which, while it agrees with *spongiosus* in general appearance, agrees more with *I. asymmetricus* in details. As *Isaurus* is likely to be met with at Krusadai, a figure of the Cape Comorin specimen is given (pl. viii fig. 15).

Genus Sphenopus, Steenstrup.

Sphenopus.—This has not been obtained from Krusadai, but *S. marsupialis* is a very common Madras form. It is solitary, has a black coat of sand and lives freely in the sand.

Other Genera.

A species of *Parazoanthus*, Haddon and Shackleton, occurs on dead coral rock on the reef to the south-west of Krusadai. Small colonies consisting of a few individuals connected by broad stolons. Average polyp about 6 mm. long and 3 mm. across at the retracted disc. Polyps encrusted with black and white sand, Formanifera tests and small fragments of shells. 24–30 tentacles, tentacles light greyish pink.

Epizoanthus, Gray, has not so far been obtained from Krusadai.

Order Actiniidea.

Suborder Malacactiniae.

The number of living species included in this suborder will be about one thousand. These are the sea-anemones properly so called. For the classification reference should be made to Stephenson, *Q.J.M.S.*, Vols. 64–65, 1920–21. In some Actiniidea, after the first twelve mesenteries have been formed, new mesenteries arise in the endocoeles. Such forms constitute the group of the Endocoelaria. The vast majority of the Actiniidea belong to the Exocoelaria in which mesenteries which are formed after the first twelve always arise in the exocoeles. Among the Exocoelaria a large number of families have simple unbranched tentacles arranged in alternate cycles and have only one tentacle communicating with each radial chamber. These families constitute the tribe Actiniina. The remaining families form the tribe Stichodactylina in which group the tentacles may be branched and are generally, if not always, arranged in radial rows on the oral disc and more than one tentacle communicate with some or all of the mesenteric chambers. The Endocoelaria have the Actiniine arrangement. Certain primitive families of the Actiniina are placed in a group called Protantheae, the remaining families of this tribe forming the Nynantheae. Similarly, two or three primitive families of the Stichodactylina are separated from the rest and placed in a group Protostichodactyleae, the remaining families then forming the Nynstichodactyleae. Most of the Actiniina as well as the Stichodactylina have a well-developed pedal disc used for

attachment and good basilar muscles. These Actiniina form the Thenaria. The rest form the Athenaria. In these there is no pedal disc or basilar muscle and the proximal end of the body forms a physa. The Thenaria are divided into the Mesomyaria and the Endomyaria according as their sphincter muscle is mesodermal or endodermal. The Stichodactylina have an endodermal sphincter. No member of the Endocoelaria or, with the uncertain exception of a specimen of *Gonactinia sp.* obtained by the author many years ago in Madras (unfortunately it is not possible now to verify this identification) of the Protantheae, has so far been recorded from India. The following families are represented in the Krusadai collection :—

Tribe Actiniina—

Athenaria : Fam. Edwardsiidae, Ilyanthidae (Steph.).

Thenaria :—

Subtribe Endomyaria : Fam. Actiniidae (Steph.).

Subtribe Mesomyaria : Fam. Phelliidae, Metridiidae, Sagartiidae.

Tribe Stichodactylina :—

Subtribe Protostichodactyleae : Fam. Corallimorphidae, Discosomidae.

Subtribe Nynstichodactyleae : Fam. Phymanthidae, Stoichactidae, Aurelianidae.

These families will be dealt with below in the above order, except that the families of the Mesomyaria will be taken up last. Examples of several of the other families, *e.g.*, Aliciidae, Phyllactidae, Minyadidae, Diadumenidae (Steph.), Chondractiniidae, have come into the author's possession from various localities in South India—Madras, Ennur, Tuticorin, Cape Comorin and Trivandrum—and from Bombay. It is extremely probable that most of the families now unrepresented in the Krusadai collection will be found to occur in Krusadai and the student should keep a sharp look-out for them.

Family EDWARDSIIDAE.

No pedal disc. Body divided into a rounded physa, a middle scapus and a capitulum. Only eight complete fertile mesenteries. An example of this family, *Edwardsiella pudica* (Klunz.) Andres, occurs in the sand at Kutikal Point (pl. vi fig. 2). Long worm-like body ; scapus with a reddish brown cuticle, eight longitudinal grooves and with low ridges between ; numerous small papillae which contain nemathybames on the ridges ; tentacles twenty. The specimens obtained are 150 mm. in length, 8 mm. at greatest width ; tentacles 8 mm. long ; physa about 7 mm. long. Cuticle reddish brown, physa white, upper part of column bluish green, tentacles greenish with round dots on inner face. The animal burrows in the sand.

Another Edwardsiid, probably *Milne-Edwardsia sp.*, if not a new sub-genus, has been obtained from the reef to the south of Krusadai. Animal firmly attached to dead coral rock by a broad base-like part of the scapus beyond which the scapus is continued at an angle into a short process ending in a small physa. Scapus broad below, narrowing towards upper part ; with a brown cuticle ; wall thin, tough, six prominent angular ridges, sometimes with six others less prominent alternating with these. Tentacles 36-45,

moderately long, in two rows, about equal in length, or inner slightly longer. Six pairs of complete mesenteries with strong retractors, two pairs of which are directives; no other mesenteries seen in the scapus; one siphonoglyph. Scapus yellowish brown, capitulum and physa white; tentacles reddish brown, dark-blue at base; reddish radiating lines in outer part of disc. Upper narrow part of scapus with capitulum and tentacles retracted in the natural state. Column about 30 mm. long.

Family ILYANTHIDAE.

Body divided into physa, scapus and capitulum. More than eight complete mesenteries. *Peachia sp.* (pl. vi fig. 3) has been obtained from Kutikal Point. A long vermiform burrowing animal looking not unlike Synapta; minute suckers on body by which the animal attaches itself to bottom of glass vessel; conchula five-branched; tentacles short, rounded, 16 in number; mesenteries only 16. Length of the animal 193 mm. without the small physa which was broken off, diameter about 10 mm. at the thickest portion which is near the oral end. Colourless.

Family ACTINIIDAE.

For definition of family see Stephenson, *loc. cit.*

Anemonia sp. (*? Isactinia badia* Crlgn.) (pl. vi fig. 4).—Base well-developed, broad. Column low, broad, smooth. Margin distinct, crenulate, with a number of irregularly arranged marginal spherules springing from its edge; marginal bodies absent in young specimens. Disc broader than column, circular, often elongated in one transverse axis, edge sometimes folded, 2 or 3 siphonoglyphes. Mouth raised, oval. Tentacles entacmaeous, numerous, situated in outer portion of disc, moderately long, pointed, with terminal pores. Colour: generally faint red; base brown-violet; tentacles deep violet with light tips, or yellowish green. In a large specimen, height of column 6 mm., breadth of base 12–15 mm., diameter of disc without tentacles 21 mm.; tentacles (inner) 7 mm., 2 mm. at base. The animal is active and readily changes its attachment. Locality, Bridge and reef to south of Krusadai.

Paranemonia (*? cinerea* = *Gyrostoma cinerea*, Steph.).—A very small anemone found attached in numbers to *Fucus* and other sea weeds. Body very small, tentacles long, no marginal spherules. Asexual reproduction occurs in this species and two individuals connected together by the edge of the disc should be looked for. Height of column 1½ mm.; diameter of base 4 mm.; length of longest tentacle 7 mm.

Bunodactis sp. 1 (*Bunodes waridi*, Crlgn.). Occurs in little hollows on the concrete blocks at the Pamban bridge, fully exposed at low tide. Column white to light-brown below, dark-brown above; suckers in vertical rows, with orange-red tips; disc dark-brown with radiating grey lines; tentacles greenish grey with light-orange or pink edges and tips; summit of oral cone yellowish. In a large preserved specimen, base 25 mm. broad, column 12 mm. high, disc with tentacles about 18 mm. Fragments of shell adhere to the suckers.

Bunodactis sp. 2 (pl. vi fig. 5).—A common form on the reef to south of Krusadai. Large numbers often occur together, covering the surface of dead coral masses. Column low, broad, with longitudinal rows of suckers in upper part; animal generally covered by fragments of shells which adhere firmly to the suckers. Animal easily recognized by its coloured disc and tentacles. Disc green, greenish yellow or greenish violet; light-green immediately round mouth; whitish radiating lines. Tentacles, brown, brownish yellow; or grey-violet, pink or dark-brown towards the end. Column white with a faint bluish or pinkish tinge, upper part bluish grey. Height about 9 mm., disc when spread out 30 mm. including tentacles.

Bunodactis sp. 3 (pl. vi fig. 6).—A common form found burrowing in the sand at Kutikal Point; specimens are also found attached by broad base to rocks on the reef opposite Krusadai. Easily distinguished from the previous species by the much longer body and the absence of the green colour. Body buried in the sand with only the disc and tentacles exposed in the burrowing form. Base well developed, swollen into a bladder in the burrowing form. Column long, broad towards oral end, tapering downwards and attaining its smallest width above the swollen base; 24 longitudinal rows of suckers in upper part, the principal rows reaching down to the base; rows of suckers ending in conical marginal outgrowths; longitudinal lines on column. Tentacles fairly long, pointed, 48. Column grey or light yellowish green with white and brown longitudinal lines, dark radiating lines on base, tentacles brownish with white oval areas on oral aspect and two interrupted dark-blue lines along the sides of the front face. These interrupted lines are also seen in very young specimens. Fragments of shells often found attached to the suckers. Length of a spirit specimen 50 mm.; disc diameter, without tentacles, 14 mm.; diameter above base 6 mm.; diameter of swollen base 13 mm.; outer tentacle 7 mm.

Gyrostoma sp. (pl. vii fig. 7).—A large, fine, vase or cornucopia-shaped, burrowing anemone found in the sand at Kutikal Point and Thonithurai. This is one of the most beautiful anemones occurring at Krusadai. The body is buried in the sand in a vertical burrow with the disc and tentacles resting on the sand. Body very long, narrow towards base, broadening towards oral disc, reaching the maximum width at the margin; smooth; longitudinal lines of attachment of mesenteries often visible; much wrinkled longitudinally and transversely in the preserved specimen. The illustration does not show the natural shape to advantage. Base well-developed, bladder-like when the animal is dug out. Margin distinct, crenulated with low, broad, conical denticulations. Oral disc broad, circular, only innermost portion free from tentacles. Mouth elongated; stomodaeum longitudinally grooved, often protruded in preserved specimens; two siphonoglyphes. Tentacles short, broad at base, pointed, perforated at tip, longitudinally fluted in preserved specimens, usually 96 in number, arranged in five cycles, 6—6—12—24—48. Sphincter muscle very weak apparently and tentacles and disc not retractile. Colour of column light cream, occasionally red, tentacles colourless, disc sometimes bluish grey. Largest specimen obtained was 300 mm. in length, 70 mm. across

disc without tentacles, 53 mm. across column below margin, 20 above base, 32 at swollen base ; inner tentacles 20 mm. in length, 5 mm. at base.

The above identification is quite provisional. In most of the examples the column is quite smooth. But in two specimens which on naked-eye examination appear to be identical with the others, rows of low, hollow projections are just visible in the upper part of the column. They do not seem to be due to the contraction of the column wall. In a similar specimen believed to be from Tuticorin, rows of suckers and marginal acrorhagi are very distinct. This is also the case in a small sessile specimen obtained from a block at Pamban bridge. These two specimens appear to be a species of *Actinioides.* Are they really identical with the other two in which the suckers and acrorhagi have presumably been reduced to vanishing point and are these latter again identical with the form provisionally named here *Gyrostoma sp.?* Fuller study is necessary before the question can be settled.

Judged by Haeckel's figure and the scanty description given by Andres, *Gyrostoma sp.* appears to be the same as *Anemonia Milne-Edwardsii* of Andres.

Family CORALLIMORPHIDAE.

Corynactis sp. occurs on concrete blocks at Pamban Bridge, generally in large numbers, scattered or more or less crowded together on the substratum, separate or connected by basal extensions. Polyps small. Animal can be easily identified by its capitate tentacles. Sixteen to eighteen large exocoelic tentacles and 16—18 radial rows of smaller endocoelic tentacles with 3-8 tentacles in each row. Column reddish brown, yellowish brown, orange or pink. Size varies; larger specimens measure 15 mm. in height of column, 10 mm. in diameter at margin, 6 mm. across column at middle: smaller specimens are very much smaller.

Family DISCOSOMIDAE.

Rhodactis rhodostoma (pl. vii fig. 8).—In the lagoon to the south of Krusadai. Individuals closely crowded together, forming thin, flat, slimy sheets spread over dead coral rock. Base well developed, broad bases of adjoining polyps contiguous. Column low, broad, smooth. Margin distinct, crenulated. Disc broad, tentacles of two kinds; simple, unbranched, conical, situated in outer part of disc and immediately round mouth; shorter, palmately branched tentacles, with short finger-shaped lobes, scattered in the intervening portion of the disc and among the outer tentacles ; the boundaries between the two kinds of tentacles not sharply defined. Column reddish grey; disc olive-green; mouth and stomodaeum rose; tentacles yellowish. Dimensions of a spirit specimen: column 8 mm. height, base 28 mm.; expanded disc 34 mm.

Family STOICHACTIDAE.

Ixalactis sp. (pl. vii fig. 9).—A very fine sea-anemone living buried in the sand, with the disc exposed, at Kutikal Point and also in other places. Base well-developed, broad. Column smooth except in uppermost part, narrow in the middle or near base;

expanding towards disc; suckers in uppermost part, arranged in short longitudinal rows. Margin dentate, with more than 300 tooth-like processes; broad and shallow fossa. Disc broader than column, edge often lobed, except in the inner third covered by tentacles; two siphonoglyphes. Tentacles numerous, short, arranged in several cycles. Some or all of the tentacles may be simple; but generally they are provided with five or six pairs of alternately large and small vesicle-like swellings on the antero-lateral edges, thus acquiring a pod-like appearance. The specimen figured does not show the swellings. All the tentacles may be of this description or the pod-like tentacles may occur mixed with the simple kind or may be completely absent in a specimen. In addition to these principal tentacles, smaller, shorter and very slender accessory tentacles often occur externally to, and forming radial rows with, the larger main tentacles, the tentacular arrangement thus becoming Stichodactyline. Colour variable. Column red or yellow or red and yellow; tentacles dark yellowish, in some specimens with violet tips; 48 thick opaque, yellowish or white radiating double lines on the disc radiating from the centre to the bases of the inner tentacles, two of these lines broader than others and at their inner ends with a bright red spot placed just outside the mouth; this colour pattern is not found in all specimens. Size: length (in preserved specimen) of column 80 mm.; diameter of column in middle 25 mm.; diameter of base 43 mm.; diameter of disc, rather contracted, 63 mm.

Stoichactis giganteum (Forsk.) Carlgr.—This very large common "Discosoma" is found in the sand in most places. The body is buried in the sand while the large-lobed disc is exposed and lies flat on the ground. Base well-developed. Column fairly high but shorter than diameter of the disc, expanding towards margin, with suckers in the uppermost part. Disc very broad, peripheral part folded in festoon-like fashion; two conspicuous siphonoglyphes. Tentacles innumerable, very short, almost knob-like, broader at tip than at base, very sticky; only one tentacle to each exocoele; endocoelic tentacles arranged in many radiating rows, two or more rows communicating with each endocoele; tentacles cover greater part of the disc. Disc may reach more than a foot in diameter. Green and white or grey colour varieties are found.

Family PHYMANTHIDAE.

Phymanthus loligo, Ehr. (pl. viii fig. 10).—Found attached to dead coral rock at low tide. Base broad. Column as high as broad, smooth generally, but in the upper part with rather poorly developed suckers, expanding towards margin; margin distinct with about 43 low conical hollow processes. Disc broad. Tentacles of two kinds; marginal tentacle-like, about 86 in number, arranged in four or five cycles, each tentacle generally with a series of small vesicle-like outgrowth on each lateral face; discal small papilla-like between the marginals and the mouth, arranged radially or irregularly. Column pinkish white below, bluish grey in upper part; disc greenish; marginal tentacles grey-blue outside, greenish on inner face with light tips. Height of column 18 mm.; diameter 9 mm.; disc diameter 20 mm.; base 11 mm.; tentacles 3–4 mm. These details are taken

from a single specimen from Shingle Island. In a second specimen since obtained from the reef to south of Krusadai, the details are rather different.

Family AURELIANIDAE.

Actinoporus (*? elegans*), Duch. (pl. viii fig. 11).—Found buried in the sand with the disc exposed, at Kutikal Point. Base well developed. Column long. Margin distinct, fossa well-developed, deep. Disc notched into about 66 little marginal lobes, often retracted. Sphincter muscle very large, circumscribed. Tentacles short vesicular knobs, arranged in irregular radiating rows on the disc, many tentacles communicating with each exocoele and endocoele; the tentacular areas separated by radial grooves on the disc. Colour of column white in fresh specimen, changing to dark or reddish brown in formalin. Measurements of a formalin specimen: length of column 150 mm.; diameter of column 35 mm.; diameter of disc 56 mm.; diameter of base 32 mm.

Family PHELLIIDAE.

In this family the column is long and consists of a main proximal portion, the scapus, which is covered by a thick or thin cuticle and a short distal capitulum which is thin-walled and has no cuticular covering. Complete mesenteries only six pairs. Acontia present.

Phellia sp. (*? decora*, Klunz.) (pl. viii fig. 12).—This small to moderate-sized pink anemone occurs very abundantly on the reef. Base distinct, attached, not broader than column. Column generally long, may be short and broad by contraction, covered by a wrinkled, rough, brown cuticle. Capitulum short, thin-walled. Disc broad, not much broader than column. Tentacles thick, short, in several cycles, about 48-72 in number, arranged in four cycles with an incomplete fifth cycle. Mesenteries 24-36 pairs, of which only 6 pairs complete; 2 siphonoglyphes and 2 pairs directives. Colour: in the undisturbed state, column has a translucent yellowish or pink colour; in the preserved animal, the scapus is brown or greenish yellow; disc in living specimens brown-red, grey violet, brown-orange, or pink, with white or green or yellowish green radiating lines; tentacles in living specimens rose with light transverse bands, or grey with chocolate or orange transverse bands. Average length about 28 mm.; disc 15 mm.; base 10 mm.; inner tentacle 3 mm.

Phellia sp. 2.—Attached to rocks, generally along with colonies of *Gemmaria* and *Zoanthus*. Column cylindrical, slightly narrowed above base; scapus with a brownish yellow cuticle beset with numerous small papillae to which sand grains are attached, the sand forming a dense covering to the scapus; capitulun very short. Capitulum and tentacles hyaline, greyish. Largest specimen obtained measures 28 mm., in length, 7 mm. across margin. Tentacles 96 in number. Externally looks very like *Isophellia sabulosa*, Crlgn.

Family METRIDIIDAE.

The genus *Aiptasiomorpha* which is placed in this family here does not, according to Carlgren, belong to it.

Two species of this genus occur at Pamban. They both have six pairs of complete fertile mesenteries and cycles of incomplete mesenteries the larger of which are also fertile. In both, the upper part of the column is retracted into the lower part and there are vertica, rows of raised cinchides.

Aiptasiomorpha sp. 1.—The body is more strongly built than in *A. sp.* 2, the body-wall being thicker and the retractors much stronger. The base is very broad, column cylindrical and comparatively narrow and disc broader than column. Smaller individuals sometimes found springing from the base of the larger. A large specimen measured 12 mm. diameter of base, 12 mm. height of column, 5 mm. diameter of column, 4 mm. length of tentacles. General colour white; tentacles white with a reddish brown core, or greenish grey; larger specimens have grey brown tentacles and the column just below the tentacles is dark grey. Found attached to pieces of concrete at Pamban bridge.

Aiptasiomorpha sp. 2.—More delicately built than the preceding and does not attain its dimensions. A fairly large mature specimen has base 6 mm. broad, column 5 mm. high, 6 mm. across disc and tentacles. Column is greenish with white longitudinal lines; tentacles white or light grey; disc at bases of tentacles reddish brown. Below the introverted part of the column, a raised annulus is often seen. This form occurs on Balanus shells attached to the wooden piles in the middle of the bridge and also on blocks at Pamban. Surrounding the older individuals, there are a number of young ones which spring from the peripheral part of the base. The individuals, large and small, form a continuous covering over the entire outer surface of the Balanus shell.

Family SAGARTIIDAE.

Sagartia sp.—A very common form on the rocks at the Pamban Bridge and also on the reef at Shingle Island; also occasionally met with elsewhere. General colour of the column varies somewhat: yellow, brownish yellow, dark brown or brownish red; greenish grey or light to dark brown below margin; occasionally with light longitudinal lines; cinchides minute dark blue dots, widely separated but arranged in longitudinal lines over column. Tentacles white with grey core or light to dark brown, sometimes longitudinally striped. Disc white or light brown with white radiating lines; tentacular region of disc often dark grey. No suckers or warts on column. An average specimen measures 15 mm. base diameter, 10 mm. column height, 11 mm. across column, 6 mm. length of inner tentacle.

PLATE VI.

Fig. 1. *Cerianthus sp.* × 1¼.

„ 2. *Edwardsiella pudica* × 1. The pharynx is shown protruded.

„ 3. *Peachia sp.* × 1½.

„ 4*a*. *Anemonia sp.* × 4.

„ 4*b*. *Do.* A portion of the margin with tentacles × 10.

„ 5. *Bunodactis sp. 2* × 3.

„ 6. *Bunodactis sp. 3* × 2. From life.

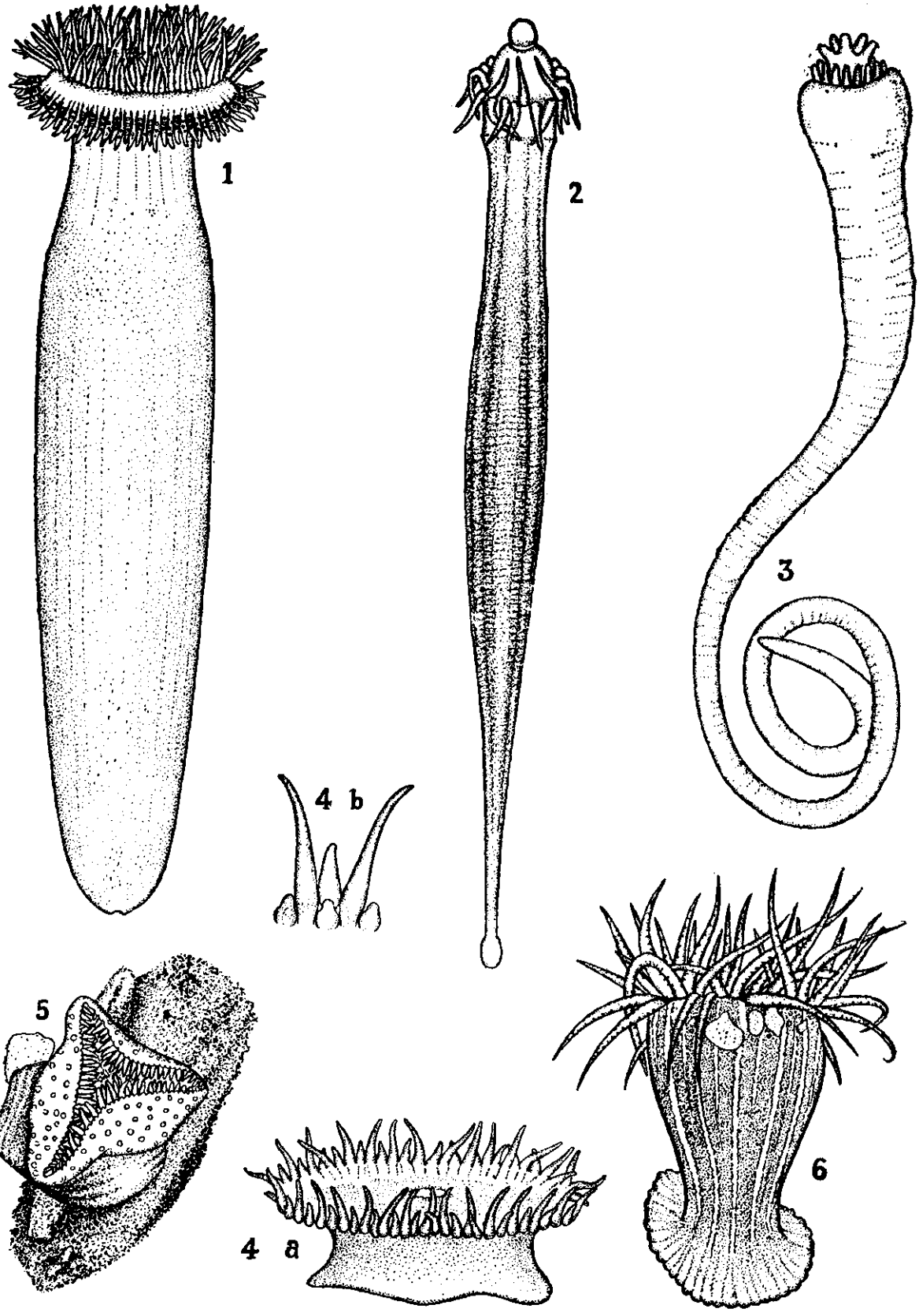


PLATE VI.—KRUSADAI SEA ANEMONES.

PLATE VII.

Fig. 7. *Gyrostoma sp.*, slightly reduced. From life.
„ 8. *Rhodactis rhodostoma*, about natural size. From life.
„ 9. *Ixalactis sp.*, slightly reduced.

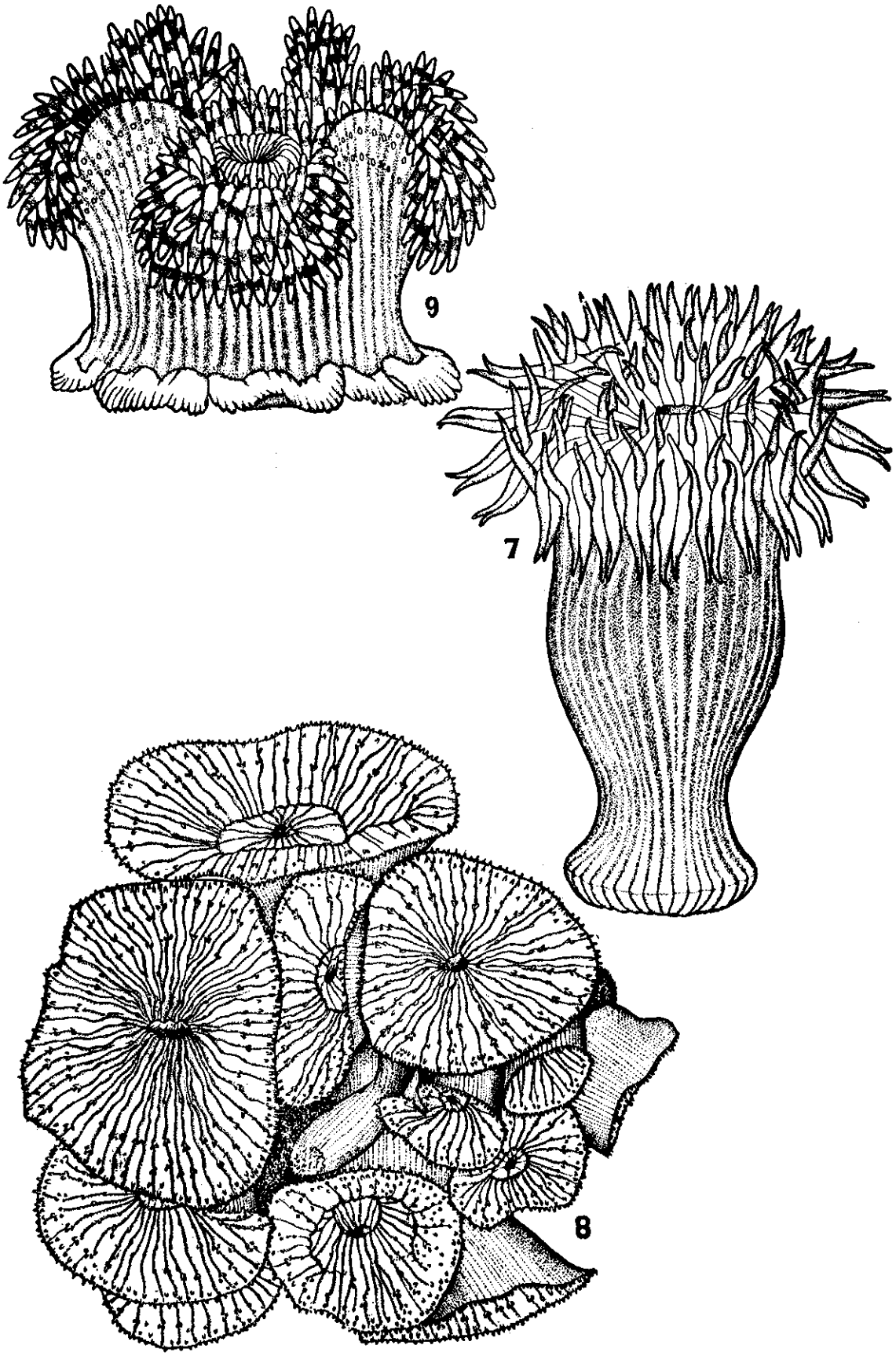
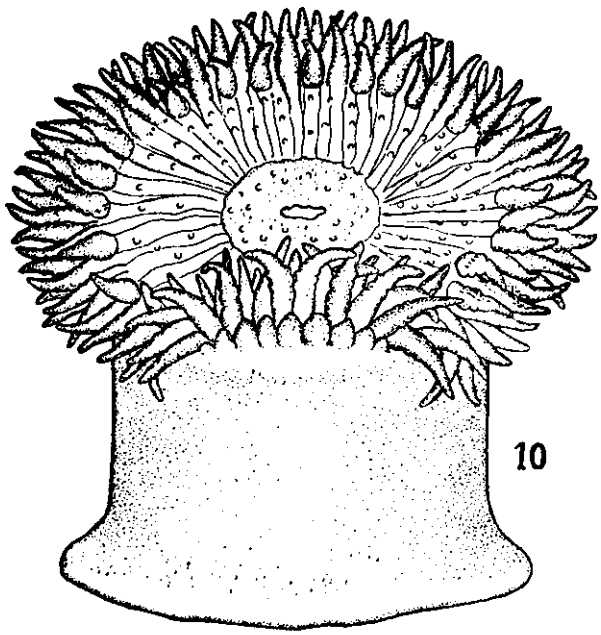
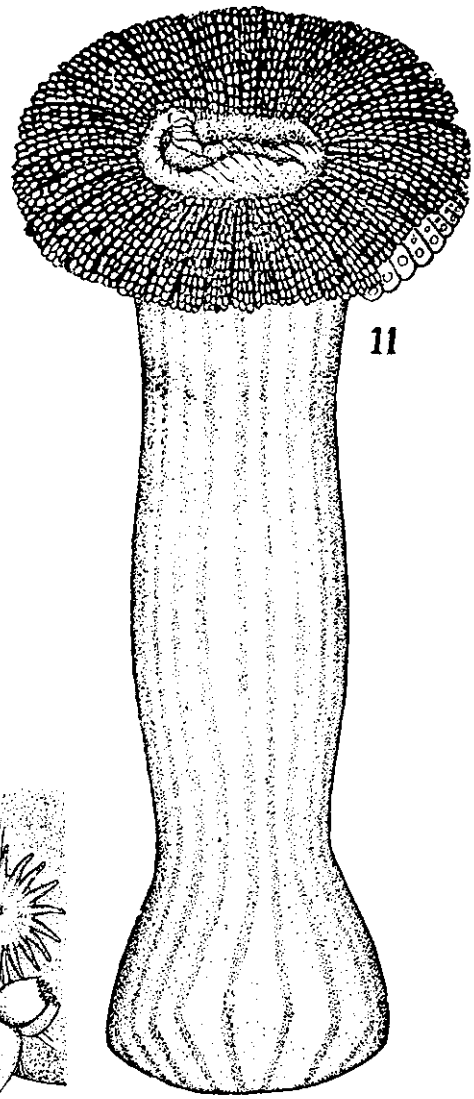


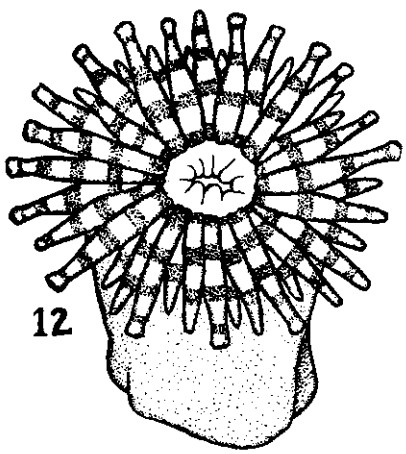
PLATE VII.—KRUSADAI SEA ANEMONES.

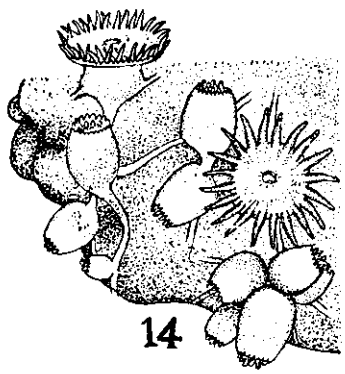
PLATE VIII.

Fig. 10. *Phymanthus loligo* × 4.
„ 11. *Actinoporus sp.* × 1.
„ 12. *Phellia sp.* × 2.
„ 14. *Zoanthus shackletoni* × 4.
„ 15. *Isaurus asymmetricus* × 1 (from Cape Comorin).









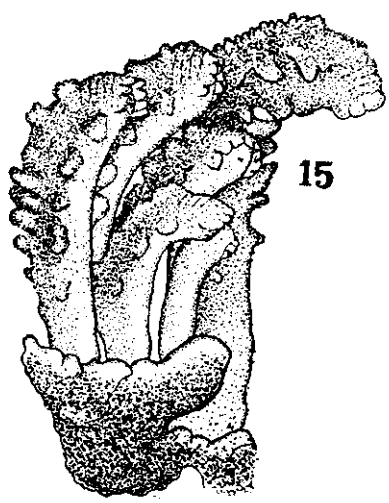


PLATE VIII.—KRUSADAI SEA ANEMONES.

Suborder Scleractiniae (Corals).

By F. H. GRAVELY, *D.Sc.*

The most important works dealing with the classification of this suborder as a whole are those of Duncan (1885) and Quelch (1886), a useful summary of whose results is given by Bourne (1900). The recent colonial Astraeidae possessing distinct corallites have been revised by Matthai (1914) and there can be no doubt that revision is required in other groups also. For more general studies of coral and coral reefs see Darwin (1842), Saville-Kent (1893), Wood Jones (1907) and Hickson (1924).

Most of the species recorded below have been identified for me by Prof. G. Matthai, whom I take this opportunity of thanking for his help.

In view of the difficulties of classification the following key to the genera found may facilitate identification :—

1.	Corallite walls imperforate	2.
—	Corallite walls perforate, the corallum being formed chiefly or wholly of porous coenenchyma	16.
2.	Corallites solitary	*Trochocyathus.*
—	Corallites not solitary	3.
3.	Corallites separate	*Cylicia.*
—	Corallites united by well developed calcareous perithecal tissue	4.
4.	Tabulae present, but no dissipiments	*Pocillopora.*
—	Dissipiments present	5.
5.	Corallites distinct, each surrounded by a complete thecal wall which is superficially visible	6.
—	Corallites not bounded by a complete and superficially visible thecal wall[1]	11.
6.	Corallites formed by extra-calycinal budding; number of septa meeting columella more or less definite ...	7.
—	Corallites usually formed by fission, sometimes by budding; number of septa meeting columella indefinite	10.

[1] In *Pavonia maldivensis* the thecal walls may with care be detected, even without a lens. But they are well below the general surface of the colony which is formed entirely by the strongly exsert septa. The general appearance of the colony is consequently very different from that of the Astraeids in the collection. Other species of the genus resemble Astraeids more closely, but have not yet been found in the area under consideration. *Pavonia* and *Psammocora*, the only members of the Fungacea in the collection, have proved most difficult to fit into the key. They should, of course, be characterized by the presence of synapticula uniting the septa, but I have not found these sufficiently distinct for use in practice.

7.	Regions between the thecae spiny	8.
—	Regions between the thecae spineless	9.
8.	Corallites small and vertical; no perithecal ridges ...	*Cyphastraea.*
—	Corallites large and oblique; perithecal spines fused at base to form ridges	*Echinopora.*
9.	Corallites usually projecting far above peritheca, which is highly vesicular; septa markedly exsert; intercorallite furrows absent	*Galaxea.*
—	Corallites level or slightly projecting, with septa little exsert; peritheca dense; polygonal intercorallite furrows present	*Leptastraea.*
10.	Septa not of equal width at the calicular margins; corallite walls usually separated by perithecal regions of varying thickness; an alternating cycle of rudimentary septa present or absent	*Favia.*
—	Septa of equal width at the calicular margins; corallite walls fused; an alternating cycle of rudimentary septa present	*Goniastraea.*
11.	Thecal walls united into more or less sinuous ridges, or broken into conical protuberances	12.
—	Thecal walls not rising to the surface of the colony [1] ...	15.
12.	Thecal walls united into ridges	13.
—	Thecal walls broken into conical protuberances ...	*Hydnophora.*
13.	Calycinal centres distinct	14.
—	Calycinal centres indistinct except when young ...	*Coeloria.*
14.	Colonies massive, compact	*Symphyllia.*
—	Colonies more or less foliaceous or branched	*Merulina.*
15.	Colony encrusting, corallites of moderate size	*Pavonia.*
—	Colony ramified, corallites very small	*Psammocora.*
16.	Extensive perithecal tissue present	17.
—	Thecal walls fused	19.
17.	Calyces tubular at least on the terminal branches ...	*Madrepora.*
—	Calyces less prominent	18.
18.	Calyces very large	*Turbinaria.*
—	Calyces quite small	*Montipora.*
19.	Calyces small and shallow	*Porites.*
—	Calyces larger, thecal walls elevated	*Goniopora.*

[1] See footnote on previous page.

Section *Aporosa.*

Family TURBINOLIIDAE.

Genus Trochocyathus, Milne-Edwards & Haime.

An undetermined species of *Trochocyathus* is found on stones round the beacon in Porites Bay and under the bridge at Pamban. It reaches a height of about 10 mm. with a breadth of about 13 mm. at the top and 21 mm. at the bottom. The outer walls are white, contrasting strongly with the septa which are dark purplish brown.

Family POCILLOPORIDAE.

Genus Pocillopora, Lamarck.

Pocillopora damicornis (Linnaeus; see Esper, 1791, pl. xlvi; 1797, pp. 38–45, pl. xlvi A) is common in the shallow water south of Krusadai Island. Prof. Matthai informs me that the species is very variable.

Family ASTRAEIDAE.

1.—ASTRAEINAE REPTANTES.

Genus Cylicia, Milne-Edwards & Haime.

The isolated polyps of a little coral, probably *Cylicia rubeola* (Quoy & Gaimard; see Milne-Edwards, 1857, pp. 607–608), form scattered colonies under stones on Krusadai Island and at Pamban. Concerning the characters of the species of this and allied genera see Matthai, 1924 (1).

2.—ASTRAEINAE AGGLOMERATAE GEMMANTES.

Genus Cyphastraea, Klunzinger.

Cyphastraea serailia (Forskal; see Matthai, 1914, pp. 39–41, pl. vii fig. 4, xi 1–9, xiii 8, xxxviii 1 and 5), is not uncommon in the shallow water to the south of Krusadai Island. It does not appear to form very extensive colonies. The calyces are about 2 mm. in diameter and are round or oval, not polygonal, being separated by minutely spiny perithecal tissue. The thecal walls project conspicuously above this and the distance between them may be slightly greater than their diameter, but is usually very much less in at least a part of the colony.

Genus Echinopora, Lamarck.

Echinopora lamellosa (Esper; see Matthai, 1914, pp. 50–51, pl. viii fig. 6, xiv 2–6, xv 1, xvi 6) is very abundant in the coral bay at the south-western end of Shingle Island and in Porites Bay, Krusadai Island, especially on very soft mud. It often forms immense colonies of delicate, finely ridged and spiny lamellae over the upper surface of which are scattered the slightly raised calices with somewhat indefinite walls but strongly exsert septa. The

colonies have a strong brownish colour in life, being much darker than those of *Montipora foliosa* to which they otherwise bear not a little resemblance superficially.

Genus Galaxea, Oken.

A species of *Galaxea*, probably *G. fascicularis* (Linnaeus; see Matthai, 1914, pp. 59-62, pl. viii fig. 4, xvi 4, xxxiv 3, xxxviii 6) has been found in very shallow water on the inner side of the reef south of Krusadai Island, about opposite the bungalow. On this small area, which is rendered somewhat difficult of approach by deep water between it and the shore, it was abundant in 1926, the only occasion on which it was visited. It has not been seen elsewhere. The polyps, which were of a pale bluish green colour, were found fully expanded by day.

Genus Leptastraea, Milne-Edwards & Haime.

Leptastraea roissyana, (M.-Ed. & Haime; see Matthai, 1914, pp. 67-68, pl. viii figs. 1-3, xvii 4, xviii 1, xix 1-2, xxxvii 4) is not uncommon on Krusadai Island. The thecae are larger than in *Cyphastraea serailia* and may be as much as 9 mm. in diameter. Being crowded together, with a minimum of intervening peritheca, they are pentagonal or hexagonal in shape. The largest colony I have seen is round and massive, its greatest diameter being about 14 cm.

Genus Merulina, Ehrenberg.

Merulina ampliata (Ellis & Solander; see Esper, 1797, pp. 96-97, pl. lxxvii; Matthai, 1924 (2), pp. 28-29, pl. v fig. 5) occurs on the outer edge of the reef in Porites Bay. In the key it has had to be grouped with the *Astraeinae confluentes*, bearing as it does to the present group the same relation as they do to the *Astraeinae agglomeratae fissiparantes.*

3.—ASTRAEINAE AGGLOMERATAE FISSIPARANTES.

Genus Favia, Oken.

This genus is represented by a larger number of species than any other; and the following key, based on superficial characters, may be useful as a guide to their identification. All have been described and figured by Matthai (1914). The polyps, so far as I have seen, expand only at night, and even then not readily.

1. Calyces 3-4 mm. in diameter ... ... *F. versipora* (Lamarck)[1].
— Some or all of the calyces at least twice that size. 2.
2. Surface between adjacent calyces depressed or hidden among strongly exsert septa ... ... 3.
— Surface between adjacent calyces crested ... 7.

[1] Represented by a specimen from Pamban in the Madras Museum. The depth at which it was found is unknown.

3. Calyces polygonal, separated by linear grooves	*F. valenciennesii*, M.-Ed. & Haime (= *bertholleti*, Valenciennes, Ms.) var.[1] 2
— Calyces more or less rounded, the space between them wider or covered by outward extension of septa	4.
4. A thin erect thecal margin present; septa thin and widely spaced where they meet it	5.
— Thecal margin more or less uniformly thick and rounded; septa thick and crowded they meet it.	6.
5. Calyces 7-10 mm. in diameter	*F. speciosa* (Dana) (=*F. clouei.* Valenciennes, Ms.).[2]
— Calyces 5-7 mm. in diameter	*F. huluensis*, Gardiner.[3]
6. Calyces 8-13 mm. in diameter, separate	*F. doreyensis*, M. E. & Haime.[4]
— Calyces 12-18 or 20 mm. in diameter, less distinctly separate	*F. complanata*, Ehrenberg, and *F. favus* (Forskal).[5]
7. Calyces 4-6 mm. in diameter; colonies incrusting or massive often with low humps	*F. pentagona* (Esper).
— Calyces up to 10-15 or even 20 mm. in diameter; colonies encrusting or massive, usually with thick, erect but somewhat irregular branches ...	*F. abdita* (Ellis & Solander).

Genus Goniastraea, Milne-Edwards & Haime.

Goniastraea retiformis (Lamarck; see Matthai, 1914, pp. 118-120, pl. x fig. 3, xxxi 1-5, xxxiii 3, xxxviii 2 and 4) occurs sparingly on Krusadai Island. The calices are about 4 mm. in diameter and a little less in depth. The fused walls between them are extremely thin, of about the same thickness as the septa.

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[1] See Matthai, 1914, p. 94, pl. xxiii fig. 6, two specimens on left. In var. 1, "the adjacent corallite walls are fused, the inter-calicinal walls thus formed being not more than 1 mm. in thickness, often thinner; over these the septa are continuous in arches, the septa being thin." This variety probably falls in the second group under "2" of the above key, but no specimens have been found. In the first group the depth of the calyces and height of the septa are very variable.

[2] The commonest Krusadai species.

[3] Represented in the Madras Museum collection from Pamban, depth unknown. Not collected by anyone recently.

[4] *F. danae*, Verrill, of which the Madras Museum possesses a specimen from the Ceylon pearl banks, has calyces of about the same size as *F. doreyensis*, but more closely united as in *F. complanata*.

[5] Only one colony of each of these species has been collected. They differ greatly one from the other; but both species are shown by Matthai's descriptions and figures to be so variable in the very characters in which they most conspicuously differ, that I hesitate to suggest any of them as aids to identification. There are two additional specimens of *F. favus* in the Madras Museum collection, but none of *F. complanata*.

4.—ASTRAEINAE CONFLUENTES.

Members of this group seem only to live where they will never be exposed even by the lowest tides. In consequence they are more rarely met with than the preceding group in shore collecting. *Hydnophora* is the genus most frequently met with.

Genus Symphyllia, Milne-Edwards & Haime.

A single large colony of *Symphyllia sinuosa*, Quoy & Gaimard (see Gardiner, 1906, pp. 760-761, pl. lix figs. 1-3; = *Mussa nobilis*, Dana, 1848, pp. 187-188, pl. viii fig. 10) from the outer edge of the reef west of Porites Bay.

Genus Coeloria, Milne-Edwards & Haime.

Two or three colonies of *Coeloria daedalea* (Ellis & Solander; see Esper, 1791, pl. lvii fig. 1 *nec* 2; 1797, pp. 63-65; Matthai, 1924 (2), pp. 22-33, pl. iii fig. 1, v 3; ?= *C. arabica* Klunzinger, 1879, pp. 17-19, pl. ii figs. 1-4 and 8, ix 10 *a-c*) were collected in Porites Bay and one small one on Shingle Island. *C. daedalea* is defined by Milne-Edwards and Haime as having short calycinal series as figured by Esper. They are, however, very variable in large colonies; and Klunzinger's *C. arabica*, in which they are described as mostly long seems to me to be probably identical.

Genus Hydnophora, Fischer de Waldheim.

Hydnophora exesa (Pallas; see Matthai, 1924 (2), p. 27, pl. v fig. 6; incl. *ehrenbergii*, M.-Ed. & Haime 1857, p. 423, pl. D5 fig. 2; = *contignatio*, Forskal, see Klunzinger, 1879, pp. 22-23, pl. iii figs. 2-3, ix 12*a-c*) is not uncommon in Porites Bay; and an immense colony was found rising to about low tide level from moderately deep water on the north-western side of Shingle Island. *H. microcona* (Lamarck; see Klunzinger, 1879, pp. 21-22, pl. iii fig. 1, ix 12*d*; Matthai, 1924 (2), pp. 27-28) also occurs on Shingle Island. In the former the cones are taller and more compressed than in the latter, with broader and more flattened valleys between them.

Section ***Fungacea***

Family PLESIOFUNGIDAE.

Genus Pavonia, Lamarck.

A single colony of *Pavonia maldivensis* (Gardiner, 1906, pp. 935-936, pl. lxxxix figs. 1-3) was found south of Krusadai Island on the same bank as *Galaxea*. It was of a brownish colour in life.

Family CYCLOSERIDAE.

Genus Psammocora, Dana.

A single colony of *Psammocora contigua* (Esper. 1791, pl. Madr. lxvi; 1797, pp. 81-82; see Gardiner, 1906, pp. 950-951; = *plicata*, Lamarck, see Dana, 1848, p. 346, pl. xxv, figs. 2-2*b*)

was found in the western part of the lagoon on the south side of Krusadai Island. Two specimens of the same species in the Madras Museum collection from the Gulf of Manaar, which are labelled *P. acerosa* (Bruggemann) are doubtless those on which Thurston's record of that species (1890, p. 75) is based. I have not been able to consult any description of Bruggemann's species; but there can, I think, be no doubt that the specimens belong to Esper's species, which has priority should the two prove to be identical.

Section ***Perforata.***

Family MADREPORIDAE.

Madrepora spp.

Some species of this section have such small polyps that their state of expansion is not readily noticeable in the field. Many (perhaps all) of those with noticeably large polyps habitually expand by day and some at least seem even to close in the dark.

On Krusadai Island *Madrepora* is found chiefly in Porites Bay. Three or four easily recognizable forms occur; but each is subject to great variation due, in part at least, to environment; and further field study is required to decide whether these should be regarded each as a single species or as a group of species.

A large irregular loose-growing form with strongly tubular subapical corallites and purple tips to the branches may provisionally be referred to *M. cervicornis*, Lamarck (see Agassiz, 1880, pl. xviii; also Brook, 1893, pp. 27–28) of the subgenus *Eumadrepora* (see Brook, 1893, p. 22). The next form is more slender, compact and low-growing. When well developed it consists of a short, stout trunk from the top of which branches normally spread out horizontally, giving rise to short slender upwardly directed branchlets bearing subapical corallites with walls prolonged on the outer and short on the inner side. It may provisionally be referred to *M. spicifera*, Dana (1848, pp. 442–444; Brook, 1893, pp. 92–24 of the subgenus *Polystachys* (see Brook, 1893, p. 22). The horizontal branches may or may not anastomose, and occasionally erect colonies are found. Both the above mentioned subgenera belong to the first of Brook's four Divisions, with cylindrical axial corallites which project at the apex of each division of the corallum. Lastly a stout and compact form with stout, thick-walled more or less hemispherical axial corallites (Division 2) and correspondingly short subapical corallites may provisionally be referred to *M. erythraea*, Klunzinger (1879, II, pp. 14–15, pl. iii fig. 5, iv 8, ix 10; Brook, 1893, pp. 157–158) of the subgenus *Tylopora* (see Brook, 1893, p. 22).

Each of these "species" may, however, be stunted by adverse conditions. This is particularly the case with the first and last, in which all intermediate stages are found between the normal forms already described and stout compact forms with short stout subapical corallites, in which the two "species" become almost indistinguishable. The only way in which I have been able to recognize to which "species" such stunted forms belong is by the shape of the terminal branches, which are conical in *M. cervicornis* but are more cylindrical at base and rounded at tip in *M. erythraea*. Klunzinger (1879, pl. x)

has figured two such forms under the names *pyramidalis* (fig. B) and *pallida* (fig. A) respectively.

A form which is, I think, probably identical with, though somewhat more erect and irregularly branched than is usual in, *M. erythraea* is not unlike Agassiz's figure (1880, pl. xix) of *M. prolifera*, Lamarck. This form is certainly identical with the stunted form described above as a form of *M. erythraea*, and if it should prove to be distinct this stunted form will have to go with it. The left half of Agassiz's figure, however, shows the terminal branches tapering more as in somewhat stunted colonies of *M. cervicornis*.

Genus Turbinaria, Oken.

Large detached dead specimens, probably *Turbinaria crater* (Pallas; see Bernard, 1897, pp. 23–25, pl. i, and pl. xxxi fig. 1) are to be seen in various stages of decomposition on the dead reef off Sandy Point and on the south-eastern shore of Shingle Island. A few living specimens of *T. crater* have been found in Porites Bay, together with a single small specimen doubtfully referred by Matthai to *T. frondens* (Dana, 1848, pp. 412–413, pl. xxx figs. 10–10*c*; see also Bernard, 1896, p. 46) and one of *T. patula* (Dana; see Bernard, 1896, pp. 41–42). *T. patula* and *T. peltata* (Esper; see Bernard, 1896, pp. 38–40, pl. vi–vii and pl. xxxi fig. 15), of which a single specimen was found at Pamban, differ from the other two in having much larger and as a rule more widely separated and less convex calicles. Our specimens are both small and are more or less distinctly stalked, *T. patula* being slightly concave above and *T. peltata* slightly convex. Both are encrusting forms in their later phases.

T. peltata differs from *T. patula* in having much larger calicles (about 5[1] and 3 mm. diameter respectively in our specimens), coarser coenenchyma and a thicker edge to the colony, but Bernard records the existence of transitional forms which it is very hard to place.

T. frondens differs from *T. crater* in that "the nearly perpendicular edge of the deep bowl-shaped cup increases in circumference by forming lobes, which may fold inwards round vertical axes" (Bernard). Our doubtful specimen is, however, too young to be deeply bowl-shaped; consequently its sides are more nearly horizontal than vertical and their lobing, which is not very extensive, may be due to external causes.

Genus Montipora, Quoy & Gaimard.

Two forms occur in abundance and another rarely.

Montipora foliosa (Pallas; see Esper, 1797, pp. 67–70, pl. lviii A and lviii B; Milne-Edwards, 1860, pp. 212–213; Bernard, 1897, pp. 156–162, pl. xxx and xxxiv fig. 13) is a foliaceous form in which the calices are surrounded by stout denticles. It is not unlike *Echinopora lamellosa* in its manner of growth, but whiter in colour and less fragile. It is very common in the Coral Bay at the south-western end of Shingle Island and not uncommon on the south side of Krusadai Island.

[1] Bernard gives 4–10 mm. as the recorded maximum variation in *T. peltata*.

A single colony of an encrusting form resembling *M. foliosa* in its denticulate calicles was found on Krusadai Island. It has been doubtfully referred by Matthai to *M. explanata*, Bruggemann (see Bernard, 1897, p. 23, pl. i fig. 3, xxxi 5).

Montipora spongiosa (Ehrenberg; see Klunzinger, 1879, II, p. 38, pl. vi fig. 3, v 10, x 10) is a thick-set, closely but somewhat irregularly branched, spineless form, common on the north side of Shingle Island and the south of Krusadai Island.

Family PORITIDAE.

Genus Porites, Milne-Edwards & Haime.

Concerning this genus see Bernard, 1905 and 1906. It is common wherever living coral is found on Krusadai and Shingle Islands, forming immense masses in places (*e.g.* Porites Bay). It is encrusting in its earlier stages, becoming massive later.

Genus Goniopora, Quoy & Gaimard.

Concerning this genus see Barnard, 1903. Several specimens have been collected in Porites Bay. The polyps, which are of a greenish grey colour, appear always to be found fully expanded by day.

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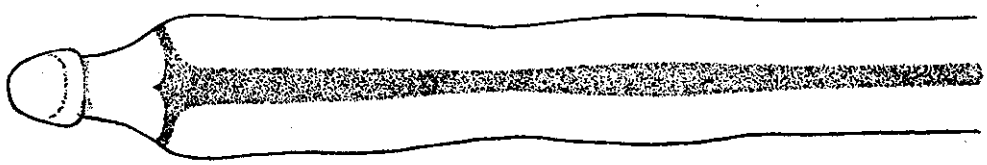
NEMERTINEA.

By F. H. GRAVELY, *D.Sc.*

The neighbourhood of Krusadai Island is not rich in Nemertines; comparatively few specimens have been collected, and as it is doubtful whether any one but a specialist could name them successfully I have thought it wiser not to risk damaging the material by attempting any anatomical investigation. Consequently I have obtained no clue to the systematic position of any but the single species, the external characters of which seem to place its identity beyond doubt.

A brief account of the classification of the group will be found in the "Worms, Rotifers and Polyzoa" volume of the Cambridge Natural History, but for details Burger (1895) should be consulted.

The only species I have been able to identify is *Eupolia hemprichi* (Ehrenberg; see Staub, 1900, p. 613, pl. xlvii figs. 11–11*a*; also Punnett, 1903, p. 104, pl. iv figs. 2–3), a species already recorded from various localities extending from the Red Sea to Polynesia. The few specimens obtained were found on stones in the lagoon on the south side of Krusadai Island, not far from the shore about opposite the bungalow. They are slender



Eupolia hemprichi.

and highly contractile worms, sometimes over 100 cm. long, white in colour but marked dorsally with a transverse dark streak close behind the anterior end, and followed a little further back by a somewhat wider dark band, from which a median dark band extends to the posterior end of the body. A dark mid-ventral band is also present, though somewhat less pronounced.

Under stones on the boulder zones south and east of Krusadai and south of Shingle Island there occurs a short stout Nemertine, about 3-4 cm. long and 5 mm. broad, bright orange-pink or red in colour, sometimes white at the posterior end. When fixed the proboscis, and often its sheath as well, are instantaneously thrown off. Both have a short undivided part from which arise a number of ramifying branches. There is a well-marked constriction behind the head and the mouth is situated immediately behind this, as in Punnett's figure of *Lineus australis* (1900, pl. lxi fig. 41), not in front with the proboscis pore as in *Drepanophorus roseus*, Punnett (1903, p. 112, pl. iv fig. 7; 1909, p.4, pl. i figs. 4*a-b*) for which it might otherwise be mistaken superficially, except that no eyes have been noticed.

A single specimen of a more slender and flattened species, brownish in colour, was found crawling on mud at Kutikal and several very small brownish specimens have been found on stones at Pamban. Pilidium larvae have been seen in the plankton.

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CHAETOPODA.

By F. H. GRAVELY, *D.Sc.*

Class Polychaeta.

Except for the removal of the Ariciidae from the Nereidiformia to the Spioniformia, the classification followed is that adopted by Benham in the Cambridge Natural History.

Order Phanerocephala.

Suborder Nereidiformia.

Benham includes in this suborder the family Ariciidae, in spite of their spioniform appearance. Without them the suborder is identical with the *Polychètes Errantes* of Fauvel (1923) whose book may be consulted for subdivision into genera. He separates the families thus[1]:—

1. Elytra on a certain number of feet, the rest carrying cirri	Aphroditidae.
— Without elytra	2.
2. A fan-shaped group of broad flattened setae (paleae) on all segments	Chrysopetalidae.
— No such groups of setae	3.
3. Prostomium not distinct; pedal cirri globular or absent ...	4.
— Prostomium distinct	6.
4. Feet biramous but without setae; prostomium fused with the following segments, flanked by two long cirri containing aciculi; pedal cirri absent	Tomopteridae.
— Feet uniramous, with globular cirri	5.
5. Pharynx armed with four teeth; prostomium fused with buccal segment, which is emarginate in front	Pisionidae.
— Pharynx unarmed; prostomium indistinct; teguments covered with small papillae and typically bearing in addition a certain number of large spherical capsules in transverse rows	Sphaerodoridae.

[1] A few changes have been introduced into this translation of Fauvel's key, which has, moreover, been made dichotomous throughout.

6. Prostomium conical, without tentacles or palps; dorsal and ventral cirri foliaceous; setae rare, simple, acicular. Typhloscolecidae.
— Prostomium with tentacles and usually with palps ... 7.

7. Prostomium small, with five tentacles; caruncle almost always present; mouth situated somewhat far back on ventral surface; gills well developed; pharynx unarmed ... ... Amphinomidae.
— Prostomium well developed ... ... 8.

8. Pharyngeal armature complex ... ... Eunicidae.
— Pharyngeal armature simple or absent ... ... 9.

9. Tentacles not more than three ... ... 10.
— Tentacles more than three ... ... 12.

10. Palps simple, but often united together so as to be hardly recognizable; pharynx armed with one large tooth or a crown of denticles and followed by a more strongly muscular gizzard; tentacles three; parapodia uniramous except in the sexually mature form of certain species ... Syllidae.
— Palps biarticulate, sometimes absent; pharynx armed or unarmed; gizzard absent ... ... 11.

11. Dorsal cirri short or of moderate length, not moniliform; pharynx armed with a single pair of strong toothed jaws; tentacles two; parapodia almost always biramous. Nereidae.
— Dorsal cirri long and more or less distinctly moniliform; pharynx cylindrical, armed with at most a small pair of jaws (*Magalia*), usually only with stylets or unarmed; tentacles two or three; parapodia sesquiramous or biramous ... ... Hesionidae.

12. Palps small; prostomium conical, slender, annulated, terminated by four small tentacles arranged in the form of a cross; pharynx large, covered with papillae, armed with at least four teeth; parapodia biramous ... ... Glyceridae.
— Palps absent; prostomium more or less normal ... .. 13.

13. Parapodia biramous, with normal cirri and a sickle-shaped gill between the rami; tentacles four; pharynx with soft papillae; all setae simple ... ... Nephthydidae
— Parapodia with foliaceous cirri, without sickle-shaped gill, generally uniramous ... ... 14.

14. General appearance (including the single pair of eyes) normal; tentacles four or five ... ... Phyllodocidae.
— Prostomium flanked by a pair of large globular eyes; tentacles four; tissues transparent; pelagic worms ... Alciopidae.

Family APHRODITIDAE.

Only one subfamily, the Polynoinae, is yet known to be represented. In this subfamily the body is relatively short and broad, the eyes are sessile and there are almost always three tentacles.

Genus Lepidonotus, Leach.

Paired tentacles short, terminal; twelve pairs of elytra.

Lepidonotus carinatulus, Grube.

Pl. IX, fig. 3.

Polynoe (*Lepidonotus*) *carinatulus*, Grube (1869) 1878, pp. 26–27, pl. iii figs. 2–2*b*.
Lepidonotus carinatulus, Willey, 1905, pp. 248–249, pl. i figs. 7–11.

Widely distributed in the Indian Ocean, and the only Aphroditid that is even moderately common on Krusadai and Shingle Islands or at Pamban. The largest specimen obtained is about 17 mm. long and 6 mm. broad. Figures and full description will be found in Herdman's Pearl Oyster Report (Willey, 1905). The elytra are smaller and overlap one another more completely in front than behind.

Lepidonotus cristatus, Grube.

Pl. IX, fig. 2.

Polynoe (*Lepidonotus*) *cristata*, Grube (1875) 1878, pp. 27–29, pl. ii figs. 3–3*d*.
Lepidonotus cristatus, M'Intosh, 1885, pp. 67–69, pl. xi figs. 1–2, xvii 1, xiA 10–11.
Lepidonotus cristatus, Willey, 1905, p. 249.
Lepidonotus cristatus, Horst, 1917, pp. 70–72, pl. v fig. 8

A single specimen from under Pamban bridge. It is longer and much broader than the preceding species, and is easily recognizable by the conspicuous tumid and more or less distinctly bilobed crest that rises from e ch elytron. The ventral setae of the first chaetigerous segment are slenderer and much more extensively pinnate than are those of the other segments. The species is also recorded from Torres Straits, the Philippines and Ceylon.

Genus Iphione, Kinberg.

Only two tentacles, which are inserted laterally; facial tubercle present; dorsal setae more slender than ventral; thirteen pairs of elytra.

Iphione muricata (Savigny).

Pl. IX, fig. 1.

Polynoe peronea, Schmarda, 1861, p. 157, text figs., pl. xxxvi figs. 315*-315*a**.
Iphione muricata, Willey, 1905, pp. 246–248, pl. i fig. 6.
Iphione muricata, Potts, 1910, p. 341.
Iphione muricata, Horst, 1917, pp. 65–66.

Two specimens from Krusadai Island and two from Pamban, all of about the same size as the last species, but with normal elytra, flat except for tubercles beside the posterior margin. The dorsal setae are extremely fine, but form large and extremely dense clusters. The stout ventral setae are arranged in a series of horizontal rows; their subterminal dilatation, though distinct, is much less pronounced than in Schmarda's figure. The head is withdrawn far back between the anterior segments so that several pairs of elytra have to be folded over to expose it. Concerning the "homing" habits of this species see Potts. Its distribution extends from the Malay Archipelago to the Red Sea.

Genus Harmothoe, Kinberg.

Three tentacles, the laterals inserted ventrally; fifteen pairs of elytra; ventral setae bidentate, but neither dorsals nor ventrals with spinous pouches.

Harmothoe imbricata (Linnaeus).

Pl. IX, fig. 4.

Harmothoe imbricata, Izuka, 1912, pp. 43–49, pl. v figs. 1–4, vi 1.
Harmothoe imbricata, Horst, 1917, p. 92, pl. xx figs. 5–6.
Harmothoe imbricata, Fauvel, 1923, p. 55, text fig. 18 *f-l*.

Four specimens from Krusadai Island, about 32 mm. long and 11 mm. broad. The elytra are somewhat inconspicuously fringed, covered with fine cornules, and bear well marked papillae near the hind border, exactly as in *H. imbricata*. This European species is common in Japan and has been doubtfully recorded from the neighbourhood of Macassa. Though I have no authenticated specimens for comparison I have little doubt that those from Krusadai belong to the same species.

Harmothoe dictyophora (Grube).

Polynoe dictyophora, Grube, 1878, pp. 44–45, pl. xv figs. 9–9*a*.
Harmothoe dictyophora, Willey, 1905, p. 251, pl. i figs. 14–16.

A much smaller and slenderer species than the last, somewhat smaller even than *Lepidonotus carinatulus*. It can readily be recognized from the elytra, from a single one of which the species was originally described. They are divided into polygonal areoles carrying chitinous spines and filiform papillae. Some of the spines are bifid at the tip, especially on the first pair of elytra; and on the elytra further back they are arranged near the posterior margin in more or less definite radial rows of about three spines each. The ventral setae are thinner than in the preceding species, but are very strongly spinulose. The species has been recorded from Ceylon and the Philippines.

Family CHRYSOPETALIDAE.

Genus Chrysopetalum, Ehlers.

Body short, segments comparatively few; notopodium carrying paleae only, which cover the greater part of the back; neuropodium carrying compound setae only.

Chrysopetalum ? ehlersi, Gravier.

Chrysopetalum ehlersi, Gravier, 1901, pp. 260–263, pl. x figs. 150–151, text figs. 276–279.

A single specimen of this minute worm was found at Pamban. In most characters it closely resembles Gravier's specimen from the Red Sea. The median tentacle arises immediately behind the anterior eyes, which are in contact with each other and are situated ventrally, agreeing in this more closely with Gravier's description than with his figures. The lateral antennae, which were absent in Gravier's (incomplete) specimen, are well developed but inconspicuous. They arise more or less ventrally, about opposite the posterior margin of the ventral ("anterior") eyes. The palps arise still further back. The position of the palps is the only character in which our specimen differs in any distinctive manner from Gravier's, in which they arise close to the anterior margin; and as there is at present no means of knowing whether this character is constant, I hesitate to regard the two forms as separate species.

Family AMPHINOMIDAE

Genus Eurythoe, Kinberg.

Caruncle moderately developed; a series of arborescent gills on each side of the body; ventral setae bifid.

Eurythoe complanata (Pallas).

Eurythoe pacifica, M'Intosh, 1885, pp. 27–30, pl. ii figs. 3–4, iiA 13–14, iii 2, iiiA 5–12, xvi 5.
Eurythoe complanata, Willey, 1905, p. 245.
Eurythoe complanata, alc. onia and *pacifica*, Potts, 1909, pp. 367–369, pl. xlvi fig. 20.
Eurythoe complanata, Horst, 1912, pp. 34–36, pl. ix fig. 20.

A large worm whose distribution coincides with that of coral reefs. It is very abundant in dead coral and when captured leaves quantities of its irritating spines in one's fingers and in any specimens that may be placed in the same vessel with it. For description see Potts, for figures M'Intosh.

Large specimens have all been colourless in life; but smaller ones (about 5 cm. long preserved) which I am unable to distinguish otherwise, though colourless in spirit, were bright pink, orange-red and greenish brown respectively in life. And the smallest specimen of all has so few segments that it resembles *Euphrosyne sp.* (see below) in shape and size. Further collecting and study is needed to show how far these are really distinct.

Genus Chloeia, Savigny.

Caruncle present, gills pinnate, a single dorsal cirrus.

Chloeia flava (Pallas).

Pl. IX, fig. 10.

Chloeia flava, M'Intosh, 1835, pp. 8-13, pl. iii figs. 1 & 3, iA 7-9.
Chloeia flava, Willey, 1905, pp. 244-245, pl. i figs. 1-2.
Chloeia flava, Horst, 1912, pp. 18-19, pl. vii figs. 2-3.

For figures of other species likely to occur see also Potts, 1909.

A fine specimen of this worm, about 120 mm. long and 35 mm. broad, was found crawling on the mud in the dock at Kutikal Point. All the setae project more or less dorsally, the dense ventral tufts being situated laterally, and the somewhat thinner dorsal tufts dorsally, with the gills on the inner side of them. Each segment bears a large black spot in the middle line, which appears to be one of the most distinctive characters of the species. The setae contain much calcareous matter and their finer structure is therefore apt to dissolve in contact with acid.

Genus Euphrosyne, Savigny.

Caruncle well developed; a series of aborescent gills behind the dorsal setae on either side of each segment.

Two specimens of a short broad worm, about 14 mm. long and of a bright reddish colour in life, were found at Pamban, and one at Krusadai Island. They appear to be most closely related to *Euphrosyne globosa*, Horst (1912, pp. 6-7, pl. i figs. 7-9, vii 11), having six rows of branched tapering gills on either side of the body, and the lateral dorsal cirrus between the second and third rows of gills. The setae, however, project much further beyond the gills than in *E. globosa* and I have not detected any ringent setae, though as I have not dissected a specimen I cannot say with certainty that they are absent.

Family PHYLLODOCIDAE.

Genus Eulalia, Oersted.

Body long and slender, segments numerous, and dorsal and ventral cirri well developed, as in other genera of the subfamily Phyllodocinae. Five tentacles, four pairs of tentacular cirri, parapodia uniramous.

Eulalia (Pterocirrus) ceylonicus, Michaelsen.

Pterocirrus ceylonicus, Michaelsen, 1892, pp. 13-16, figs. 7-8.
Pterocirrus ceylonicus, Willey, 1905, p. 226.

Isolated specimens of this green worm have been found on Krusadai and Shingle Islands and at Pamban. The subgenus to which it belongs is distinguished by the foliaceous (instead of cylindrical), form of the ventral tentacular cirrus of the second

segment.[1] The tentacles are about as long as the head. The first segment is hidden; its single tentacular cirrus is of about the same length as the ventral cirrus of the second segment. The second segment bears two tentacular cirri, the ventral foliaceous one already referred to and a much longer dorsal one. The fourth tentacular cirrus is borne on the third (first chaetigerous) segment and is of about the same length as the dorsal one of the second segment.

Eulalia sp.

Two worms of this genus were collected at Pamban, in which the ventral tentacular cirrus of the second segment is cylindrical. The dorsal cirrus of this segment and of the next is missing. The general appearance and setal characters are very similar to those of the preceding species. The parapodia of both specimens were pale greenish in life, the body of one being ochraceous and of the other dull violet.

Family HESIONIDAE.

Genus Hesione, Savigny.

Two tentacles, no palps, eight pairs of tentacular cirri, parapodia sesquiramous; pharynx unarmed.

Hesione ceylonica, Grube.

Pl. IX, fig. 6.

Hesione ceylonica, Grube, 1874, p. 327.
Hesione ceylonica, Willey, 1905, pp. 266–267.

This is probably at most a local race of *H. splendida*, Savigny, from the Red Sea, as suggested by Willey. Fauvel (1923, p. 233) suggests that *H. splendida* may be identical with *H. pantherina* (Risso) from the Mediterranean.

A single specimen, 37 mm. long was found on Krusadai Island and a smaller one at Rameswaram.

Genus Leocrates, Kinberg.

Pl. IX, fig. 5.

Three tentacles, two biarticulate palps, eight pairs of tentacular cirri; pharynx with two denticles, one dorsal and one ventral.

Several specimens of this worm, which is very like the preceding one in form, have been found at Pamban and one on Krusadai Island. It is pink in colour when alive.

[1] This character, though well marked, may easily be overlooked, especially in mounted specimens, as in dorsal view the ventral membrane, to which the foliaceous form is due, is often completely hidden by the thicker dorsal margin, so that the cirrus becomes indistinguishable from a normal cylindrical one.

Family SYLLIDAE.

Only three species have been found in even moderate abundance, all of them belonging to the subfamily Syllinae, in which ventral cirri are present, the palps are not fused, and the cirri are more or less distinctly monilliform. At least two of them belonging to the genus *Syllis*, Savigny, in which the pharynx is armed with a single tooth.

Syllis (s. str.) gracilis, Grube.

Syllis gracilis, de Saint Joseph, 1895, pp. 190-191, pl. xi figs. 4–7.
Syllis gracilis, Gravier, 1900, pp. 150–154, text figs. 8–16, pl. ix figs. 4–6.
Syllis gracilis, Willey, 1905, pp. 269–270.
Syllis gracilis, Fauvel, 1923, p. 259, text figs. 96 *f-i*.

Several specimens of this small slender worm were collected at Pamban and one on Shingle Island, the largest being about 30 mm. long. It can at once be distinguished by the stout crutch-like setae which occur on all segments of the middle region of the body. The species has been recorded from the English Channel, Atlantic, Mediterranean, Red Sea and Ceylon.

Syllis (Typosyllis) variegata, Grube.

Typosyllis variegata, Gravier, 1900, pp. 158–160, text figs. 24–27, pl. ix fig. 8.
Syllis (Typosyllis) variegata, Fauvel 1923, p. 262, text figs. 97 *h–n*.

This species has the same distribution as the last, which it closely resembles in size and general appearance. It belongs, however, to a subgenus characterized by the presence on all segments of compound setae only, and these all of one general type, though somewhat variable in detail. In our specimens they are extremely variable, and it is possible that further investigation may show that some of the specimens provisionally placed here are really distinct. In the majority of specimens the movable portion is bidentate at the tip and finely pectinate on the straight (or lightly concave) edge below; but in certain specimens both these characters tend to disappear, and in some of these the movable portion becomes somewhat strongly curved.

? Syllis sp.

While bathing a little to the east of the anchorage at Krusadai Island on May 7, 1924, a few days after the new moon, a brilliantly phosphorescent worm was captured at the surface, and a number of others were seen almost immediately afterwards on the north side of Sandy Point; but by the time a tube could be brought the display was over. Several specimens were, however, captured under similar circumstances the following evening, which was unfortunately the last we could spend on the island on that occasion; so further observations could not then be made. On both evenings the display lasted only for a very brief period. The worms were brilliantly luminous and very active; and they poured out luminous matter forming a trail which could be detected without difficulty at close quarters as much as three feet behind them. In September 1925 a few more specimens were obtained under similar circumstances, but they were scarcer and

seemed less brilliant. This may, however, have been due to our not having looked for them at the right phase of the moon.

The number of segments varies from about 100–150 and a preserved but expanded specimen of 150 segments is about 30 mm. long. The dorsal cirri are well developed and of moderate length; they show little trace of the segmentation so characteristic of most worms of this subfamily. The ventral cirri are short and conical. The anterior segments, about 30 in number, bear a single bundle of setae, all compound but of two kinds, one with the articulated portion bidentate and relatively short, and the other with this portion drawn out into a slender filament distally. The next 40–50 segments bear in addition a dorsal bundle of the natatory setae usually found in pelagic Syllids, the remaining segments, like the anterior ones, having only the ventral bundle of compound setae. The worms are whitish in colour, with a well-defined mid-dorsal streak of dark pigment.

The systematic position of this worm is somewhat puzzling. The chitinous anterior margin of the pharynx is strongly oblique on either side dorsally, the two sides meeting in an angle that might possibly be regarded as a backwardly directed tooth. This, however, bears little resemblance to the well-defined forwardly directed tooth of other species of the genus *Syllis* known to me. The form of the body seems, on the other hand, to preclude its inclusion in the genus *Xenosyllis*; and this appears to be the only genus of the subfamily in which the pharynx is unarmed. In the absence of knowledge of its bottom-living phase it seems best to regard it provisionally as belonging to the genus *Syllis*.

Other Species.

It is possible, as already pointed out, that there are other species of the genus *Syllis* (*Typosyllis*) that I have been unable to distinguish from *S. variegata*. In addition to these, isolated specimens of a few other species, mostly somewhat larger, have also been found, including one each that appear to belong to the genera *Opisthosyllis* (subfamily Syllinae, pharyngeal tooth posterior) and *Pionosyllis* (subfamily Eusyllinae, palps fused at base, two pairs of tentacular cirri, one large anterior pharyngeal tooth, compound setae with long movable portion).

Family GLYCERIDAE.

For classification into genera see Fauvel, 1923 p. 381, and Gravier, 1906, p. 135, who differs somewhat in the genera recognized.

Genus Glycera, Savigny.

Parapodia biramous in all parts of the body.

Glycera alba, Rathke.

Glycera alba, Southern, 1921, pp. 627–629, text fig. 16 *a–e*, pl. xxvii figs. 17 A–J.
Glycera alba, Fauvel, 1923, p. 385, text figs. 150 *i–m*.

Two specimens of this slender species of *Glycera* were obtained at Kutikal. The dorsal cirrus is small and globular and the gill short and unbranched. There is a

single dorsal bundle of capillary setae and two ventral bundles of compound ones. In *G. lancadivae*, Smarda (1861, pp. 95–96, 7 text figs.) recorded by Smarda and by Willey (1905, p. 286, pl. v figs. 113–116) from Ceylon, a hooded crochet is also present.

G. alba has already been recorded from California, Ireland and France, and from the Cochin backwater in Southern India.

Genus Goniada, Audouin & M.-Edwards.

Paropodia uniramous in the anterior and biramous in the posterior segments.

A single specimen, bright red in front, pale ochraceous behind, was dug up in sand near the roots of bushes not far from the bungalow on Krusadai Island. All setae of the uniramous parapodia and the ventral setae of the biramous ones are compound, the former with relatively short and strongly serrate, the latter with long and finely tapered movable piece. The dorsal setae are stout and acicular, about two in number (in addition to the aciculus) as in *G. emerita*, Audouin and M.-Edwards (see Fauvel, 1923, pp. 391–392, text fig. 154 h–o).

Family NEREIDAE.

Saint-Joseph (1898, pp. 285–286) gives a key to the genera and sub-genera of Nereidae. This needs modifying slightly in view of Ramsay's work of the genera *Ceratocephale* and *Tylorhynchus* (1914, pp. 231–235) and Fauvel's additional genus *Tylonereis* (1911, p. 373). With these modifications, and excluding the synonymy, it may be translated as follows:—

1. Branchedg ills on some of the anterior segments; paragnaths absent	*Dendronereis.*
— No branched gills	2.
2. Paragnaths absent	3.
— With soft paragnaths only	5.
— With both soft and horny paragnaths	*Leonnates.*
— With separate conical horny paragnaths only	(*Nereis*) 7.
— With separate conical and transverse paragnaths	8.
— Horny paragnaths of three forms: conical, transverse and pectinate. All the groups complete[1]	*Pseudonereis.*
— Very small horny paragnaths, set close together in pectinate lines.	9.
3. Feet uniramous	*Lycastris.*
— Feet biramous	4.
4. Buccal segment with feet and setae	*Micronereis.*
— Buccal segment without feet or setae	*Leptonereis.*

[1] Except the mid-dorsal group of the proximal ring in *P. anomala*. The differences between the three forms of paragnaths are apt to be very minute (see pl. x figs. 25) and may easily be overlooked.

5. Eyes absent; neuropodium with well developed ventral ligule as well as setigerous lobe; ventral cirri double, the two parts arising from a common base	*Ceratocephale.*
— Eyes present; neuropodium and ventral cirrus normal ...	6.
6. Dorsal ligule of notopodium absent; setae of the usual three kinds	*Tylorhynchus.*
— Dorsal ligule folioceous, all setae homogomph spinigerous.	*Tylonereis.*
7. All groups of paragnaths complete	*Nereis (Neanthes).*
— The mid-dorsal and sometimes also the dorso-lateral groups missing on the proximal ring	*Nereis (Nereis).*
— All dorsal groups missing except the dorso-laterals of the proximal ring	*Nereis (Cirronereis).*
— All groups both dorsal and ventral missing on the proximal ring.	*Nereis (Ceratonereis)*
— The dorso-laterals alone present on the proximal ring, none on the distal	*Nereis (Eunereis).*
8. All the groups complete	*Perinereis.*
— The mid-dorsals missing on the proximal ring	*Arete.*
9. The mid-dorsals missing on the distal ring	*Pisonoe.*
— All dorsal groups missing on the distal ring and at least the middorsals (sometimes all, both dorsal and ventral) on the proximal ring	*Platynereis.*

In addition to forms recorded below, a few specimens have been collected which seem to belong to distinct species but which do not show their pharyngeal characters sufficiently clearly to admit of satisfactory classification.

Genus Tylonereis, Fauvel.

Tylonereis ? bogoyawlenskyi, Fauvel.

Pl. X, figs. 18–19.

Tylonereis Bogoyawlenskyi, Fauvel, 1911, pp. 373–380, pl. xix figs. 1–7.

I am indebted to Mr. G. Verugis for the provisional identification of this species, which is abundant in Y-shaped burrows with two apertures in somewhat muddy sand on Krusadai Island (Watchman's Bay and the point to the east of it) and at Kutikal.

The largest complete specimen is about 15 cms. long and has about 230 segments. In life the worms are of a bright pink colour, with a transverse brown line on each segment at the anterior end and a dark red mid-dorsal line.

A typical parapodium is shown in pl. x fig. 19. The two rami are alike in general structure, with a small filiform basal cirrus, a large ligule between it and the setae, and a lobe supported by a black aciculum with two or three more or less cirriform terminations:

dorsal ligule, however, except in the first two or three segments, is very large and foliaceous, its base extending from the (in most segments) minute dorsal cirrus, to the uppermost bundle of setae, whereas the ventral ligule is smaller, widely separated from the cirrus and more narrowly from the setae. Both dorsal and ventral acicular lobes have two stout conical terminations, but the ventral has a filamentous one in addition.

The head bears the usual palps, tentacles and large eyes, the anterior pair of the latter being directed forwards and the posterior upwards. The peristomium bears the usual four pairs of tentacular cirri. The first parapodium is small, with the dorsal ligule stoutly cirriform and scarcely longer than the dorsal cirrus; but the full size and typical form is reached in about the third segment. All the setae are homogomph spinigereous with striated shaft and finely tapered articulated portion of the knife-blade type, its sharp edge finely denticulate. The dorsal bundle is divided into two by the acicular lobe, the lower half being the larger; the ventral is undivided.

The proximal ring of the pharynx bears one pair of somewhat widely separated dorsal accuminate papillae, and two more closely approximated lateral ones. It is without papillae ventrally. The distal ring bears a pair of lateral tufts of about six papillae each. Three papillae are about equally spaced between them dorsally with two (often absent) immediately below the median one. A double row of somewhat closely approximated papillae extends between the lateral tufts of papillae ventrally. The jaws are somewhat weakly serrate. The anal segment is broad and often appears much thickened. It bears a pair of anal cirri which arise near the middle line on the ventral side.

Genus Nereis, Cuvier.

Nereis (s. str.) falcaria (Willey).

Pl. X, fig. 20.

Ceratonereis falcaria, Willey, 1905, p. 272, pl. iv fig. 89.

Several specimens from Krusadai and Shingle Islands. The largest specimen is about 20 mm. long with about 70 segments, and a mounted specimen which is evidently a mature male is only about 11 mm. with about 65 segments. The type of Willey's species from Ceylon was 27 mm. long with about 107 segments. But the setal characters seem to me to indicate the identity of our specimens with this species, particularly the change in the dorsal setae at about the seventeenth segment from spinigerous to bidentate falcigerous.

The paragnaths on the distal ring agree with Willey's description, but are somewhat variable. The dorso-laterals (ii) may be from two to four in number, arranged in an oblique row, or they may be more numerous and more irregular (see figs.). The mid-ventrals (iii) may be as few as three. Willey makes no mention of the paragnaths of the proximal ring, and places the species in the subgenus *Ceratonereis*, in which they are absent. But he had only two specimens, and if the pharynx was not extruded they would be most difficult to recognise in so small a worm, and I conclude that he overlooked them.

On the ventral side these paragnaths form a single line. Dorsally the laterals (vi) form a very small group on each side, the median group (v) being absent.

No observations on living specimens of this small worm have been recorded; but spirit specimens show a characteristic pattern of pale reddish brown patches, constant in arrangement though variable in extent. The arrangement is shown in fig. 20.

Nereis (s. str.) sp. nr. ezoensis, Izuka.

Pl. X, fig. 22.

A single specimen from Pamban seems to be closely related to *N. ezoensis*, Izuka (1912, pp. 173-174, pl. xviii figs. 12-20). The pharyngeal characters are practically identical in the two forms, but the parapodia differ in structure. In *N. ezoensis* the dorsal ligule is of abnormal size, particularly in the posterior segments. In the Pamban form the dorsal and ventral rami of the parapodia are of about equal length and the dorsal ligule is of normal proportions. The setae of the two forms agree closely, but the spinigerous ones are homogomph, not heterogomph as shown in Izuka's figure.

Nereis (Ceratonereis) mirabilis, Kinberg.

Pl. X, fig. 21.

Nereis (Ceratonereis) mirabilis, Ehlres, 1887, pp. 117-120, pl. xxxvi figs. 1-6.
Ceratonereis mirabilis, Gravier, 1900, pl. xi fig. 42; 1901, pp. 172-174.

A rather stout worm, the largest about 3 cm. in length. In life semi-transparent, broadly marked transversely on each segment with a dull greenish tint. It was first described by Kinberg and again by Ehlers from the Central American part of the Atlantic Ocean, and later by Gravier from Djibouti in the Gulf of Aden. It is not uncommon on Krusadai and Shingle Islands. On one occasion at least it was found among Zoanthids.

The species may easily be recognized from all others in our collection by the great length of the dorsal cirri and by the large lamelliform end-piece of the falcigerous setae. A typical parapodium from about the fortieth segment shows setae as described in detail by Gravier, except that the heterogomph falcigerous setae are much more and the setigerous much less numerous in the dorsal and the lower ventral bundles, and the setigerous more numerous in the upper bundle of the ventral ramus. The falcigerous setae, which are all heterogomph, have a long and broad end-piece which broadens rapidly from the point of attachment, after which it is practically straight and parallel sided till it narrows below the strongly hooked tip. The setigerous setae have the end-piece very long and slender. Those of the ventral bundle of the ventral ramus are strongly heterogomph, the rest are almost homogomph.

The pharynx is shown in pl. x fig. 21. The paragnaths vary slightly in number and arrangement and also in relative size.

Genus Perinereis, Kinberg.

Perinereis nuntia, Savigny.

Pl. X, fig. 24.

Nereis (Neanthes) quatrefagesi,[1] Grube, 1878, pp. 79-80.

Abundant in clean sand near high tide mark on Krusadai Island (Sandy Point and among bushes on sandy beaches in Watchman's Bay). Pink in colour when fresh with a dark mid-dorsal line. Stouter and of firmer consistency than *Tylonereis bogoyawlenskyi*. The largest specimen is nearly 13 cm. long and has about 200 segments. The dorsal cirrus is scarcely as long as the dorsal ligule. The dorsal setae are homogomph spinigerous; the ventral are homogomph spinigerous above and heterogomph falcigerous below. The paragnaths on the ventral side of the proximal ring of the pharynx (vii and viii) are usually arranged more or less distinctly in a treble band. The dorso-laterals of the same segment (vi) are transverse, each group forming a single transverse line, the two lines being sometimes (in abnormal specimens) united by the addition of one or two denticles, usually somewhat irregular, across the middle line as in *N. brevicirrus*, Grube (1868, pp. 19-21, pl. ii figs. 2-2*f*). The proximal mid-dorsals (v) are usually three in number, forming an equilateral triangle as in *N. brevicirrus*, not one only as described for *N. quatrefagesi*. In abnormal specimens, however, they are sometimes reduced to two, irregularly placed, or even to one, or may be as many as five, three in a row behind with one in front of each of the two outer ones, or more irregularly placed: and as the jaws are denticulate and the parapodia also agree with those of *N. quatrefagesi* from the Philippines rather than with those of *N. brevicirrus* from St. Paul Island, the Krusadai specimens must certainly, I think, be referred to the former. Grube only appears to have seen a single specimen. On the distal ring of the pharynx the mid-dorsal paragnaths (i) are rarely one, usually two or three, in number and the dorso-laterals (ii) five to seven (rarely as few as two). The mid-ventrals (iii) form a somewhat small and widely separated group, usually with one tooth on either side rather far from the rest. The ventro-laterals (iv) form a larger and more compact group and are individually larger also. The last segment bears a pair of anal cirri.

The *Heteronereis* form is usually found at a deeper level in the sand than the normal form. The size is somewhat variable, but the length seems always to be less than the maximum reached in the *Nereis* phase. The eyes are much enlarged and in the modified segments the parapodia are much more crowded than in the anterior part of the body, as is usual in this phase. The body is much swollen by the sexual products, and in the female (which seems to be much more abundant than the male) the bluish colour of the ova completely masks the normal pink colour. Males and females are thus easily distinguishable in life.

[1] Mr. Verugis informs me that Grube's *Nereis* (*Neanthes quatrefagesi*, really belongs to the genus *Perinereis* is now recognized as identical with *P. nuntia*, Savigny, or possibly a variety of it. See Fauvel, 1919.

Perinereis cultrifera (Grube).

Pl. X, fig. 26.

Perinereis floridana (Ehlers), Gravier, 1900, pl. ii fig. 48; 1901, pp. 185-188, figs. 185-189.
Nereis cultrifera, Izuka, 1912, pp. 151-153, pl. xvi figs. 7-14.
Perinereis cultrifera, Fauvel, 1923, pp. 352-354, figs. 137 *a-l*.

This widely distributed worm has been described from various places under a variety of names, as indicated in the synonymy given by Fauvel. It is occasionally found among stones and shingle on Krusadai and Shingle Islands.

The pharynx is shown in pl. x fig. 26. Little or no variation in the paragnaths is shown by our specimens, but the descriptions and figures cited show that the distal mid-dorsals may vary from 1-2 in number and the proximal from 1-3, and that the transverse proximal dorso-laterals may have at least one conical paragnath associated with them.

The parapodia differ only slightly in different parts of the body. The dorsal cirrus seems to be rather long in our specimens, probably because they were narcotized before they were fixed. The setae are of two kinds, heterogomph falcigerous with small almost straight end-piece of the usual type, and almost homogomph spinigerous. The dorsal bundle consists entirely of the latter, which predominate in the upper bundle of the ventral ramus but are in a minority in its lower bundle.

Izuka gives "65 mm. (rarely 85 mm.)" as the length of this worm. One of our specimens is about 90 mm. long, but this is much the largest of them.

Pseudonereis anomala, Gravier.

Pl. X, fig. 25.

Pseudonereis anomala, Gravier, 1900, pl. xii figs. 50-52; 1901, pp. 191-197, text figs. 194-202.

This species was described by Gravier from Suez and Djibouti. It is not uncommon under stones on Shingle Island and has also been found on Krusadai Island (Porites Bay) and at Pamban. It reaches a length of about 6 cm. and is moderately stout. Immature forms are of a dull greenish colour when alive, and mature females bright blue-green; in spirit all are dull brownish above, pale beneath.

The pharynx is shown in pl. x fig. 25. There is very little difference between the three different forms of paragnath, the transverse ones being conical, not linear as in the preceding species, and the pectinate ones even less differentiated. The former are arranged alternately with others on the ventral side of the proximal ring.

The anterior parapodia are of typical form, but in the hinder part of the body the dorsal ligule becomes more and more prominent, carrying the dorsal cirrus with it, so that in the hindermost segments both appear to be mounted on an elongate pedicle. The setae are of four kinds: homogomph spinigerous with rather small and slightly curved end-piece, which are confined to the dorsal ramus; homogomph spinigerous with long straight end-piece, which are confined to the dorsal bundle of the ventral ramus heterogomph falcigerous with very short stout end-piece, which are confined to the ventral ramus; and homogomph falcigerous with somewhat more slender end-piece, which

are confined to the posterior part of the body. I have not been able to check the distribution fully in our specimens as their setae are much broken, but all four varieties have been recognized.

Platynereis insolita, Gravier.

Pl. X, fig. 23.

Platynereis insolita, Gravier, 1900, pl. xii fig. 53; 1901, pp. 197–200, text figs. 203–206.

A rather delicate worm reaching a length of about 2 cm., pale greenish in life, of which numerous specimens were collected from Pamban and Krusadai Island and one from Shingle Island. Gravier's specimens came from the Red Sea.

Our specimens seem to agree with Gravier's in all respects except in the smaller number of distal mid-ventral paragnaths (group iii) which I have been unable to distinguish at all in many specimens. The species is probably the tropical representative of *P. dumerilii* (Audouin and Milne-Edwards; see Fauvel, 1923, pp. 359–360, text figs. 141 *a–f*; and Izuka, 1912, pp. 158–160, pl. xvii figs. 7–8) from which it differs in having the dorsal and ventral rami of the parapodia more distinctly separated and in having no prominence on the vertex of the homogomph falcigerous setae, the strong hook of which is smoothly rounded. It is by means of these setae, which are confined to the dorsal bundle, that members of this genus can as a rule be most readily recognized when the pharynx is not extruded, the end-piece being bent right round so as somewhat to resemble the upper half of the beak of a bird of prey.

Family EUNICIDAE.

The Eunicidae can be divided into subfamilies as follows (see Fauvel, 1923, pp. 396–397):—

1. Prostomium without (visible) tentacles or palps. No ventral cirri. Dorsal cirri rudimentary ... ... Lumbriconereinae.
— Prostomium with tentacles ... ... 2.

2. No ventral cirri. Dorsal cirri foliaceous. Three tentacles. Lysaretinae.
— Ventral cirri present. Dorsal cirri not foliaceous ... ... 3.

3. Two tentacles and two cylindrical palps. Upper teeth composed of from two to four longitudinal series of very small and numerous pieces ... ... Staurocephalinae.
— From one to seven tentacles. Palps short, globular. Upper teeth consisting of four or five pairs of pieces ... ... 4.

4. Seven tentacles (often missing in preserved specimens), five occipital, mounted on a ringed ceratophore, and two frontal which are ovoid ... ... Onuphidinae.
— From one to five occipital tentacles, frontals absent ... Eunicinae.

Gravier, who gives a very complete system of classification (1900, pp. 217–224), uses slightly different definitions, which enables him to reduce the number of subfamilies to

three, merging the Lysaretinae in the Lumbriconereinae and the Onuphidinae in the Eunicinae, which is in some ways more convenient.

Subfamily EUNICINAE.

Three genera occur, *Eunice* and *Marphysa* with five tentacles, and *Lysidice* with three. *Eunice* differs from the other two in possessing a pair of dorsal tentacular cirri.

Genus Eunice, Cuvier.

Specimens of this genus are chiefly found among stones and shingle.

For keys to a number of species see Grube, 1878, pp. 144-146, and Crossland, 1904, pp. 287-288.

Eunice antennata, Savigny.

Eunice torresiensis, M'Intosh, 1885, pp. 270–272, text figs. 32–33, pl. xxxvii figs. 18–21, xix-*a* figs. 12-13.
Eunice antennata, Crossland, 1904, pp. 312-318, text figs. 56–60, pl. xxii figs. 1–7.
Eunice antennata, Willey, 1905, p. 280.

This is by far the commonest species of *Eunice* on Krusadai and Shingle Islands, where it is found among dead coral. It has also been found at Pamban. It is known to occur from the Red Sea to Zanzibar and the Philippines. Large specimens are about 13 cm. long. The gills are multifilar and are well developed from the sixth segment onwards. A small gill is often present on the fifth segment. The colour of living specimens is somewhat variable. The general colour is a dull greenish grey,[1] with the tentacles and tentacular cirri and the area between, and to a greater or less extent on either side of, the latter white. Sometimes the constrictions on the tentacles are thrown into special prominence by dark green or red pigment.

Eunice siciliensis, Grube.

Eunice siciliensis, Crossland, 1904, pp. 323-326, pl. xxii figs. 8–9.
Eunice siciliensis, Willey, 1905, p. 282.

The distribution of this worm seems to coincide with that of limestone suitable for its borings. Two specimens have been obtained from Pamban and one from Shingle Island. The gills are unbranched and do not commence till about the fiftieth segment, sometimes not till the two hundred and fiftieth.

Eunice spp.

Three or four other species have been found which I cannot identify. One, on account of its size and colour, is the most striking Eunicid of the district. In structure it closely resembles *E. antennata*, but it attains a length of nearly 20 cm., and the gills are vestigial on the third segment, distinct on the fourth and fully developed on the fifth;

[1] Many of Crossland's specimens were pink (1904, p. 313).

their filaments are stouter and less numerous, a character which is particularly noticeable in the posterior part of the body. The general colour is dull red above. The tentacles are white with reddish constrictions. The tentacular cirri and the whole width of the fourth chaetigerous segment are white. The parapodia are white with the bases of the setal bundles dark. A pair of transverse white spots are found immediately above the gills from the sixth chaetigerous segment onwards, and a round median white spot from about the thirtieth. Specimens have been found on Krusadai and Shingle Islands.

A second species, of which one specimen has been obtained at Krusadai and one at Shingle Island, neither of them complete, probably belongs to the subgenus *Nicidion*, Kinberg, in which gills are entirely absent.

Genus Marphysa, Quatrefages.

This genus differs from the last only in the absence of tentacular cirri, and in living mostly in mud.

Four species have been found, *M. macintoshi* with undivided prostomium; *M. furcellata* with divided prostomium and knife-like compound setae in the ventral bundle of all segments; *M. gravelyi* with divided prostomium and similar compound setae only in the ventral bundle in the anterior segments and simple capillary setae only in the ventral bundle in the posterior segments, mixed in the middle segments; and *M. mossambica* with divided prostomium and capillary setae only in all segments.

Marphysa macintoshi, Crossland.

Marphysa macintoshi, Crossland, 1903, pp. 137–138, text fig. 12, pl. xiv, figs. 3–6.

A single specimen from Kutikal. The gills are of moderate size and extend over the greater part of the length of the body, though absent from the anterior part. In other species with undivided prostomium the gills are large and are confined to a few anterior segments. Originally described from Zanzibar.

Marphysa furcellata, Crossland.

Marphysa furcellata, Crossland, 1903, pp. 141–143, text fig. 15, pl. xv figs. 13–14.

Common in mud and muddy sand on Krusadai Island; also found in Kutikal backwater. The round anterior segments with the rest of the body broader, flat above and only slightly convex below, taken in conjunction with the character of the gills and setae, leave little room for doubt that the Krusadai specimens are identical with *M. furcellata* from Zanzibar, though they apparently taper somewhat less gradually towards the apex. In the posterior part of the body the comb setae are identical with those figured by Crossland for this species, but in the anterior part they are long and slender as in the allied but more uniformly cylindrical species which he describes and figures under the name *M. simplex*. Specimens reach a length of about 13 cm., the maximum breadth being about 2 mm.

Marphysa mossambica, Peters.

Marphysa mossambica, Crossland, 1904, pp. 139–140, pl. xv figs. 7–10.

This widely distributed species, characterized by the complete absence of compound setae, is abundant in mud at Krusadai Island and both on the mud flats and in the backwater at Kutikal. It was also found in an overheated and rapidly drying pool at the edge of the terrestrial vegetation line on Shingle Island. The body resembles that of the preceding species in shape and general appearance, but it attains a much larger size and is much broader in proportion to its length, at least when contracted. It is the largest common polychaet found on the island. A complete specimen, which is much more slender than usual, partly at least because less contracted, is about 28 cm. long and has about 350 segments. It is probably not full-grown.

Marphysa gravelyi, Southern.

Marphysa gravelyi, Southern, 1921, pp. 617–622, text figs. 13–13 (2), pl. xxiv figs. 13 A–G xxv 13 H.L.

Two specimens of this worm, which appears to be the common brackish water Eunicid of the Coromandel Coast, were found in Kutikal backwater. It was described from the Chilka Lake and is common in backwaters around Madras. Its most distinctive character is found in the setae of the ventral bundle, all of which are compound in the anterior segments, simple in the posterior and mixed between.

Genus Lysidice, Savigny.

Lysidice collaris, Grube.

Lysidice collaris, Marenzeller, 1879, pp. 28–29, pl. v figs. 2–2 *b*.
Lysidice collaris, Crossland, 1904, pp. 143–144.
Lysidice collaris, Willey, 1905, p. 284.
Lysidice collaris, Izuka, 1912, pp. 133–135, pl. xiv figs. 9–10.

Several specimens of this worm, already recorded from the Red Sea, Zanzibar, Philippines and Japan, were found on Krusadai and Shingle Islands and at Pamban. The middle tentacle arises a little in front of the others, instead of in the usual position slightly behind, but the actual distance is minute. The mandibular plates are most characteristic, being usually calcareous with special black or brown horny portions, of which the most conspicuous is a longitudinally crescentic one separating the inner front angle from the rest of the plate. The body is flattened below and strongly arched above—the opposite of what is found in the Krusadai species of *Marphysa*. The eyes vary from crescentic to bean-shaped, but are never oval or round. The general colour of the body is dull reddish, sometimes bluish behind. The tentacles are whitish and unbanded. The palps are white laterally and below. The peristomial segment may have a large white mid-dorsal patch extending from the posterior almost to the anterior margin, the next segment, similar but smaller patch and the first chaetigerous segment a smaller one still, likewise in contact with the posterior margin. The second chaetigerous segment, and sometimes the third also, are white.

Subfamily ONUPHIDINAE.

Two genera are represented, *Onuphis* with pectinate or cirriform gills and *Diopatra* with spiral gills. Both can be distinguished from the common and widely distributed *Hyalonoecia*, not yet found on the island, by the presence of the usual pair of dorsal tentacular cirri. Both tentacles and tentacular cirri seem, however, to be readily shed.

Genus Onuphis, Audouin & Milne-Edwards.

Two forms occur, one with the gills bifid (except in the anterior segments) and one with all of them undivided. The former is evidently identical with *O. dibranchiata*, Willey, from Ceylon. The latter is smaller and may possibly be the young form of the same. For the present it seems best, however, to leave this unidentified.

Onuphis dibranchiata, Willey.

Pl. IX, fig. 7.

Onuphis dibranchiata, Willey, 1905, pp. 277–278, pl. iv fig. 100.

Several specimens from Krusadai Island, some of them in tubes covered with coarse sand grains. Easily recognized by its filamentous gills which are bifid after about the first 17 segments.

Genus Diopatra, Audouin & Milne-Edwards.

Diopatra neapolitana, Della Chiaje.

Diopatra neapolitana, M'Intosh, 1903, pp. 128–133, pl. x figs. 1–4.
Diopatra neapolitana, Crossland, 1903, pp. 132–135, pl. xiv fig. 1.
Diopatra neapolitana, Fauvel, 1923, pp. 419–420, text fig. 166 *a–h*.

A single specimen of this widely distributed species was found on Krusadai Island and one at Kutikal. Crossland notes that the species is a variable one and that some of the variations seem to be correlated with locality.

Subfamily LYSARETINAE.

Genus Halla, Costa.

One complete specimen and two posterior fragments were collected at Pamban. The former was dark purplish brown, the two latter dull orange, in life. The usual crochets are present, but the capillary setae are drawn out to a fine point and are all of one kind, without markings of any sort. In other respects the specimens closely resemble *H. parthenopeia* (Della Chiaje; see Fauvel, 1923, pp. 426–427, fig. 169 *a–h*) from the Mediterranean.

Subfamily LUMBRICONEREINAE.

For the classification of this subfamily, see Gravier, 1900, p. 222.

Specimens of at least two species of *Lumbriconereis* were collected at Pamban and Shingle Island, and specimens of *Arabella* from Krusadai and Shingle Islands and

Pamban, some of them from sponge. I have not succeeded in identifying them. *Lumbriconereis* can be recognized by the presence of compound setae or crochets, the remaining genera of the subfamily having simple setae only. *Arabella* has no setae on the first two segments and no acicular setae on any segments. It has four eyes in a transverse line.

Suborder Spioniformia.

The families, among which the Ariciidae are here included, may be separated thus—

1. Mouth and prostomium normal	2.
— Mouth and prostomium modified	4.
2. Peristomial cirri absent; setae all capillary, not feathered; short, stout ventral setae often present, especially in the anterior segments, but no true crochets.	Ariciidae.[1]
— Peristome provided with a pair of long cirri (tentacles) which, however, are readily shed; crochets or feathered setae present	3.
3. Dorsal setae fringed capillaries, ventral crochets; no feathered setae	Spionidae.[2]
— Feathered setae present in some part of the body, no true crochets	Disomidae.
4. Prostomium large, spoon-shaped	Magelonidae.
— Prostomium merged in lips of wide and more or less funnel-like mouth	5.
5. Anterior segments elongate, but arrangement of setae alike throughout	Ammocharidae.
— Body divided into strikingly dissimilar regions ...	Chaetopteridae.

Family ARICIIDAE.

Genus Scoloplos, Blainville.

Neuropodia simply bifid or entire, not connected by a membrane across the middle line in any segments as in the genus *Aricia*. The prostomium is pointed in *Scoloplos, s. str.*, rounded in the subgenus *Nainereis*.

[1] ? Incl. Apistobranchidae and Levinsenidae, though closely allied to the Ariciidae, the former of these two families has palps and the latter one tentacle, so should probably be placed at the end of the Nereidiformia, thus linking the two suborders (see Mesnil, 1898).

[2] Incl. Polydoridae.

Scoloplos marsupialis, Southern.

Pl. IX, fig. 11.

Scoloplos marsupialis, Southern, 1921, pp. 632–634, text fig. 18, pl. xxvii figs. 19 A–G.

Several specimens from muddy sand on Krusadai Island (Watchman's Bay) of which the largest is about 10 cm. long. Pink in life. Though about twice as long as the type specimen, the Krusadai specimens agree closely with Southern's description and figures. The pocket-like membranes situated immediately below the parapodia from about the twentieth segment onwards, are the most distinctive feature of the species.

Scoloplos sp.

A single specimen of another species of *Scoloplos* was collected from shingly ground south-west of Krusadai Island. There are no pocket-like membranes; the gills are much smaller than in *S. marsupialis*; and the ventral rami of the anterior parapodia, with their special stout setae, project strongly from the body wall.

Family SPIONIDAE.

Concerning the classification of this family see Mesnil, 1897, and Elwes, 1910, p. 70.

Genus Scolecolepis, Blainville.

Prostomium with frontal processes. Gills from the first setigerous segment. No hooded setae in the dorsal bundle.

A small species of this genus, pink in colour when alive, is not uncommon in muddy sand on Krusadai Island (Watchman's Bay). The largest specimen obtained is about 4 cm. long but is incomplete, as are all the others also.

Genus Spio, Fabricius.

A single incomplete specimen from Watchman's Bay probably belongs to this genus, in which the prostomium is without frontal processes and gills extend from the first setigerous segment to the posterior end of the body. Our specimen is of about the same size as the species of *Scolecolepis* above recorded or a little smaller. The gills of the first five setigerous segments are filamentous, those of the first three particularly being long and tentaculiform. The gills of the remaining segments are normal.

Genus Polydora, Bosc.

Fifth setigerous segment modified by the presence of specially stout posterior dorsal setae.

Polydora coeca, Oersted.

Polydora coeca, St. Joseph, 1894, pp. 59-61, pl. iii figs. 65-70.
Polydora coeca, Mesnil, 1896, pp. 191-193 (keys, pp. 236 and 241), pl. xii figs. 23-29.

A species of *Polydora*, probably about 3 cm. in length, is often found on Krusadai and Shingle Islands, burrowing in large numbers in the superficial layers of coral rock, from which specimens are difficult to extract satisfactorily. The mouths of the burrows are coated with mud, which makes the presence of the worm easy to detect. Its characters agree exactly with those of *P. coeca*, Oersted, as given by Mesnil, and with those of specimens from the Isle of Man. The species is known to occur in the North Sea and Arctic Ocean. Mesnil records it from calcareous algae, and St. Joseph from oyster shells. Its discovery in coral rock in the Gulf of Manaar suggests that it will prove to be a limestone borer of world-wide distribution.

Family CHAETOPTERIDAE.

For the classification of "the lower Chaetopteridae" see Crossland, 1903, p. 170. The more highly specialised genus *Chaetopterus* differs from the four genera there enumerated in the presence of "wings" (see Benham, 1901, fig. 173). In this genus the tentacles are small and the body is divided into three regions.

Genus Phyllochaetopterus, Grube.

One pair of long tentacles, grooved and ciliated (and readily shed) as in the Spionidae, and an additional much smaller pair often obscured by the first. Body divided into three regions.

Phyllochaetopterus sp.

Pl. IX, fig. 15.

Colonies of a *Phyllochaetopterus*, closely allied to *P. ramosus*, Willey (1905, p. 293, pl. v figs. 133-136) from Ceylon, are sometimes found in the cavities of sponges and coral rock on Krusadai and Shingle Islands. The worms are difficult to extract satisfactorily from their brown chitinous ramified tubes, but it seems probable that complete specimens would be about 2 cm. long. The anterior part of the body is whitish, the posterior part dark olive, the change taking place in about the middle of the second or branchial region. The long tentacles are whitish, with extensive transverse brown bands in worms from coral rock, and with less extensive ones in those from the group of colonies from sponge.

The first region of the body consists of 13 short, broad segments or (more rarely) of one more. The second region consists of more elongate segments, about 12 in number. A pair of elongate eyes are present in some specimens but are often difficult to detect and are probably not constantly present. There is a single enlarged seta on each side of the fourth chaetigerous segment. It is more or less obliquely truncate and cupped distally with a large tooth at the apical point of the margin of the cup, a smaller one opposite this and three (? sometimes only two) on each side between (pl. ix fig. 15). I have been unable to detect more than one or two setae supporting internally the bilobed notopodia

of the branchial region. The abdominal notopodia are clavate papillae, each supported by a single internal seta. The uncini of the branchial region seem to be less numerous and less conspicuous than in *P. ramosus.* I have not been able to detect the bend in the specialised setae of the fourth segment, nor the special setae of the last notopodium of the first body region, characteristic of *P. pictus.* Crossland (1903, pp. 174–176, pl. xvi figs. 5–7 and 9 *a–d*) from Zanzibar.

It seems to me not unlikely that further study will show that *P. pictus, P. ramosus* and the Krusadai form all belong to a single variable species with a wide distribution round the shores of the Indian Ocean. For the present, however, it seems necessary, in view of the described differences, to keep them distinct.

Post-larval Chaetopterid.

Pl. IX, figs. 12–14.

Specimens of a deeply pigmented post-larval Chaetopterid are sometimes found in abundance, each in a minute mud-covered tube adherent throughout its length to the surface of a sponge. From the fact that they are always found in a state of active proliferation, and from their abundance, it seems probable that they belong to the above described common colonial species of *Phyllochaetopterus*, though there is as yet no real proof of this. A well-marked bilobed prostomium and two long peristomial tentacles are present; the second pair of tentacles is not developed. The modification of the fourth chaetigerous segment has begun but I have not been able to distinguish the characteristic stout setae. Proliferation takes place by the formation of the head of a daughter worm and a new tail for the parent between the ninth and tenth segments.

Genus Spiochaetopterus, Sars.

Characters as in *Phyllochaetopterus* except for the absence of the second pair of tentacles.

From a cluster of tubes, slightly more slender than those of the preceding species but with the same manner of growth in a cavity of a sponge, a slender whitish Chaetopterid was extracted, with a pair of long slender tentacles. Unless a second pair of tentacles is hidden beneath the bases of these, it must belong to the genus *Spiochaetopterus.* It seems better to leave detailed examination till it can be sent to a specialist rather than risk damaging the specimen.

Suborder Terebelliformia.

The families may be separated thus :—

1. Segments distinct and similar throughout ... ... Cirratulidae.
— Body more or less clearly divided into regions ... ... 2.
2. Paleae absent ... ... Terebellidae.
— Paleae present ... ... 3.
3. Posterior part of body normal ... ... Ampharetidae.
— Posterior part of body reduced to a small leaf-like scapha for closing the tube ... ... Amphictenidae.

Family CIRRATULIDAE.

For classification see St. Joseph, 1894, pp. 42–47.

Genus ? Audouinia, Quatrefages.

Tentacular cirri borne on one or more segments behind the first gill-bearing segment.

Several worms about 3 cm. long, probably belonging to this genus, were found in a cavity in a sponge on Krusadai Island. They were of a deep orange red colour in life. The tentacular cirri are borne on about the fourth segment, and in some specimens there appears to be a short pair of gills on the first or second segment. Possibly these have been shed in other specimens.

Family TEREBELLIDAE.

For classification see St. Joseph, 1894, pp. 166–184 and 235.[1]

With the possible exception of some of the smaller forms, mostly from Pamban, which have not yet been identified, all the specimens collected belong to the subfamily Amphitritinae, in which the cephalic lobe is short and truncate, gills are usually present, the uncini are of one form throughout the body and the vascular system is conspicuous. Only two genera are represented: *Polymnia*, which is one of many genera in which the uncini are avicular, with transverse rows of denticles on the vertex, and *Loimia*, which is distinguished from all other genera of the subfamily by its pectinate uncini without transverse rows of denticles.

Genus Polymnia, Malmgren.

Several specimens about 3 or 4 cm. long (excluding tentacles) and somewhat slender, from Krusadai Island. The species appears to be allied to *P. triplicata*, Willey, but to differ slightly in the form of the uncini and in the less abrupt termination of the ventral shields, which disappear so gradually that their number (probably 12) is difficult to determine with certainty.

Genus Loimia, Malmgren.

Loimia annulifilis (Grube).

Terebella annulifilis, Grube, 1878, pp. 225–226, pl. xiii fig. 2.
Loimia annulifilis, Willey, 1905, pp. 301–302, pl. vi figs. 153–154.

A single specimen from Pamban. Willey's description and figures of this species and the next render their identification easy.

Loimia medusa (Savigny).

Loimia medusa, Willey, 1905, pp. 302–303, pl. vi figs. 155–159.

A single specimen from Shingle Island, slightly smaller than the specimen of the preceding species but slightly longer and much stouter than the one before that.

[1] Keys to the genera of Amphitritea and Polycirridea are given by St. Joseph. The three remaining groups apparently each consist of a single genus.

Suborder Capitelliformia.

Family CAPITELLIDAE.

For classification see Eisig, 1887, p. 860.

Genus Heteromastus, Eisig.

Capitellidae in which the thorax consists of twelve segments, of which the second to sixth bear capillary setae only, the rest bearing crochets only, as do the abdominal segments also.

Worms of this genus, deep red in colour, about 8 cm. long but exceedingly slender, live in the mud between tide marks in Watchman's Bay and at Kutikal. It is difficult to obtain complete specimens and it is possible that other genera may also be represented.

H. filiformis (Claparede) from the Atlantic and Mediterranean is described and figured by Eisig (1887, pp. 839–840, pl. i, figs. 4–4*a*, xxvii 15–21, xxxii 17–18). It is possible that the Krusadai species will prove to be identical with it.

Suborder Scoleciformia.

The Cambridge Natural History may be consulted concerning the families of this somewhat heterogeneous suborder. In addition to the forms recorded below several unidentified species have been collected. But none of these are at all common.

Family MALDANIDAE.

St. Joseph (1894, pp. 130–132) and Arwidson (1907, pp. 4–6) should be consulted for the classification of this family.

Genus Axiothea, Malmgren.

Head plate-like. Anal funnel well developed, with numerous cirri. Ventral setae crochets in the anterior as well as the posterior segments.

Several specimens about 1 cm. long were found among a colony of *Polydora coeca*.

Other forms.

Several larger Maldanids have been obtained from mud or sand, and one from a sponge; but all are incomplete.

Family SCALIBREGMIDAE.

A single specimen of *Scalibregma* was found on Shingle Island. It is about 35 mm. long and can easily be recognized by the tessellated appearance of its integuments (compare M'Intosh, 1885, pl. xliv figs. 1–3).

Family CHLORHAEMIDAE (= FLABELLIGERIDAE).

Two species of *Stylarioides* have been found in mud embedded in hollows in coral rock in Porites Bay. In one the segments, though coated with sand grains, are clearly marked throughout the body, which is about 6 cm. long and tapers gradually posteriorly;

and every segment bears two pairs of bundles of long slender setae as in the subgenus *Trophonia*, Audouin and M.-Edwards. Of this only a single specimen has been found.

In the other, of which four specimens have been found, the body is not coated with sand grains, but the anterior segments at least are less distinct. The body is about 2 mm. long, the anterior part very stout, the posterior part, which is often recurved, very slender; and the setae, with the exception of those protecting the head, are inconspicuous as in the subgenus *Stylarioides*, Della Chiaje, *s. str.* It is possible that these worms belong to the species *S. parmatus*, Grube (1878, pp. 199-201, pl. xi figs. 1-1*d*) which has been recorded from Ceylon by Willey (1905, pp. 289-290, pl. viii fig. 5).

Order Cryptocephala.

Suborder Sabelliformia.

Family SABELLIDAE.

For classification into genera see St. Joseph, 1894, pp. 248–251. Three genera are represented in our collection. They may be separated as follows:—

1. Thoracic tori with two rows of setae, one of avicular uncini and one of cuspidate uncini; gills without dorsal stylodes ... ... 2.
— Thoracic tori with a single row of avicular uncini only; gills with eyes and pairs of dorsal stylodes arranged alternately ... ... *Dasychone.*
2. Ventral abdominal setae of one kind; setae on first thoracic segment normally arranged ... ... *Potamilla.*
— Ventral abdominal setae of two kinds; setae on first thoracic segment forming a pair of anteriorly divergent lines ... ... *Hypsicomus.*

Genus Potamilla, Malmgren.

Pl. IX, fig. 17.

Several specimens from Krusadai Island, slender, under 15 mm. long, in sandy tubes. I have been unable to determine the species.

Genus Hypsicomus, Grube.

Pl. IX, fig. 16.

Two forms occur. One, with the anterior end shaped as in Grube's fig. (1878, pl. xv fig. 1-1*a*) of *Sabella pyrrhogaster* (= *Hypsicomus phaeotaenia*, see Willey, 1905, p. 307), has been found in burrows in coral rock on Krusadai and Shingle Islands. The other is of larger size and has much more prominent thoracic parapodia; it has been found on Shingle Island and at Pamban, probably among stones. They both appear to be closely related to *H. phaeotaenia* (Schmarda), which is recorded from Ceylon by Willey (1905, pp. 307–308); but their setae differ. The largest specimen is about 7 cm. long (gills excluded). The form from coral rock is difficult to extract whole, but the specimens so

far seen are markedly smaller than those of the other form in every way. In the large form the upper row of thoracic paleae are distally expanded on the anterior side only, the second row being expanded on both sides as in Marenzeller's figure of the thoracic paleae of *H. phaeotaenia* (1884, pl. iii fig. 30D). In the coral rock form the upper row are very broadly paddle-shaped with symmetrical blade which is broader than it is long; the second row are spoon-shaped, sometimes apparently with the tip produced into a spine, but being arranged so as only to be seen edgeways unless teased out they are difficult to examine in detail. Some which were teased appear to have the bowl of the spoon flattened on one side, but this may not have been natural.

Genus Dasychone, Sars.

A single specimen from Krusadai Island which I have been unable to identify. In size and superficial appearance it is not unlike the preceding species.

Family SERPULIDAE.

For classification of genera see St. Joseph, 1894, pp. 259-263.

Several species have been found, belonging to at least four different genera. *Pomatostegus actinoceros*, Morch, is a comparatively large form, of which isolated specimens have been found on Krusadai and Shingle Islands in tubes rounded above with a number of longitudinal ridges. It can easily be distinguished from other Serpulids of similar size that have been found by its operculum, which consists of a series of plates borne one above another on a central axis. These worms have been figured by Watson (Willey, 1905, pl. viii figs. 3-4), but in none of our specimens are the plates so widely separated as he shows them. As a rule they are closely crowded. Possibly this may be accounted for by the great variability noticed by Willey (*loc. cit.*, p. 314) or possibly the figure is somewhat diagrammatic. *Spirobranchus semperi*, Morch (see Willey, 1905, p. 318, pl. vii fig. 193) is of about the same size as the last, but usually makes tubes which are strongly keeled above. It may be recognized by the antler-like processes of the operculum. It has been found at Pamban and Rameswaram. Several smaller specimens, possibly young of one of the above, but perhaps more probably (from the form of the operculum) distinct, have been found but have not been identified.

The other two species are gregarious and comparatively minute. One is found on stones, which it more or less covers with its slender elongate tubes. It seems closely allied to, and may even belong to, the genus *Filograna*, Oken, though it has never been seen to make the anastomosing masses of tubes characteristic of that genus, which are, however, made by a species found at Rameswaram.

The last species, which belongs to the genus *Spirorbis*, Daudin, characterised by its spirally coiled tube, is abundant on a grass-like weed that grows in shallow water in the lagoon on the south side of Krusadai Island.

Suborder Hermelliformia.

For classification see Gravier, 1909.

Specimens of the genus *Sabellaria* have been collected occasionally from Krusadai and Shingle Islands. At least two species seem to be represented. The same genus makes sandy tubes of the usual type in the channel between Krusadai Island and Kutikal Point, where they may be collected with the aid of a D-net. It is characterized by the presence of numerous tentacles and of an operculum consisting of three rows of paleae.

Class Oligochaeta.

The Indian members of this class have recently been monographed by Stephenson (1923), where an account of the classification will be found. A number of specimens, which he has identified for us as *Pontodrilus bermudensis*, Beddard, were found in clean sand a little below high tide mark near the bungalow on the north side of Krusadai Island. A few specimens overlooked when these were sent to him, were found in Kutikal backwater. They will probably prove to belong to the same species.

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PLATE IX.

Fig. 1. *Iphione muricata* × 2.
„ 2. *Lepidonotus cristatus* × 2 (after Grube).
„ 3. *Lepidonotus carinatulus* × 2.
„ 4. *Harmothoe imbricata* × 2.
„ 5. *Leocrates sp.* × 2.
„ 6. *Hesione ceylonica*, end of compound seta highly magnified.
„ 7. *Onuphis dibranchiata*, anterior end × 7.
„ 8. *Eunice sp.*, anterior end × 4.
„ 9. *Do.* segments from posterior end × 4. From life to show colour pattern.
„ 10. *Chloeia flava*, typical segments × 7½.
„ 11. *Scoloplos marsupialis*, anterior end × 6.
, 12. Post larval Chaetopterid from tube on sponge × 42.
„ 13. Do. do. Early stage of budding.
„ 14. Do. do. Budding almost complete.
„ 15. *Phyllochaetopterus sp.* nr. *ramosus*, stout seta of fourth segment.
„ 16. *Hypsicomus sp.*, anterior end from above × 7.
„ 17. *Potamilla sp.*, do. × 10.

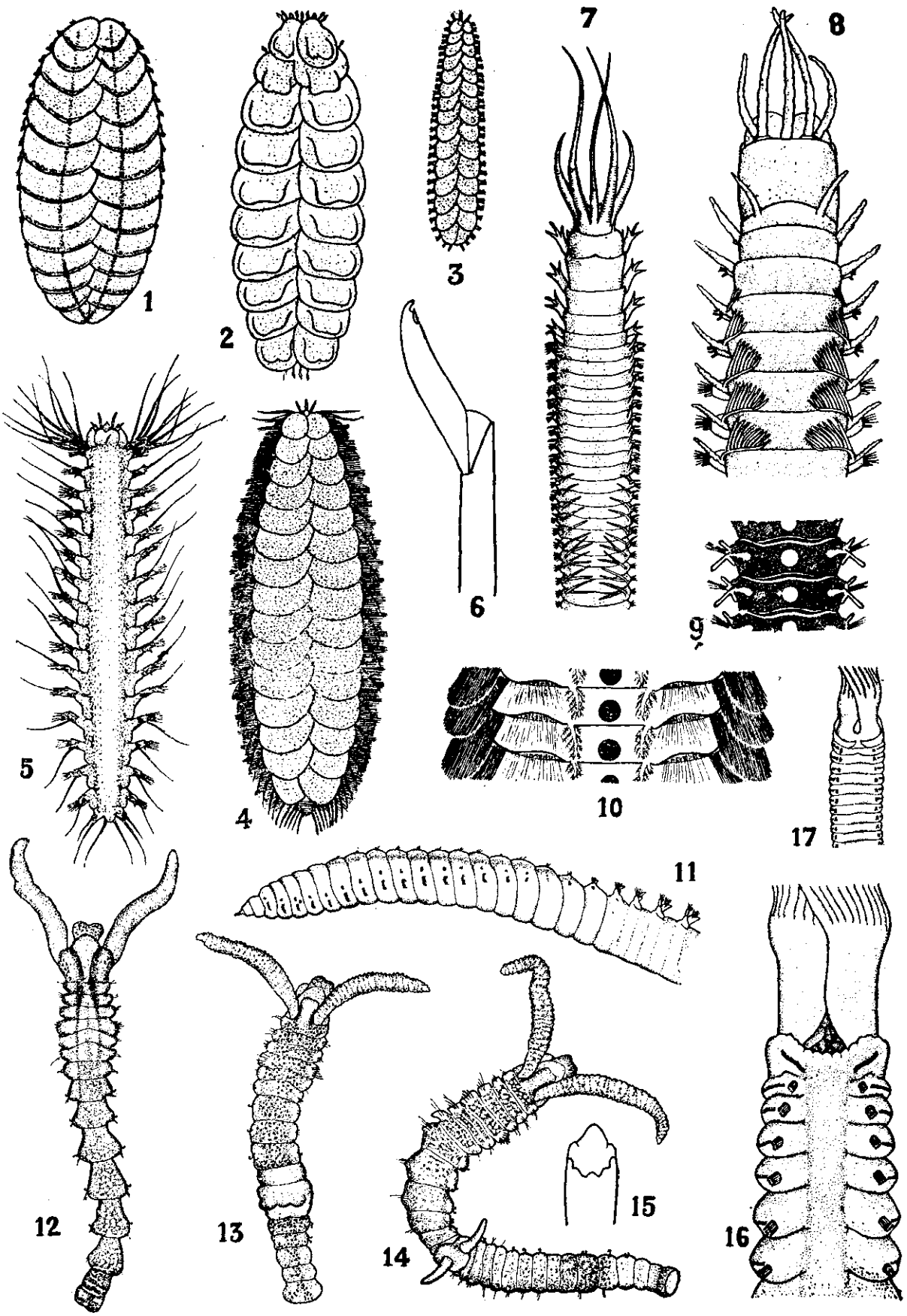


PLATE IX.—KRUSADAI POLYCHAETA.

PLATE X.

Fig. 18. *Tylonereis? bogoyawlenskyi.* Pharynx from left side × 7.
„ 19. *Do.* Typical parapodium × 20.
„ 20. *Nereis (s. str.) falcaria.* Head, pharynx and anterior segments from above and below; also pharynx from in front × 15.
„ 21. *Nereis (Ceratonereis) mirabilis.* Head, pharynx and anterior segments × 10.
„ 22. *Nereis (s. str.) sp.* nr. *ezoensis.* Do. × 11.
„ 23. *Platynereis insolita.* Do. × 25.
„ 24. *Perinereis nuntia.* Do. × 7.
„ 25. *Pseudonereis anomala.* Do. × 7.
„ 26. *Perinereis cultrifera.* Do. × 6.

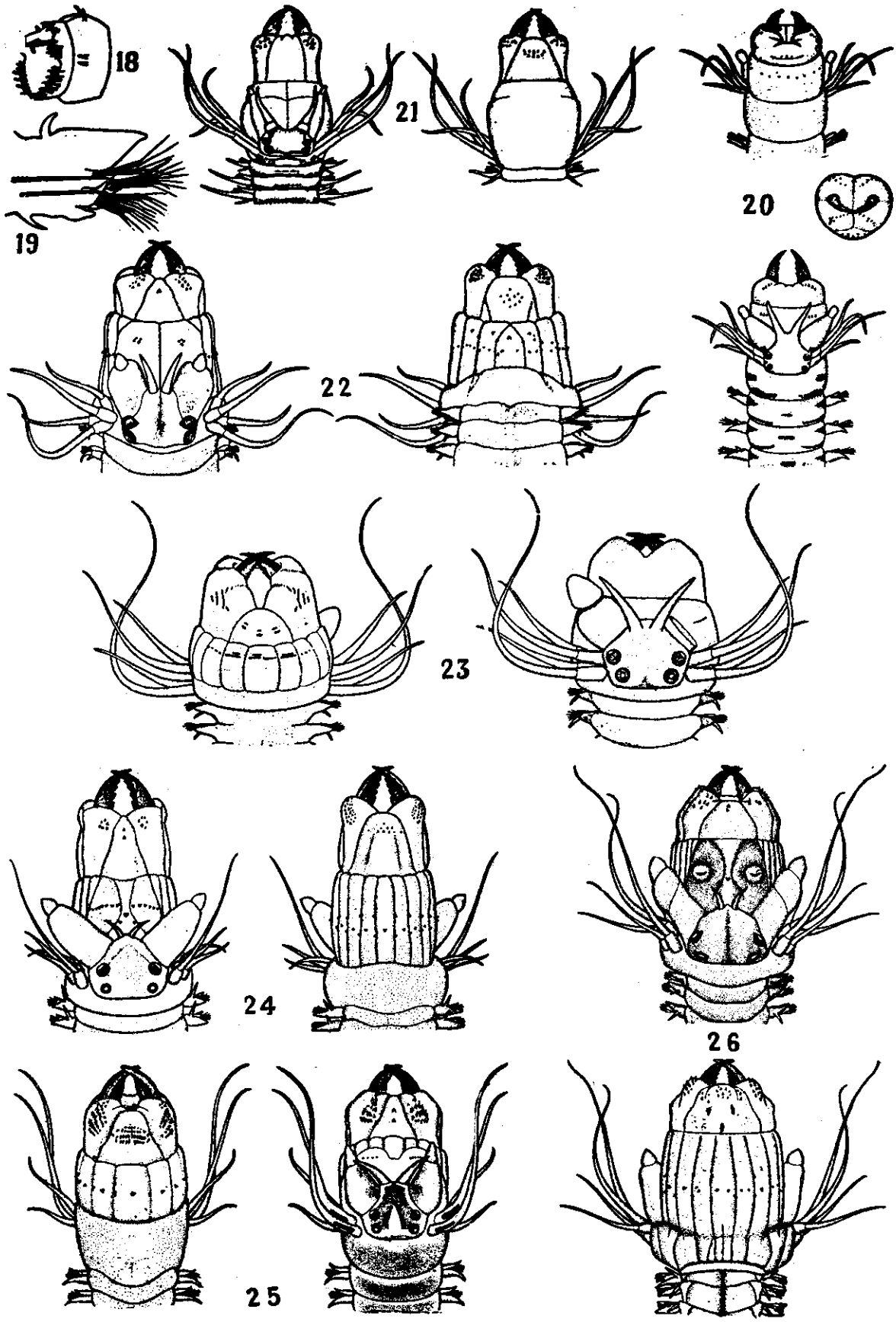


PLATE X.—KRUSADAI POLYCHAETA.

GEPHYREA AND PHORONIS.

By F. H. GRAVELY, *D.Sc.*

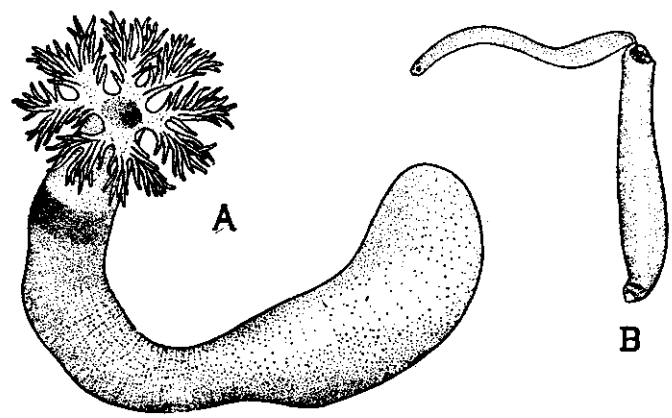
Order Sipunculoidea.

Of the species of Gephyrea collected four have been identified by Dr. Baini Prashad, all of them belonging to the order Sipunculoidea. A translation of Selenka's key (Semper's "Reisen in Archipel der Philippinen," II (4) i, 1883, 131 pp., 14 pl.) to the genera of this order is given by Shipley in the "Worms, Rotifers and Polyzoa" volume of the Cambridge Natural History.

The species from Krusadai Island are *Sipunculus australis*, Keferstein, *Physcosoma* (= *Phymosoma*) *nigrescens*, Keferstein, *Aspidosiphon elegans* (Chamisso and Eysenhardt) and *Dendrostoma signifer*, Selenka and de Man.

Only one or two specimens of each of the first two have been found, the *Sipunculus* in mud exposed at low water on the west side of Porites Bay, the *Physcosoma* in dead coral. The former is about 9 cm. long, apart from the proboscis which is very small and slender. The bands of longitudinal muscles can be clearly seen through the body wall. The latter is only about 2 cm. long apart from the proboscis, which, though not fully extended, is evidently well developed. The body wall is more opaque and the muscle bands are scarcely distinguishable externally.

Both *Dendrostoma signifer* (fig. A) and *Aspidosiphon elegans* (fig. B) are abundant in blocks of dead coral on Krusadai Island. *Aspidosiphon* can be recognized at once by its dark coloured anterior shield, but apart from this both closely resemble *Physcosoma* in external appearance when retracted, except that *Dendrostoma* may be as much as 3 cm. in



KRUSADAI GEPHYREA.

A. *Dendrostoma signifer.* B. *Aspidosiphon elegans.*

length and that *Aspidosiphon* is not more than about 1·5 cm. The proboscis of *Physcosoma* is, however, about as long as the body, very slender and without distinct tentacles, while

that of *Dendrostoma* is much shorter and thicker and ends in a group of large plumose tentacles.

In addition to Selenka's monograph (*loc. cit.*) Selenka's Gephyrea of the Mergui Archipelago (*I. Linn. Soc. London*, Zool. XXI, 1889, pp. 220–222), and Shipley's Gephyrea of the Ceylon Pearl Banks and of the Maldive and Laccadive Archipelagoes (Herdman's Report I, pp. 169–176, 1 pl.; and Stanley Gardiner's "Fauna and Geography * * *), pp. 127–140, pl. vi-vii) should be consulted for Indian records and references to other papers.

Phoronis.

A single specimen of a large species of Phoronis was dug up when collecting for worms west of Porites Bay. For accounts of the genus the Cambridge Natural History (Worms, Rotifers and Polyzoa, pp. 450–462, text figs. 226–231) and Selys-Longchamp's monograph (*Fauna u. Flora des Golfes von Neapel*, xxx, 1907) may be consulted.

POLYZOA.

By F. H. GRAVELY, *D.Sc.*

For the general classification of the Polyzoa see Harmer, 1901, pp. 475–477 and 513–523. On pp. 523–525 a useful introduction to the terminology of the group will be found.

The second part of Harmer's account of the Polyzoa of the Siboga Expedition also deals with terminology and includes important contributions towards revision of classification.[1] For definitions of the families and genera see Macgillivray, 1887 (*b*); also Busk, 1852 and 1884.

Suborder Cyclostomata.

Family CRISIIDAE.

Colony divided into distinct internodes by flexible joints, attached by radical tubes.

Crisia holdsworthi, Busk (1875, p. 7, pl. vi B fig. 2; 1886, p. 6, pl. iii fig. 2), previously recorded from Ceylon, is the only Cyclostome that has been found (pl. xi fig. 6). It occurs at Pamban and Rameswaram. The stems are somewhat small and slender, and very hard and brittle. The upper ends of the zooecia are usually free, but this is not always the case, especially in the Rameswaram specimens.

Suborder Cheilostomata.

Seven families are represented, the first three belonging to the Cellularina, the second two to the Flustrina, and the last two to the Escharina.

Family CATENARIIDAE.

Colony more or less erect, branched, articulate (*i.e.*, divided into a series of parts by flexible joints); each internode consisting of a single zooecium or of two or three united laterally (except rarely in ovigerous cells); zooecia all facing the same way, front entirely calcareous or membrano-calcareous, orifice situated in the upper part.

Slender filaments of *Catenaria lafonti* (Audouin; see Busk, 1852, p. 14, pl. xiv figs. 1–5, and *C. otophora*, Kirkpatrick (1890, pp. 17–18, pl. v figs. 1–1*c*) were found among *Phyllochaetopterus* tubes on Shingle Island. The former, recorded by Busk from the coast of Spain, by Thornely (1905, p. 108) from Ceylon, and by Waters (1909–10, pp. 131–132) from Naples, the Red Sea, Zanzibar, etc., has also been found at Pamban. The latter (pl. xi fig. 3) first recorded from algae at 27 fms. on the Tizard Reef (China Sea) and later from New Guinea (Thornely, 1900, p. 441) has also been found on seaweed on Krusadai Island.

The specimens of *C. otophora* differ from the type specimen in having four instead of three large punctures on the sides of the zooecia; but one is often less distinct than the others.

[1] Unfortunately this was not received till after the paper was finished, and it has not been possible to make use of it.

C. lafonti differs from *C. otophora* in the presence of large spines round the orifice and of a single avicularium (often absent) immediately below it in place of the two lateral ones.

Another species which appears to belong to this family, and perhaps to the genus *Catenaria*, was found mixed with the above species of the genus on *Phyllochaetopterus* tubes from Shingle Island. But it differs greatly from all species of which I have seen figures. The relation of the zooecia of a single branch is that found in normal species of *Catenaria*, and the branches arise as in that genus, but nearer the base of the parent zooecium than seems to be usual. Only a few small fragments have, unfortunately, been isolated; but from these it is clear that two may, and perhaps always do, arise from opposite sides of a single cell; and that a filamentous stolon normally arises from the back of the cell between them, apparently as a means of obtaining additional support by attachment to objects at a distance. Each zooecium bears a pair of avicularia one on each side of the orifice as in *C. otophora*; but they are shortly pedunculate instead being fused to the cell as in this and other members of the family. The zooecia are convex behind, flattened or concave in front, with a well-developed ridge where the two surfaces meet.

The genus *Catenaria*, Savigny, is distinguished from others of the family by all the zooecia being distinct, instead of some being closely united. In the genus *Catenicella*, Blainville, those at the bifurcations are closely united. *C. elegans*, Busk (1852, p. 10, pl. ix; 1884, p. 12, pl. i figs. 2, 3 and 5) was collected at Rameswaram and is recorded by Miss Thornely from Ceylon (1905, p. 109).

Family CELLULARIIDAE.

Colony erect, branched, continuous or articulated. Zooecia all facing the same way, in single or multiple series or in pairs or arranged around an imaginary axis; partly or wholly open, and membraneous in front. Avicularia, when present, sessile.

A species of *Scrupocellaria* is not uncommon under Pamban bridge. The genus is characterised by the articulation and dichotomous branching of the colony, and by biserial, quadrate zooecia furnished with oral spines, with a sessile avicularium at the upper and outer angle and a vibraculum in a sinus on the outer and lower part behind. The species found is probably *S. diadema*, Busk (1852, p. 24, pl. xxviii figs. 1–3) though in most of the zooecia the operculum is not to be seen and, when present, it is more strongly lobed than in the typical form, being clearly Y-shaped or sometimes trifid or even more extensively branched (see pl. xi fig. 5). The sessile avicularium situated in the lower part of the cell in front is not developed in the younger cells near the tips of the branches but only in the older and more basal ones. The typical form came from Australia.

Scrupocellaria diadema has already been recorded by Miss Thornely as common in the Gulf of Manaar (1905, p. 109).

Family BICELLARIIDAE.

Colonies erect, dichotomously branched, branches ligulate. Avicularia, when present, pedunculate ; vibracula absent.

A small colony that seems to be closely related to *Bugula longissima*, Busk (1884, pp. 42–43, pl. xxxi figs. 7–7*c*) and *B. scaphoides*, Kirkpatrick (1890, p. 18, pl. iv fig. 1) in its manner of growth was collected at Pamban. It differs from these species, however, in that each zooecium is surmounted by an avicularium, avicularia being absent in *B. longissima* and situated near the base of the zooecium in *B. scaphoides*.

Colonies of a more typical species of *Bugula* have been collected at Rameswaram.

Family CELLARIIDAE.

Colony erect, simple, branched, cylindrical, with the zooecia arranged in series round an imaginary axis, or lobed and bi-laminated. Zooecia with raised margins and depressed surface. Ooecia immersed, opening by a pore above the aperture.

Nellia occulata, Busk (1852, p. 18, pl. lxiv fig. 6, lxv *bis* fig. 4) occurs under Pamban bridge (pl. xi fig. 2). It was originally described from Torres Strait and has since been recorded by Busk (1884, p. 27) from Arracan, Trincomalee and Florida, and by Miss Thornely (1905, p. 110) from the Gulf of Manaar. This genus comprises articulated colonies with short quadrangular internodes ; zooecia quadriserial, front flat or convex at bottom with the greater part occupied by a large aperture, border prominent especially above, smooth and thick ; orifice quite at the summit.

Family STEGANOPORELLIDAE.

Colony encrusting or free and uni- or bi-laminate. Zooecia quadrate, arched above, separated by thick calcareous margins ; divided into two chambers, an upper one closed by the thick epitheca, and a lower one separated by a perforated calcareous lamina and opening anteriorly by a tubular orifice. Ooecia altered zooecia.

A variable and widely distributed encrusting species, *Thalamporella rozieri* (Audouin ; see Busk, 1852–4, p. 59, pl. lxv fig. 6 ; Hincks, 1880 *b*, pp. 379–380, pl. xvi figs. 1–3 and 1887, p. 164 ; and Waters, 1909, pp. 141–142, pl. xv figs. 12–15) occurs on dead coral on both Krusadai and Shingle Islands. Miss Thornely (1905, p. 112) records the form *falcifera*, Hincks (1880 *b*, p. 380) as " generally distributed round the Ceylon coast." In this form, which was originally described from Australia, marginal tuberosities are present on either side of the orifice and the avicularia have much elongated, tapering falciform mandibles. In the form *indica*, Hincks, the marginal tuberosities are absent and the avicularia have somewhat elongate, slender, pointed mandibles. The Krusadai and Shingle Island specimens (pl. xi fig. 4) have marginal tuberosities but no avicularia, thus resembling the typical form.

A colony from Pamban, with smaller orifice and browner colour, probably belongs to another species of the same genus.

Family MICROPORELLIDAE.

Colony encrusting or erect, uni- or bi-laminate. Zooecia with the mouth entire below; front pierced by a single special pore or perforated plate, or by several pores opening into the perivisceral cavity. Ooecia prominent and external, or modified zooecia.

A colony of *Microporella sp.* was found partially encrusting a colony of *Porites* on Krusadai Island in 1922. It bears numerous large avicularia with long slender mandibles. Each cell has a single median pore. In 1925 another small colony was found on Krusadai Island and others at Pamban.

Family ESCHARIDAE.

Colony encrusting or erect, uni- or bi-laminate or dendroid. Zooecia entirely calcareous, horizontal, entire or variously punctured, but without special pores opening into the peri-visceral cavity. Ooecia external.

Two forms from Pamban, which have not been identified, probably belong to this or a closely allied family. One is erect and foliaceous, the other encrusting. Each is represented by a single colony.

Subfamily LEPRALIINAE.

Lower lip of mouth entire; no special development of the peristome. A small colony which appears to belong to the genus *Lepralia* was collected on Krusadai Island. No less than seventeen species of this genus have been recorded by Miss Thornely from the Gulf of Manaar.

Family CELLEPORIDAE.

Colony encrusting, or more or less free and uni- or bi-laminate, or dendroid, or forming clustered masses. Zooecia (adult) urceolate, irregularly heaped together, the upper parts being free; orifice terminal, sub-circular or with a straight or hollowed lower lip, with or without a sinus.

Small, bluntly spiney, reddish encrusting colonies not infrequently found on dead coral appear to belong to the genus *Lagenipora*, Hincks, though they differ considerably in detail from all species of which I have seen descriptions (Hincks, 1880, pp. 235–236, pl. xxxiv figs. 7–8, and 1884, pp. 210–211, pl. ix fig. 4; MacGillivray, 1883, p. 132, pl iii fig. 15, and 1887, pp. 180–181, pl. i fig. 1*a–b*; Waters, 1909, pp. 172–173 and 174–175).

Encrusting colonies of very irregularly heaped zooecia with a more or less distinct rostral process in front of the orifice are the commonest Polyzoa on the island. They appear to belong to the genus *Cellepora*, Fabricius.

Suborder Ctenostomata.

Family ALCYONIDIIDÆ.

Zooecia more or less closely united, immersed in an expanded and adherent gelatinous crust or forming an erect cylindrical or compressed zooecium; orifice closed by the mere invagination of the tentacular sheath, not protected by external labia.

Extensive encrusting colonies of zooecia, each with an elongate erect dark brown tubular mouth, found on stones at Pamban, probably belong to the genus *Alcyonidium*, Lamouroux. They somewhat resemble *Flustrella flabellaris*, Kirkpatrick (1890, p. 23, pl. iv figs. 3–3*a*) in the tubular mouth, but it is circular in section, not flattened as described by Kirkpatrick.

Family VESICULARIIDAE.

Zooecia contracted below, not closely united to the stem at the base, deciduous, destitute of a membraneous area.

Amathia distans, originally described by Busk (1886, p. 33, pl. vii fig. 1) from the coast of Brazil, since recorded by Miss Thornely (1905, p. 128; 1907, p. 196; 1916, p. 165) from the Gulf of Manaar and other Indian localities, has been found under Pamban bridge. For the separation of the species of *Amathia* see Waters (1909–10, p. 243, pl. xxiv figs. 5–7).

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PLATE XI.

Fig. 1. *Amathia distans* × 30.
„ 2. *Nellia occulata* × 30.
„ 3. *Catenaria otophora* × 30.
„ 4. *Thalamporella rozieri* × 30.
„ 5. *Scrupocellaria? diadema* × 30.
„ 6. *Crisia holdsworthi* × 50.

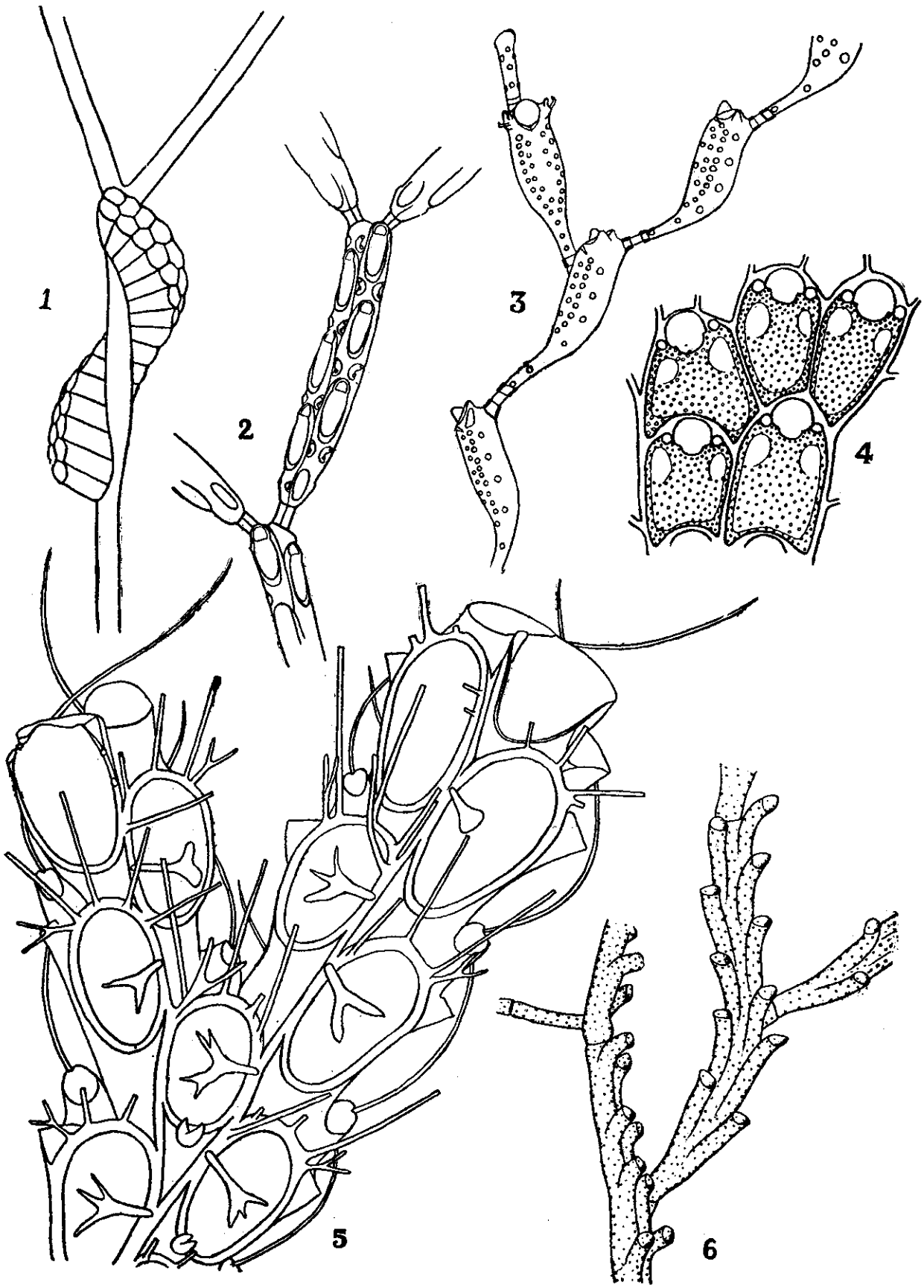

PLATE XI.—KRUSADAI POLYZOA.

MOLLUSCA.

The Mollusca collected have been identified for us by Mr. R. Winckworth, to whom our thanks are due for this great help; but it has not yet been possible to prepare a report upon them for the use of students on the lines of the other reports in this volume. It is hoped that this may be done before long. Meantime the following list is published for reference. It has been compiled by Mr. H. Chennappayya, M.A., Zoological Assistant in the Madras Museum, following the classification adopted by Pelseneer in the Oxford Natural History, but with additional assistance from Fischer's "Manuel de Conchyliologie" (Paris, 1887), and has been checked and revised by Mr. Winckworth, who has added a preliminary list of literature that may usefully be consulted in connexion with it.[1]

Class Polyplacophora.

Family ACANTHOCHITONIDAE.

Genus Acanthochitona, Gray, 1821.

Acanthochitona sp. Gulf of Manaar.
Not *A. penicillatus*, Sykes: nor *A. penicillatus* (Deshayes).
Compare fig. of *A. fascicularis* in Icon. 4, Chiton 53.

Genus Craspedochiton, Shuttleworth, 1853.

Craspedochiton laqueatus (Sowerby). Pamban, 1925.
Herdman, I, p. 179 and fig. 7.

Family ISCHNOCHITONIDAE.

Genus Ischnochiton, Gray, 1847.

Ischnochiton herdmani, Sykes. Krusadai Island, 1925.
Herdman, I, p. 178 and fig. 6.
Ischnochiton variegatus, Nierstrasz. Krusadai Island, 1924 and 1925.
Siboga Expedition, Chitonen, pl. I, fig. 9 and pl. II, figs. 71-76.

Family CHITONIDAE.

Genus Tonicia, Gray, 1847.

Tonicia pectinoides, Sykes. Krusadai Island, 1925.
Herdman, I, p. 179 and fig. 1.

[1] Four species which were not sent to Mr. Winckworth should be added to this list—*Pinctada sp.* (probably *vulgaris*) of which young specimens are common under stones, though none seem to have been collected; *Leiodomus vittatus*, common on the sandy side of Kutikal Point, also not collected: *Cypraea tigris* of which a single living specimen was found on Shingle Island; and *Turbinella pyrum* of which single large specimen was found crawling on the sand in a few inches of water in the lagoon on the south side of Krusadai Island.

Class Gastropoda.

Subclass Streptoneura.

Order Aspidobranchia.

Suborder Docoglossa.

Family PATELLIDAE.

Genus Cellana, H. Adams, 1869 (=Helcioniscus, Dall, 1871).

Cellana aster (Reeve). Krusadai Island (dead shell).
Icon. 8, Patella 80 (aster) and 86 (luzonica).

Genus Patella, Linnaeus, 1758.

Patella sp. Almost certainly an undescribed species.
Pamban, 1925.
Shell somewhat similar to last: gills and epipodium quite distinct.

Suborder Rhipidoglossa.

Family HALIOTIDAE.

Genus Haliotis, Linnaeus, 1758.

Haliotis varia, Linne. Krusadai Island, 1924 and 1925.
Icon. 3, Haliotis 4.

Family FISSURELLIDAE.

Genus Diodora, Gray, 1821.

Diodora funiculata (Reeve). Krusadai Island, 1922.
Icon. 6, Fissurella 65.

Diodora bombayana (Sowerby). Krusadai Island, 1924.
Thes. 3, p. 196, Fissurella, fig. 166.

Genus Scutum, Montfort, 1810.

Scutum unguis (Linné). Krusadai Island, 1924.
Icon. 17, Scutus 3 (corrugatus), not 5 (unguis Reeve non L.).

Genus Emarinula, Lamarck 1801.

Emarginula sp. Pamban, 1925.

Family TROCHIDAE.

Genus Euchelus, Philippi, 1847.

Euchelus asper (Gmelin). Krusadai Island (dead shell).
Fischer's Kiener, Trochus, pl. 94, fig. 1, and pl. 93, fig. 1 (var. tricarinata).

Family UMBONIIDAE.

Genus Umbonium, Link, 1807 (=Rotella, Lamarck, 1822).

Umbonium vestiarium (Linné). Krusadai Island 1924 (dead shells).
Icon. 20, Rotella 12.

Family TURBINIDAE.

Genus Turbo, Linnaeus, 1758.

Turbo intercostalis, Menke. Krusadai Island (dead shells).
Icon. 4, Turbo 39 (articulatus.)

Family NERITIDAE.

Genus Nerita, Linnaeus, 1758.

Nerita polita, Linné. Shingle Island, 1924.
Icon. 9, Nerita 2.

Nerita plicata, Linné. Shingle Island, 1924.
Icon. 9, Nerita 42.

Nerita albicilla, Linné. Krusadai Island, 1922.
Shingle Island, 1925.
Icon. 9, Nerita 64.

Genus Neritina, Lamarck, 1822.

Neritina oualanensis, Lesson. Krusadai Island, 1924.
Kutikal, 1925 (dead shells).
Icon. 9, Neritina 168 (oualanensis).

Order Pectinibranchia.

Suborder Taenioglossa.

Family LITTORINIDAE.

Genus Littorina, Férrusac, 1822.

Littorina scabra (Linné) Krusadai Island, 1922.
Icon. 10, Littorina 21.

Family CLAVIDAE (=CERITHIIDAE).

Genus **Potamides**, Brouquiart, 1810.

Potamides cingulatus (Gmelin). Krusadai Island, 1924.
Icon. 15, Tympanotonos 9 (fluviatilis).

Family VERMETIDAE.

Genus **Vermetus**, Cuvier, 1800.

Vermetus sp. Krusadai Island, 1925.

Genus **Spiroglyphus**, Daudin, 1800.

Spiroglyphus spirulaeformis (de Serres). Krusadai Island, 1922 and 1924.
Tryon Manual viii, pl. 51, figs. 48, 49.

Genus **Vermicularia**, Lamarck, 1799.

Vermicularia sp. Perhaps *V. inopertus*, Rüppell.
Krusadai Island, 1924.
Tryon Manual viii, pl. 54, fig. 78.

Family TURRITELLIDAE.

Genus **Turritella**, Lamarck, 1799.

Turritella duplicata (Linné). Krusadai Island, 1924
Icon. 5, Turritella 2.

Family CHEILEIDAE (=CALYPTRAEIDAE).

Genus **Crucibulum**, Schumacher, 1817.

Crucibulum extinctorium, Lamarck. Krusadai Island (dead shell).
Icon. 11, Crucibulum 14.

Family NATICIDAE.

Genus **Sinum**, Bolten, 1798 (= **Sigaretus**, Lamarck, 1799).

Sinum planulatum (Rècluz). Krusadai Island, 1924.
Icon. 15, Sigaretus 7.

Genus **Natica**, Scopoli, 1777.

Natica marochiensis (Gmelin). Krusadai Island, 1925.
Tryon Manual viii, pl. 5, fig. 86.

Family JANTHINIDIAE.

Genus **Janthina**, Bolten, 1798.

Janthina roseola, Reeve. Krusadai Island, 1925.
Icon. 11, Ianthina 1 (roseola) and 2 (affinis).

Family CYPRAEIDAE.

Genus Cypraea, Linnaeus, 1758.

Cypraea arabica, Linne. Krusadai Island, 1924.
Shingle do. 1924.
Pamban bridge, 1924 (dead shell).
Icon. 3, Cypraea 2.

Cypraea caputserpentis, Linne. Shingle Island, 1924.
Icon. 3, Cypraea 44.

Cypraea errones, Linne. Krusadai Island, 1922 and 1924.
Shingle do. 1924.
Icon. 3, Cypraea 56.

Cypraea erosa, Linne. Krusadai Island, 1924.
Shingle do. 1924.
Icon. 3, Cypraea 43.

Cypraea fimbriata, Gmelin. Krusadai Island, 1924.
Icon. 3, Cypraea 92.

Cypraea moneta, Linne. Krusadai Island, 1922.
Shingle do. 1924.
Icon. 3, Cypraea 74.

Cypraea ocellata, Linne. Krusadai Island, 1924.
Icon. 3, Cypraea 73.

Cypraea onyx, Linné ? A young specimen, probably this species.
Shingle Island, 1924.
Icon. 3, Cypraea 39.

Cypraea pallida, Gray. Pamban, 1922.
Icon. 3, Cypraea 54.

Suborder Stenoglossa.

Tribe ***Rhachiglossa***

Family BUCCINIDAE.

Genus Engina, Gray, 1839.

Engina zonata (Reeve). Krusadai Island (dead shell).
Icon. 3, Ricinula 33.

Family THAIDIDAE.

Genus **Thais**, Bolten, 1798 (=**Purpura**, Lamarck non-Bolten).

Thais rudolphi (Lamarck). Krusadai Island, 1924.
Shingle do. 1925.

Icon. 3, Purpura 10.

Thais sacellum (Lamarck). Krusadai Island (dead shell).

Family PYRENIDAE.

Genus **Pyrene**, Bolten, 1798 (=**Columbella**, Lamarck, 1799).

Pyrene versicolor (Sowerby). Krusadai Island (dead shell).

Icon. 11, Columbella 51.

Pyrene zebra, Gray. Krusadai Island (dead shell).

Icon. 11, Columbella 79.

Family OLIVIDAE.

Genus **Oliva**, Martyn, 1786.

Oliva gibbosa, Born. Krusadai Island, 1925.

Icon. 6, Oliva 12.

Oliva nebulosa, Lamarck. Krusadai Island, 1925.

Icon. 6, Oliva 32.

Genus **Ancilla**, Lamarck, 1799.

Ancilla cinnamomea, Lamarck. Krusadai Island, 1922.

Icon. 15, Ancillaria 19.

Tribe ***Toxoglossa.***

Family CONIDAE.

Genus **Conus**, Linnaeus, 1758.

Conus acuminatus, Bruguière. Shingle Island, 1924.

Icon. 1, Conus 173.

Conus ebraeus, Linne. Krusadai Island, 1924.

Icon. 1, Conus 104 (hebraeus).

Conus coronatus, Gmelin. Krusadai Island, 1924.

Icon. 1, Conus 143 (minimus).

Subclass Euthyneura.

Order Opisthobranchia.

Suborder Tectibranchia.

Tribe ***Bullomorpha.***

Family BULLIDAE.

Genus Bullus, Montfort, 1810.

Bullus ampulla, Linnè. Krusadai Island (dead shells).

Icon. 16, Bulla 3.

Genus Haminoea, Turton, 1830.

Haminoea tenera (Adams). Pamban, 1922.
Krusadai Island, 1925.

Icon. 16, Haminea 3.

Tribe ***Aplysiomorpha.***

Family TETHYIDAE.

Genus Tethys, Linne, 1758 (=Aplysia, Linnè, 1767).

Tethys benedicti, Eliot. Krusadai Island, 1924.
Shingle do. 1925.

Eliot in Proc. Acad. Nat. Sci. Phila., 1899, p. 513 and plate 19.

Genus Dolabella, Lamarck, 1801.

Dolabella scapula (Martyn). Krusadai Island, 1924.

Icon. 16, Dolabella 3 (rumphii).

Suborder Nudibranchia.

Tribe ***Zonabranchiatae.***

Family DUVAUCELIIDAE (=TRITONIIDAE, auct.).

Genus Marionia, Vayssiere, 1877.

Marionia arborescens, Bergh. Pamban, 1924.

Semper, Phil. 2, p. 891, pl. 88.

Tribe ***Holohepatica.***

Family BORNELLIDAE.

Genus **Bornella**, Gray, 1850.

Bornella digitata (H. & A. Adams). Krusadai Island, 1922.
Shingle do. 1924.

A. & H., pl. 33, figs. 8, 9.

Family ARCHIDORIDIDAE.

Genus **Discodoris**, Bergh, 1877.

Discodoris fragilis (Alder and Hancock). Kutikal, 1925.

A. & H., pl. 28, figs. 7, 8.

Genus **Trippa**, Bergh, 1877.

Trippa tristis (Alder and Hancock). Pamban, 1925.

A. & H., pl. 30, figs. 6, 7.

Family DORIDOPSIDAE.

Genus **Doridopsis**, Alder and Hancock, 1864.

Doridopsis rubra (Kelaart). Shingle Island, 1925.

A. & H., pl. 31, figs. 1, 2.

Also one specimen (? the same species) from Krusadai Island, 1925.

Tribe ***Cladohepatica.***

Family AEOLIDIDAE.

Genus **Galvina**, Alder and Hancock, 1857.

Galvina producta, Farran. Krusadai Island, 1922.
(Identification doubtful.)

Herdman, 3, p. 331 and figs. 6–9.

Genus **Phidiana**, Gray, 1850.

Phidiana unilineata (Alder and Hancock). Pamban, 1922.
Pamban bridge, 1924.
Shingle Island, 1925.

A. & H., pl. 33, fig. 14.

Genus **Hervia**, Bergh, 1877.

Hervia ceylonica, Farran. Krusadai Island, 1922.

Herdman, 3, p. 331 and figs. 1–5.

Family DOTONIDAE.

Genus Doto, Oken, 1807.

Doto indica, Bergh. Krusadai Island, 1924.
Semper Phil. 2, p. 795, pl. 78, figs. 23-27.

Family PLEUROPHYLLIDIIDAE.

Genus Pleurophyllidia, Meckel.

Pleurophyllidia gracilis, Bergh. Pamban, 1922.
Semper Phil. 2, p. 250, pl. 31, figs. 6-21.

Tribe ***Ascoglossa.***

Family PHYLLOBRANCHIDAE.

Genus Phyllobranchus, Alder and Hancock, 1864.

Phyllobranchus orientalis (Kelaart). Shingle Island, 1925.
A. & H., pl. 33, figs. 18, 19.

Family ELYSIIDAE.

Genus Elysia, Risso, 1826.

Elysia grandifolia, Kelaart. Krusadai Island, 1925.
Eliot, Proc. Zool. Soc., 1906, p. 689 and pl. 46, fig. 4 (not good).

Order Pulmonata.

Suborder Stylommatophora.

Tribe ***Ditremata.***

Family ONCIDIIDAE.

Genus Oncidium, Buchanan.

Oncidium sp. Krusadai Island, 1925.
Perhaps *O. verruculatum*, Cuvier. Compare Pelseneer.

Class Scaphopoda.

Family DENTALIIDAE.

Genus Dentalium, Linnaeus, 1758.

Dentalium octangulatum, Donovan. Krusadai Island (dead shells).
Icon. 18, Dentalium 12 (octagonum).

Class Lamellibranchia.

Order Filibranchia.

Suborder Arcacea.

Family ARCIDAE.

Genus **Arca**, Linnaeus, 1758.

Arca navicularis, Bruguiere. Krusadai Island, 1924.
Icon. 2, Arca 70.

Arca complanata, Bruguiere. Krusadai Island, 1922 and 1924.
Pamban, 1922.
Icon. 2, Arca 79 (velata) and 96 (nivea).

Arca (*Scapharca*) *gubernaculum*, Reeve. Pamban, 1925.
Icon. 2, Arca 14.

Suborder Mytilacea.

Family MYTILIDAE.

Genus **Mytilus**, Linnaeus, 1758.

Mytilus viridis, Linn. Pamban, 1925 (dead shells).
Icon. 10, Mytilus 28 (smaragdinus).

Genus **Modiolus**, Lamarck, 1799.

Modiolus metcalfei, Hanley. Shingle Island, 1924.
Icon. 10, Modiola 16.

Genus **Lithodomus**, Cuvier, 1817.

Lithodomus straminea, Dunker. Krusadai Island, 1925 (dead shell).
Icon. 10, Lithodomus 11.

Lithodomus teres (Philippi). Pamban, 1922.
Shingle Island, 1925.
Krusadai do. (dead shells)
Icon. 10, Lithodomus 13 (teres) : compare also species 7 (antillarum)

Genus **Septifer**, Récluz.

Septifer bilocularis (Linné.) Krusadai Island, 1924.
Shingle Island, 1925.
Icon. 10, Mytilus 42 (nicobaricus).

Genus **Musculus**, Bolten, 1798 (=**Modiolaria**, Beck, 1846).

Musculus nanus (Dunker). Pamban, 1925 (dead shells).

Icon. 10, Modiola 56 (fig. 69).

Musculus cumingianus (Dunker). Pamban, 1925 (dead shells).

Icon. 10, Modiola 50.

Family ISOGNOMIDAE.

Genus **Isognoma**, Solander, 1786 (=**Perna**, Bruguiére, 1792).

Isognoma legumen (Gmelin). Krusadai Island, 1924.

Icon. 11, Perna 22.

Isognoma nucleus (Lamarck). Krusadai Island, 1924.

Icon. 11, Perna 4.

Suborder **Pectinacea.**

Family PTERIIDAE.

Genus **Pteria**, Scopoli, 1777 (=**Avicula**, Cuvier, 1800).

Pteria castanea (Reeve). Krusadai Island, 1924.

Icon. 10, Avicula 49.

Genus **Pinctada**, Bolten, 1798 (=**Meleagrina**, Lamarck, 1819).

Pinctada anomioides (Reeve). Krusadai Island, 1924.

Icon. 10, Avicula 26.

Order **Eulamellibranchia.**

Suborder **Ostreacea.**

Family OSTREIDAE.

Genus **Ostrea**, Linnaeus, 1758.

Ostrea cucullata, Born. Krusadai Island, 1924.

Icon. 18, Ostrea, 34.

Ostrea sp. (young specimen). Krusadai Island, 1924.

Family PINNIDAE.

Genus **Pinna**, Linnaeus, 1758.

Pinna aequilatera, Martens. Kutikal, 1925.

Von Martens Moll. Seychellen, pl. 22, fig. 4.

Suborder Submytilacea.

Family CARDITIDAE.

Genus **Cardita**, Bruguiére, 1792.

Cardita variegata (Brugiére). Krusadai Island, 1922.

Icon. 1, Cardita 3.

Family GALEOMMIDAE.

Genus **Galeomma**, Turton, 1825.

Galeomma paucistriata, Deshayes. Krusadai Island, 1922.

Icon. 19, Galeomma 2.

Genus **Scintilla**, Deshayes, 1858.

Scintilla hanleyi, Deshayes. Krusadai Island, 1922 and 1924.

Icon. 19, Scintilla 12.

Scintilla sp. Krusadai Island, 1922.

Suborder Tellinacea.

Family TELLINIDAE.

Genus **Tellina**, Linnaeus, 1758.

Tellina ala, Hanley. Krusadai Island, 1925.

Icon. 17, Tellina 144.

Family DONACIDAE.

Genus **Donax**, Linnaeus, 1758.

Donax cuneatus, Linne. Krusadai Island, 1922, 1924 and 1925.

Icon. 8, Donax 15.

Family MESODESMATIDAE.

Genus **Atactodea**. Dall.

Atactodea glabrata (Lamarck). Krusadai Island, 1922.

Icon. 8, Mesodesma 20.

Family MACTRIDAE.

Genus **Mactra**, Linnaeus, 1767.

Mactra cuneata (Gmelin). Krusadai Island, 1922.

Icon. 8, Mactra 109.

Suborder Veneracea.

Family VENERIDAE.

Genus **Dosinia**, Scopoli, 1777.

Dosinia nana, Reeve. Shingle Island, 1924.

Icon. 6, Artemis 57.

Genus **Gafrarium**, Bolten, 1798 (=**Crista**, Romer, 1857).

Gafrarium tumidum (Born). Krusadai Island, 1922.
Shingle Island, 1925.

Icon. 14, Circe 20 (pectinata).

Gafrarium dispar (Dillwyn). Krusadai Island, 1922 and 1924.

Icon. 14, Circe 24.

Subgenus **Circe**, Schumacher, 1817.

Gafrarium (*Circe*) *personatum* (Lamarck). Krusadai Island, 1922 and 1924.

Icon. 14, Circe 6.

Genus **Chione**, Megerle von Mühlfeldt, 1811.

Chione sp. nr. scabra, Hanley. Shingle Island, 1924.
Krusadai Island (dead shells).

Compare Icon. 14, Venus 97.

Genus **Periglypta**, Jukes-Browne, 1914.

Periglypta fischeri (Récluz). Shingle Island, 1924.

Récluz 3, p. 411, pl. 12, fig. 9.

It is very close to '*Venus*' *reticulata*, L., which also occurs in S. India.

Suborder Cardiacea.

Family CARDIIDAE.

Genus **Cardium**, Linnaeus, 1758.

Cardium rugosum, Lamarck. Krusadai Island, 1922.

Icon. 2, Cardium 68.

Suborder Myacea.

Family ROCELLARIIDAE.

Genus **Rocellaria**, Blainville, 1828 (=Gastrochaena auct non Spengler).

Rocellaria apertissima (Deshayes). Pamban, 1922.
Icon. 20, Gastrochaena 4.

Rocellaria indistincta (Deshayes). Krusadai Island, 1925.

Rocellaria lamellosa (Deshayes). Pamban, 1922.
Icon. 20, Gastrochaena 14.

Rocellaria sp. (Probably *R. philippinensis*, Deshayes). Krusadai Island, 1925.
Icon. 20, Gastrochaena 7.

Suborder Pholadacea.

Family PHOLADIDAE.

Genus **Pholadidea**, Goodall, 1819.

Pholadidea sp. Young specimen. Krusadai Island, 1925.

Genus **Jouannetia**, des Moulins.

Jouannetia cumingii (Sowerby). Krusadai Island, 1925 (dead shells).
Pamban, 1922.
Shingle Island, 1925.
Thes. 2, p. 502 (Triomphalia), figs. 56, 57.

Suborder Laternulacea.

Family LATERNULIDAE.

Genus **Laternula**, Bolten, 1798 (= Anatina, Lamarck non Schumacher).

Laternula boschasina (Reeve). Krusadai Island (dead shells).
Icon. 14, Anatina 13.

Class Cephalopoda.

Order Dibranchia.

Suborder Octopoda.

Tribe ***Trachyglossa***.

Family OCTOPODIDAE.

Genus **Octopus**, Lamarck, 1798.

Octopus hongkongensis, Hoyle. Krusadai Island, 1922 and 1924.
Pamban, 1922.
Challenger Reports, XVI, p. 100, pl. V.

Genus Cistopus, Gray, 1849.

Cistopus bursarius, Steenstrup. Krusadai Island, 1924.
Férussac & d'Orbigny, Hist. Nat. Ceph. Octopus, pl. 26 (indicus).

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ARTHROPODA.

Class Crustacea.

Order Cirripedia (Barnacles).

By B. SUNDARA RAJ, *M.A., Ph.D.*

The classification followed is that found in Sedgewick's Text-book of Zoology.

Suborder Cirripedia pedunculata.[1]

Family LEPADIDAE.[2]

Stalk and capitulum sharply marked off, peduncle flexible without calcareous plates. Scuta with an adductor muscle.

Genus Lepas, Linnaeus.

Valves 5. Carina extending between the terga, ending below in a fork or disc. Scuta sub-triangular with their umbones at the rostral angle. Filaments beneath the basal articulation of the first cirri.

Lepas anserifera, Linnaeus.

Pl. XIV, figs. B 1–2.

A cluster of young specimens on drift wood was found cast on shore at Krusadai Island.

This is a common widely distributed species and is distinguished from the equally common species *L. anatifera*, Linn., chiefly by the possession of 5 or 6 filaments instead of a pair.

The chief distinguishing characters of *L. anserifera* are—

(1) the valves are distinctly furrowed, especially the tergum;

(2) the right hand scutum has a well developed umbonal tooth; the left hand one has a small tooth, sometimes only a prominence;

(3) the occludent margin of the scuta are arched and protuberant;

(4) five or six filaments on each side. The Krusadai specimens have both the umbonal teeth and only 5 filaments.

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[1] Leach's original classification of the Cirripedia (1825) was revised by Darwin in 1851–1853. The accepted classification of most authors since then is more or less that of Darwin. For suggested modifications of the classification the student should refer to Gruvel, Hoek and Pilsbry.

[2] Family Pentaspidae of some authors.

Suborder Cirripedia sessilia (Operculata).[1]

Family BALANIDAE, Gray, 1825.

Scuta and terga articulated, freely movable and furnished with depressor muscles; Rostrum with radii and without alae; labrum notched in the middle. Third cirrus resembles the second cirrus.

Genus Balanus, De Costa, 1778.

Shell cylindrical or conical, composed of 6 compartments; opercular valves subtriangular, as wide as orifice. This large genus is divided into sections by Darwin[2] and Hoek[3] and into subgenera by Pilsbry[4]; but the division is not satisfactory and only tentative. Three species of *Balanus* are in the collection from Krusadai Island.

Balanus tintinnabulum (Linnaeus).

Var. communis, Darwin.

(Subsp. tintinnabulum, Pilsbry.)

Pl. XIV, figs. A 1–5.

B. tintinnabulum is the best known species of sessile barnacles and has a world-wide distribution, having been carried everywhere by ships.

This large conspicuous barnacle is common on the piers of the Pamban bridge. The shell in all the specimens in the collection is covered by a dense growth of hydroids and weeds.

The Pamban form agrees remarkably well with the description given by Pilsbry[5] and reaches a size of 65 mm. along the basal diameter. The important differences noticeable are--The radii are transversely grooved *throughout*; walls are stained inside with pale purple and the sheath with dark purple. The peripheral margin of the basis as well as the lower margin of the wall are ribbed inside. The growth ridges of the scutum are absent (evidently worn off) near the apex. Scuta and terga are according to the figures given by Pilsbry. There are small differences in the mouth parts and cirri but the species is very variable.

The parietes, basis and radii being permeated by pores, the species belongs to section A of Darwin and section *Megabalanus* of Hoek and Pilsbry.

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[1] A new classification of sessile barnacles based on the number of compartments in the wall was proposed by Gruvel in 1905 but is not apparently a natural classification though adopted in the Cam. Nat. Hist. though Pilsbry in 1916 has proposed a division of Darwin's order Thoracica into four suborders instead of the usual groups Cirripedia pedunculata, and Cirripedia operculata or sessilia. As already stated the classification adopted in this paper is that of Sedgewick in his text-book.

[2] Monograph of the Cirripedia, 1853, page 193.

[3] Hoek. The Cirripedia of the Siboga-Expedition, page 158, 1913.

[4] Pilsbry. Sessile Barnacles contained in the collection of the U.S. National Museum. Bull. 93, 1916, page 51.

[5] Pilsbry. Sessile Barnacles contained in the collection of the U.S. National Museum. Bull. 93, 1916, page 55.

Balanus amphitrite, var. venustus, Darwin.

Pl. XII.

B. amphitrite is another very common and variable species of wide distribution. Little is known of the oriental varieties of this species. Darwin described his variety *venustus* from Ceylon very briefly as follows:—

"White or pale pink, with narrow bright pink or broad pinkish purple stripes, orifice either much dentated or nearly entire, tergum with the carinal half of the basal margin sometimes much hollowed out."

As this description applies to the specimens from Krusadai more or less I have referred the form to the variety *venustus* pending a fuller investigation of the oriental varieties of *B. amphitrite*. The numerous teeth in the labrum, however, is an important difference.

The specimens in the Krusadai collection consist of bleached and compressed forms from a dead tree at Bushy Point and normal examples from the bottom of the motor launch "Sea Scout."

As a detailed description of the mouth and cirri of the variety *venustus* in the light of recent research is desirable, I give below particulars of the specimens in the Krusadai collection.

Colour.—Dirty white with regular longitudinal violet-brown moderately broad stripes which are generally arranged in groups of 3 or 4. Sheath dark brown, radii freckled in several examples with purple.

Shell.—Conical, often depressed, and in a few cases laterally compressed when the specimen is attached to twigs, orifice small. Parietes smooth, permeated by pores. Radii of moderate size with crenated edges and septa denticulated on the lower side only. Summits of radii usually parallel with the basis. Basis calcareous, with concentric ridges internally and porous only towards the peripheral margin, which is considerably thicker than the centre. Normally the basis is flat and attached throughout, but in the case of specimens attached to twigs or other rounded surfaces the basis is curved correspondingly and the barnacle is laterally compressed as in the variety *malayensis*.

Scutum.—The adductor ridge not prominent; the articular ridge well developed, more than half as long as the tergal margin and ending in a projecting point. The growth ridges are distinct and in many adults obsolete towards the apex.

Tergum.—Spur broad, removed from the basi-carinal angle by about its own width, the angle of the apex very obtuse. The crests for depressor muscles very prominent, usually projecting below the basal margin. Externally there is no distinct furrow along the line of the spur. The lower end of the spur is square and nearly parallel with the basal margin.

Mouth.—Labrum with the notch deep. Teeth about 21: the first one separated by a wide interval, the rest close together. Palp with the upper and lower margins parallel. An oblique row of long spines in a single row as in the variety *communis*.

Mandible.—Teeth 1, 2 and 3 all pointed; teeth 4 and 5 rudimentary, inferior angle poorly developed.

Maxillae.—Edge slightly lobed, step at lower part slightly developed, lower margin pairs of excavated, notch not noticeable. Six small spines between the upper and lower pair. The first 4 are in pairs. Outer maxillae and cirri of the usual type described by Hoek.

From the above it will be seen that the Krusadai variety (*venustus*) differs from var. *malayensis* in shape, size of orifice, colour and in the form of the tergum and number of teeth on the labrum. It differs from the var. *communis* among other characters in the feeble development of the adductor ridge and in the longer articular ridge of the scutum and the teeth on the labrum. In other words the Krusadai specimens combine the characters of the above two varieties in some respects and possess distinct characters of their own.

Several specimens. The largest is 16 mm. along the longest basal diameter and about 6 mm. in height.

Balanus longirostrum, Hoek.

Pl. XIII.

This small fragile barnacle occurs completely imbedded in the sponge *Suberites inconstans*, Dendy, which is extremely common between tide marks at Krusadai. Several barnacles inhabit the same sponge. They are usually found near the surface of the sponge, their positions being indicated by small orifices through which the barnacle protrudes its cirri. In the places where the barnacle is imbedded, very often it causes a greenish discolouration in the sponge.

The Krusadai specimens seem to differ from the typical form of *Balanus longirostrum* in the following particulars :—

(1) The shell is distinctly conical and the orifice is small, and not very irregularly toothed.

(2) The shell is about as high as it is broad.

(3) The lower half of the carina becomes very abruptly narrow and attenuated.

In other respects, particularly in the armature of the 4th cirri, this form corresponds to *B. longirostrum*. It may prove later to be a distinct variety.

Chelonobia testudinaria (Linn.).

Pl. XIV, figs. C 1-2.

This characteristic turtle barnacle is common on the carapaces of turtles lying on the island.

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1916 PILSBRY, H. A. "The sessile barnacles (Cirripedia) contained in the collection of the U.S. Nat. Museum." Bull. 93.

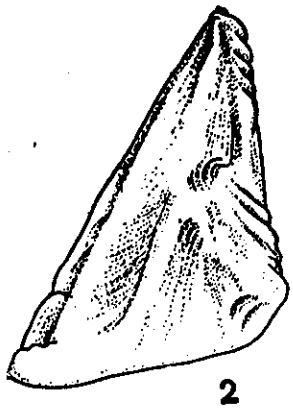
... BORRADAILE, L. A. Brit. Antart. (Terra Nova) Exp., 1910. *Nat. His. Rep. Crustacea*, Part III.

1924 ANNANDALE, N. Cirripedea. Associated with Indian Corals of the families Astraeidae and Fungidae. Mem. of the Ind. Museum. Vol. VIII, No. 1, p. 61.

PLATE XII.

Balanus amphitrite var. **venustus**, Darwin.

1. Specimen attached to a twig.
2. Scutum, internal view.
3 & 4. Tergum, internal view of young and old specimens.
5. Labrum showing the notch and teeth. (In some examples the teeth are fewer in number.)
6. Mandible.
7. Labial palp.
8. Maxilla.



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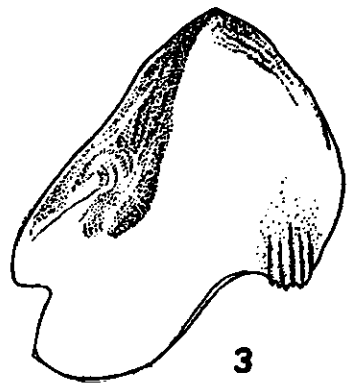

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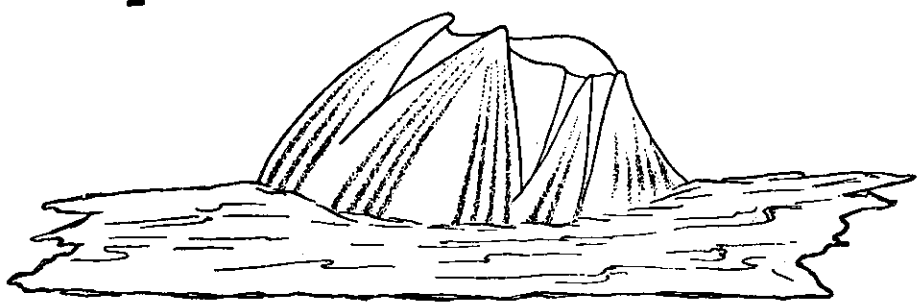

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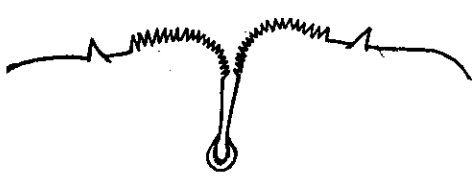

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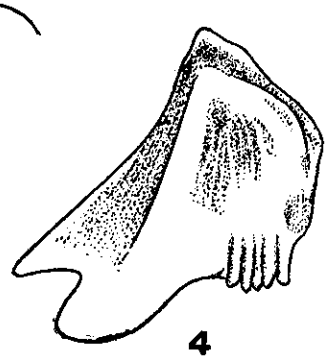

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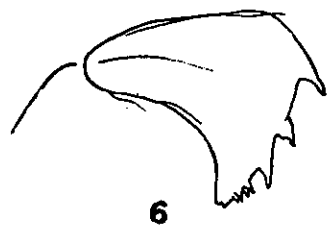

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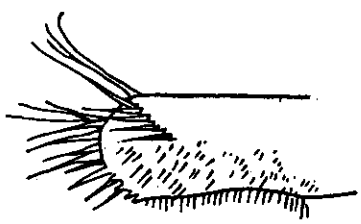

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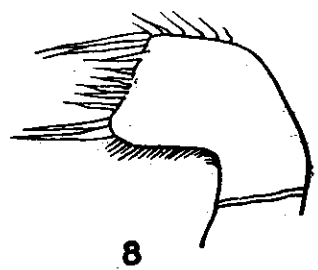

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PLATE XII.—KRUSADAI BARNACLES.

PLATE XIII.

Balanus longirostrum, Hoek.

1. Entire animal.
2 & 3. Scutum, external and internal view.
4 & 5. Tergum, external and internal view.
6. Elongated carina or rostrum.

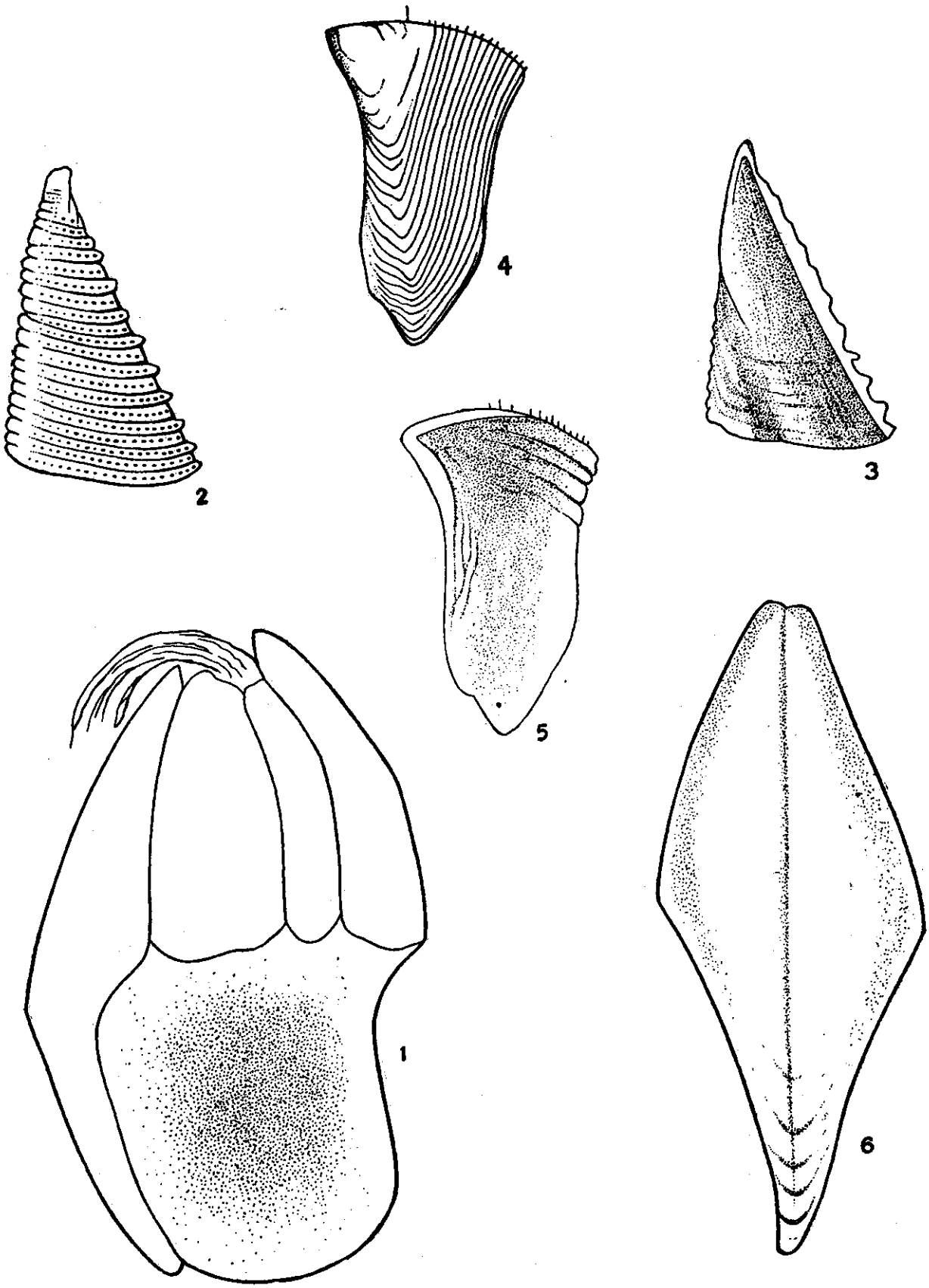

PLATE XIII.—KRUSADAI BARNACLES.

PLATE XIV.

A.—Balanus tintinnabulum (Linnaeus).

var. communis, Darwin.

(subsp. tintinnabulum Pilsbry.)

1. Shell.
2. Scutum, internal view.
3. Do. external view.
4. Tergum, internal view.
5. Do. external view.

B.—Lepas anserifera, Linnaeus.

1. Entire animal.
2. With one side of the capitulum removed to show the position of the body and organs.

F. Ap.—Filamentary appendages.

C.—Chelonobia testudinaria (Linnaeus).

1. Shell seen from above.
2. Shell seen from below.

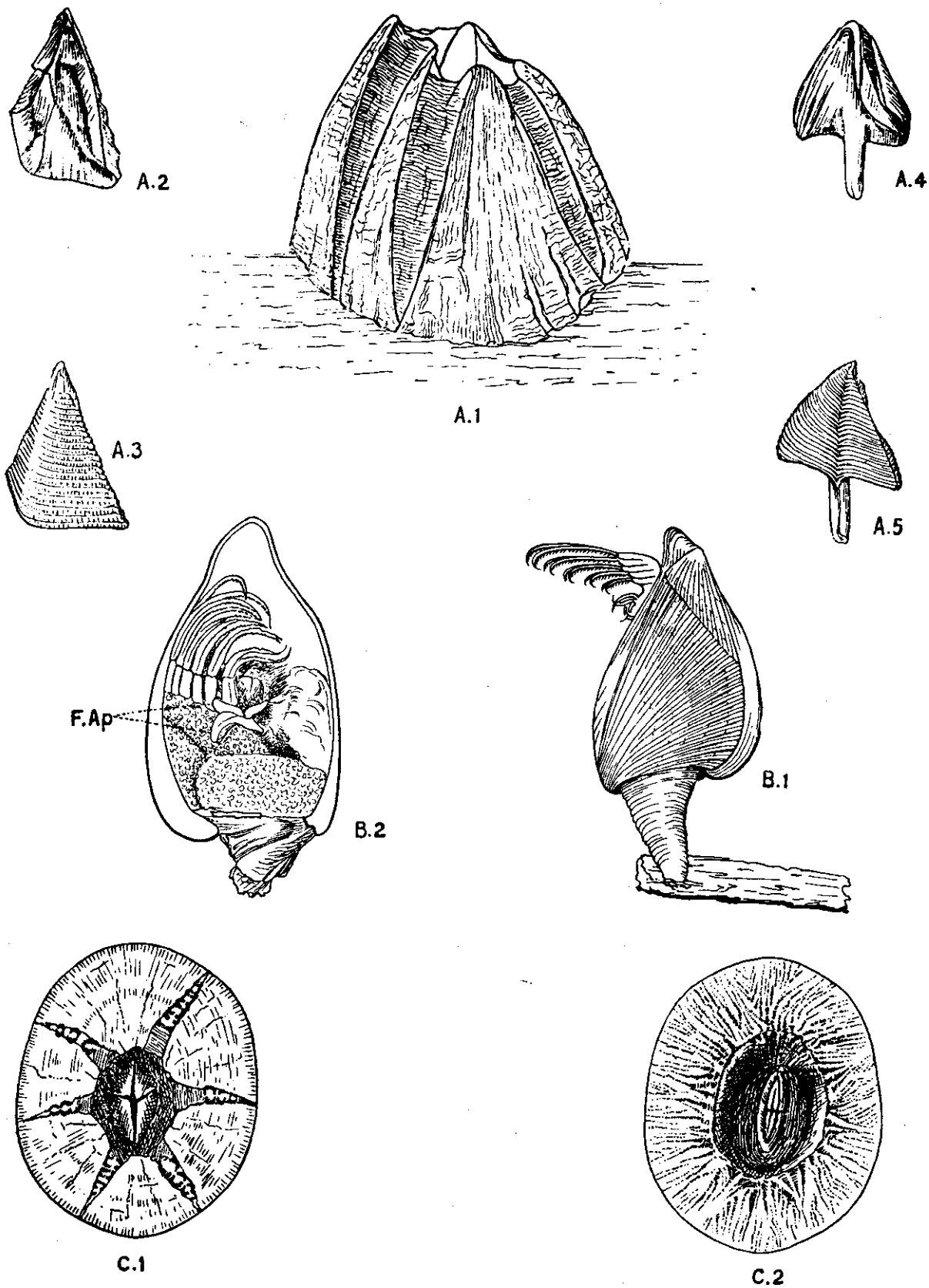

PLATE XIV. KRUSADAI BARNACLES.

Order Isopoda.

By F. H. GRAVELY, *D.Sc.*

The following common Isopods have been identified provisionally with the help of the keys in Richardson's "Monograph on the Isopods of North America" (1905). They have since been sent with others to Dr. Chilton for further investigation.

Suborder Flabellifera.

Uropods lateral, lamellar, forming a caudal fin for swimming.

Family CYMOTHOIDAE (s. lat.).

Abdomen usually composed of six segments; uropods with both branches well developed.

Cirolana spp.

A species of *Cirolana*, in which the dorsal surface is somewhat hispid, is not uncommon on Krusadai Island. The Museum collection includes a smooth species from Shingle Island.

Family SPHAEROMIDAE.

Abdomen composed of two segments.

Exosphaeroma sp.

Two species occur on Krusadai Island. In one there is a projecting bifid lamella immediately above the middle of the posterior margin of the terminal segment of the abdomen; in the other this segment is bent downwards laterally in such a way as to produce a median emargination from certain points of view. Both species appear, therefore, to have affinities with *Dynamene* as well as with the genus to which I have provisionally referred them.

Suborder Valvifera.

Uropods lateral, opercular, folded inwards over pleopods, exopodite vestigal or absent.

Family IDOTEIDAE.

Synidotea sp.

A slate-coloured Isopod of this genus is very abundant among the luxuriant growth of hydroids under Pamban bridge.

Suborder Oniscoidea.

Terrestrial forms.

Uropods subterminal, generally biramous and styliform.

Family LIGIIDAE.

Buccal mass prominent; head without lateral lobes; both branches of uropods styliform.

Ligia exotica, Roux.

A specimen of this well-known maritime genus was collected at Pamban. It has been identified for us by Mr. Chilton as *Ligia exotica*, Roux.

Suborder Epicarida.

Parasitic on crustacea. Adult female greatly modified; mouth parts suctorial, with simple piercing mandibles; maxillulae and maxillae vestigial or absent.

The specimens of this suborder have been identified by Dr. Chopra, whose account of them forms the next section of this report.

LITERATURE FOR NON-PARASITIC ISOPODA.

1884 & 86 BEDDARD, F. E. "Isopoda, Pts. I and II." *Rep. Sci. Res. H.M.S. "Challenger"* Zool. XI, 85 pp., 10 pl.; and XVII, 179 pp., 2 text figs., 25 pl., 1 map.

1905 STEBBING, T. R. R. "Isopoda." Herdman's *Rep. Ceylon Pearl Oyster Fisheries*, IV, pp. 1–64, pl. i–xii.

1906 STEBBING, T. R. R. "Isopoda." Gardiner's *Fauna and Flora of the Maldive and Laccadive Archipelagoes*, II, pp. 699–721, pl. xlix–liii.

1909 CALMAN, W. T. "Crustacea." Lankester's *Treatise on Zoology*. (London 1909), 346 pp., 194 text figs.

1910 STEBBING, T. R. R. "Crustacea Isopoda and Tanaidacea." Herdman and Crossland's Rep. Mar. Biol. Soudanese Red Sea. *J. Linn. Soc. London* (2) Zool. XXXI, pp. 215–230, pl. xxi–xxiii.

1911 STEBBING, T. R. R. "Indian Isopods." *Rec. Ind. Mus.*, VI, pp. 179–191, pl. x–xii.

1917 COLLINGE, W. E. "Description of a new species of Isopoda of the Genus *Synidotea*, Harger, from the Gulf of Mannar." *Rec. Ind. Mus.*, XIII, pp. 1–3, pl. 1.

1924 CHILTON, C. "Fauna of the Chilka Lake—Tanaidacea and Isopoda." *Mem., Ind. Mus.*, V, pp. 877–895, pl. lx.

Bopyrid Isopods.

By B. CHOPRA, *D.Sc., Zoological Survey of India, Calcutta.*

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Through the kindness of Dr. F. H. Gravely, Superintendent, Madras Museum, I have been able to examine the two Bopyrids that he collected at Krusadai Island. The third Bopyrid dealt with in this note was collected by my colleague Dr. H. Srinivasa Rao and myself under Pamban bridge in the neighbourhood of Krusadai. The three Bopyrids belong to three known species of the genus *Bopyrella*, Bonnier. Two of these, *B. thomsoni* Bonnier, and *B. deformans* (Hay) subspecies *indica* Chopra, are already known from Indian waters and were described by me in 1923[1]; the third is *B. distincta*, a species described by Nierstrasz and Brender à Brandis[2] in the series of the Siboga Expedition Reports. The latter species was hitherto known from a female only, but I am now able to describe its male also.

All the three species of Bopyrids are parasites of Alpheids, but the latter have not been identified.

The genus *Bopyrella*, as I understand it, includes the form described by Hay[3] under the generic designation of *Synsynella*. This question was fully discussed in my memoir of 1923.

In this note, as also in my former paper on the subject, I, like most other workers on Isopoda, consider—for the present at any rate—the thorax to be formed of seven somites, calling the first somite behind the head the first and not the second as it is morphologically believed to be.

Bopyrella thomsoni, Bonnier.

1900. *Bopyrella thomsoni*, Bonnier, *Trav. Stat. Zool. Wimereux*, VIII, pp. 348–351, pl. xxxiii.
1923. *Bopyrella thomsoni*, Nierstrasz and Brender à Brandis, *Siboga-Exped. Rep.*, XXXII *b*, p. 97.
1923. *Bopyrella thomsoni*, Chopra, *Rec. Ind. Mus.*, XXV, pp. 469–470.

Two females and a male of this species are represented in the Krusadai collection. The females are very large, being considerably larger than even the Andaman specimen described by me in 1923. They are 14·5 and 12·5 mm. in their greatest length and at the

[1] Chopra, *Rec., Ind. Mus.*, XXV, pp. 469–473, pl. xiv figs. 1–6 (1923).
[2] Nierstrasz and Brender à Brandis, *Siboga-Exped. Rep.*, XXXII *b*, p. 97, pl. vi fig. 22 (1923).
[3] Hay, *Proc. U.S. Nat. Mus.*, LI, pp. 571–572, pl. ic figs. 13–18 (1917).

level of the third thoracic somite are 9 and 8 mm. broad, respectively. Bonnier's example, it may be remarked, was only 2·5 mm. long, while that from the Andaman was 10·5 and 6·5 mm. in its length and breadth, respectively.

The Krusadai specimens agree closely with the one previously described by me, as also with the type specimen. Eyes are present in both the specimens in the form of two very faint dark spots, one near each antero-lateral corner of the head. The maxilliped is like that figured by Bonnier, and its palp, in one of the specimens that I have partly dissected, has about 15 setae, of which 8 are arranged along the inner margin.

The internal crest of the first oostegite is slightly better developed than that in the type specimen or in the Andaman example previously studied by me, and has a larger number of digitations.

The pleopods are very well developed, and those of the first pair meet in the middle line. The ridges on the ventral surface of the abdomen are rather inconspicuous in the larger of the two females, but are quite clearly seen in the other.

Only the larger female is accompanied by its male. The latter is short and stumpy, being 2·5 and 1·5 mm. in its greatest length and breadth, respectively. The head is completely fused with the first somite, and has a pair of fairly large eyes. As in Bonnier's specimen the thoracic somites increase in breadth progressively from the first to the last, but their lateral parts are not very considerably enlarged. The abdomen is like that figured by Bonnier, and under high magnification slight traces of the first two pleopods can be made out.

The two specimens described above were collected by Dr. F. H. Gravely at Krusadai Island in the Gulf of Manaar in April and September 1924, respectively. The Alpheids on which they were living have not been identified.

The species is already known from Amis Island, Oceania, and Port Blair, Andaman Islands.

The specimens are preserved in the Madras Museum.

Bopyrella deformans (Hay).

1917. *Synsynella deformans*, Hay, *Proc. U.S. Nat. Mus.*, LI, pp. 571–572, pl. ic figs. 13–18.

Subspecies indica, Chopra.

1923. *Bopyrella deformans*, subsp. *indica*, Chopra, *op. cit.*, pp. 470–473, pl. xiv figs. 1–6.

A single pair (female and male) parasitic on an undetermined Alpheid, and collected by Dr. Gravely at Krusadai Island in the Gulf of Manaar in September 1924, appears to belong to the Indian subspecies of Hay's *B. deformans*, described by me in 1923. I have nothing to add to my former description of the female of this form. The male is, however, proportionately slightly broader, and the thoracic somites are not so deeply cleft laterally.

As pointed out in 1923, the present form is only tentatively regarded as a local race or subspecies of Hay's *deformans*. As in most cases, the term subspecies is rather loosely

used in the present instance. Until Hay's form is re-examined and compared with the Indian specimens it is difficult to say whether the two are really so closely allied as I believe them to be.[1]

The Indian subspecies seems to have a very wide range of distribution, it having been recorded both from the Arabian Sea and the Bay of Bengal. The present record extends further the distribution on the eastern coast. The two specimens provisionally referred to this form in 1923 came from north-east of Ceylon. The *forma typica* is from the Atlantic coast of North America.

The specimens are in the Madras Museum.

Bopyrella distincta, N. & B.

1923. *Bopyrella distincta*, Neirstrasz and Brender à Brandis, *Siboga-Expd. Rep.* XXXII *b*, p. 97, pl. vi fig. 22.

A single pair (female and male) of this species was collected by Dr. H. Srinivasa Rao and myself on rocks under the railway bridge at Pamban near Krusadai Island. The specimens are an ovigerous female accompanied by its male, and are parasites of an undetermined Alpheid. It was collected in February 1925.

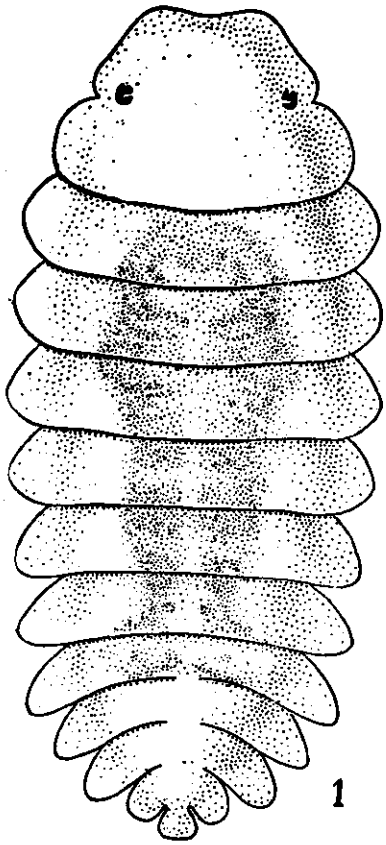
In all important characters the female agrees closely with the description and figures published in the *Siboga-Expedition Report*. The present specimen is, however, smaller than that examined by Neirstrasz and Brender à Brandis, it being 5 mm. long and slightly over 4 mm. broad at the level of the third thoracic somite. The shape and arrangement of the segments is exactly like that described by the Dutch authors, the ridges on the ventral surface of the incubatory cavity being very prominent. The palp of the maxilliped is large and carries a large number of setae. The distal part of the first oostegite appears to be somewhat more drawn out than it is shown in the Siboga report figures. The internal crest also seems to be fairly well developed and has a number of small digitations near the proximal end.

The shape of the abdomen with the long posteriorly cleft terminal segment is very characteristic of this species. The overlapping of the lateral parts of the segments on the longer side of the body is well seen in my specimen also. The pleopods on the shorter side are greatly reduced and crowded together.

The male of this species was hitherto unknown. I, however, give below a description of it.

The *male* is short and stumpy, being 1·3 mm. long and 0·55 mm. broad at the level of the third somite. The head is semi-circular with the anterior margin somewhat depressed in the middle. It is fused with the first free thoracic somite in the middle, though the two are quite distinct laterally. A pair of large eyes is present near the posterior end of the head. Ventrally the antennules appear to be formed of three segments—two large basal and a small terminal one. The antennae are biarticulate and the mandibles are long and curved.

[1] In 1923 (*op. cit.*, addendum, p. 541) I was wrong in thinking *B. bonnieri* Nierstrasz and Brender à Brandis (*op. cit.*, pp. 95–96) to be closely similar to the present form. It is, however, possible that *B. indica* may turn out to be identical with the Dutch author's *B. intermedia*.



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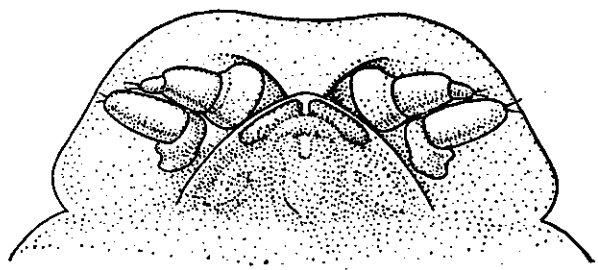

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Fig. 1.—*Bopyrella distincta*, N. & B. Dorsal view of male × 80.

Fig. 2.—*Bopyrella distincta*, N. & B. Head appendages of male from ventral surface × 200.

The thoracic somites are distinct from one another and their lateral parts are well developed. The legs have the usual shape and structure.

The abdominal segments are fused in the middle of the dorsal surface, though they are quite free laterally. Five segments are distinctly visible, with their lateral parts well separated from one another. The last segment is a broad squarish process, with the posterior margin truncate. No pleopods seem to be developed.

The species was hitherto known from a single female collected by the Siboga Expedition at Kaniungan Island, off the coast of Borneo in the Celebes Sea. The present specimens come from the Gulf of Manaar and thus extend the range of the species very considerably.

The specimens are preserved in the collections of the Zoological Survey of India in the Indian Museum, Calcutta.

Order Amphipoda.

Suborder Gammaridea.

By F. H. GRAVELY, *D.Sc.*

Dr. Chilton has kindly identified all the specimens for me. For classification see Della Valle, 1893.

Family COROPHIIDAE.

General form normal; thoracic legs with glandular patches; telson entire, rarely bilobed; two eyes of ordinary form.

Podocerus brasiliensis (Dana) and a species of *Amphithoe* have been found under Pamban bridge. In the genus *Podocerus* the anterior margin of the external lamina of the lower lip is entire; in *Amphithoe* it is incised.

Family TALITRIIDAE (=ORCHESTIDAE).

General form normal; thoracic feet without glandular patches; anterior antenna without accessory flagellum, much shorter than posterior; mandibles without palps; anterior maxilla with at most a rudimentary 1-joined palp; posterior caudal feet uniramous.

Talorchestia gracilis, Dana, is a sand-hopper common among debris on the shore at Krusadai Island. The specimens were collected on the northern shore between the bungalow and Sandy Point.

Family GAMMARIDAE.

General form normal; thoracic feet without glandular patches; anterior antenna with accessory flagellum; third joint of posterior gnathopods of normal length.

Several specimens of *Stenothoe valida*, Dana, were found at Pamban. They are all small in size and almost black in colour (preserved). A single specimen each of *Melita sp.* and *Elasmopus subcarinatus* (Haswell) were also found at Pamban, and a single specimen of the latter and of *E. pectinicrus* (Bate) at Shingle Island. Single specimens of *E. spinimanus* (Walker), *E. suensis* (Haswell) and *Leucothoe spinicarpa* (Abildgaard) have been found on Krusadai Island, and one of the last named at Pamban also.

LITERATURE FOR GAMMARIDAE.

1862. SPENCE BATE, C. "Catalogue of the Specimens of Amphipodous Crustacea in the Collection of the British Museum." (London, 1862) 399 pp., 58 pl.

1888. STEBBING, T. R. R. "Amphipoda." *Rep. Sci. Res. H.M.S. "Challenger"* Zool. XXIX, xxiv+1737 pp. (bound in two halves), 210 pl., 1 map (bound as separate vol.).

1893. DELLA VALLE, A. "Gammarini del Golfo di Napoli." *Fauna u. Flora des Golfes von Neapel* XX, xi+948 pp., 61 pl. (in separate vol.).

1904. WALKER, A. O. "Amphipoda." Herdman's *Rep. Ceylon Pearl Oyster Fisheries.* II, pp. 229–300, 8 pl.

1906. WALKER, A. O. "Amphipoda." Gardiner's *Fauna and Geog. Maldive and Laccadive Archipelagoes.* II, pp. 923–932, pl. lxxxviii, text figs. 140—142.

1909. WALKER, A. O. "Amphipoda Gammaridea from the Indian Ocean, British East Africa, and the Red Sea." Rep. Percy Sladen Trust Exp. to Ind. Ocean under J. Stanley Gardiner I., *Trans. Linn. Soc. London* (2) Zool. XII, pp. 323–344, pl. xlii–xliii.

1921. CHILTON, C. "Amphipoda." Fauna of the Chilka Lake. *Mem. Ind. Mus.* V, pp. 519–558, 12 text figs.

Suborder Caprellidea (Laemodipoda).

By B. SUNDARA RAJ, *M.A., Ph.D.*

Family CAPRELLIDAE, Dana.

Caprellidae abound on the algae, zoophytes and polyzoa growing luxuriantly on the piers of Pamban bridge, and can be collected conveniently at low tide. Though in colour and form they closely resemble their surroundings, their caterpillar-like movements on lifting a tuft of hydroids or weeds from the water render them conspicuous. Species of *Metaprotella* and *Paradeutella* are common. The genera *Hemiaegina* and *Pseudocaprellina* are also found, but are rare.

Genus Metaprotella, Mayer.

Second artennae with 2 jointed flagellum, mandibles with 3 jointed palps; 2 pairs of gnathopods (chelate legs). First two pairs of thoracic legs (peraeopods) rudimentary and single joined. The posterior 3 pairs of peraeopods well developed; 2 pairs of branchial vesicles on the 2nd and 3rd body segments, abdominal appendages rudimentary.

The genus *Metaprotella* is distinguished from the older genus *Protella* by the fusion of the last 2 segments of the thorax and the extreme shortening of the last thoracic segment, which displaces the penis from the median line. Several examples of the species *M. problematica*, Mayer, and *M. haswelliana*, Mayer, are in the present collection but *M. excentrica* recorded from Pamban bridge by Thurston is not represented there.

The three species can easily be distinguished as follows:—

1. Dorsal surface of head and body smooth, gills oval ... ... *M. problematica.*
— Dorsal surface of head and body carrying spines, gills rod-like 2.
2. Second or large gnathopod with knobs (in old males), body attenuated ... ... *M. excentrica.*
— Second or large gnathopod smooth, body plump ... ... *M. haswelliana.*

Metaprotella problematica, Mayer.

Pl. XV, figs. 1 *a-c.*

Males are 7 mm. and females 5 or 6 mm. in length. The flagellum of the 1st antennae has 17–18 joints in the male and 15–16 joints in the female. The body is sometimes covered with minute pigment spots.

Very common.

Metaprotella haswelliana, Mayer.

Pl. XVI.

The flagellum of the 1st antennae has 15 joints in the male. Pairs of spines on the head and first body segment, a median spine often present dorsally at the posterior end of that segment. Diffuse pigment cells occur on the sides of the body.

Very common. Males attain 10 mm. in length.

Metaprotella excentrica, Mayer.

This species has been recorded by Thurston from Pamban. It is a large one attaining 13 mm. in length. The flagellum of the 1st antennae has 14 joints in the male and 13 in the female. The peculiar knobs on the 2nd gnathopods are seen only in old males when lying on their back. These knobs and the slender form of the body distinguish this species from *M. haswelliana* which it closely resembles.

Genus Paradeutella, Mayer.

Mandibular palps 3-jointed; the flagellum of the 2nd antennae 2-jointed; rudiments of legs on the 3rd and 4th body segments very small; in the female the hinder pair is inserted at a distance from the gills. This genus differs from the older genus *Deutella* in the form of the abdominal appendages which are shaped like valves as in the genus *Pseudoprotella*.

Paradeutella bidentata, Mayer.

Pl. XV, figs. 2*a–b*.

Spines on forehead and 1st body segment (2nd thoracic segment). A smaller species than the foregoing but equally common at Pamban, whence the genus was first recorded. Males grow to a length of 5 mm. There are 12 or 13 joints in the whip of the 1st antennae of the male and 11 in that of the female. The shape of the large chela is characteristic of the species.

Genus Hemiaegina, Mayer.

Mandibular palps absent; 2nd antennae with 2-jointed whip; rudiments of legs on the 3rd and 4th body segments; a pair of 2-jointed legs on the abdomen both in the male and female, which resemble the 1st pair of abdominal legs of the genus *Aegina*.

The moniliform body, the comb-shaped base of the terminal claws of the posterior thoracic legs, and the pair of 2-jointed legs of the abdomen, render this genus easily recognizable.

Hemiaegina quadripunctata, n.sp.

Pl. XVIII.

Resembles *H. minuta*, Mayer, closely. The differences are—(1) the dent or notch in the palm of the big chela is squarish and not triangular; (2) the shape of the abdomen is also slightly different. The largest male specimen in the collection is 4.5 mm. long. There are 11 segments in the whip of the 1st antennae of both male and female.

This may prove to be only a variety of *H. minuta*, Mayer, when more extensive collections are available for study and the range of variations of the two forms are determined. As, however, no intermediate forms have been found I have ventured to refer the Krusadai examples to a new species.

Genus Pseudocaprellina, n. gen.

I refer to this new genus two male specimens in the collection as they do not conform to any of the described genera. They are very closely related to the genus *Caprellina*, Thomson, from which they differ chiefly in the form of the abdomen, which resembles that of the genus *Hircella*.

The specimens are less than 6 mm. in length. The flagellum of the 1st antennae has the first 4 or 5 segments fused into a single segment and the following 4 or 3 free. The 2nd antennae have no distinct flagellum. It has 2 tiny basal segments, 2 moderately long middle ones and 2 terminal ones (see pl. xvii fig. 1). The mouth parts resemble those of the genus *Proto*. The mandibular palp is 3-segmented. The chela of the second thoracic appendage has no "cushion" but has a circular ridge carrying 4 teeth of which the 3rd is the largest. Segments 2 to 4 carry pairs of branchial vesicles. Segments 3 and 4 are devoid of legs. Segment 5 carries a small 3-jointed appendage ending in a claw. The 6th and 7th pair of thoracic legs are normal. The abdomen carries 2 pairs of prominent *unsegmented* appendages of which the lower is the longer. There is one row of hairs on the smaller and 2 rows of hairs on the larger appendage. The whole abdomen with the appendages closely resembles that of *Hircella cornigera*.[1]

Pseudocaprellina pambanensis, n.sp.

Pl. XVII.

Only 2 males were found in the collection from Pamban bridge.

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PLATE XV.

1. **Metaprotella problematica**, Mayer. Male.

a. Second chela.
b. End joints of 7th pair of thoracic legs.
c. First chela.

2. **Paradeutella bidentata**, Mayer. Male.

a. Second chela.
b. End joints of 7th pair of thoracic legs.

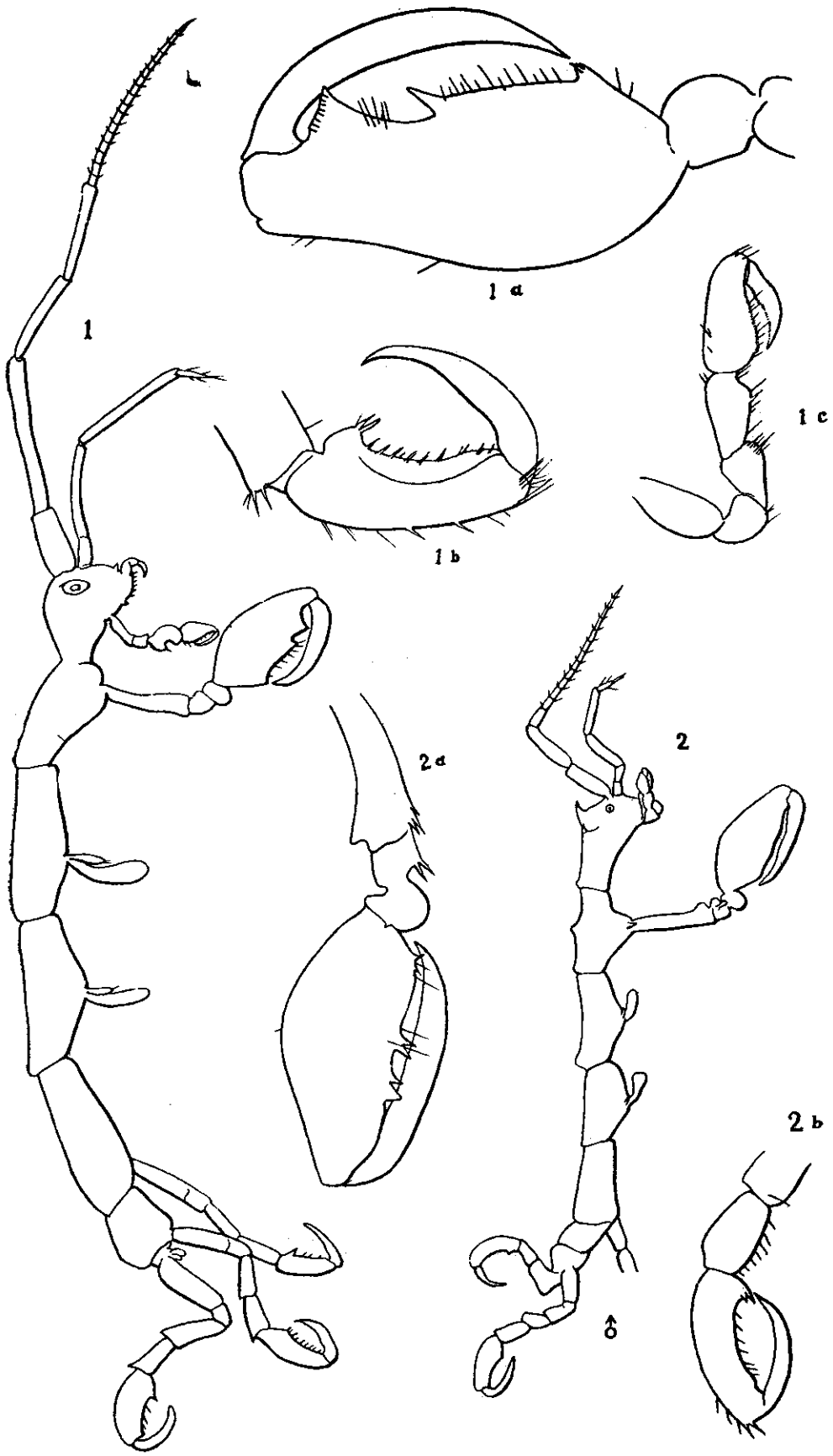


PLATE XV.—KRUSADAI CAPRELLIDEA.

PLATE XVI.

Metaprotella haswelliana, Mayer.

1. Adult male.
2. Second chela.
3. End joints of 7th pair of thoracic legs.
4. First chela.
5. Second gill with reduced appendage.

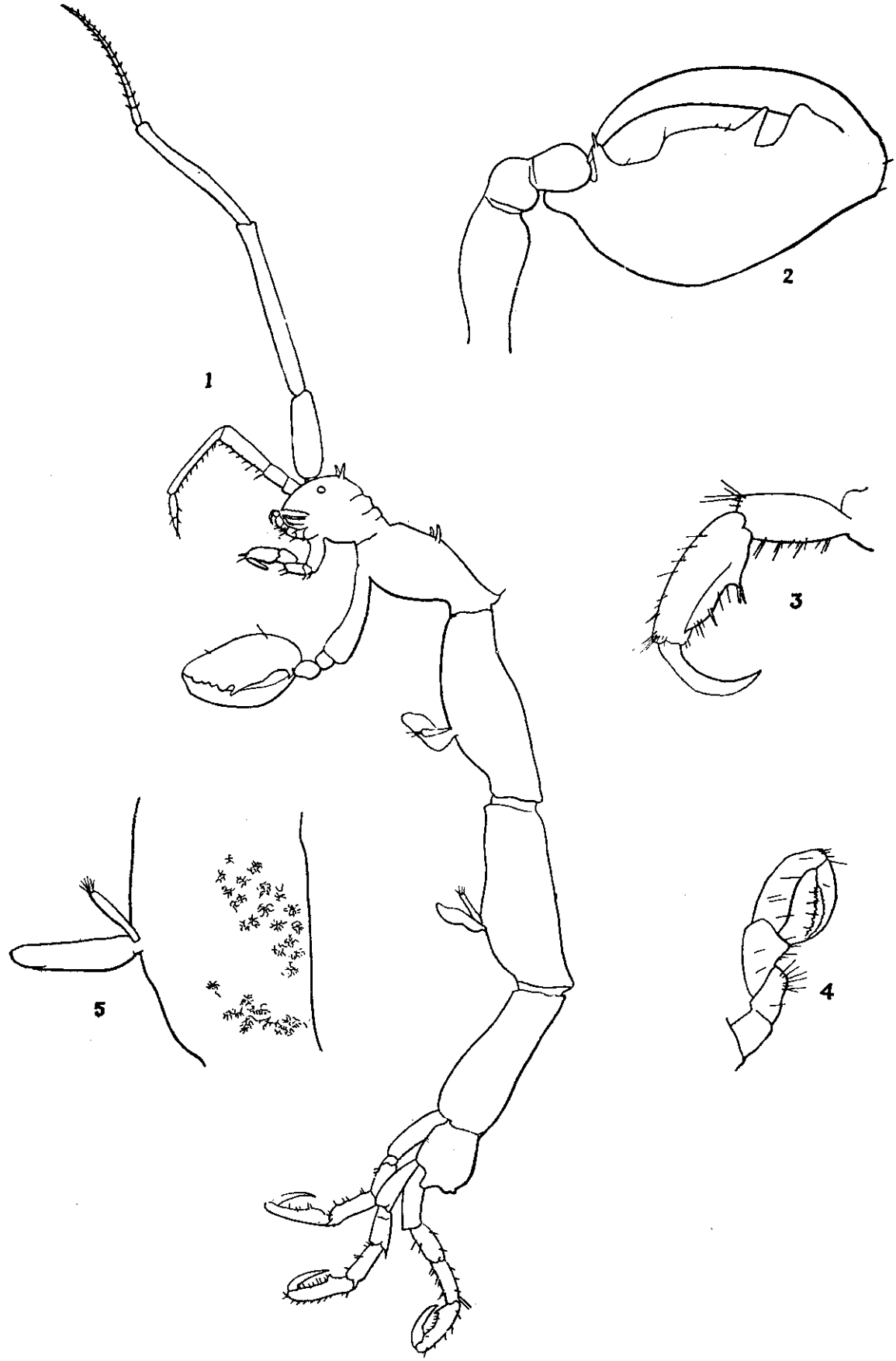


PLATE XVI.—KRUSADAI CAPRELLIDEA.

PLATE XVII.

Pseudocaprellina pambanensis, n.sp.

1. Adult male.
2. Abdomen and appendages.
3. End joints of 7th pair of legs.
4. Gill from 3rd body segment.
5. Mandible and palp.
6. First chela.
7. Reduced appendage of 5th body segment.
8. Second chela.
9. Maxilla.

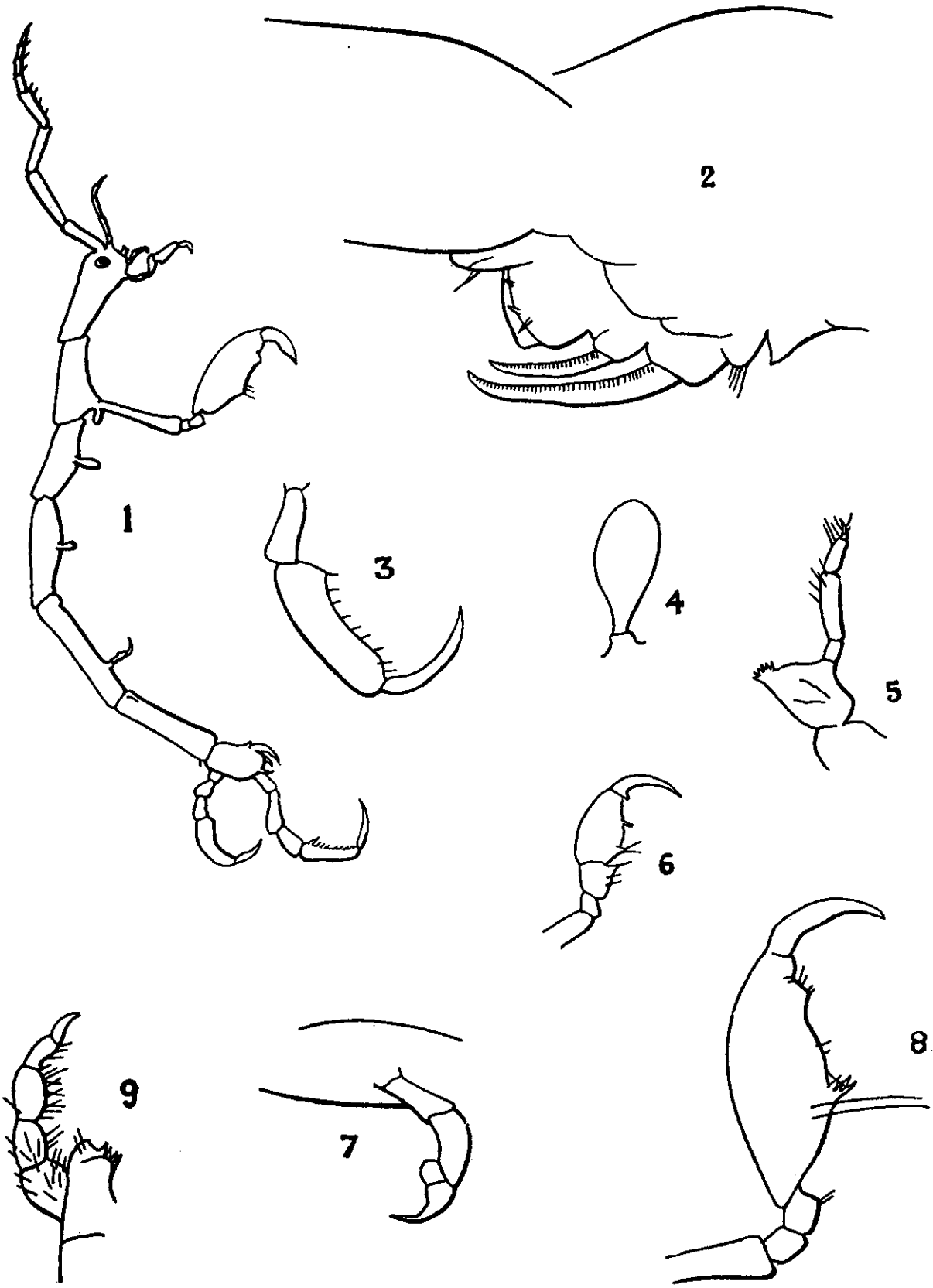


PLATE XVII.—KRUSADAI CAPRELLIDEA.

PLATE XVIII.

Hemiaegina quadripunctata, n. sp.

1. Adult male.
2. „ female.
3. First chela.
4. Dorsal view of abdomen and appendages.
5. End joints of 7th pair of thoracic legs.
6. Side view of the abdomen.
7. Second chela.

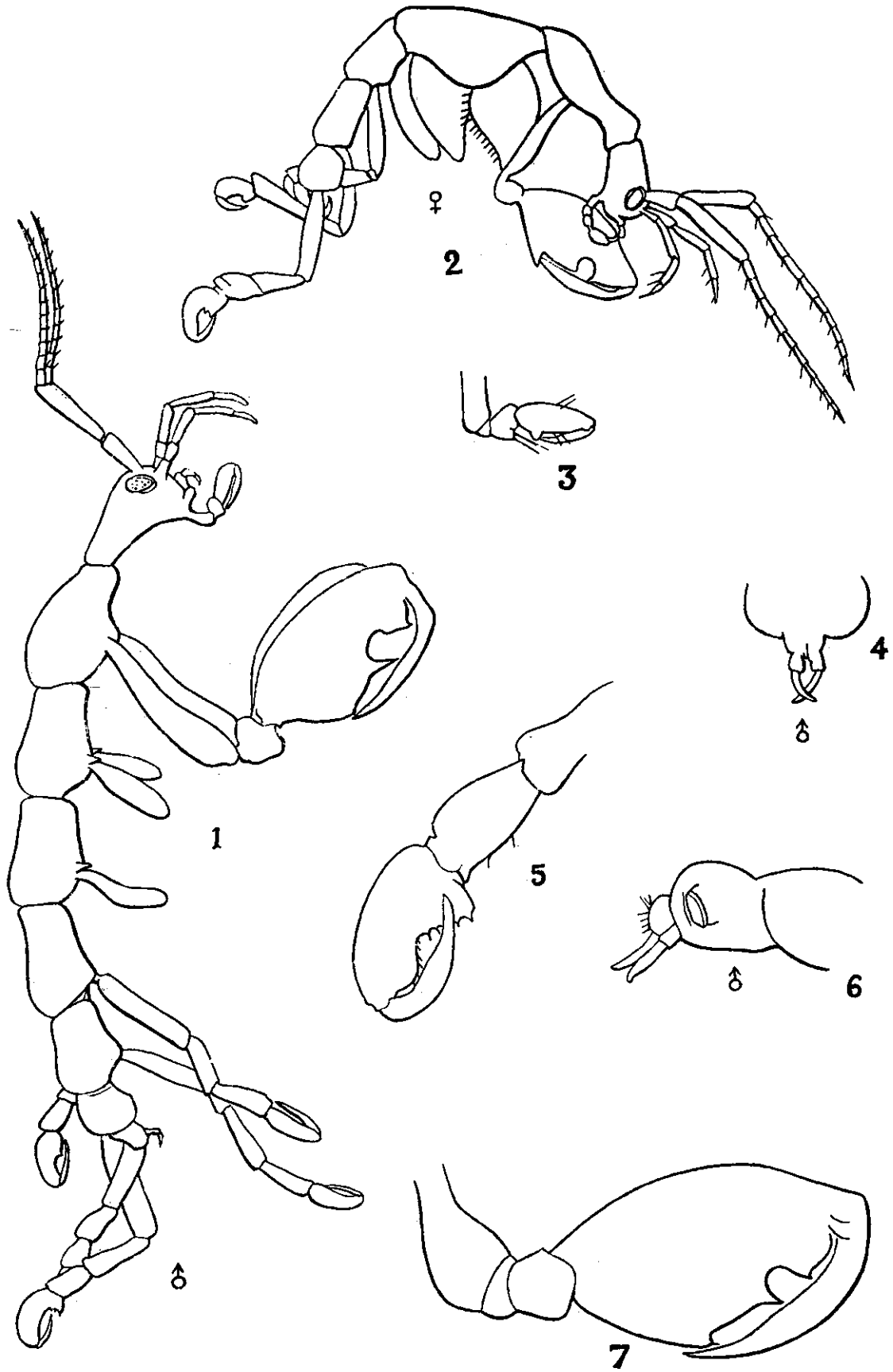


PLATE XVIII.—KRUSADAI CAPRELLIDEA.

Order Decapoda.

Suborder Anomura (Anomala).

Tribe *Paguridea.*

By B. SUNDARA RAJ, *M.A., Ph.D.*

The littoral hermit crabs from Krusadai Island and its neighbourhood belong to the two families Paguridae and Coenobitidae.

Family PAGURIDAE, Dana.

Uropods present. Penultimate pair of thoracic legs much shorter than those in front of them. Abdomen generally spirally coiled. Paired appendages never present in all abdominal somites. Antennular flagella ending in a filament; antennular peduncle rarely approaching the carapace in length.

KEY TO THE LOCAL GENERA.

The external maxillipeds are juxtaposed at base. When the chelipeds are unequal the left is vastly the larger.

I. Fingers of chelipeds opening and closing horizontally (chelipeds subequal); fingers spooned; antennal flagellum long and not setose ... ... *Clibanarius.*

II. Fingers opening and closing obliquely or nearly vertically; the chelipeds may be sub-equal but the left is usually vastly the larger:—

(*a*) Finger tips corneous and blackened; chelipeds occasionally sub-equal but the left usually vastly the larger; finger tips somewhat spooned ... ... *Pagurus.*

(*b*) Finger tips calcareous; left chelipeds vastly the larger; rostrum replaced by a movable scale or spine (a process from the opnthalmic somite) lying between the eye-stalks. *Diogenes.*

Genus Clibanarius, Dana.

Two species of this essentially littoral genus are in the collection. Three other species which are common in estuaries and backwaters in South India are likely to occur and are hence included in the diagnostic key below.

KEY TO THE SPECIES COLLECTED OR LIKELY TO OCCUR.[1]

I. The dactylus of the third pair of thoracic legs (second pair of crawling legs) is decidedly longer than the propodite:—

A. Eyestalks much shorter than antennular peduncles. A strong tooth at proximal end of inner lower border of merus of chelipeds ... ... *C. infraspinatus.*

[1] The Key in Colonel Alcock's "Catalogue of Pagurides in the collection of the Indian Museum" (1905, pp. 42 and 43) does not include the two common South Indian species *C. longitarsis*, de Haan, and the newly described *C. olivaceous*, Henderson, both of which may occur in Pamban waters.

B. Eyestalks as long as antennular peduncle and usually longer than anterior border of carapace:

1. Red or blue stripes on legs:

(*a*) A series[1] of straight red longitudinal lines on eyestalks and second and third pairs of legs, broken and indistinct on chelipeds ... ... *C. padavensis.*

(*b*) A pale blue longitudinal band bordered above and below by red on distal joints of second and third legs, best seen on propodi; eyestalks and chelipeds without stripes ... ... *C. longitarsis.*

2. No stripes on legs. Chelipeds and second and third pairs of legs olive green, three pale red lines on inner, upper and outer surfaces of eyestalk, upper one sometimes obsolescent ... ... *C. olivaceous.*

II. The dactylus of the third pair of thoracic legs, though it looks shorter, exactly the same length as the propodite; ophthalmic scales, as usual, almost in contact:—

Chelipeds, etc., deep red without spots ... ... *C. arethusa.*

Clibanarius infraspinatus, Hilgendorf.

A fair-sized, orange yellow species with a carapace 30 mm. long. The presence of a strong conical tubercle on the under surface of the merus of the chelipeds is the chief distinguishing feature of this species, which closely resembles *C. clibanarius*, a common species at Madras. Two specimens in the collection of the Fisheries Bureau at Ennur come from backwaters near Tuticorin and the species is therefore likely to occur on and near Krusadai Island. This is the first record of this species from the Gulf of Manaar.

Clibanarius padavensis, de Man.

This common South Indian backwater species occurs in suitable localities round the Indian coasts from Burma to Bombay. Dr. Henderson has recorded it from Rameswaram.[2] But in none of the collections recently made from Pamban waters does the species occur. As *C. longitarsis*, De Haan, an even more common South Indian species, had not at that time been sufficiently distinguished from *C. padavensis* and Dr. Henderson has not recorded the former from Rameswaram, it is not unlikely that the species recorded under the latter name is *C. longitarsis*, which is extremely common in the Pamban backwaters.

Clibanarius longitarsis, de Haan.

Very common at Pamban. Specimens have also been collected from the Krusadai Island. It resembles *C. padavensis* closely, but is readily distinguished by its colouration.

[1] Vide Henderson, *Rec., Ind. Mus.*, XI, pp. 27 and 28 (1915).

[2] Henderson, *Trans. Linn. Soc.*, (2) Zool., V, p. 423.

Clibanarius olivaceous, Henderson.

Another small backwater species found on the east coast. It has been recorded from the Chilka Lake and Madras and may occur at Pamban.

Clibanarius arethusa, de Man.

A fair sized species. The carapace in adults is about 30 mm. long. Several specimens have been collected at Pamban. It is easily distinguished from all the previous species by its distinctive colouration. The cephalothorax is yellow, the eyestalks, antennal peduncles, chelipeds and legs deep red, the finger tips and claws of the legs black. Some stray yellow specks on the legs.

Genus Pagurus, Fabricius.

The largest and the most brightly coloured hermit crabs are included in this genus.

KEY TO THE LOCAL SPECIES.

The eyestalks reach very nearly to, or even surpass, the end of the antennular peduncles; the eyes never occupy as much as one-third of the terminal joint of the eyestalk; the greatest breadth of the carapace across the branchial region is less than the length of the carapace in the middle line.

Left cheliped vastly larger and longer than right. Whole outer surface of left hand spinose:—

(*a*) Outer surface of propodite of third left leg spinose; chelipeds and legs very hairy; hand of left cheliped not inclined inwards; carapace and legs copiously ocellated ... ... *P. punctulatus.*

(*b*) Outer surface of propodite and dactylus of third left leg with regular, transverse squamiform markings ... ... *P. setifer.*

Pagurus punctulatus, Olivier.

This large and beautiful hermit crab is easily distinguished by its huge size and characteristic colour. The carapace, external maxillipeds, chelipeds and legs are bright red with numerous large bluish-white black-edged ocelli. Two fine specimens from the Rameswaram reef are in the collection at Ennur.

Pagurus setifer, Milne-Edwards.

Another common but smaller species, which apparently inhabits deeper water below tide marks and is often found in chank shells. In this species the carapace is yellowish, the chelipeds and legs are yellow and red, the red tending to form cross bands best marked on the merus and carpus. The colour and the peculiar tesselated outer surface of the last two joints of the two ambulatory legs are characteristic of the species.

NOTE.—Other common South Indian species of *Pagurus* are *P. hessii*, Miers, which is common in Madras, and *P. varipes*, Heller, and *P. deformis*, Milne-Edwards, recorded from pearl banks in the Gulf of Manaar and Palk Bay.

Genus Diogenes, Dana.

This characteristic Indo-Pacific genus is represented by at least five species in Pamban waters.

KEY TO LOCAL SPECIES.

I. Rostrum a narrow lamina, with free edge spinose at any rate distally:

A. Carapace longer than broad; left hand when fully extended not inclined inwards:

(*a*) Antennal acicle bifurcate, inner branch reaching about half way along penultimate joint of peduncle:

1. Outer (longer) branch of antennal acicle just, or barely, reaching base of terminal joint of peduncle; outer surface of left hand beset with claw-shaped spines ... *D. diogenes.*

2. Outer branch of acicle reaching well beyond base of last joint of peduncle; outer surface of left hand closely and finely granular ... ... *D. custos.*

(*b*) Antennal acicle obscurely bifurcate; outer branch not reaching base of last joint of peduncle; left palm as long as high, lower part of its outer surface flattened ... *D. planimanus.*

B. Carapace broader than long; left hand, even when fully extended, strongly inclined inwards ... ... *D. miles.*

II. Rostrum a slender, simple (non-serrated) spinule. Eyestalks not so long as anterior border of carapace or as antennal peduncle:

(*a*) Eyestalks reaching nearly to middle third of terminal joint of antennular peduncle; wrist and hand of left cheliped of adult male remarkably elongate ... ... *D. avarus.*

(*b*) Eyestalks hardly reaching base of terminal joint of antennular peduncle; a single obliquely longitudinal crest on outer surface of left palm ... ... *D. costatus.*

Diogenes diogenes, Herbst.

Dr. Henderson has recorded this species from Rameswaram and Tuticorin. It is a common species at Madras. There are several specimens in the Ennur collection. The eyestalks in some examples are shorter than the second joint of the antennular peduncle. The relative lengths of the legs and chelipeds vary.

Diogenes custos, Fabricius.

Two specimens in the collection at Ennur are from Rameswaram. It is the commonest species of *Diogenes* at Madras.

The variety *planimanus*, Henderson, is recorded from Rameswaram. There are no examples of this variety in the collection at Ennur or in the Madras Museum.

Diogenes miles, Herbst.

According to Dr. Henderson it is a common species on the east coast of India, living almost exclusively in shells of *Oliva gibbosa*, and not affecting brackish water. It has been recorded from Rameswaram by this author.

Diogenes avarus, Heller.

This common South Indian species lives both in backwaters and in the sea. Dr. Henderson has recorded it both from Tuticorin and Rameswaram between tide marks.

Diogenes costatus, Henderson.

This species has been recorded from Tuticorin and Rameswaram by Dr. Henderson.

NOTE.—The last three species are not represented in either the Fisheries Department or in the Madras Museum collections.

Family COENOBITIDAE.

The Coenobitidae are land hermits which visit the sea occasionally. The important characters of the family are: paired appendages never present on all abdominal somites; antennular flagella ending abruptly and bluntly without a filament; antennular peduncles nearly as long as or even longer than carapace.

Genus Coenobita, Latreille.

The carapace is elongate and the abdomen soft and coiled as in the Paguridae. They have little to do with the sea and live almost entirely on land, sometimes far away from the shore. They seem to prefer stout heavy shells (*Turbo*, *Natica* and *Nerita*) but live in almost any shell—even a cocoanut.

KEY TO LOCAL SPECIES.

Antennal acicle fused with second joint of peduncle: eye stalks strongly compressed. A brush of hairs on inner surface of both palms.

1. An oblique file of upright laminar teeth (stridulating mechanism) on upper part of outer surface of left palm.

Outer surface of propodite of third left leg flat and separated from anterior surface by a well-defined crest. Coxa of fifth right leg of male moderately produced ... ... *C. rugosus.*

2. No stridulating mechanism on left palm. Coxa of fifth right leg hardly more prominent in male than in female ... *C. cavipes.*

Coenobita rugosus, Milne-Edwards.

This yellowish or yellowish red hermit crab is extremely common on Krusadai Island, at Pamban, and on the neighbouring islands. It swarms on the beach everywhere. It does not grow to a large size.

Coenobita cavipes, Stimpson.

This common backwater species of South India is represented by a single adult male from Krusadai in the Madras Museum collection. It is comparatively rare and is easily distinguished from *C. rugosus* by its larger size, dusky purple colour of the legs, chelipeds and anterior portions of the carapace, and the absence of the stridulating mechanism on the left palm. This is the first time this species is recorded from the Gulf of Manaar.

Orders Decapoda (except Paguridea) and Stomatopoda.

By F. H. GRAVELY, *D.Sc.*

Order Decapoda.

For the broader outlines of the classification of this order, see Calman, 1909 (Oxford Natural History). For further details see Borradaile, 1907.

Suborder Natantia.

Pleopods used for swimming, well developed, their number always complete. Male genital apertures in the articular membrane.

This suborder may be divided into three tribes as follows:—

1. Third legs chelate, except in genera with much reduced legs; pleura of first abdominal segment not overlapped by those of second ... 2.
— Third legs not chelate; pleura of first abdominal segment overlapped by those of second ... ... Caridea.
2. Legs of third pair not stouter than those of first two pairs ... ... Penaeidea.
— One or both legs of third pair longer and much stouter than those of first two pairs ... ... Stenopidea.

The Penaeidea are, strictly speaking, represented in the collection under consideration only by the family Penaeidae. The Sergestidae are, however, represented in the plankton.

The Caridea are represented by a number of species, the most abundant being those of the family Alphaeidae. Of the rest, those which have been identified belong to the Hippolytidae and Palaemonidae. All three of these families belong to the group known as the Palaemonoida. In this group the seventh joint of the second maxillipede is short and usually applied as a strip to the end of the sixth; the mandibles are almost always deeply cleft, rarely simple, never imperfectly cleft; at least the basipodites of the second maxillae are well developed; and either the first or second pair of legs is more or less (often very) stout, both being chelate.

The Stenopidea are represented by a single species only.

Family PENAEIDAE.

Last two pairs of legs well developed. Gills many.

Subfamily PENAEINAE.

Carapace normal. A leaf-like appendage present on inner side of first joint of first antennae. Concerning the Indian forms of this subfamily, see Alcock, 1906.

Genus Penaeus, Fabricius.

A number of specimens of *P. indicus*, Milne-Edwards, were found in a small pond, just above high water, adjoining Porites Bay. A single specimen, probably of *P. monodon*, Fabricius, as redefined by Alcock (1906, pp. 8–10, pl. i figs. 1–1*b*), was taken at Kutikal; and a second, probably of the same species, in a D-net in deep water in the channel between Krusadai Island and Kutikal Point.

Family SERGESTIDAE.

Last two pairs of legs reduced or absent. Gills few (up to 8) or none.

The curious little shrimp *Lucifer* occurs in the plankton.

Family ALPHAEIDAE.

Second wrists sub-divided, first legs much stronger than the rest, eyes usually covered by the carapace.

Several species occur, at least one being very abundant, but I have not been able to identify any of them with certainty. Some can easily be separated by the form of the chelae and, during life, by distinctive colouration as well. The classification is dealt with by Coutiére (1899), by whom also a number of species from the Maldives and Laccadives have been described and figured (1906).

Family HIPPOLYTIDAE.

Second wrists sub-divided, first legs not much stronger than others, eyes not covered by carapace.

The classification of the genera has been revised by Calman (1906) and the Indo-Pacific genera and species by Kemp (1914). My thanks are due to the latter author for the two following identifications.

Genus Saron, Thallwitz.

Arthrobranchiae present at base of first four pairs of peraeopods; a movable tooth present at base of uropods; mandibles with incisor process.

Several specimens of *Saron marmoratus* (Olivier; see Kemp, 1914, pp. 84–87) were found on Krusadai Island. They attain a length of about 5–6 cms. and can readily be distinguished from other prawns occurring on the island by the continuation backwards on to the carapace of the dentate keel of the rostrum, and by the coarse tufts of hair borne here and elsewhere on the integuments. In life they are of a dark mottled brown colour (see pl. xix fig. 1).

Genus Hippolysmata, Stimpson.

No arthrobranchiae at base of peraeopods; mandible without palp, but with incisor process; carpus of second peraeopods many-jointed; abdomen without large spines, carapace without lateral keels; ultimate segment of antennal peduncle not abnormal in size; epipods at base of first four peraeopods; upper flagellum of antennule uniramous.

Several specimens of *Hippolysmata vittata*, Stimpson (see Kemp, 1914, pp. 113-115, pl. vi figs. 6-10), a shrimp about 3 cms. long, have been collected at Krusadai Island and one small specimen at Shingle Island. A figure showing the markings characteristic of living specimens will be found on pl. xix (fig. 2).

Family PALAEMONIDAE.

Second wrists undivided; rostrum not movable.

Subfamily PONTONIINAE.

First antennae with two flagella (one usually cleft for some distance from the tip); third joint of maxillipedes flattened; mandibles without palps; limbs not specially broadened.

The genera have been revised by Kemp (1922) to whom I am indebted for the identification of the following two species of *Periclimenes*:—

Genus Periclimenes, Costa.

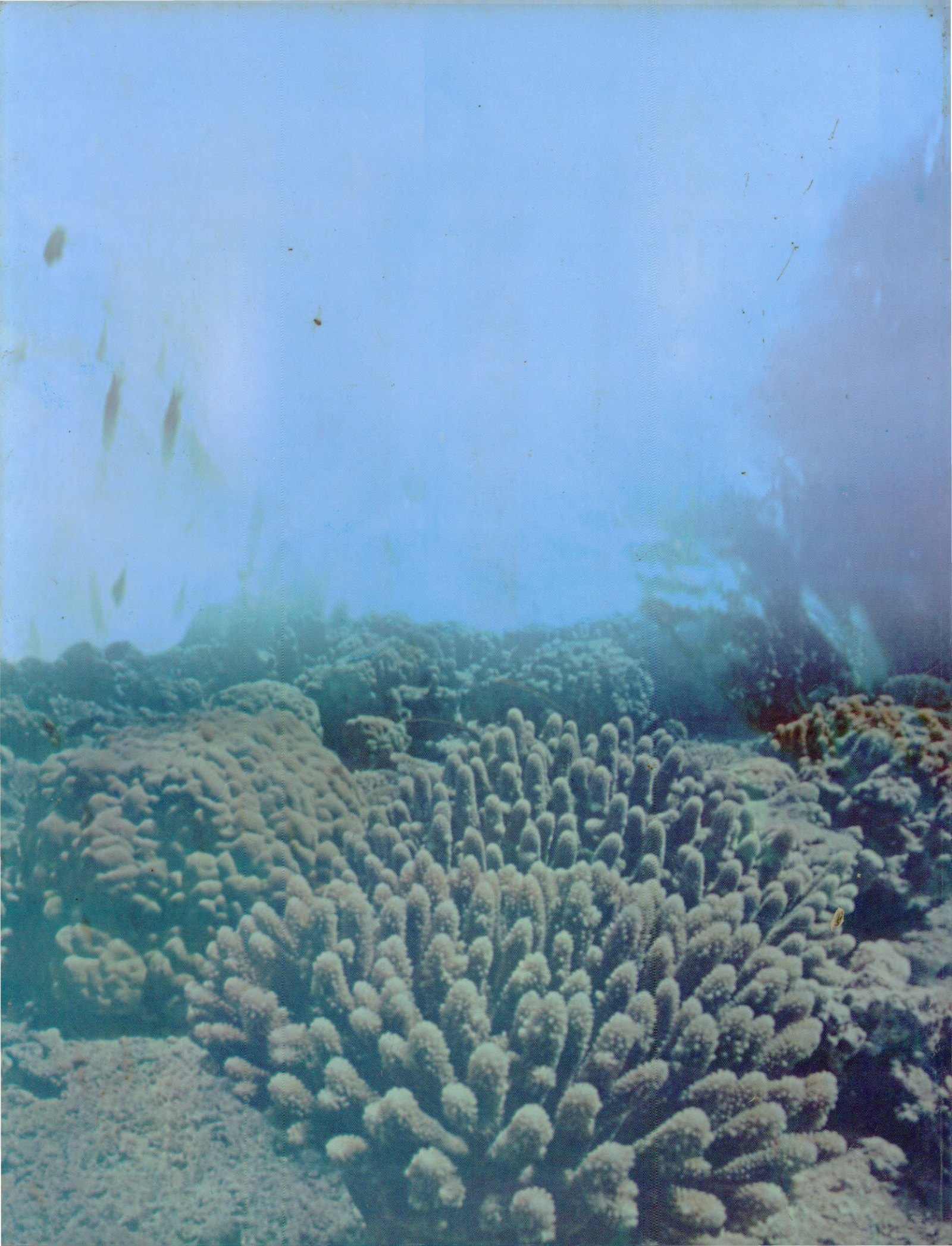
Mandibular palp absent; antennal scale well developed; terminal joint of last three legs without basal protuberance; all three maxillipedes with exopods; inner lacina of maxillula narrow; first wrist not segmented; basal antennular segment normal; carapace not depressed, not areolated; rostrum laterally compressed, with conspicuous teeth.

Periclimenes brevicarpalis (Schenkel; see Kemp, 1922, pp. 185–191, pl. vi fig. 8, text figs. 40–42) and *spiniferus*, de Man (see Kemp, 1922, pp. 195–196), are not uncommon on Krusadai Island. The former (pl. xix fig. 3) is a well-known associate of the giant sea anemone *Stoichactis giganteum* and the latter (pl. xix fig. 4) of Madrepores. The former attains a much larger size than the latter and the merus of its second leg lacks the two spines which are present on the distal border in the latter. The fingers of the second chela of *P. spiniferus* each bear a large oval cup-shaped depression, the two cups being opposed to each other when the claw is shut, a character in which this species is almost unique. *P. brevicarpalis*, when seen under natural conditions, appears absolutely transparent and colourless except for a pattern of opaque yellow patches; at first sight these look like flakes of broken shell which have been washed on to the disc of the anemone with which it is living. The colour pattern renders this prawn a most striking object when captured.

Genus Anchistus, Borradaile.

Mandibular palp absent; antennal scale well developed; claw of last three legs without basal protuberance; inner lacina of maxillula very broad; rostrum laterally compressed in distal half.

A. inermis (Miers; see Kemp, 1922, pp. 249–252, text figs. 81*a–d*) is common in the mantle cavities of *Pinna* at Kutikal. Its rostrum is directed downwards, is toothless and has the apex broadly rounded in lateral view. The most characteristic feature of the



collected, the four small teeth of the inner square are very irregularly developed, and the carapace is somewhat more generally spiney than seems to be the case in the typical form. For classification, etc., see Milne-Edwards, 1837, pp. 289–303 and Bate, 1888, pp. 74–77.

Family PORCELLANIDAE.

Telson composed of three pairs of lobes surrounding a median unpaired lobe; carapace broad and flat; abdomen flattened, non-muscular, folded beneath carapace much as in a true crab.

The genera of this family are not very well marked, gradations being found in the front from strongly to scarcely tridentate, and in the ends of the legs from a single claw preceded by four hair-like ventral spines, through forms in which these spines are thickened, the distal ones more so than the proximal, to forms with two and three claws. The following table may serve to indicate the way in which I have interpreted Stimpson's definitions (1858, pp. 227–229).

1. First joint of antennal peduncle short, not reaching margin of carapace	2.
— First joint of antennal peduncle produced and united with margin of carapace	3.
2. Carapace somewhat flattened, not broader than long; front triangular	*Petrolithistes.*
— Carapace more or less convex, not longer than broad; front straight as seen from above	*Pisosoma.*
3. Carapace broader than long, front tridentate	*Raphidopus.*
— Carapace longer than broad *or* front not tridentate	4.
4. At least the large chela stout, more or less rounded; carapace not longer than broad; front entire	5.
— Hand slender *or* flattened *or* with angular crests; carapace not broader than long; front more or less distinctly tridentate	7.
5. Feet with a single claw which may, however, be followed by ventral spines of which the distal are successively thicker than those proximal to them	6.
— The last one or two ventral spines of the feet thick, the others thin, giving a definitely two-or three-spined appearance ...	*Polyonyx.*
6. Front narrow, more or less straight	*Megalobrachium.*
— Front broader, more or less prominent and angular in the middle line	*Pachycheles.*
7. Feet as in 5 (1) above	*Porcellana* (incl. *Minyocerus*).
— Feet as in 5 (2) above	*Porcellanella.*

Genus Petrolithistes, Stimpson.

The species found on Krusadai Island may be distinguished from one another as follows:—

1. Supraorbital spinule present; two or three spinules behind the outer orbital angle ... ... *P. militaris.*

— Supraorbital spinule absent; only one spinule behind the outer orbital angle ... ... 2.

2. Sculpture of carapace weak except at margin; chelae granular rather than scaley, very dark in colour when alive ... ... *P. dentatus.*

— Integuments, especially of carapace and chelae, closely covered with conspicuous piliferous scale-like elevations ... ... *P. boscii.*

All these species have a wide distribution, being recorded from Australia and intermediate localities to the Gulf of Manaar, and *P. boscii* (pl. xx fig. 7) from the Red Sea also (see Henderson, 1892, de Man 1888 and Miers, 1884). In the area under consideration, *P. militaris* (Heller) and *P. boscii* (Audouin) have been found chiefly on the banks of Shingle that extend towards the land from the western part of the dead reef on the south side of Krusadai Island, and *P. dentatus* (Milne-Edwards) on the dead reef off Sandy Point and on Shingle Island. All live under stones.

Genus Pisosoma, Stimpson.

One species which seems to belong to this genus is common under stones and has been collected from Krusadai Island, Shingle Island and Pamban. It is a minute crab (pl. xx fig. 8) closely resembling specimens of the following genera in form and appearance, but agreeing with the preceding genus as regards the basal joint of the antenna. It is evidently identical with "*Porcellana*" *sculpta*, Milne-Edwards (1837, p. 253; see also Dana, 1852–5, I, p. 412, pl. xxvi fig. 2; and Nobili, 1906, p. 136) from the Malay Archipelago and Red Sea. In its specific characters, including the four characteristic longitudinal grooves on the upper surface of the hand, it also closely resembles *Pachycheles pulchellus* (Haswell) from Melanesia (Miers, 1884, pp. 273–274, pl. xxx figs. A-a''), which has been recorded by Southwell (1906, p. 220) from Ceylon; but the whole surface of the hand is strongly granular, instead of the ridges being smooth as described and figured by Miers. "*Porcellana*" *monilifera*, Dana (*loc. cit.*, pp. 413–414, pl. xxvi fig. 3) has hands similar to those of *P. sculpta* but still coarser.

Genus Pachycheles, Stimpson.

A minute crab of this genus (pl. xx fig. 9) is abundant with the last, but I have not been able to identify it specifically.

Genus Polyonyx, Stimpson.

P. obesulus, Miers (1884, pp. 272-273, pl. xxix figs. D-d') and *P. hendersoni*, Southwell (1909, pp. 117-118, figs. 6-9), occur on Krusadai Island and at Pamban, the former being found in sponges. In *P. obesulus* (pl. xx fig. 10) the forearm is unusually long and slender and both arm and hand are smooth with small pits. In *P. hendersoni* (pl. xx *fig. 11)* the arm and hand are granular and the forearm is of normal form.

Genus Porcellana, Lamarck.

Two specimens of *P. serratifrons*, Stimpson (1859, p. 242; see Henderson, 1888, pp. 110-111, pl. xi figs. 5-5*a*, and Southwell, 1909, pp. 111-112) were collected from Krusadai Island. The hand is long and slender and the front strongly trilobed and serrate (pl. xx fig. 12). Its feet (pl. xx fig. 13), though uniunguiculate, have their distal spines thickened, and Southwell (1909, p. 113) has already pointed out the close resemblance between this species and his *P. gaekwari*, a species commensal with *Spongodes*, also from the Gulf of Manaar, the biunguiculate feet of which clearly place it in the genus *Porcellanella*.

A second, but so far unidentified, species (pl. xx fig. 14) has been found on Shingle Island as well as on Krusadai Island. The carapace is strongly biconvex between the eyes, so that in anterior view the front appears strongly trilobed with the median lobe strongly grooved, though the lateral lobes are not distinctly separated from the orbit. The chelipeds seem to indicate relationship with the species doubtfully identified by Southwell (1909, pp. 114-115, fig. 4) with *P. tuberculosa*, Milne-Edwards.

Family CALLIANASSIDAE.

Two species of small, whitish, soft-shelled crayfish of the genus *Upogebia*, Leach, occur in sponges on Krusadai Island, one of which has been found at Pamban also. They differ in the form of the carapace and in the presence in only one of them of a spine on the carpus of the chelipeds. Both belong to the subgenus *Calliadne* (= *Gebiopsis*), but I have not been able to identify either of them. Concerning this genus see Nobili, 1906, pp. 96-100 (Red Sea species).

Family ALBUNEIDAE.

A single specimen of *Remipes testudinarius*, Latreille, var. *denticulatifrons*, White, was brought in by fishermen from Krusadai Island (see pl. xxi fig. 17). We do not know from what depth it was obtained. For description see Miers, 1878, pp. 316-389, figs. 1 (typical form) and 2 (variety).

Family DROMIIDAE.

A single specimen, probably belonging to the genus *Cryptodromiopsis*, Borradaile, was found on Krusadai Island (see pl. xx fig. 15). For the Indian species of Dromiacea see Alcock, 1899, and for a revised classification of the genera of Dromiidae, see Borradaile, 1903 (2).

Family DORIPPIDAE.

A single specimen of *Dorippe dorsipes* (Linnaeus) was collected on Krusadai Island (see pl. xxv fig. 41). See Alcock, 1896, pp. 277-288.

Family CALAPPIDAE.

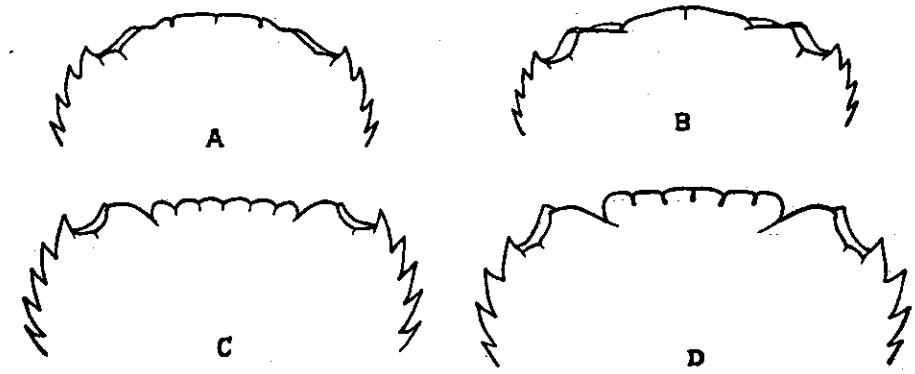
Calappa hepatica (Linnaeus) and *Matuta victor*, Fabricius, occur on Krusadai Island and the latter has been found at Kutikal also. In both species the inner side of the hand is concave so as to be closely apposable to the carapace. *M. victor* (pl. xxii fig. 28) is a swimming crab with a stout, outwardly directed spine on each side of the carapace and all the feet flattened for use as paddles. *C. hepatica* (pl. xxii fig. 27) has feet formed for walking but capable of being drawn up into, and completely concealed by a special enlargement of the carapace, from which it can easily be recognized. See Alcock, 1896, pp. 142–144 and 160–161.

Family LEUCOSIIDAE.

Philyra scabriuscula (Fabricius) is abundant on the sandy side of Kutikal Point. It is a round-bodied crab with slender appendages (pl. xx fig. 16) and may often be seen disappearing into sand freshly disturbed by a retreating wave. See Alcock, 1896, pp. 239–240.

Family PORTUNIDAE.

The members of this family are swimming crabs with the anterior legs normal but the feet of the last pair almost invariably flattened and paddle-like.

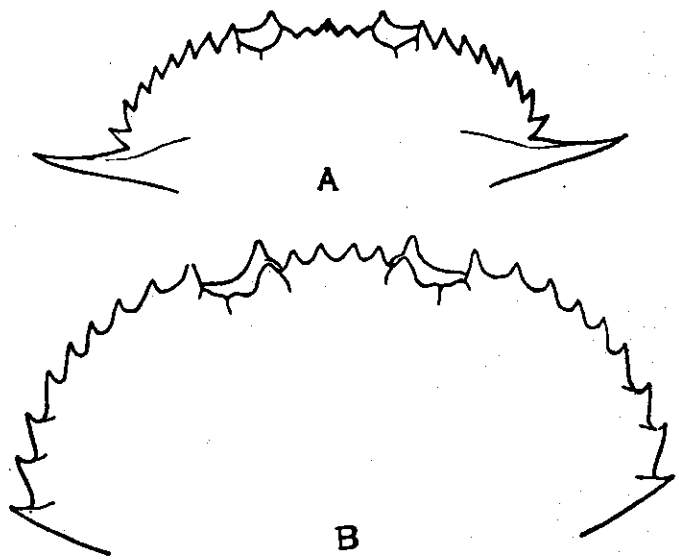


TEXT FIG. 1.

A. *Thalamita wood-masoni*, carapace × 3. C. *Thalamita crenata*, carapace × ¾.
B. *Thalamita admeta* var. *edwardsi*, carapace × 1½. D. *Thalamita prymna*, carapace × ½.

Scylla serrata (Forskal; see Alcock, 1899, pp. 27–28), *Neptunus pelagicus* (Linnaeus; see Alcock, 1899, pp. 34–35), *Charybdis* (*Goniosoma*) *annulata* (Fabricius; see Alcock, 1899, pp. 54–55) and four species of *Thalamita* (see Alcock, 1899, pp. 72–92, and Borradaile, 1903, pp. 201–207) are found in the neighbourhood of Krusadai Island, most of them in

abundance. *Scylla serrata* (text fig. 2B) is a large crab, in which the eyes are separated by rather less than a third of the almost uniformly serrated antero-lateral border of the carapace, and the hand is very stout with one spine at the proximal and two at the distal end of the upper margin. *Neptunus pelagicus* (text fig. 2A) has a pair of long spines projecting outwards from the sides of the carapace as in *Matuta victor*. *Charybdis annulata* (pl. xxii fig. 29) resembles *Scylla serrata*, but is smaller with the eyes somewhat more widely separated and two additional spines on the upper margin of the hand, situated about half way between the others. In *Thalamita* the eyes are much more widely



TEXT FIG. 2.

A. *Neptunus pelagicus*, carapace × 1. B. *Scylla serrata*, carapace × ½.

separated, the fronto-orbital border of the carapace being nearly equal in length to its greatest breadth and meeting the lateral borders in more distinct angles. The species collected may be separated as follows:—

1. Extreme extent of basal antenna joint far greater than major diameter of orbit ... ... 2.
— Extreme extent of basal antenna joint about equal to major diameter of orbit; front cut into a pair of very broad median and a pair of very small lateral lobes, exclusive of the inner supra-orbital angles ... ... *T. wood masoni*, Alcock.
2. Front cut into six lobes of nearly equal size, exclusive of the broad inner supra-orbital angles ... ... 3.
— Front cut into two lobes, exclusive of the broad inner supra-orbital angles ... ... *T. admeta* (Herbst) var. *edwardsi*, Borradaile.

3. All five teeth on antero-lateral borders of carapace of about equal size ... ... *T. crenata* (Latreille).
— Fourth of five teeth on antero-lateral border of carapace minute ... ... *T. prymna* (Herbst).

Family XANTHIDAE.[1]

The Indian genera and species of Xanthidae have been dealt with by Alcock (1898, pp. 67–233) whose paper, though far too long to be summarised here, is indispensable to anyone who has occasion to deal with them. The following key to the Krusadai and Pamban forms, being based on external characters only, is quite artificial but will probably be found useful in connexion with field work:—

1. Carapace, smooth, without grooves ... ... 2.
— Carapace more or less distinctly grooved ... ... 6.

2. Carapace not much broader than long; small and somewhat flattened crabs ... ... (*Trapezia*) 3.
— Carapace fully twice as broad as long; stout crabs attaining a much larger size ... ... (*Atergatis*) 4.

3. Upper margin of outer surface of hand hairless; carapace decorated with a meshwork of brown lines ... *Trapezia ferruginea*, Latr., var. *areolata*, Dana. Pl. xxiii fig. 38.
— Upper margin of outer surface of hand hairy; carapace without markings ... ... *Trapezia cymodoce* (Herbst).

4. Edge of antero-lateral borders of carapace sharp and crest-like, forming a tooth or ridge at lateral epibranchial angle ... ... 5.
— Edge of antero-lateral borders of carapace thick and blunt; no ridge or tooth at lateral epibranchial angle. *Atergatis roseus* (Ruppell).

5. Carapace uniformly coloured ... ... *Atergatis intergerrimus* (Lmk.). Pl. xxv fig. 45.
— Carapace with sharply defined white border ... ... *Atergatis dilatatus*, de Haan.

[1] The families Xanthidae, Grapsidae and Ocypodidae may be separated as follows:—
1. Carpus of third maxillipedes articulating at or near antero-internal angle of merus; body usually round or transversely oval ... ... Xanthidae.
— Carpus of third maxillipedes not articulating at or near antero-internal angle of merus; body usually squarish ... ... 2.
2. Gap present between third maxillipedes; front at least moderately broad ... ... Grapsidae.
— Mouth almost or quite closed by third maxillipedes; front moderately or very narrow ... Ocypodidae.

6. Hair on legs mixed with dense clusters of short black spines	*Eriphia laevimana*, Latr. Pl. xxiv fig. 40.
— Legs without clusters of short black spines	7.
7. Carapace rounded, about as long as broad	*Cymo andreossyi* (Aud). Pl. xxi fig. 25.
— Carapace distinctly broader than long	8.
8. Carapace dark brown or black	9.
— Carapace paler	11.
9. Fingers normal, rounded at tip; legs clothed with close velvety pile, not conspicuously hairy	*Ozius rugulosus*, Stimpson. Pl. xxiv fig. 39.
— Fingers hollowed at tip; legs conspicuously hairy ...	10.
10. Grooves of carapace somewhat faint; legs without tubercles	*Chlorodius niger*[1] (Forskal). Pl. xxiii fig. 36.
— Grooves of carapace stronger; legs strongly tubercular.	*Phymodius monticulosus* (Dana). Pl. xxi fig. 23.
11. Carapace and legs thickly covered with long hair, only the fingers and part of the hand being bare ...	*Pilumnus*[2] *vespertilio*, Fabr. Pl. xxiii fig. 34.
— Hair much less extensive or absent	12.
12. Front very prominent, cut into four equal lobes, carapace evenly granular, especially in front	*Etisodes electra*, Herbst. Pl. xxiii fig. 33.
— Front less prominent, two lobed or with the inner pair of lobes much larger than the outer	13.
13. Areas of carapace very coarsely granular or tubercular.	14.
— Areas of carapace smooth, at least to the naked eye ...	16.

[1] This species and *Etisus laevimanus*, though they appear in different sections of this key, are in reality very much alike. In addition to its somewhat darker colour the former differs from the latter in having the carapace somewhat flatter, with less prominent front, and in having somewhat more slender chelae and legs. The latter attains a much greater size than the former.

[2] Two very small species with small tufts of similar hair on the carapace, which I have been unable to identify, probably belong to this genus. In one the front is rounded, in the other it is square-cut with the orbits much more widely separated.

14. Chelae and legs ornamented like carapace with deep reticulate grooves	*Actaea speciosa* (Dana). Pl. xxiii fig. 32.
— Chelae and legs without reticulate grooves	15.
15. Carapace closely and uniformly granular as in preceding species	*Carpilodes margaritatus*, M.-Edwards. Pl. xxi fig. 26.
— Carapace with much coarser and more sparcely scattered granules	*Lophactaea cristata*, M. Edwards. Pl. xxiii fig. 30.
16. Carapace somewhat convex above, with areas somewhat ill defined; legs distinctly hairy	17.
— Carapace flatter above, with more clearly defined areas; legs less hairy	18.
17. Front strongly bilobed, antenna in orbital hiatus which is open	*Menippe rumphii*, Fabr. Pl. xxi fig. 18.
— Front faintly bilobed, orbital hiatus closed, antenna excluded	*Etisus laevimanus*,[1] Randall. Pl. xxiii fig. 31.
18. Fingers pointed, not hollowed at tip	*Xantho* (*s.str.*) *impressus* (Lamarck).
— Fingers hollowed at tip	19.
19. Areas of carapace well defined in front, less sharply behind (abundant)	*Xantho* (*Leptodius*) *exaratus*, M.-Edwards.
— Areas of carapace very strongly defined throughout (scarce)	*Xantho* (*Leptodius*) *eugylptus*, Alcock. Pl. xxiii fig. 35.

Family PINNOTHERIDAE.

Alcock dealt with the Indian members of this family in 1900 (pp. 331–342).

Pinnotheres ridgewayi, Southwell (1911, pp. 226–227, pl. iii figs. 1–2*a*) occurs in *Pinna* at Kutikal (see pl. xxiii fig. 37).

[1] See footnote 1 on previous page.

Family GRAPSIDAE.[1]

The Indian Grapsidae were dealt with by Alcock in 1900 (pp. 389–440). The largest and most conspicuous member of the family common in the district is *Grapsus strigosus* (Herbst). In this species (pl. xxvi fig. 52) and in the scarcer *Liolophus planissimus* (Herbst) and *Plagusia depressa* (Herbst) var *squamosa* (Herbst) the front is very narrow and the sides strongly arched, giving the carapace a somewhat rounded appearance. All three species are somewhat flattened, young specimens of *L. planissimus* (pl. xxvi fig. 54) very much so. In the genus *Grapsus* the antennules fold beneath the front in the ordinary way. In the other two genera they fold nearly longitudinally in deep notches in the front which are visible from above. In *Plagusia depressa* the anterior margin of the merus of the legs bears distally a single tooth and subsequent joints are strongly and evenly fringed with hair, which is absent in the other two. In *Liolophus planissimus* the anterior margin of the merus of all legs is armed throughout with strong spines; in *Grapsus strigosus* this margin is unarmed. In *Liolophus planissimus* and *Plagusia depressa* the margin of the carapace is more spiney than in *Grapsus strigosus.*

Varuna litterata (Fabricius), a common crab which may be included here on the strength of two specimens from Palk Strait in the Madras Museum collection, is intermediate in shape between the last three and the next two. It differs from all of them in having the legs shortened and flattened distally and fringed with long hair such as is found as an aid to swimming in many aquatic insects—much longer than in *Plagusia depressa.*

In the two remaining species the front is very broad and the sides are practically straight, giving the carapace a quadrangular shape. In the genus *Metograpsus*, of which one species—*M. messor* (Forskal)—is found at Krusadai and Kutikal (pl. xxvi fig. 49), the antennae are completely excluded from the orbit and there is no oblique hairy ridge, on the exposed surface of the external maxillipedes. In *Sesarma quadratum* (Fabricius), which is also found in the Kutikal backwater and at Krusadai Island (pl. xxvi fig. 51) the antennae are lodged in the orbital hiatus and there is a conspicuous oblique hairy ridge on the exposed surface of the external maxillipedes (pl. xxi fig. 22), characters common to all species of the genus to which it belongs.

Family OCYPODIDAE.[1]

The Ocypodidae were dealt with by Alcock in 1900 (pp. 342–383). The subfamily Scopimerinae and the genus *Macrophthalmus* have been further dealt with by Kemp in 1919.

Five genera have been obtained from Krusadai Island—*Ocypoda, Gelasimus, Dotilla, Scopimera* and *Macrophthalmus.* The first of these genera consists of crabs of medium size, with almost rectangular carapace, which live in large numbers on moist clean

[1] See footnote to family Xanthidae, above.

sand near high water mark, where they make their burrows. Alcock separates the four species which occur on Krusadai Island as follows :—

1. No stidulating ridge on inner surface of palm; eyestalks not forming a horn beyond eyes ... ... *O. cordimana*, Desmarest Pl. xxvi fig. 50.

— Stridulating ridge present on inner surface of palm; eyestalks (except sometimes in young) prolonged as a horn beyond eyes ... ... 2.

2. Fingers of small chela expanded and flattened; stridulating ridge consisting entirely of striae ... ... *O. macrocera*, M.-Edwards. Pl. xxi fig. 21.

— Fingers of both chelae normally pointed ... ... 3.

3. Stridulating ridge consisting of tubercles gradually passing into striae; anterior surface of protopodites of first two pairs of legs thickly furnished with hairs ... ... *O. ceratophthalma*, (Pall.) Pl. xxi fig. 20.

— Stridulating ridge narrow, consisting entirely of small tubercles; no brushes of hairs on protopodites of any legs ... ... *O. platytarsis*, M.-Edwards. Pl. xxi fig. 19.

O. platytarsis seems to be much the most abundant, at least in the western part of the island. When young it is mottled with brown, but when adult it is more uniformly pale. *O. macrocera* is of a somewhat brighter colour than the others, the chelae especially being of an orange colour. It is said to be found in the western part of the island.

The Calling Crabs or Dhobie Crabs, as they are often called, form the next genus, *Gelasimus* (pl. xxv figs. 42-44). Like *Ocypoda* they are gregarious, but they burrow in dense mud or muddy sand. The enormous enlargement of one of the chelae in the male is their most striking characteristic. Two species, *G. annulipes*, Latreille, and *G. marionis*, Desmarest, occur at Krusadai Island, Kutikal and Pamban. In the former the front is fully one-sixth of the greatest breadth of the carapace, the lateral borders of the dorsal area of the carapace are clearly defined for about two-thirds of their length, and the outer surface of the hand of the large chela of the male is smooth; in the latter the front is very much narrower, the dorsal area of the carapace is less clearly defined, and the outer surface of the hand of the large chela of the male is very coarsely granular.

The male of *G. marionis* has two varieties. In the typical form the crests on the inner surface of the palm are moderately prominent, the movable finger is blade-like and the cutting edge of the immovable finger is not much scallopped. In var. *nitidus* the crests on the inner surface of the palm are extremely prominent, the cutting edge of the movable

See footnote to family Xanthidae, above.

finger is slightly sinuous and that of the immovable finger is scallopped into two large triangular lobes. Both forms occur at Kutikal.

G. annulipes occurs in enormous numbers in Kutikal backwater. Females seem to be much less numerous than males, and much more variable in colour. There is usually a broad white band on the posterior border of the carapace, or the whole carapace may be whitish. When the anterior part is dark, the white markings on the anterior part found in the male may be clearly marked or may be more clouded. The legs, especially the last two pairs, are often white wholly or in part.

The genera *Scopimera* and *Dotilla* both belong to the subfamily Scopimerinae. They are very small crabs, not unlike *Ocypoda* and *Gelasimus* in habit and often found with them. They can most readily be distinguished from them by their much smaller maximum size and more globose bodies. They are separated from one another by Kemp as follows:—

A conspicuous brush of hair, indicating the position of the accessory branchial orifice, between bases of first and second walking legs; fourth segment of abdomen not overlapping fifth, nor with a brush of hair at its distal end; abdomen of male with fourth and fifth segments constricted, the fifth occasionally linear; lateral walls of carapace usually without conspicuous sculpture ... ... *Scopimera*, de Haan.

No brush of hair between bases of walking legs; fourth segment of abdomen overlapping fifth and with a thick brush of hair at its distal end in both sexes; abdomen of male not constricted; lateral walls of carapace with deep convolute sculpture ... ... *Dotilla*, Stimpson.

Dotilla myctiroides (Milne-Edwards) lives on the mud flats at Kutikal, Pamban (backwater) and Krusadai Island. *Scopimera pilula*, Kemp, lives with it probably in all three places, though it has not actually been collected from Krusadai Island. It is very abundant in Kutikal backwater, burrowing largely in sand, but not arranging its pellets in neat radial rows as *S. proxima* does on the sandy beaches of Krusadai Island. *Scopimera proxima*, Kemp, lives in sand nearer high water mark. *Dotilla myctiroides* (pl. xxvi fig. 48) can readily be distinguished by the unusually globular form of its body, the carapace of most species of the subfamily being distinctly broader than long. In *Scopimera proxima* the tympana on the meral segments of the walking legs (except those on the upper surface of the last legs) are divided longitudinally by a narrow ridge which is absent in *S. pilula* (pl. xxvi fig. 46).

Macrophthalmus also lives on muddy or sandy ground, mostly well below high water mark. The body is flattened, more or less quadrilateral and often much broader than long. The first antennae are transverse, separated by a narrow septum. The eyestalks

are usually very long and remarkably slender. The colour is dull greyish. *M. telescopicus* (Owen) is recorded by Kemp from Pamban backwater and one specimen (pl. xxvi fig. 47) was collected by us on Krusadai Island and another at Kutikal. *M. depressus*, Rüppell, is abundant in Pamban backwater and a few specimens have been collected on Krusadai Island and at Kutikal. The form of *M. convexus*, Stimpson, recorded by Kemp (1919, pp. 389-390, pl. xxiv fig. 2) from a male and ovigerous female from Pamban is also found at Krusadai Island and Kutikal. The female "is as nearly as possible identical with other females taken in company with normal males"; but the chela of the male is abnormal, "resembling that of females and very young males" even in a particularly large specimen. In the absence of further specimens Kemp concludes, though evidently with some hesitation, that his male is an abnormal specimen of the true *M. convexus*. As, however, the seven males (two small) in our collection all agree with this abnormal specimen it is evident that they represent a distinct local race for which I propose the name *kempi*. The specimens described by Kemp, which have kindly been lent to me by the Zoological Survey of India, may be regarded as the types.

The above three species may be separated as follows :—

1. Eyestalks projecting nearly half their length beyond antero-lateral angles of carapace	*M. telescopicus* (Owen)
— Eyestalks not projecting beyond antero-lateral angles of carapace	2.
2. Antero-lateral angles of carapace acute, spiniform ...	*M. convexus*, Stimpson, subsp. *kempi*, n. subsp.
— Antero-lateral angles more or less rectangular ...	*M. depressus*, Rüppell

Family HYMENOSOMATIDAE.

Elamene cristatipes n. sp.

Pl. XXI, fig. 24.

Elamene truncata, Henderson (*nec* Stimpson), 1893, p. 395.

Two specimens of this family have been collected on Krusadai Island, one male and the other female. Both agree with Henderson's description of five specimens collected by Thurston on the Silavaturai Par, which he refers to the species *Elamene truncata* (Stimpson). They differ, however, from the descriptions by Alcock (1900, p. 386), Tesch (1918, pp. 22-24, pl. I figs. 4-4*c*) and Kemp (1917, pp. 272-274 fig. 22) of specimens from more easterly localities, the front being rounded, not truncate. Comparison with specimens in the collection of the Zoological Survey of India shows, moreover, that the strong crest that is present on the tibiae of all legs in our specimens is scarcely indicated in the true *E. truncata* (compare pl. xxi fig. 24 with Kemp's fig.) and their tarsi are bifid distally instead of trifid. It is therefore evident that they must be regarded as a distinct species for which the name *cristatipes* seems appropriate.

Family MAIIDAE.

Six species have been collected. Of these one, probably allied to *Menaethius* but with a strongly biramous rostrum, remains unidentified. It is represented by a single specimen from Krusadai Island. *Menaethius monoceros* (Latreille) is the common spider crab of Krusadai Island and one specimen was obtained from Kutikal. Of *Hyastenus pleione* (Herbst) a single specimen was obtained, but unfortunately the precise locality was not recorded. *Tylocarcinus styx* (Herbst) (Pl. xxvi fig. 53) is represented by a single specimen from Krusadai Island, *Schizophrys aspera* (Milne-Edwards) by two specimens from Kutikal and one from Krusadai (pl. xxvi fig. 55), and *Micippa philyra* (Herbst) by four specimens from Krusadai Island.

They may be separated as follows:—

1. No true orbits (eyestalks hidden under a supra-ocular spine or sunk in the sides of the rostrum); second joint of antenna truncate-triangular; eyestalks very short. ACANTHONYCHINAE *Menaethius monoceros.*

— True orbits, containing both supra-and post ocular elements sheltering the eyes, more or less completely formed, except in a few genera where the eyestalks are long and slender; second antennal joint broad, usually not truncate-triangular; eyestalks variable ... ... 2.

2. A large, cupped, usually blunt post-ocular process present; eyestalkss hort; cornea not completely hidden when eyes are folded back ... ... PISINAE 3.

— Post-ocular process, if present, usually sharp and not cupped, when not so the cornea hidden (as also in most other cases); eyestalks usually long ... ... MAIINAE 4.

3. A single tubercle present in middle of posterior border of carapace; distance between tips of branches of rostrum equal to about two-thirds of their length ... ... *Hyastenus pleione.*

— Five tubercles grouped in middle of posterior border of carapace; distance between tips of branches of rostrum about equal to their length ... ... *Tylocarcinus styx.* Pl. xxvi fig. 53.

4. Rostrum normal, its spines horizontal ... ... *Schizophrys aspera.* Pl. xxvi fig. 55.

— Rostrum laminar, strongly deflected ... ... *Micippa philyra.*

Order Stomatopoda.

Concerning the classification of this order see Kemp, 1913. *Gonodactylus glabrous*, Brooks, in which the mid-dorsal portion of the telson has five long keels, is very abundant among coral and has been collected at Pamban and Rameswaram as well as on Krusadai Island. *Gonodactylus demani*, Henderson, in which the mid-dorsal portion of the telson

has only three long keels, is much rarer. It has been collected at Pamban and Shingle Island but not elsewhere.

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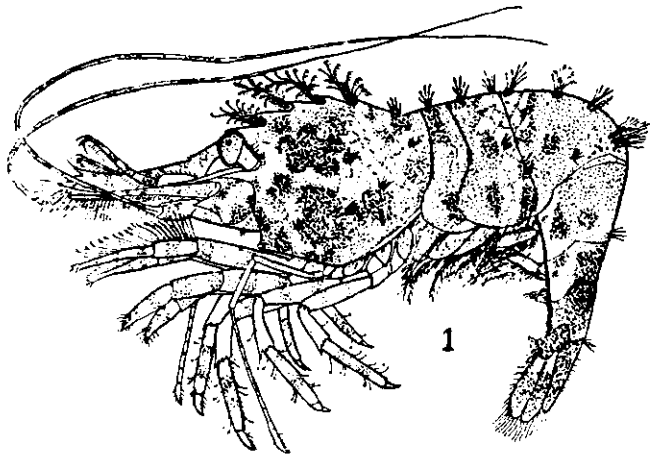
PLATE XIX.

Fig. 1. *Saron marmoratus* (from life) × 2.
„ 2. *Hippolysmata vittata* (from life) × 3.
„ 3. *Periclimenes brevicarpalis*, female × 2.
„ 4. *Periclimenes spiniferus*, second chela × 5.
„ 5. *Anchistus inermis*, first chela × 23.
„ 6. *Stenopus robustus* × 2.



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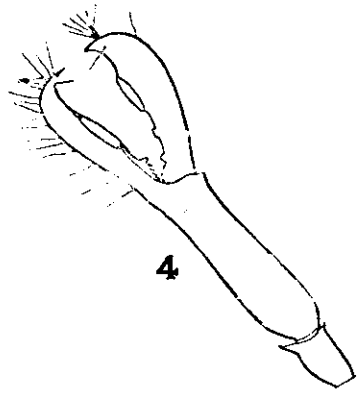

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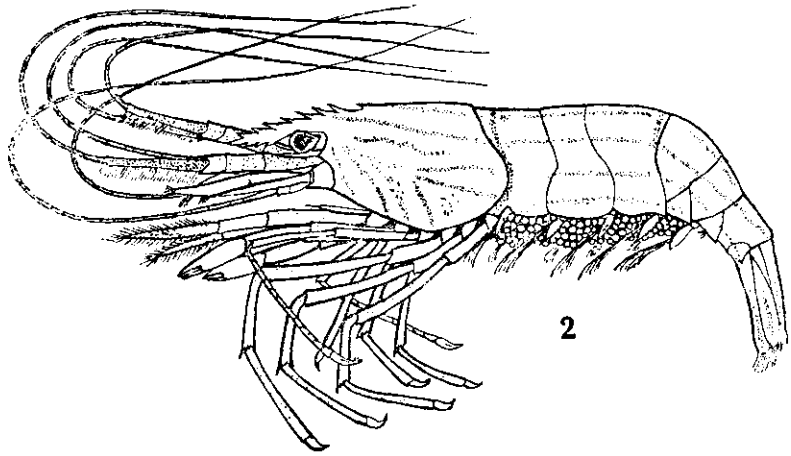

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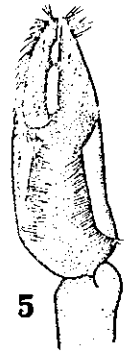

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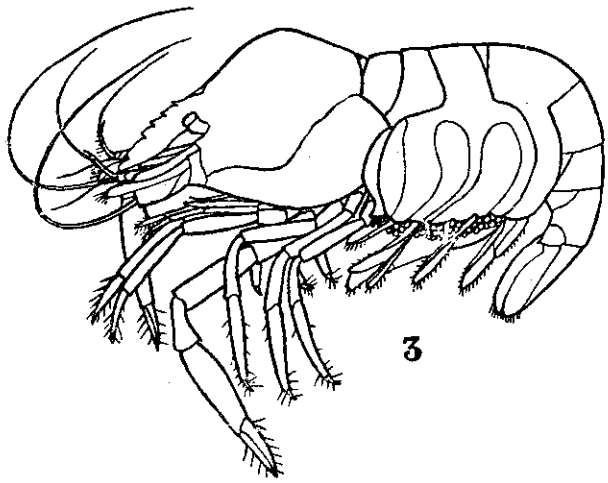

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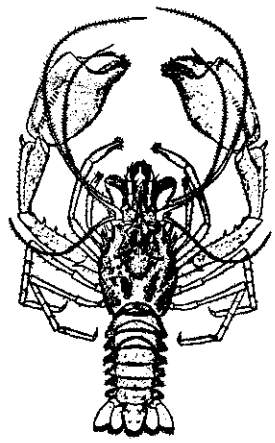


PLATE XIX.—KRUSADAI DECAPOD CRUSTACEA.

PLATE XX.

Fig. 7. *Petrolithistes boscii* × 2½.
„ 8. *Pisosoma sculpta* × 3.
„ 9. *Pachycheles sp.* × 4.
„ 10. *Polyonyx obesulus* × 3.
„ 11. *Polyonyx hendersoni* × 3.
„ 12. *Porcellana serratifrons* × 3.
„ 13. *Do.* foot more highly magnified.
„ 14. *Porcellana sp.* × 4.
„ 15. *? Cryptodromiopsis sp.* × 3.
„ 16. *Philyra scabriuscula* × 1½.

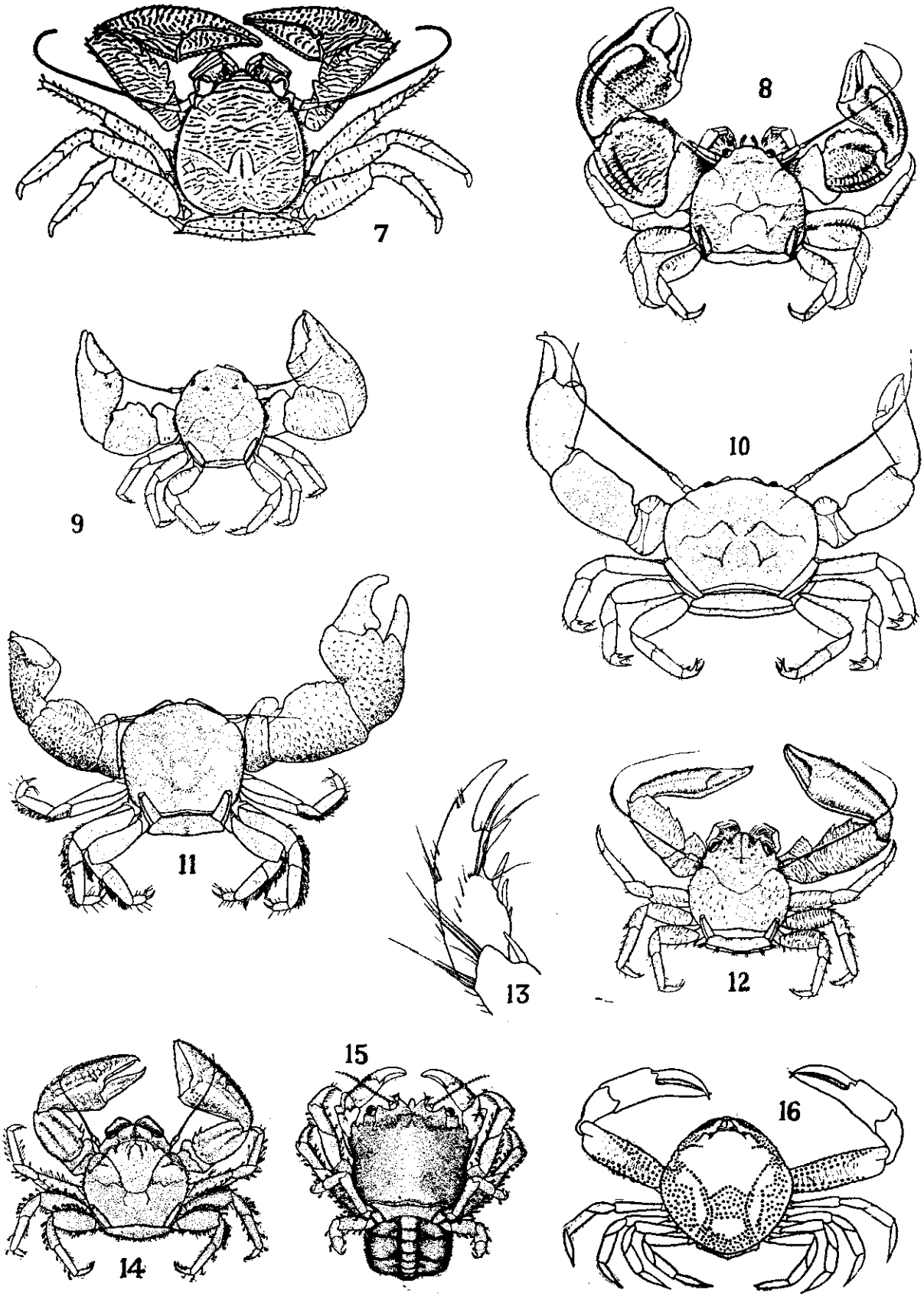


PLATE XX.—KRUSADAI DECAPOD CRUSTACEA.

PLATE XXI.

Fig. 17. *Remipes testudinarius*, var. *denticulatifrons*, slightly reduced.
„ 18. *Menippe rumphii*, slightly enlarged.
„ 19. *Ocypoda platytarsis*, lower surface of hand, slightly enlarged.
„ 20. *Ocypoda ceratophthalma*, do.
„ 21. *Ocypoda macrocera*, do.
„ 22. *Sesarma quadratum*, external maxillipede from below × 3.
„ 23. *Phymodius monticulosus* × 2.
„ 24. *Elamene cristatipes*, type female × 4.
„ 25. *Cymo andreossyi* × 2.
„ 26. *Carpilodes margaritatus* × 2.

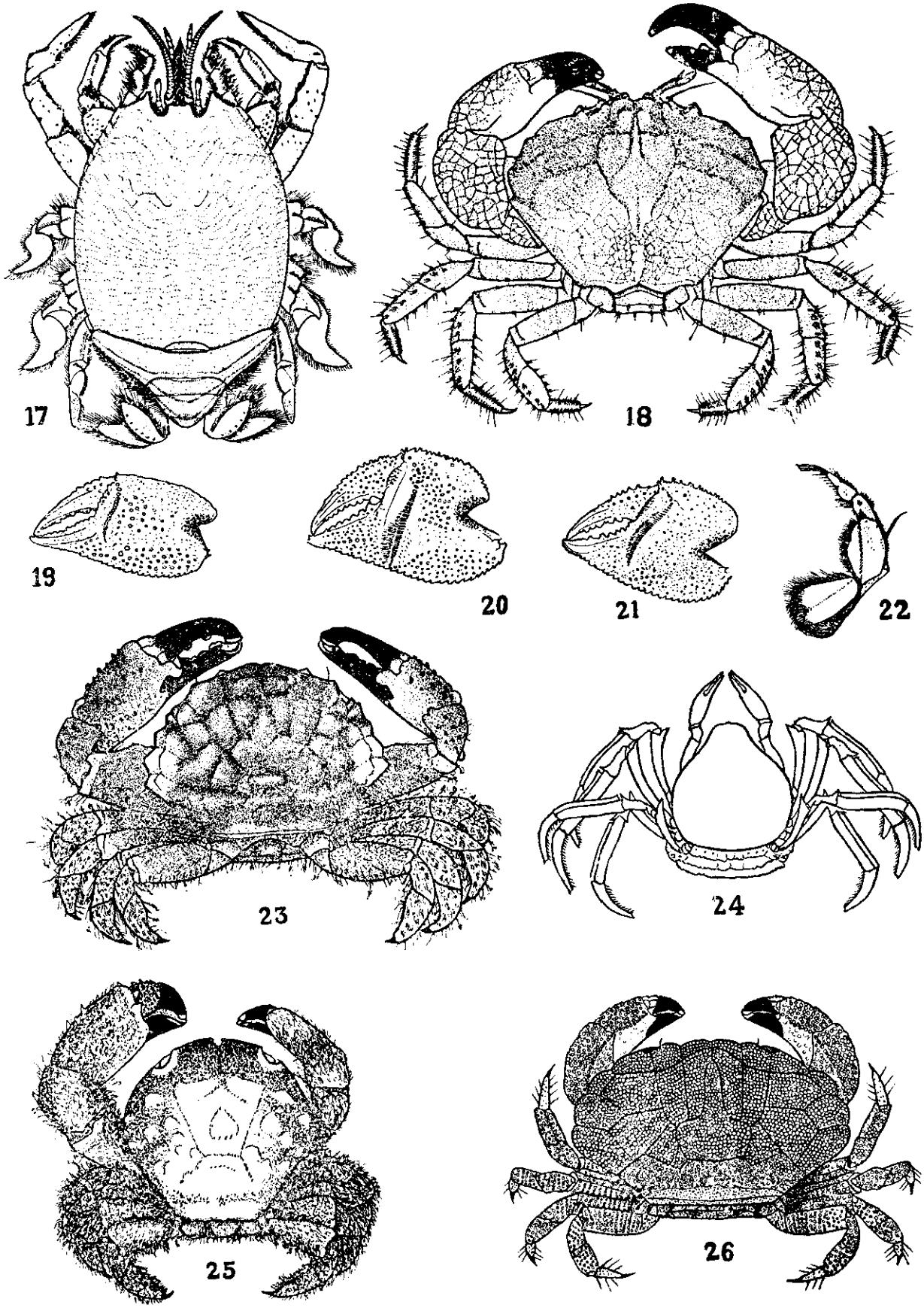


PLATE XXI.—KRUSADAI DECAPOD CRUSTACEA.

PLATE XXII.

Fig. 27. *Calappa hepatica*, slightly less than natural size.

„ 28. *Matuta victor*, slightly less than natural size.

„ 29. *Charybdis* (*Goniosoma*) *annulata*, young, slightly less than natural size.

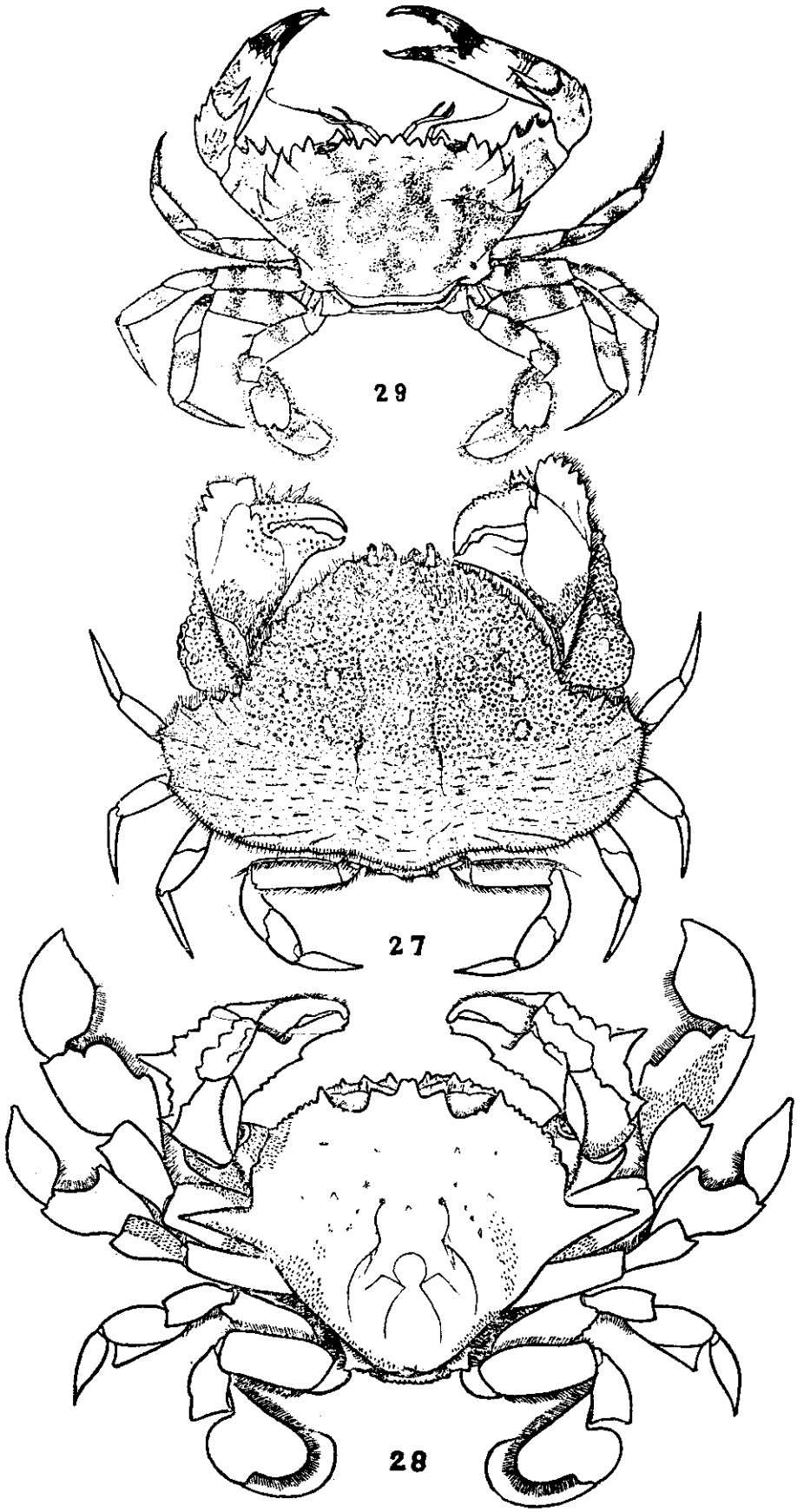
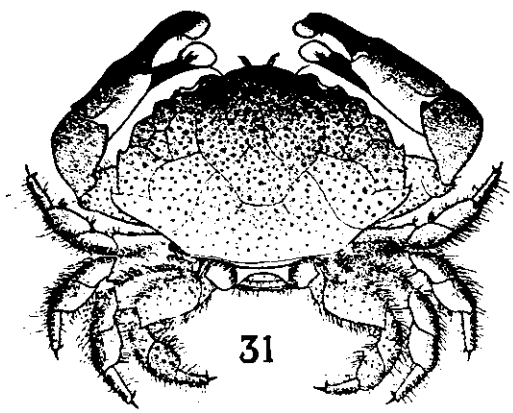
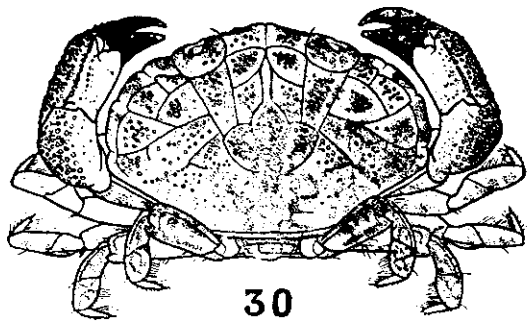


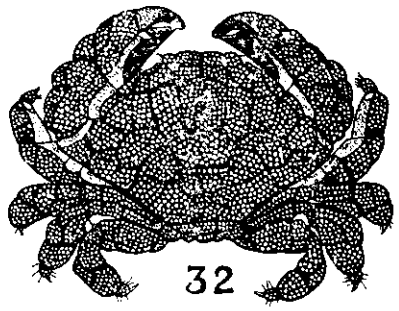
PLATE XXII.—KRUSADAI DECAPOD CRUSTACEA.

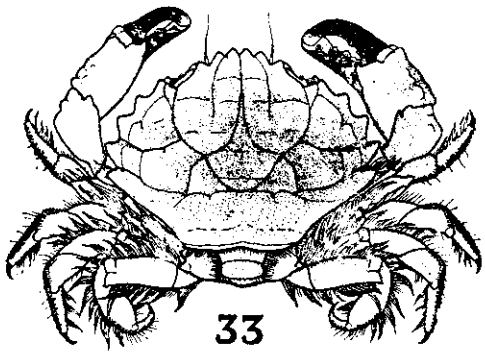
PLATE XXIII.

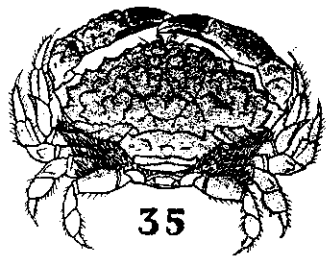
Fig. 30. *Lophactaea cristata* × 1.
„ 31. *Etisus laevimanus* × 1.
„ 32. *Actaea speciosa* × 2.
„ 33. *Etisodes electra* × 2.
„ 34. *Pilumnus vespertilio* × 1.
„ 35. *Xantho* (*Leptodius*) *euglyptus* × 1.
„ 36. *Chlorodius niger* × 1.
„ 37. *Pinnotheres ridgewayi* × 2.
„ 38. *Trapezia ferruginea* var. *areolata* × 1½.

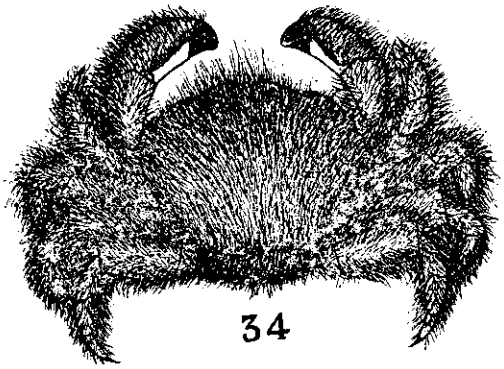


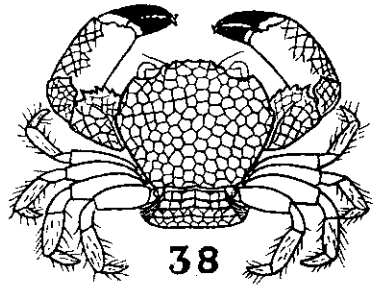


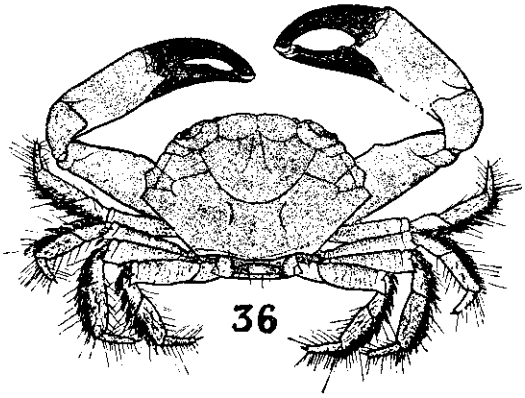












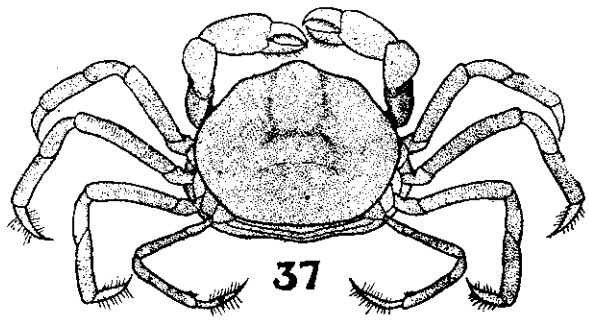
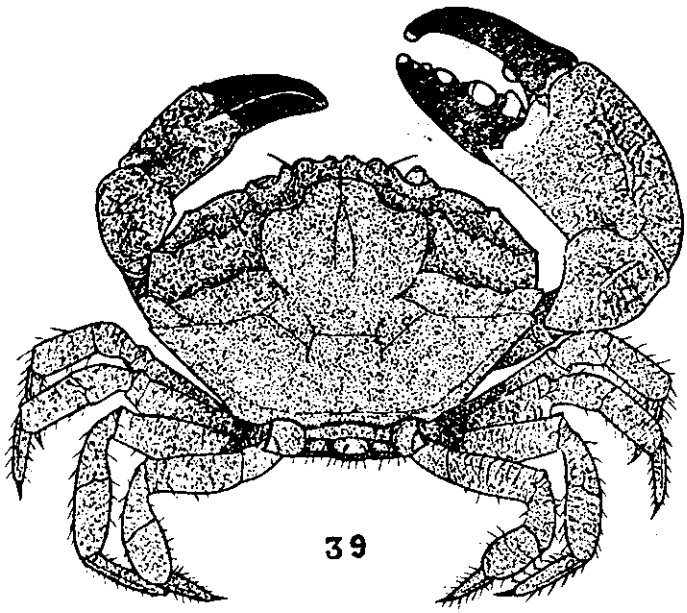


PLATE XXIII.—KRUSADAI DECAPOD CRUSTACEA.



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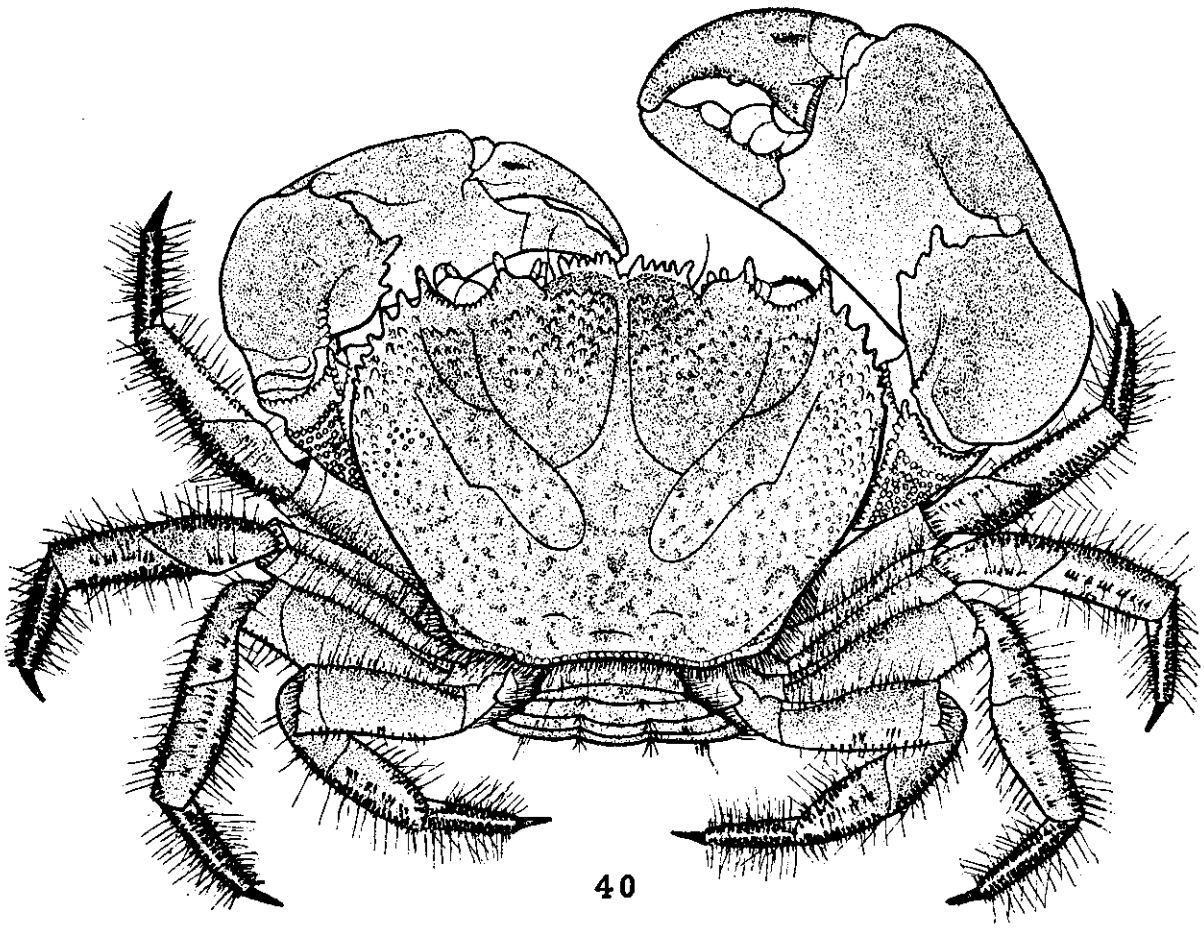

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PLATE XXIV.—KRUSADAI DECAPOD CRUSTACEA.

PLATE XXV.

Fig. 41. *Dorippe dorsipes* × 1.

„ 42. *Gelasimus annulipes*, large chela of male × 1.

„ 43. *Gelasimus marionis* var. *nitidus*, male × 1.

„ 44. *Do.* female × 1.

„ 45. *Atergatis intigerrimus* × 1.

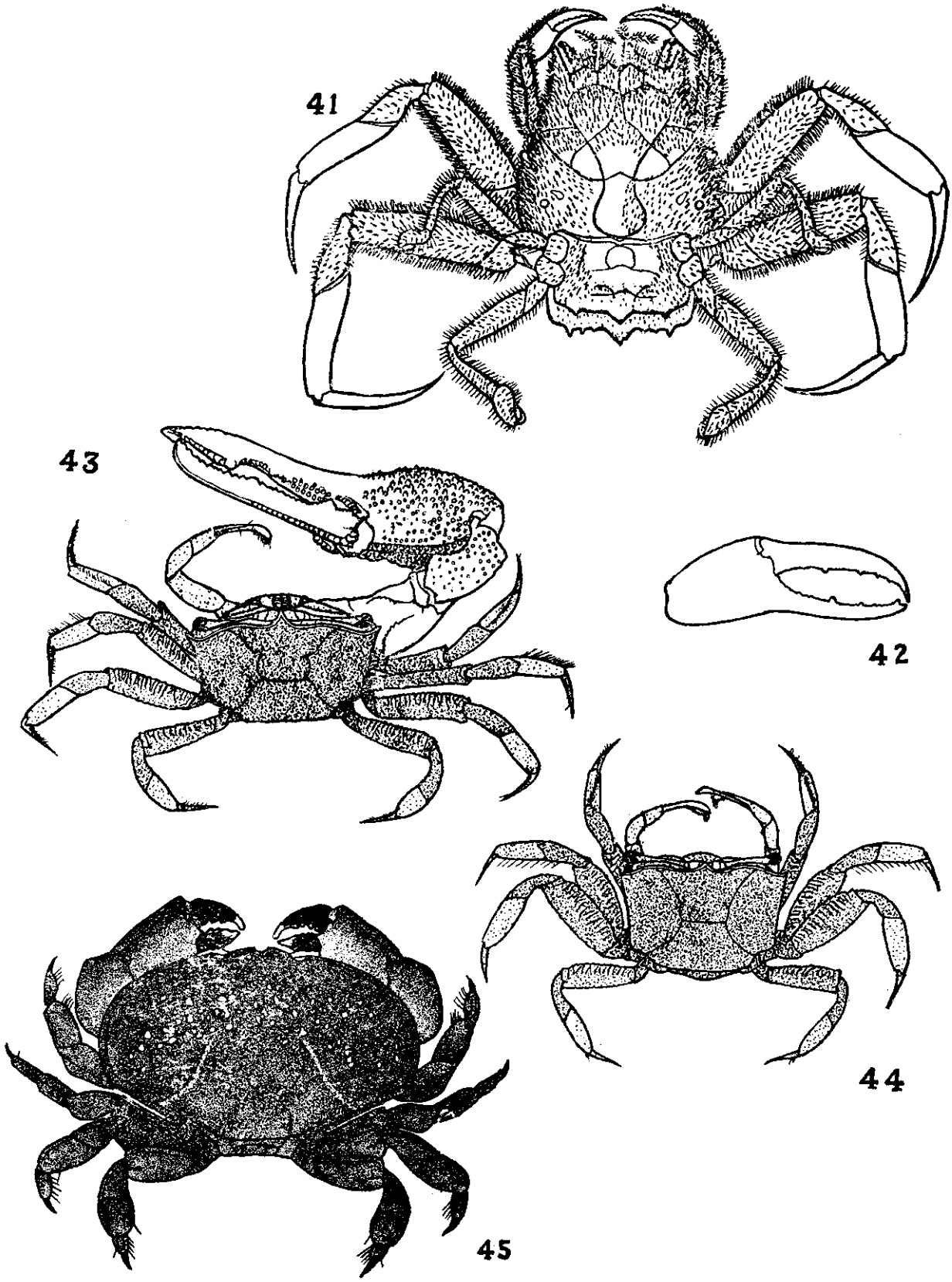

PLATE XXV.—KRUSADAI DECAPOD CRUSTACEA.

PLATE XXVI.

Fig. 46. *Scopimera pilula* × 1½.
„ 47. *Macrophthalmus telescopicus* × 1½.
„ 48. *Dotilla myctiroides* × 1½.
„ 49. *Metograpsus messor* × 1.
„ 50. *Ocypoda cordimana* × 1.
„ 51. *Sesarma quadratum* × 1.
„ 52. *Crapsus strigosus* × ¾.
„ 53. *Tylocarcinus styx* × 1.
„ 54. *Liolophus planissimus* (from life), juv. × 2½.
„ 55. *Schizophrys aspera* × ¾.

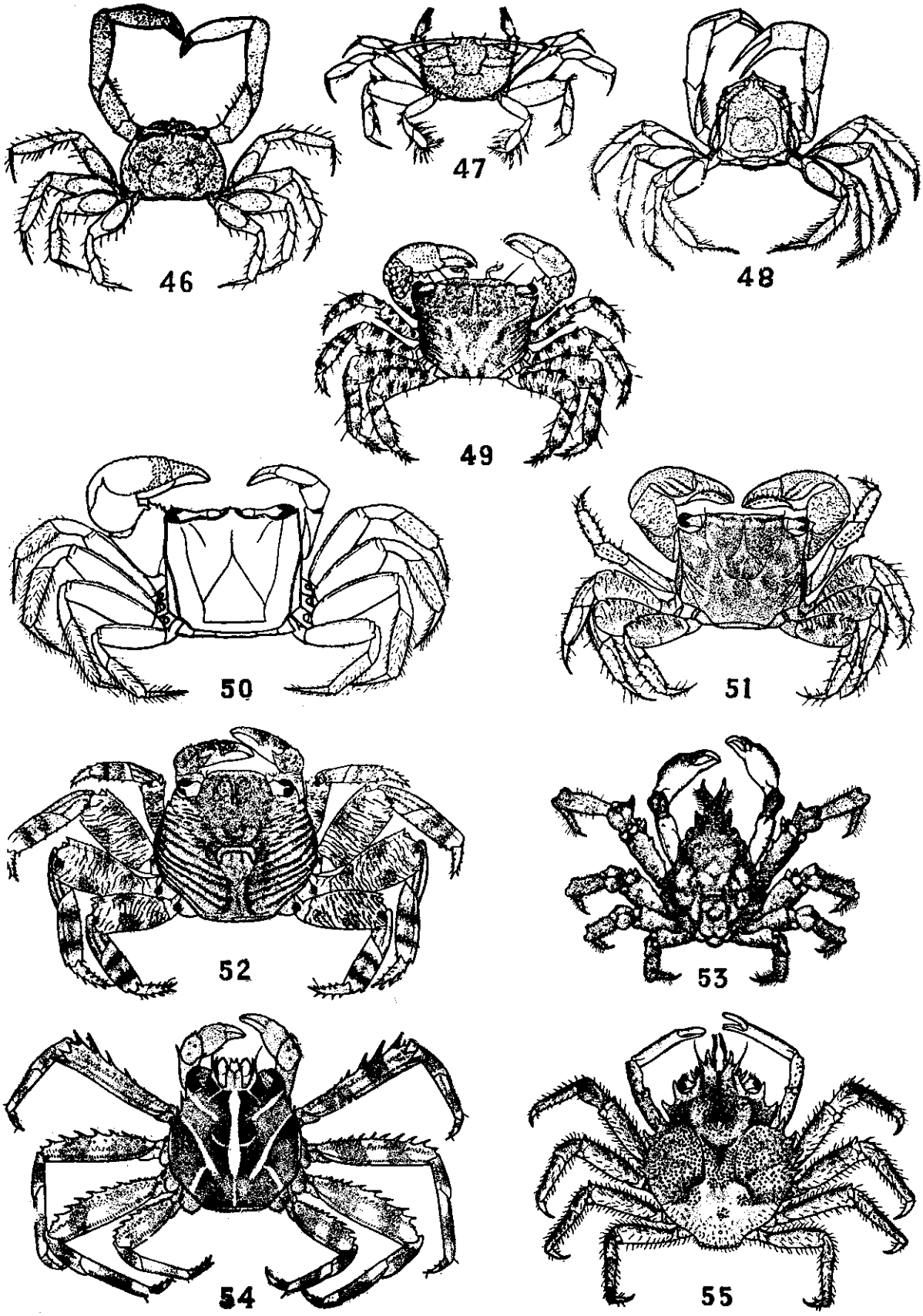

PLATE XXVI—KRUSADAI DECAPOD CRUSTACEA.

Class Pycnogonida, Latr.

By B. SUNDARA RAJ, *M.A., Ph.D.*

(Podosomata Leach, or Pantopoda Gerstaecker.)*

Family NYMPHONIDAE.

Chelophores (appendage I) well developed, scape large; 1-jointed, chelate.

Palps (appendage II) well developed, usually 5-jointed, a large fixed proboscis.

Ovigers (appendage III) well developed in both sexes, with 8 to 10 joints, the terminal joints with a row of denticulated spines.

Genus Nymphon, Fabricius.

The last four tarsal joints of the oviger carry denticulated spines, auxiliary claws present. Four pairs of legs. Palps 5-jointed. Ovigers with 10 joints.

Nymphon longicaudatum Carpenter.

Length 5–8 mm. Head segment nearly as long as the three thoracic segments behind. Proboscis swollen centrally and with a constriction some distance below the mouth. Ocular tubercle vertical, low and with a conical apex. Chelophores long, scape as long as proboscis, hand rather longer than scape, with slender tapering evenly curved fingers. Palp half as long as body; relative length of its segments as 2: 8: 9: 10: 6. Oviger about as long as body relative length of its segments as 2: 4: 4: 20: 24: 19: 6: 4: 4: 3. The last four segments bear rows of denticulate spines. Legs long and slender, propodus about four times as long as tarsus. Claw slender, slightly longer than tarsus, auxiliary claw ¾ as long as claw. Abdomen very slender and club-shaped, as long as the first two thoracic segments together. Colour of body and legs yellow (orange brown in old specimens preserved in spirit), dark pigment specially well developed along two lateral longitudinal lines on the thorax on the dorsal surface.

There are two specimens in the collections of the Fisheries Bureau from the Pearl Banks in the Gulf of Manaar. Though there are no specimens of *N. longicaudatum* in the Krusadai collections the species is common in the Gulf of Manaar.

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* A natural classification of the group is not possible. The classification here followed is that of D'Arcy Thomson in the *Camb. Nat. Hist.* For other suggested classifications reference may be made to the following:—

Hoek's Report on the Pycnogonida of the *Challenger* Expedition (*Challenger* Reports, Vol. III, No. 2, 1881).

E. R. Lancaster. The structure and classification of the Arthropoda. *Quart. Journ. Micr. Sci.* XLVII (1904).

Cole suggests a phylogenetic classification of the group (Ann. Mag. Nat. Hist. (7) XV, 1905, pp. 405–415).

Loman in his report on the Pycnogonida of the Siboga expedition has suggested a novel classification (Die Penta da der Silv. Ex. Mon. XL. Livr. XL, 1908).

Family PHOXICHILIDIDAE Sars.

Chelophores well developed. Palps absent. Ovigers developed only in the male and bear a few simple spines in a single row.

Genus Anoplodactylus, Wilson.

Ovigers 6-jointed, auxiliary claws absent or rudimentary.

Anoplodactylus saxatilis, Calman.

Nine male specimens from Pamban bridge and Shingle Island. The specimens conform to the description and figure of the species except in the following particulars.— The abdomen varies in size and does not always exceed the last pair of lateral processes. In all the specimens the abdomen is recurved and projects obliquely upwards. The chelophores also vary in thickness. The genital process is found on all the four legs in the larger males carrying eggs, but are longest on the third and fourth legs. The body and legs are more heavy than in the type specimen.

Anoplodactylus investigatoris, Calman.

Four female specimens, all of which show the papillae on the ventral surface of the proboscis. They differ from Calman's description in having only two unpaired spines on the basal process of the propodus of the third leg.

Anaplodactylus sp.

Four immature females, which are probably young forms of *A. investigatoris*, are in the collection. They do not show the characteristic papillae on the proboscis and have only one unpaired spine at the base of the propodus.

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ARACHNIDA AND INSECTA

By F. H. GRAVELY, *D.Sc.*

Class Arachnida.

Order Araneae.

Only one genus of spiders is yet known to be definitely marine. This is the genus *Desis* of the family Agelenidae. It frequents coral reefs which are exposed only when the tide goes out. When the tide comes up the spiders take shelter in cavities which they close above with silk, thus preventing the escape of air. One species occurs on Krusadai and Shingle islands.

Desis inermis, n. sp.

The total length, excluding the chelicerae, is about 8 mm. in both sexes, the length of the carapace being about 3·5 mm. The general form and colour resembles that of other species of the genus. The eyes of the posterior line are subequally spaced and the tibia and protarsus of the posterior legs are strongly spined as in *D. maxillosa*, etc.

The vulva lacks the lateral teeth found in other species. Its posterior median angle is upturned as in *D. crosslandi*, Pocock (1902, p. 390, fig. C, and 1906, pl. lxvi fig. 4*c*), but is constricted off from the body of the plate, forming a small circular projection as in *D. gardineri*, Pocock (1906, pl. lxvi fig. 4*a*).

The chelicerae of the female bear five equally spaced teeth, of which the second is the largest, on the anterior margin of the fang groove. The anterior of the two teeth on the posterior margin is situated nearer to the base of the fang than to the much smaller second tooth. In the male all the teeth tend to be smaller than in the female, and the second and third teeth of the anterior row are subequal.

The tibiae of the palps of the male are terminated on the outer side by a somewhat expanded apophysis, yellowish in colour except for the anterior margin which is black, with a curved black spine immediately in front.

Desis inermis n. sp.
A. Vulva.
B. Outer side of distal end of tibia of palp of adult male.

LITERATURE FOR ARACHNIDA.

1902 POCOCK, R. I. (1) "On the Marine Spiders of the genus *Desis*, with Description of a new Species." *Proc. Zool. Soc. London*, 1902 (II), pp. 98–106, text-fig. 21.

(2) "On a new species of Marine Spider of the genus *Desis* from Zanzibar." *T.c.*, pp. 389–392, text fig. 78.

1906 POCOCK, R. I. "Arachnida." Gardiner's *Fauna and Geography of the Maldive and Laccadive Archipelagoes*, II (Cambridge, 1906), pp. 797–805, pl. lxvi.

Class Insecta.

Specimens of *Halobates*, one of the few marine genera of Water-Skaters (Fam. Hydrometridae) have been found on the surface of the sea at Krusadai Island and Pamban, but unfortunately few adults have yet been caught for examination and all have proved to be females. Several species are recorded by Distant in the *Fauna of British India* (Hemiptera, vols. II and V) from near Ceylon. In none of them, however, is the proportion between the two joints of the middle tarsi the same as in our specimens. Buchanan White (*Challenger Reports*, Zool. vii, 1883) gives a key to the identification of the species known at that time. Of these *H. sobrinus*, B.W., from Tahiti seems to agree with our specimens in all respects, including the joints of the middle tarsus of which the first is between three and four times as long as the second. The first joint of the fore tarsus is slightly shorter than the second. There is very little difference in length between the second and fourth joints of the antenna, both of which are longer than the third.

ECHINODERMATA.

By F. H. GRAVELY, *D.Sc.*

For general classification see Bather, Gregory and Goodrich, 1900 (Oxford Natural History). Dr. Pearson informs me that Ludwig's work in Bronn's "Thier-Reich" is also important; but I have not been able to consult it.

I have to thank Professor Koehler and Dr. Pearson for most of the following determinations.

Class Crinoidea.

No representative of this class has yet been found in the area under consideration. Specimens have, however, been collected by fishermen at Mandapam.

Class Holothuroidea.

For synopsis of genera and species see Théel (1886). For additional figures see Semper (1868). For more recent accounts of collections from India and Ceylon see Pearson (1903) and Koehler and Vaney (1905—8).

Order Actinopoda.

Radial canals supplying tentacles and podia.

Only two families have been found, the Holothuriidae and the Cucumariidae. In the former the tentacles are peltate, in the latter they are arborescent.

Family HOLOTHURIIDAE.

Only two genera are represented. They can be distinguished from one another by the presence of two bundles of genital tubes in *Stichopus*, one on each side of the dorsal mesentery, and of only the one on the left side in *Holothuria*.

Genus Holothuria, Linnaeus.

Holothuria lubrica, Selenka.

Holothuria lubrica, Koehler and Vaney, 1908, p. 10, pl. i figs. 5*a–b*.

A single specimen from Shingle Island, about 12 cm. long, dark brownish in colour. It can readily be distinguished from all other species of the genus in the collection by its roughened rod or spindle-shaped spicules, somewhat resembling those of Alcyonaria. The species is widely distributed in the Indian and Pacific Oceans and West Indies

Holothuria atra Jäger.

Holothuria atra, Semper, 1868, pp. 88 and 250, pl. xxvi.
Holothuria atra, Théel, 1886, pp. 181 and 213-214, pl. vii figs. 4*a–c*.
Holothuria atra, Pearson, 1903, pp. 212–213.

This abundant and widely distributed species is very common in the lagoon on the south side of Krusadai Island. It is a dark purplish brown (almost black) creature, often a foot or even more in length. It lives on the surface of sandy ground in shallow water. The spicules comprise small incomplete (and consequently irregular) buttons, and small tables with a small perforation in the smooth-edged disc at the base of each rod of the spire (sometimes absent according to Théel), the rods joined by one tier of cross-pieces below the terminal ring, and each bearing at the apex one vertical and two outwardly directed teeth.

Holothuria monacaria (Lesson).

Holothuria monacaria, Semper, 1868, pp. 78 and 247.
Holothuria monacaria, Théel, 1886, pp. 172–173 and 217–218, pl. viii figs. 10*a–f*.
Holothuria monacaria, Pearson, 1903, p. 201.

Three specimens about 15 cm. long from Shingle Island, one from Krusadai Island. The species is stated by Semper to be common and widely distributed from Zanzibar to Australia and the Sandwich Islands. Our specimens were found among stones. They are of a dark brownish colour, but of a somewhat more yellowish tint than that of *H. lubrica*. In the Krusadai specimen the tubercles on the dorsal surface are pale yellowish, contrasting strongly with the ground colour, and the tube-feet on the ventral surface are in three very distinct rows. In the other specimens this is not so, though one of them shows traces of both these characters. The spicules are alike in all. The buttons are without processes and mostly have three pairs of perforations; the tables are small and of the same general form as those of *H. atra*, but have a larger number of perforations in the disc, are without vertical teeth on the terminal ring of the spire, and have the eight outwardly directed teeth equally spaced.

Holothuria pardalis, Selenka.

Holothuria pardalis, Théel, 1886, pp. 224–225.
Holothuria pardalis, Bedford, 1899, p. 145.

This species lives in cavities in dead coral. It is widely distributed from Zanzibar to New Caledonia and the Sandwich Islands. It attains a length of nearly 15 cm., but is the smallest and slenderest species of *Holothuria* found. It is of a pale brown colour, with somewhat indistinct whitish spots. The buttons are somewhat irregular, some smooth, some knobbed, some incomplete. The tables are also irregular, with the terminal ring of the spire often incomplete, with teeth varying in number accordingly; or the spire may be still further reduced or absent, leaving only the disc with its four perforations and spinous margin. Occasionally the spines on the margin of these simple discs are also obsolete.

Holothuria scabra, Jäger.

Holothuria gallensis, Pearson, 1903, pp. 203-204, pl. iii figs. 46-50.

Dr. Pearson informs me that *H. gallensis* is a synonym of *H. scabra*.

The largest specimen collected is nearly a foot long and nearly four inches in diameter. Though scarcely as long as the much slenderer *H. atra* it is thus much the most bulky of the Holothurians of the district. The ground colour of the dorsal surface varies from grey to almost black, and the transverse yellow streaks are not so extensive in any of our specimens as in the one figured by Pearson. In our smallest specimen (about 5 cm. long) the yellow streaks are scarcely visible, and in a slightly larger specimen from Kutikal they are entirely absent and the ventral surface is much speckled with dark grey. The spicules agree closely with Pearson's description and figures. The buttons have normally two knobs and three pairs of perforations; but in small specimens many of them are longer with more numerous knobs and perforations, the former being less regularly arranged. The tables are large, with two rows of teeth on the terminal ring of the spire. According to Pearson the tables are not so well developed in older specimens as in younger ones. I have not been able to detect any such difference.

H. scabra seems to like the same conditions as *H. atra* and is sometimes found in company with it, though as a rule much less abundant. As noted by Pearson it is, however, sufficiently common to be used commercially for trepang.

Genus Stichopus, Brandt.

Stichopus chloronotus, Brandt.

Stichopus chloronotus, Théel, 1886, pp. 159-160 and 189-190, pl. vii figs. 6 *a-g*.

Stichopus chloronotus, Pearson, 1903, pp. 204-205.

A single specimen was collected at Kutikal, and a number in shallow water opposite the fisheries office at Rameswaram. The species can easily be distinguished from all other Holothurians in the collection by its two dorsal double rows and lateral simple rows of large conical tubercles, and by the presence of finely tapered C-shaped spicules which, however, scarcely have a trace of the thickening in the middle shown in Théel's figure. The tables are small with the tier of cross-pieces of the spire much nearer to the smooth-edged disc than to the terminal ring. The teeth on the terminal ring are somewhat variable, but are concentrated at the places of junction between this ring and the four vertical rods. Théel records the presence in his specimens of "a very few incomplete rosettes or dichotomously branched bodies which were absent in the typical specimens examined by Selenka and others." In the single preparation made from our specimens these are very numerous.

Family CUCUMARIIDAE.

The genera represented in the collection may be distinguished from one another thus:—

1. Ambulacral appendages confined to a distinct creeping sole ... *Psolus.*
— Without distinct creeping sole ... ... 2.

2. Pedicels scattered all over the body	3
— Pedicels more or less completely confined to the radii	4
3. Tentacles ten	*Thyone.*
— Tentacles in two crowns, twelve to sixteen in the exterior and five or six in the interior	*Phyllophorus.*
4. Tentacles ten	*Cucumaria.*
— Tentacles eighteen to twenty	*Actinocucumis.*

Psolus complanatus, Semper.

Psolus complanatus, Semper, 1868, pp. 61–62, pl. xiii fig. 19 *a-b*.
Psolus complanatus, Théel, 1886, pp. 127–128.

A single specimen of this little Holothurian, mottled dark greyish in colour above, whitish on the sole, and with upwardly directed anterior and posterior ends, was found at Pamban. It differs from the type specimen from the Philippine Islands in its less uniform colour but agrees closely in the nature of the spicules. These are mostly thick oval buttons with four perforations, ten marginal knobs and a larger central knob on each of the two surfaces. Some of the buttons are, however, more elongate, with more numerous perforations and knobs. There are also thinner saucer-shaped perforated plates with dentate margin, as well as the large plates of the dorsal surface. The saucer-shaped plates differ somewhat from what I take to be the corresponding plates of Semper's figure, being without knobs and having a more evenly dentate margin.

Thyone sacellus (Selenka).

Thyone sacella, Théel, 1886, p. 138.
Thyone sacellus, Pearson, 1903, p. 192, pl.i figs. 9–10.

Two specimens from Pamban, a very small one from our collection and one about 7 cm. long from an older collection. Both are white in spirit; the colour in life was not noted. The buttons are very like those of *Psolus complanatus* but have the central knobs horizontally perforated at the base. In addition to the buttons, Pearson found in his specimens "numerous plates having more than four holes and having short spines on the surface (fig. 10)." Such plates have not been seen in either of our specimens, but in the larger of them there are a number of more elongate smooth perforated plates, somewhat variable and often irregular in shape; they usually have a small piece at each end either more or less irregularly perforate or dentate, separated by a constriction from a larger diamond-shaped middle piece with four perforations. In the small specimen only buttons have been seen.

Phyllophorus sp.

One specimen from Shingle Island, a little longer and much stouter than the preceding species. Its not very numerous needle-shaped spicules, mostly pointed at each end and often slightly curved, suggest that it may prove to be allied to or even identical with

Crcula (? *Phyllophorus*) *dubia*, Bedford (1899, p. 144, pl. xvii fig. 4) from the Loyalty Islands. It is of a dark purplish brown colour above, paler beneath. The tentacles of the inner ring are much smaller than those of the outer. Very occasionally one end of a spicule is knobbed (like a pin) or provided with three recurved teeth. Such of the latter as have been seen all appear to be broken, so it is impossible to say what the other end was like. These and many others appear to have a hollow axis. Dr. Pearson who examined the specimen later suggests that they may belong to a Tetractinellid sponge as he could not find any spicules at all; but I do not see how this can have happened.

Cucumaria conjungens, Semper.

Cucumeria conjungens, Semper, 1868, pp. 51-52, pl. xi fig. 5, xiii 7, xiv 4.
Cucumaria conjungens, Théel, 1886, p. 112.
Cucumaria conjungens, Pearson, 1903, p. 191.

Two specimens of this small Holothurian were collected at Pamban. It was first described from the Philippine Islands and has since been recorded from Ceylon.

They are of a brownish colour. The buttons are of two kinds. Those from the body wall are flat and roughly oval in shape, with knobbed margin. Their centre supports on one side only a trilobed arch, each of the three lobes sometimes bearing a group of small teeth. Those from the pedicels are curved and more elongate with a somewhat diamond-shaped centre piece drawn out at either end into a more or less circular end piece. They are without knobs and the central arch, which always rises from the convex surface, is less distinctly trilobed and more strongly toothed. Scattered pedicels occur on the two lateral interambulacra, as well as on the ventral pair, being indeed less general on the latter than on the former. But the mid-dorsal interambulacrum is entirely free from them.

Cucumaria frauenfeldi, Ludwig.

Cucumaria sp. Semper, 1868, pl. xxxix fig. 22.

A single specimen from Pamban, about 4 cm. long, pale pink with dark brown tentacles in life, much as in *Thyone mirabilis*, Ludwig (see Sluiter, 1901, pl. i fig. 4). Its spicules are stout curved smooth rods with slightly enlarged perforate and dentate ends. They are abundant in the surface layer of the body wall. Dr. Pearson informs me that Ludwig in 1882 identified Semper's Javanese specimen with the above species, which is apparently a common South African form but has not previously been recorded from India or Ceylon.

Actinocucumis typica, Ludwig.

Actinocucumis difficilis, Bell, 1884, pp. 148-149, pl. ix fig. c.
Actinocucumis typica + difficilis, Théel, 1886, p. 125.

Five specimens from Pamban, two of them old ones labelled *A. difficilis* and presumably collected by Thurston and named by Bell. Théel's doubt as to the distinctness of *A. difficilis* from *A. typica* seems to me to be fully justified in view of the range of variability of many of the characters of this and other species, a view that appears to have

been accepted by Sluiter as, in his list of Holothuria recorded from the East Indian Archipelago and neighbouring seas but not found during the Siboga expedition (1901, p. 142), he mentions the latter species only.

The species is brownish grey in colour when alive, and attains a length of about 7 cm. It is more or less pentagonal in section. The spicules vary greatly, many apparently being imperfectly developed. The simplest are small and delicate smooth plates more or less oval in shape as a rule, with one or more small perforations at each end, and between them either a pair of elongate perforations side by side or two rows of smaller punctures. These plates are not referred to by Bell. Much more abundant and strong looking are the knobbed 8-shaped spicules. In many of them some of the knobs are united to form arches across the middle line or sometimes longitudinally. The tables are almost equally variable. Their basal plate is not quite straight in side view as shown in Bell's figure, but curves slightly away from the spire; it is slender throughout, broadest in the middle with one or two perforations, and again enlarged (though to a less extent) at each end with one or two smaller perforations. The spire is slender and conical, often more or less incomplete. When complete the apex is solid, often with a transverse perforation and a few small teeth, and the four upright bars are united by a single cross piece near their base. When incomplete the apex may be bifid or solid or may be absent, leaving only the bases of the upright bars. Or the plate may be still more imperfect.

Order Paractinopoda.

Neither radial canals nor podia; tentacles supplied from the circular canal.

A single specimen, probably of the genus *Synapta*, Eschscholtz, was found under Pamban bridge. It was a slender purplish creature about 6 cm. long and very active. Smaller similar looking specimens are abundant at Rameswaram. Dr. Pearson has identified them for us as *S. recta*, Semper (=*S. striata*).

Class Stelleroidea.

Subclass Asteroidea.

For details of classification, including generic definitions, see Sladen, 1889.

Order Phanerozonia.

Family ASTROPECTINIDAE.

Astropecten indicus, Döderlein.

Astropecten indicus, Koehler, 1910, pp. 27–31, pl. iv figs. 8–15.
Astropecten indicus, Döderlein, 1917, pp. 53 and 146–147, pl. xiv figs. 4-4*a*.

One specimen from Kutikal and two from Krusadai Island. The arms are slender and bordered by a conspicuous row of plates with strong spines on their outer side. The disc is relatively small.

For a full account of the genus, with keys to species, see Döderlein, 1917.

Family PENTACEROTIDAE.

Pentaceros hedemanni (Lütken).

Pentaceros Hedemanni, Koehler, 1910, pp. 96–98, pl. x fig. 6, xi 7.

Very common at Mandapam and in moderately shallow water at low tide on the western side of Kutikal Point, lying on the bottom. Only specimens from the former locality were preserved but those from the latter were almost certainly identical with them. The species is much the largest starfish in the collection, with a big and sparsely tubercular disc and relatively short, thick arms. There are five rather large tubercles arranged pentagonally on the aboral surface of the disc, from each of which a line of tubercles extends to the tip of the corresponding arm.

Family ASTERINIDAE.

Two genera are represented, *Asterina* and *Palmipes*, belonging respectively to the subfamilies Asterininae with dermal branchiae arising from any part of the abactinal surface, and Palmipedininae with dermal branchiae confined to the radial regions. All three species are small with relatively large disc and short obtuse arms. The two species of *Asterina* are smaller than the *Palmipes* and both have the upper surface of the disc ornamented in the middle with a low crown of plates which is not found in the *Palmipes*.

Asterina ? cephea (Müller & Troschel).

A single specimen from Kutikal. References to *A. cephea* are given by Sladen (1889, p. 393).

Asterina coronata, von Martens.

A single specimen from Krusadai Island. The arms are longer and meet in a more distinct angle than in the preceding species.

Palmipes sarasini, de Loriol.

Palmipes sarasini, Koehler, 1910, pp. 127–128, pl. xix figs. 1 and 9.

A number of specimens from Pamban.

Subclass Ophiuroidea.

For generic definitions and keys to species see Lyman, 1882.

Order Cladophiurae.

Family AMPHIURIDAE.

Ophiactis savignyi (Müller & Troschel).

Ophiactis savignyi, Lyman, 1882, pp. 113 and 115.
Ophiactis savignyi, Koehler, 1905, pp. 26–29.

A somewhat small brittle-star of a mottled dark greenish colour (in spirit) common at Krusadai Island and Pamban. It usually has six arms, instead of the normal five. The spines on the sides of the arms are of moderate size.

Ophiophragmus relictus (Koehler).

Amphiura relicta, Koehler, 1900, pl. xvi figs. 15-16.

A dull ochraceous species (in spirit) with relatively small disc and enormously long arms bearing spines of moderate size. One specimen was collected at Krusadai Island and one at Pamban.

Family OPHIOCOMIDAE.

Ophiocoma scolopendrina (Lamarck).

Ophiocoma scolopendrina, Lyman, 1882, pp. 169-170, pl. xlvii fig. 3.
Ophiocoma scolopendrina, Koehler, 1905, pp. 60-61.

A single specimen from Shingle Island, large and stout with very thick smooth spines on the sides of the arms. Colour (in spirit) a dull purplish brown.

Family OPHIOTHRICIDAE.

Ophiothrix hirsuta, Müller & Troschel.

Ophiothrix hirsuta, Lyman, 1882, pp. 217 and 226.
Ophiothrix hirsuta, Koehler, 1905, p. 93.

Two specimens from Krusadai Island, many from Pamban. Bluish grey in colour (in spirit). Arms long and slender, about nine times as long as the diameter of the disc, their sides thickly covered with long slender finely serrate spines.

Class Echinoidea.

Keys for the identification of the Echinoids of the East Indian Archipelago are given by Meijere (1904, pp. 220-237). For generic definitions see Agassiz, 1872-4, pt. ii.

Subclass Regularia Ectobranchiata.

Family TEMNOPLEURIDAE.

Two species have been found, both belonging to the subfamily Temnopleurinae, in which the compound ambulacral plates are composed of two primaries and an intermediate demi-plate, while true sutural pits are present and often undermine the plates.

Two species occur. *Temonopleurus toreumaticus* (Klein; see Agassiz, 1872-4, pp. 463-464, pl. viii *a* figs. 4-5, and Meijere, 1904, pp. 80-81 and 228), is the commonest sea urchin of the district. Most of our specimens are from Kutikal, but it has also been found on Krusadai Island. It is a small form of a somewhat dull greyish colour with rather long and more or less distinctly banded spines. The tubercles form two principal vertical rows in each area; the pores are arranged in simple rows, but form more or less undulating and irregularly arranged zones; the angles of the plates are separated by deep lateral and vertical grooves in the ambulacral as well as the interambulacral areas.

Salmacis virgulata, Agassiz (see Meijere, 1904, pp. 83 and 229, pl. xvii figs. 273*a-b*) occurs on both Krusadai and Shingle Islands but is not common on either. The largest specimen has a shell about 12 cm. in diameter, but no others have been found nearly as large as this. It was found on Shingle Island. The species can easily be distinguished from the last by its shorter and uniformly purplish blue spines and by the absence of deep transverse grooves between the plates of the shell.

Family ECHINOMETRIDAE.

Two species occur but neither of them are common. Both have long thick spines. *Stomopneustes variolaris* (Lamarck; see Agassiz, 1872-4, pp. 437-438, pl. iv*b* figs. 1-3, vi 11-11*a*, xxiv 31-32, xxxvi 2-3, and Meijere, 1904, pp. 87-88 and 229) has a practically round shell with broad ambulacral areas and dark purplish brown spines much longer on one side of the shell than on the other. It has only been found alive on Shingle Island, but dead shells have been picked up on the shore of Krusadai Island also.

Echinometra mathaei, de Blainville (see Meijere, 1904, pp. 101-102 and 230) is a smaller species with strongly asymmetrical shell and much narrower ambulacral areas. Its spines are paler in colour and of a more greenish tint. It has been found on both Krusadai and Shingle Islands.

Subclass Irregularia.

A single specimen of the Spatangid *Lovenia elongata* (Gray; see Meijere, 1904, pp. 193 and 237; Koehler, 1914, pp. 111-114, pl. xi figs. 5-6, xii 10, xiii 8, xix 25-32) picked up at low tide at the sandy edge of the Kutikal mud flats, is the only irregular Echinoid found alive. Other species are, however, represented by dead shells washed up on the shore. These include a flattened "cake urchin" and the Cassidulid *Echinolampas ovatus* (Leske; = *oviformis*, Gmelin; see Koehler, 1922, pp. 140-144, pl. vi fig. 5, xiv 8; also Meijere, 1904, p. 234). The latter may be distinguished from *E. depressa*, Grey (see Meijere, 1904, pp. 144-145 and 233, pl. xix figs. 380-383), which probably also occurs, by its more widely separated rows of pores in each ambulacrum, and by the smaller difference in length between its ambulacra, a difference of about four instead of over a dozen pairs of pores.

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CHORDATA.

Class Urochorda.

By F. H. GRAVELY, *D.Sc.*

For the classification of this group see Herdman, 1891 and 1904. This classification is admittedly unnatural in certain respects (see phylogenetic table, Herdman, 1886, p. 388). Those who wish to pursue the subject further may consult Michaelsen, 1900 and 1904.[1]

Order Ascidiacea.

Suborder Ascidiae Simplices.

Family ASCIDIIDAE.

In this family the test is gelatinous or cartilaginous. Each individual lives singly, never forming a colony. Seven specimens, belonging to at least three species, have been collected from the under sides of stones, mostly picked up from under water at low tide.

Family CYNTHIIDAE.

In this family the test is usually leathery or fibrous and opaque.

Subfamily STYELINAE.

Stomach present, tentacles simple, branchial sac with at most four folds on each side.

Small, dull reddish, leathery ascidians of the genus *Polycarpa*, Heller, are not uncommon on Krusadai Island; and a similar but more brightly coloured form has been found at Pamban. This genus differs from *Styela*, Macleay, of which a similar but slightly larger species also occurs at Pamban, in having the gonads in the form of numerous small scattered masses instead of a few elongated tubular masses.

Family CLAVELLINIDAE.

Ascidians which, by budding, form colonies whereof the individuals, though remaining in organic connexion with each other, are each enveloped in a separate test.

Genus Ecteinascidia, Herdman.

Branchial sac with internal longitudinal bars, no distinct abdomen, no blood-vessels in the test.

Four species have been found, of which two—*E. multiclathrata*, Sluiter (1904, pp. 12–13, pl. iii figs. 6–8) and *E. thurstoni*, Herdman (1906, p. 239, pl. i figs. 18–23)—have been

[1] A useful summary of the revised classification appears to have been published by Hartmeyer in Bronn's "Klassen und Ordnung des Tier-Reichs," but I have not seen it, so have followed Herdman.

identified. *E. multiclathrata* is the smallest and commonest. It may be recognized by its small size (about 2·5 mm. diameter) and rounded shape.

E. thurstoni is much larger and more rectangular in form. Its most distinctive character is its straight and horizontal upper margin, the atrial aperture being about on a level with the mouth.

One of the other two species is intermediate in size and character between these two though it seems to be distinct from either. The remaining species differs from *E. thurstoni* chiefly in its large siphons, of which the oral is much more prominent than the atrial.

Genus Clavellina, Savigny.

Branchial sac without internal longitudinal bars, thorax and abdomen distinct but not separated by a definite peduncle; stolons distinct, delicate, branched.

A single colony was collected at Pamban.

Suborder Ascidiae Compositae.

Tribe ***Holosomata.***

Family POLYSTYELIDAE.

Ascidiozooids not grouped in systems.

Genus Diandrocarpa, Van Name.

Colony encrusting. Apertures simple, without lobes. Tentacles few. Branchial sac simple, no folds and only four internal longitudinal bars on each side. No small intermediate transverse vessels. Loop of alimentary canal large, placed beside the branchial sac. Gonads consisting of a single mass on each side of the body, each with two large pyriform or lobed testes and a group of ova.

Extensive colonies of *D. brackenhielmi*, Michaelsen (1904, pp. 50–53, pl. i fig. 4; Herdman, 1906, pp. 331–333, pl. vii figs. 10–18) were found on *Pteria* shells on the Rameswaram chank beds. Smaller colonies are not uncommonly found on seaweed, *Telesto* and hydroids, and more rarely on stones, at Pamban and have also been found on (? drift) seaweed at Krusadai Island. These colonies have not been so well preserved as the former, but are almost certainly of the same species. They were pale pinkish yellow in life, often with a red line round each aperture as already noted by Herdman. The number of folds in the stomach wall is apparently about 12 in a few specimens, but is usually nearer 20. The testes vary greatly, probably in accordance with the state of expansion and preservation of the specimen. In a preparation made from a Rameswaram specimen they are exactly as shown in Herdman's figure; but in preparations from the more contracted Pamban and Krusadai colonies they are much more compact, each gonad often forming an almost spherical mass with the ovary in the middle.

Family BOTRYLLIDAE.

Ascidiozooids grouped in systems round common cloacal apertures.

The two common genera, *Botryllus*, Gaertner and Pallas, and *Botrylloides*, Milne-Edwards, can be distinguished from each other by the arrangement of their zooids, the systems being circular in the former and elongated or irregularly branched in the latter.

A single colony of *Botryllus* was found at Pamban. The zooids were greyish in colour when alive, and well preserved expanded specimens are greyish, some of them with black branchial aperture, in spirit. Contracted and ill-preserved specimens are, however, black and narrow, and I think there can be little doubt that the species is that described by Herdman (1906, p. 333, pl. vii figs. 19–20) under the name *Botryllus ater*, though the marginal parts of the test seem less (in many places much less) crowded with terminal knobs.

Two specimens of *Botrylloides chevalense*, Herdman (1906, p. 333, pl. vii figs. 21–24) have been found at Krusadai Island (Porites Bay). Though the zooids are of a dull purplish pink colour in spirit, those of one colony at least were whitish or yellowish in life. They have only eight tentacles, four large ones alternating with four small ones, and may thus at once be distinguished from the zooids of the preceding species which have more numerous long slender tentacles.

A species of *Botrylloides* with pink zooids closely packed in yellow test with yellowish common apertures, is probably distinct. It was collected at Pamban.

Tribe ***Merosomata.***

The character by which typical representatives of the families of this group may be recognized are indicated in the following key, which may be taken as a convenient guide if it is remembered that it is not of universal application, certain species of Didemnidae, for instance, being without spicules.

1. Colonies fixed	2.
— Colonies free	Coelocormidae.
2. Colonies thin, encrusting, *or* with stellate calcareous spicules in test	3.
— Colonies more massive, sometimes pedunculate; test without spicules	4.
3. Spicules usually present; test normal	Didemnidae.
— Test soft, more or less vacuolated; spicules rarely present ...	Diplosomatidae.
4. Body divided into two regions	Distomatidae.
Body divided into three regions	Polyclinidae.

Family DIDEMNIDAE.

The thin opaque white or brown colonies, often very extensive, which occur abundantly under stones throughout the area, belong to this family, as does also a pale purplish

form of which extensive groups of small colonies are sometimes found. How many species are represented I have been unable to determine, but all of which I have made preparations seem to belong to the genus *Leptoclinum*, Milne-Edwards, in which the branchial sac has four rows of stigmata.

The genus *Didemnum*, Savigny, in which the colony is thick and fleshy and the branchial sac has three rows of stigmata, is represented by two forms, one of a uniform dark purplish colour and the other dark purplish spotted with red. Four colonies collected in 1924 and varying (in spirit) from dark purplish grey to almost colourless, and one collected in 1922 probably belong to the same genus, though they are scarcely thicker than some colonies of *Leptoclinum*. The zooids of these colonies are arranged in distinct though irregular systems, so as superficially to resemble the genus *Botrylloides*.

Family DIPLOSOMATIDAE.

At least two species of the genus *Diplosoma* have been found, one in which the zooids are small and often more or less enveloped in opaque greyish pigment, and one in which they are much larger and perfectly white. Forms with zooids of intermediate size also occur and are probably distinct. The larvae of the form with small zooids, each form two zooids as in *D. raynori*, Macdonald, from Australia. Those of the other forms have not been seen. Herdman (1906, p. 342) records the European *D. crystallinum*, Giard, from Ceylon. I have not been able to consult full descriptions of either of these species.

Family DISTOMATIDAE.

A species of *Distoma* is not uncommon on the under sides of stones in the lagoon on the south side of Krusadai Island. It forms moderately thick colonies, usually small and rounded but sometimes more extensive, yellowish in colour with the black eye-spots of the zooids often showing through the test so clearly as to be conspicuous even to the naked eye.

Family POLYCLINIDAE.

An Ascidian which forms somewhat massive colonies of a dark purplish or almost black colour belongs to this family, and to the genus *Tylobranchion*, Herdman (1886, pp. 157–163, pl. xxii figs. 1–17), which is peculiar in having well-marked papillae on the transverse vessels of the branchial sac. The stigmata are of uniform size, not variable as described and figured by Herdman in *T. speciosum* from Kerguelen, on which the genus was based.

A number of small colonies found in 1922 at Pamban embedded in dense masses of alga probably also belong here.

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APPENDIX I.

THE VERTEBRATE FAUNA OF KRUSADAI ISLAND.

By B. SUNDARA RAJ, *M.A., Ph.D.*

N.B.—The Tamil names given are those in use at Pamban.

Mammals.

Only two land mammals are found on the island and both have been introduced from the Pamban Island.

The Common Indian rat (*Rattus rufescens*?) Tam. சருக்கெலி.

These infest the fishermen huts. They have evidently been carried to the island.

Cuvier's Jerbil (*Tatera cuvieri*?) Tam. வெள்ளெலி.

This is eaten by the fishermen and was deliberately introduced by the watchmen from Pamban Island some 10 or 15 years back. It lives on the sand hills in the centre of the island in winding burrows with one main entrance hidden under a bush and two or three inconspicuous ones in different directions not far from the main entrance.

Dolphins (*Tam.* ஓங்கி) are often found in the Pamban Channel. I saw two in Porites Bay in October but not sufficiently close to identify the animal.

The Dugong (*Halicore dugong*).

One was captured between Krusadai Island and Koipadu Island some 10 years back.

Birds.

Many birds visit the island in the cold weather, only a few are permanent residents and still fewer are known to nest on the island. No specimens were collected.

1. *The Indian Paradise Flycatcher* (*Terpsiphone paradisi*) Tam. கொண்டை இளாச்சி.
   A winter visitor.
2. *The Curlew* (*Numenius arquata*) Tam. கோட்டான்.
   A permanent resident.
3. *The Brahminy kite* (*Haliaster indus*) Tam. செம்பிராத்தி.
   Resides permanently and nests on the island.
4. *The common Pariah Kite* (*Milvus govinda*) Tam. கரும்பிராத்தி.
   Visits the island occasionally from the mainland.
5. *The Shikra* (*Astur badius*) Tam. வைரி.
   A visitor from the mainland. I saw one in October.
6. *The Spotted Owlet* (*Athene brama*) Tam. ஆந்தை.
   Recently one has arrived on the island and could be heard calling at night.

7. *The Jungle Crow* (*Corvus macrorhynchus*) Tam. அண்டம் காக்காய்.
   Not known to nest on the island.
8. *The Indian House Crow* (*Corvus splendens*) Tam. மணிகாக்காய்.
   A permanent resident and nests on the island.
9. *The King Crow* (*Dicrurus ater*) Tam. கரிகுருவி.
   A permanent resident but not known to nest on the island.
10. *The Indian Sky Lark* (*Alauda gulgula*) Tam. வானம்பாடி.
    A permanent resident, nests on the island.
11. *The Indian Pitta* (*Pitta brachyura*) Tam. மஞ்சங்கட்டி or களச்சி குருவி.
    A regular cold weather visitor.
12. *The Indian Ring Dove* (*Turtur risorius*) Tam. காட்டுபுரா.
    A permanent, resident nests on the island.
13. *The Indian Koel* (*Eudynamis honorata*) Tam. குயில்.
    Visits the island during the rains.
14. *The common Small Kingfisher* (*Alcedo ispida*) Tam. மீன் குருவி.
    A permanent resident.
15. *The Whistling Teal* (*Dendrocycna javanica*).
    One was seen by me on the southern shore of the island in October.
16. *The Grey Partridge* (*Francolinus pondicerianus*) Tam. கதுவாவி.
    One pair was introduced on the island some years ago, as follows :—a male escaping from a schooner flew into the island and the watchman brought a female from Pamban. Now they abound both on Krusadai and all the neighbouring islands and nests have been found on the Krusadai Island.
17. *The Indian Reef Heron* (*Lepterodius asha*).
    I surprised a pair in the Mangrove Bay one morning. They are permanent residents and are known to nest on the island.
18. *The Pelican* (*Pelecanus sp.*) Tam. கூளக்கடா.
    Occasionally visits Porites and Watchman's Bay.
19. *The common Flamingo* (*Phoenicopterus roseus*) Tam. செங்கால் நாரை.
    They appear in great numbers on the landward side of the island, occasionally.

Grass warblers and various kinds of snippets and plovers have been seen on the island.

Reptiles.

Lizards.

1. *The Gecko* (*Hemidactylus frenatus*) Tam. பல்லி.
   Is found in the bungalow and huts.
2. *The Blood-Sucker* (*Calotes versicolor*) Tam. ஓந்தான்.
   Is common in bushes.

3. *The Red Lizard* (*Cabrita leschenaultii*).
Is also said to occur but I have not been able to collect a specimen.

Land and Freshwater Snakes.

Dendrelaphis tristis—கொம்பேரி மூக்கன் and a water snake (*Chersydrus?*) are common.

Sea Snakes.

**Pelamis platurus*, *Hydrophis spiralis*, *Cerberus rhynchops*, and *Chersydrus granulatus* (the two latter not true sea snakes) are often found cast upon the shore. I found several live ones in October on the northern shore.

Tam. கண்டங் கரவலை.

Turtles.

All the three common sea turtles occur on the island.

1. *The Loggerhead* (*Thalassochelys caretta*) Tam. பங்குனி ஆமை.
Called after the month of April as it is said to come up for breeding during that month. It nests regularly on the island.

2. *The Green Turtle* (*Chelone mydas*) Tam. பச்சாமை.
This is the commonest turtle at Krusadai and some very large specimens have been captured, hence the Tamil name பச்சாமை. It is not known to nest on the island.

3. *The Hawksbill* (*Chelone imbricata*) Tam. அலுங்காமை.
A rare specimen. It breeds on the island. The eggs are spherical and smaller than those of the loggerhead and the shell is thick.

* Vide "Monograph of the Sea Snakes" by Malcolm Smith—Brit M. (N.H.), 1926.

APPENDIX II.

KRUSADAI ISLAND FLORA.

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The flora of the island may be divided into two groups, viz., (1) inland and (2) marine vegetation.

Inland vegetation.

The vegetation of the island is very varied though the area of the island is very small. The following types of vegetation may be distinguished:—

Mangroves.
Halophytes.
Pes caprae (shore plants trailing on the open sand, like *Ipomaca biloba*).
Strand plants (plants distributed by ocean currents, but growing above high tide mark and inland).
Dune plants.
Other plants.

Mangroves.

The quiet northern muddy shore of the island, especially to the west of the Porites Bay, is fringed with a narrow belt of mangroves consisting chiefly of *Pemphis acidula* with a sprinkling of *Avicennia officinalis, Excaecaria aghallocha, Bruguieria caryophylloides* and *Ceriops candolleana.* One or two plants of *Rhizophora mucronata* were also found. *Lumnitzera racemosa* was found growing in the swampy regions inside the island. Here were found many plants of *Avicennia officinalis* also.

Halophytes.

On the coasts and inside the island in salt water logged parts were found the following halophytes:—

Suaeda maratima, S. monoica, Arthrocnemum indicum, A. fruticosum var. *glaucum, Sesuvium portulacastrum, S. portulacastrum* var. *repens, Atriplex repens,* etc.

Pes caprae plants.

Ipomaea biloba, Spinifex squarrosus and *Launcea pinnatifida.* On the southern side of the island *Spinifex* was growing densely in many places.

Strand plants.

The chief strand plants are *Thespesia populnea* and *Pandanus odoratissimus.* These two plants are found not only on the shore but also scattered all over the island. A few stray *Caesalpinia bonducella* plants were also found near the northern shore of the island. *Scaevola lobelioides* forms small dense patches near the shore region on the sand above high tide mark. This plant was found in plenty in the adjoining Shingle Island also.

Dune plants.

The following plants were found on the sand hillocks that were found on the island:—

Ipomaea biloba, Spinifex squarrosus, Launaea pinnatifida, Calotropis gigantea and *Cyperus arenarius. Calotropis gigantea* plants have grown to good dimensions with thick stems. On these hillocks were growing ultimately *Thespesia* and *Pandanus.*

Besides the above there were many weeds which are fairly common on the mainland. One big species of *Cyperus* was growing all over the island. *Cassytha filiformis* was found all over the island parasitic on many plants. One plant of *Suriana maratima,* belonging to the Simarubaceae, was found on the southern side of Krusadai Island and three or four plants were growing on the Shingle Island. This is a very rare plant and has not been mentioned by Gamble in his flora of the Presidency of Madras.

Marine vegetation.

The marine vegetation forms the really interesting part of the flora, and one which offers much scope for future research. The vegetation can be divided under (1) Marine Phanerogams and (2) Marine Algae.

Marine Phanerogams.

The following plants are found growing in the muddy soil inside the water. The soil is often exposed during low tide:—

Halophila ovalis, Hook. fil., *H. stipulacea,* Aschers., *Cymodocea isoetifolia,* Aschers., *C. rotundata,* Aschers., *C. serrulata,* Aschers. and *Enhalus Koenigii,* Rich.

Marine Algae.

The coral reefs all round the island and the shallow lagoon-like portion between the reef and the shore form excellent collecting grounds for numerous different kinds of algae. During the low tide, the water is quite clear and often quite still and many interesting algae can be conveniently studied in their natural habitats. The reefs and the lagoon are very close to the bungalow and so the specimens can easily be brought to the bungalow in a fresh condition for detailed study.

The outer portion of the reefs is exposed to the surf during low tide but during high tide the waves just roll over and the algae on the reefs are then exposed only to the swell. The lagoon portion during low tide is more or less completely calm, but, during high tide the waves reach the shore from the reefs. The lagoon portion is sandy and in places even somewhat muddy with plenty of dead coral stones strewn all over with a few living corals growing here and there.

The most prominent plants on the surf-beaten region are *Sargassums*, *Caulerpa* (about ten species), *Ulva reticulata* (entangled among the *Sargassums*), *Turbinaria*, *Spatoglossum*, *Ceramium*, *Gracilaria*, *Gelidium*, *Lithothamnia* (calcareous algae), *Chaetomorpha* growing in brush-like tufts, etc.

The algae growing within the lagoon portion are *Halimeda* in plenty, *Codium* 2 spp., *Ulva lactuca*, *Sargassums*, *Hormosira triquetra* (stray), many *Caulerpas*, *Gracilarias*, *Acanthophora*, *Polysiphonia*, *Padina pavonia*, *Dictyota dichotoma*, *Cystophyllum muricatum*, *Hypnea musciformis*, etc. Sticking to the dead coral stones are found *Dictyosphaeria favulosa*, *Udotea* sp., *Neomeris annulata* (stray), *Struvea*, etc. *Valonia Forbesii* was found here and there scattered. It was growing in clusters in rather shallow water. At the bushy point I found plenty of this alga growing attached to small pieces of dead coral stones.

Other collecting grounds.

(1) *Shingle Island.*—The algal flora on the reefs round the island and in the lagoon within is quite similar to that of Krusadai Island. The lagoon to the south of the island was full of many of these algae. In this region I was able to collect some specimens of *Martensia*, *Claudia* and *Anadyomene* which I was not able to collect at Krusadai Island.

(2) *Pamban.*—Just opposite the Port Office, a little to the south of it, I found a species of *Acetabularia* and *Neomeris annulata* growing quite close to the shore on pieces of dead coral. Among the other algae growing in this region may be mentioned *Ceramium*, *Gracilaria*, *Champia*, *Padina pavonia*, *Ectocarpus* (growing on the leaves of *Enhalus Koenigii*), *Enteromorpha*, *Chaetomorpha*, etc.

(3) *Under the bridge (Pamban).*—The big stones under the bridge offer a very favourable place for the growth of various kinds of algae, and form an excellent collecting ground for various forms. Many of the forms occurring round the islands were found here also, but their growth was more stunted.

Among the algae may be mentioned *Caulerpa* (many species), *Valonia Forbesii*, *Halimeda tuna* (stray), *Ceramium*, *Chlorodesmis*, *Dictyota*, *Sargassum*, etc. In one place I found *Caulerpa Fergusoni* in about three feet of water on one of the stones under the bridge.

(4) *Mandapam.*—On the southern side close to the shore there are many rocks on which a fair amount of algal growth can be seen. The water is clear and collecting is quite easy. Among the many other forms that are growing here, particular attention may be drawn to the following—*Caulerpa scalpelliformis*, *C. clavifera*, *Chlorodesmis*, *Bryopsis*. These are growing in plenty on the rocks.

(5) *Rameswaram.*—The bay to the east of the temple is shallow in some places owing to the coral growing quite close to the surface of the water. Many forms were collected here. Among the forms which were not found in the other places may be mentioned *Caulerpa Freycinetii* f. *lata* which I found growing fairly commonly on the living corals along with species of *C. racemosa, C. peltata, Lithothamnia*, etc.

Close to the shore near the bathing ghat, I found *Caulerpa crassifolia, Valonia Forbesii, Caulerpa corynephora, Chlorodesmis, Ceramium*, etc.

In the chank beds to the north of Rameswaram, we got some divers to collect specimens and they brought up from a depth of some 20 feet very beautiful specimens of *Halymenia floresia.* This alga I was not able to collect anywhere else in the Pamban region. Evidently it is a deep-water form.

From the above account it may be seen that the algal vegetation of Krusadai Island and its environs is very rich and full of possibilities to research students. Specimens are in plenty and quite within easy reach, not requiring any elaborate equipment for collecting, except a time-table for finding out the lowest tide of each day. All the specimens except the few collected at the chank beds near Rameswaram were collected by hand inside three or at the most four feet of water. I am sure the dredge will bring to light many other interesting species or their forms. I have not made any serious plankton collection with the townet. There is much possibility for research in this direction also. On one or two occasions I found plenty of *Trichodesmium erythraeum* floating near the shore in large quantities as a frothy plankton. I therefore consider that the place (Krusadai Island) is a most suitable one for a marine biological station. I cannot compare it with Karachi, for I have not seen the place, but as far as South India is concerned, I think, this place is, from all points of view, the most suitable one.

INDEX TO GENERA AND SPECIES.

Names followed by an asterisk (*) refer to plants mentioned in the introduction and the botanical appendix. All other names refer to animals. Those in italics are synonyms.

Page numbers printed in Roman type refer to the main references (including all descriptive ones), those in italics to subsidiary ones.

[*From the* JOURNAL OF THE BOMBAY NATURAL HIST. SOC., *May* 31, 1928.]

REVIEW

THE LITTORAL FAUNA OF KRUSADAI ISLAND IN THE GULF OF MANAAR WITH APPENDICES ON THE VERTEBRATES AND PLANTS. By Various Authors.

This interesting publication marks the revival of a serial publication-Bulletin of the Madras Government Museum-which, as is stated in the editor's foreword, has been in abeyance since 1907. The series will hereafter be issued in two sections, the Natural History and General Sections, and the number under review forms No. I of vol. I of the Natural History Section of the *New Series* of this publication. As the general title of the work indicates it deals with the Littoral Fauna of Krusadai Island in the Gulf of Manaar, and is a systematic account of practically all groups of Invertebrates excluding Protozoa, Porifera, flatworms and some of the smaller groups. From amongst the Chordates only the Urochordates have been dealt with, while a list of the Vertebrates generally is included in an appendix. An account of the Flora of the area is published as a second appendix.

The volume has been prepared primarily for the use of the students who will be working in the Biological Station which is proposed to be established on Krusadai Island and should serve as a very valuable handbook. The visits of the students, as is pointed out in the introduction can as a rule only be of short duration, and if full value is to be obtained from them some ready means, by which at least the commoner organisms that will be met with can be identified, must be provided. In Europe this can to a great extent be done with the aid of the many excellent monographs that have been published on various groups. But in India, few such monographs have yet been written. To prepare a complete and self-sufficient monograph of the fauna and flora even of so small an area as that under consideration, with a full account of the classification of every group, would swell the work to an inordinate size with matter which would be largely a repetition of the work of others already published elsewhere. And, however convenient it might be, it would be undesirable; in as much as it would help to confirm the impression which students so often get that all knowledge is to be found between the covers of their text-books. On the other hand, to write an account which could only be followed by specialists or with the aid of books that cannot, for some time at least, be available on the island, would be to defeat the object of the work. We have therefore followed as far as possible the classification set forth in some standard text-book such as the Oxford and Cambridge Natural Histories. The particular book followed has been mentioned under each group and should be consulted for details. As, however, only the broad outlines of classification are dealt with in such books, reference is given to other works that have been found helpful

in connexion with more detailed classification, and it has usually been necessary to insert a brief account of the distinctive characters of such of the smaller subdivisions as are represented in the collections. These have been kept as short and clear as possible, only the most useful characters being included. But keys have as a rule been avoided on account of the sense of completeness and finality which they are apt, often falsely, to convey. Descriptions of species have also been kept as brief as possible, especially in the case of those already described in the publications of the Indian Museum, in Alcock's 'Materials for a Carcinological Fauna of India[1] (1895-1900), in Stanley Gardiner's 'Fauna and Geography of the Maldive and Laccadive Archipelagoes', in the reports of the Percy Sladen Trust Expedition to the Indian Ocean[2] and in Herdman's 'Report on the Pear Oyster Fisheries of the Gulf of Manaar', works bearing in so definite a manner on the fauna under consideration that they must obviously be available for reference along with the standard text-books already mentioned in the library of the Krusadai biological station.

The different chapters dealing with the various groups have been written by different authors, but the greater part of the volume is the work of Dr. F.H. Gravely, Superintendent of the Madras Museum, who has also acted as the editor for the reamining contributions, and Dr. B. Sundara Raj, Director of Fisheries, Madras. In each case the commoner forms met with have been dealt with in sufficient detail for identification and very instructive line and dot drawings of the species have been published. Fairly extensive literature references have been included at the end of each chapter and these with the work under review should enable students to identify most of the commoner forms, which are found in the region.

A general description of the island and other collecting grounds in this region together with maps of the different parts is also included.

The work is by no means the last word on the subject and as the editor remarks will need revision after the various groups have been revised by specialists.

The editors and the authors, however, deserve the thanks of students and incidentally of others interested in Marine Biology on producing a really useful handbook on the littoral fauna of the island and the adjacent parts, and it is sincerely hoped that it will stimulate more detailed research on Indian marine fauna of the region.

The printing and general getup of the work is really excellent and the price (Rs. 8) for a work of its size with 26 plates, is by no means exorbitant.

B.P.

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[1] *Journ. Asiatic Soc., Bengal,* 1895-1900.

[2] *Trans. Linn. Soc. London* 1907 onwards.