

INDIAN SPECIES OF MALACOSTEGA (POLYZOA, ECTOPROCTA)*

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ABSTRACT

Twenty species of polyzoans belonging to the Division Malacostega occurring in the Indian waters are described and illustrated. Two species *Electra crustulenta* sub species *borgii* are described as new. Details regarding the range of variations in the zoological characters of the species are presented, together with comparisons with earlier descriptions and figures of the species recorded from elsewhere have also been furnished and discussed. Distributional aspects of the forms recorded have also been presented.

INTRODUCTION

POLYZOANS of Indian waters has been dealt with, partly by investigators from the collections of expeditions, but no serious attempt has, hitherto, been made towards a study of their taxonomy and ecology from the Indian region. The paucity of even general information on polyzoans from the west coast of India, has been a serious lacunae especially in the context of fouling in these waters.

The pioneering work on this subject is that of Hincks (1884) describing six species from India, Singapore and Sri Lanka. Subsequently Hincks (1887) described 7 more species from the Mergui Archipelago. Krikpatrick (1905) identified 15 species collected by Thurston from the Indian waters. In her report Thornely (1905) has described and listed 116 species of which 31 had already been recorded from the Indian Seas, 32 from the Australian waters, 3 from the China Sea and outlying waters of the coast, west and south Indian Ocean, and of these 16 species and one variety as new to science. She has given reasonably complete descriptions of only 36 species and no figure has been given of species other than those described as new. Thornely (1907) also worked on the Indian Museum collections of R.I.M.S. *Investigator*. She has included 81 species in this report among which 4 were new to science. She has given descriptions of only 12 species and the figures of 8 species presented are not very satisfactory.

Annandales' studies (1906, 1907 a, b, c, 1908 a, 1911 a, b, 1912) were mainly confined to the fresh and brackish water species. He described nearly 8 species from the brackish waters along the coasts of India. Robertson's report (1921) on a collection of Bryozoa from the Bay of Bengal and other eastern seas dealing with 95 species of which 9 species and a variety are considered new to science is the latest important paper to appear on the Indian Polyzoa. Recently Menon and Nair (1967) have listed 70 species hitherto not recorded from the Indian Seas.

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The present paper deals with descriptions, figures and morphological notes of 20 species of the Division Malacostega, of which one sub-species and two species are new to science.

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DIVISION : MALACOSTEGA Levinsen, 1902

FAMILY : *Membraniporidae* Busk, 1854

Membranipora de Blainville, 1830

Membranipora Osburn 1950, 19.

Twinned ancestrales, mural spines wanting, gymnocyst usually wanting, cryptocyst wanting to well developed, proximal dentate tooth and lateral cryptocystal spinules present or absent.

***Membranipora membranacea* (Linnaeus) 1758 (Fig. 1 a - c)**

Membranipora membranacea Borg 1931; Osburn 1950, 21.

Occurrence : Five small colonies, encrusting on algal fronds were collected at Mandapam from the Gulf of Mannar.

Measurements : Zoecium L - 320 to 450 μ , I - 190 to 220 μ .

Salient features: Zoarium encrusting. Very simple zoecium elongated. Opesia occupy the whole front. Gymnocyst and cryptocyst vestigial. Operculum membraniporine (Fig. 1 a, c). Twinned ancestrula present (Fig. 1 b). Spines, avicularia and ovicells absent.

Remarks : Two differences are noticed in the present material from what Osburn (1950) observed in his specimens. He noticed knobs at the distal corners and "tower cells" in the median proximal part. Both these structures are absent in the present material. Even though Robertson (1908) did not observe any "tower cell" in her specimens she noticed "a blunt chitinous spine" at each anterior angle. The twinned ancestrula together with the simplicity in structure sufficiently justify the avipresent placing.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Enjoys a very wide distribution.

***Membranipora amoyensis* Robertson, 1921 (Fig. 1 d - f)**

Occurrence : Several specimens were collected on 8-2-1963 from bamboo piles removed from the Ernakulam Channel.

Measurements : Zoecium L - 540 μ , I - 250 μ .

Salient features: Encrusting, spreading with an even growing margin. Zoecia large and usually quadrangular and arranged in an alternate fashion. Zoecia show

variations in shape in the region where overlapping has taken place in colony. Gymnocyst developed, more extensive proximally, bearing small spines directed inwards from clear calcareous margin of gymnocyst. Smaller spines occupy spaces between larger ones (Fig. 1 d). Opesia oval. Operculum membraniporine with very thin margin (Fig. 1 f). Simple or trifold spine arises from two lateral tubercular areas distally (Fig. 1 e)

Remarks : Present specimens agree closely with both the description and figures of *Membranipora amoyensis* Robertson (1921) recorded from Amoya, China. Robertson did not mention the gymnocyst and the granulations over it even though her figures clearly show them. Whereas Robertson's figure shows upto marginal spines, none of the zooecia in the present form has more than 12 spines. The trifold spines present at the distal corners of the zooecium arise from two well marked tubercular areas. These tubercles have chitinous borders, which are continuous with the thickened chitinous lines separating each zooecium. Though Robertson stated that the spines may be simple in young zooecia and become branched as the zooids get older, she has not stated anything about the tubercles from which they arise. The trifold spines shown in Robertson's figures are very stout, but in the present specimens they are much more slender and longer, though the pattern of branching is similar.

The cryptic description and the incomplete sketches given by Robertson (1921) are certainly not helpful for a correct identification of this species. The difficulties have been considerably augmented owing to the paucity of the material and the absence of any subsequent record of this species. That there is a great range of infraspecific variations in species of *Membranipora* and as such it is not clear whether the differences though conspicuous are sufficient to justify the treatment of the present specimen as distinct from *M. amoyensis*. For the present, the characters which are peculiar to this material are considered as ecotypical variations of *M. amoyensis*.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Amoya, China (Robertson, 1921).

***Membranipora savartii* (Audouin) 1826 (Fig. 1 g)**

Acanthodesia savartii Harmer 1926, 213.

Acanthodesia savarti Osburn 1947, 59.

Membranipora savarti Osburn 1950, 27.

Occurrence : Four colonies encrusting on gorgonians were collected from Cap Comorin.

Measurements : Zooecium L - 480 μ , l - 300 μ .

Salient features : Encrusting, vincularian, zooecia arranged in very regular longitudinal rows. Zooecium from which bifurcation takes place comparatively bigger than rest. Zooecia short and wide with slightly curved and raised distal portion. Gymnocyst absent. Cryptocyst thick, well calcified, with small denticles projecting from lateral edges. A large and conspicuous proximal denticle projects into opesium, bearing small conical spines at its edge. Opesia deep and oval divided into two lateral compartments proximally by large proximal denticle (Fig. 1 g).

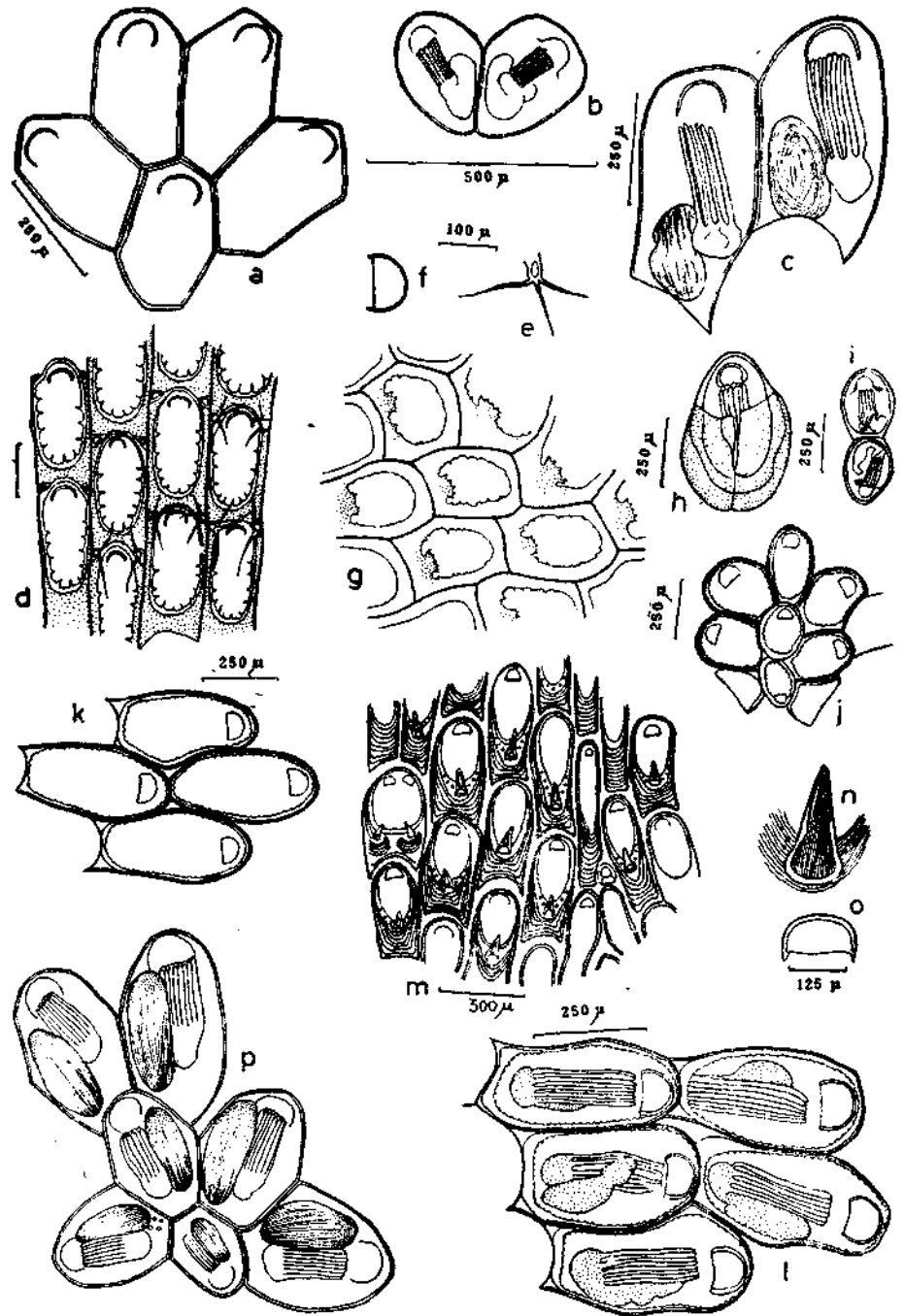


Fig. 1 a-c: *Membranipora membranacea* (Linnaeus) - a. portion of a colony showing the details of zooecia, b. ancestrula, c. two marginal zooecia; d-f: *M. amoyensis* Robertson - d. portion of a colony showing the details of zooecia, e. detail of a zooecial opening, f. detail of a zooecial opening; g-i: *M. amoyensis* Robertson - g. portion of a colony showing the details of zooecia, h. detail of a zooecial opening, i. portion of a colony showing the details of zooecia; j-l: *M. amoyensis* Robertson - j. detail of a zooecial opening, k. portion of a colony showing the details of zooecia, l. portion of a colony showing the details of zooecia; m-o: *M. amoyensis* Robertson - m. portion of a colony showing the details of zooecia, n. detail of a zooecial opening, o. detail of a zooecial opening; p-q: *M. amoyensis* Robertson - p. portion of a colony showing the details of zooecia, q. portion of a colony showing the details of zooecia.

(Continued on facing page)

Remarks: Forms included under this species show great variations, especially in the presence or absence of proximal denticles and in the presence or absence of teeth at the tip of the denticles. Both Harmer(1926) and Osburn (1950) have stated that the proximal denticle may or may not be present. The specimens closely agree with both the description and figure given by Harmer(1926) and with the description given by Osburn (1950) of this species. In some zooecia the proximal denticle was found to be devoid of any teeth as observed by Silen (1942).

Previous records from Indian waters: Mangalore (Thornely, 1907), Arabian Sea (Menon and Nair, (1967).

Distribution: This is a common species around the world in warmer shallow waters.

Electra Larnouroux, 1816

Electra Osburn 1950, 38.

Colonies encrusting, zooecia pear-shaped or rectangular. Proximal symnecyst may be evanescent distally. Frontal membrane covers an opesia of same extent. Opesia overarched by marginal spines, sometimes only one spine on proximal side of opesia. Cryptocyst wanting or barely indicated. No avicularia, ovicells, or pore chambers. Ancestrula single.

***Electra crustulenta* (Pallas) 1766 (Fig. 1 h - l)**

Electra crustulenta Osburn 1950, 35.

Occurrence: Several colonies were collected from glass and wooden panels used for studies on fouling at Cochin Harbour during the monsoon and post-monsoon (June to January) periods of 1963, 1964 and 1965.

Measurements : Zooecium L - 480 μ , l - 230 μ .

Salient features : Encrusting. Colonies appear as light brownish patches with numerous pinkish spots. Zoarium show a definite pattern of growth even though regularity is lost as growth proceeds. Zooecia arranged in regular rows, but normal arrangement may be upset as a result of crowding. Mural rim finely granulated. Gymnecyst present, slightly developed. Cryptocyst granulated with internally directed small tubercles, the shape of which vary from blunt when young to slightly pointed as zooids attain age. Distal region of zooecia raised so as to overarch proximal part of succeeding one. Opesia elongated oval (Fig. 1 k, l). Operculum chitinised, marginal sclerite brownish in hue. Pharyngeal region with a pink coloured area giving colony a characteristic spotted appearance. Cyphonautes present.

colony showing the details of zooecia, e. spine, f. operculum, g. *M. savartii* (Audouin) - portion of a colony showing the details of zooecia; h - l: *Electra crustulenta* (Pallas) - h. ancestrula, i. ancestrula with first daughter zooecium, j. a young colony, k. portion of a colony showing the details of zooecia, l. portion of a colony showing details of zooecia; m - o: *E. crustulenta* sub sp. *arctica* (Borg) - m. portion of a colony showing the details of zooecia, n. the proximal spine, o. operculum, and p. *E. crustulenta* sub. sp. *Borgii* nov. - portion of a colony showing the details of zooecia.

Remarks: The colonies observed during the present study showed a regular mode of growth during the initial stages, even though this was lost to a certain extent as they attained age.

The absence of calcified protuberance on the frontal wall of the zooecium proximal to the apertural area, and the lack of calcification of the operculum are two characters in which the present form agrees well with *Electra crustulenta* as described by Osburn (1950). The colouration of the pharyngeal region is a character not observed either by Borg (1931) or Osburn (1950).

Cyphonautes present; numerous ancestrulae examined shortly after attachment possessed triangular bivalve shells. Ancestrula is single. This gives rise to a single daughter zooid from the proximal region. Hence the opercula of the ancestrula and the daughter zooid are placed opposite to each other. Further budding takes place from these two zooids. This peculiar mode of budding was noticed in every colony (Fig. 1 h - j).

Electra crustulenta shows variations in diagnostic characters such as the mode of spreading; dimensions of zooecia; nature of operculum; and the cryptocyst. A close study of Borg's work (1931) shows that most of these variations are dependent on the habitat. Borg has come to the conclusion that the brackish water form in comparison with marine forms shows "(i) distinctly shorter cystids, (ii) a lesser degree of calcification, (iii) a very slightly developed cryptocyst, (iv) an operculum, the calcification of which becomes gradually thinner, about all in its distal part, or is lacking, the operculum instead being chitinized." So it is quite probable that the variations noticed in the present form are due to the estuarine condition of its habitat.

Previous records from Indian waters: Arabian Sea (Menon and Nair, 1967).

Distribution: Baltic, Germany, Swedish Coast, England (Borg, 1931), Yaquins Bay, Oregon, California (Osburn, 1950).

***Electra crustulenta* sub sp. *arctica* (Borg) 1931 (Fig. 1 m - o)**

Electra crustulenta var. *arctica* Osburn 1950, 36.

Electra crustulenta sub sp. *arctica* Hensen 1962, 15.

Occurrence: Four colonies were collected from a bivalve shell (*Mytilus viridis*) attached to a water conduit tube in the Mattanchery Channel.

Measurements: Zooecium L - 375 μ , I - 110 μ .

Salient features: Colonies form thin encrusting irregular patches over substratum. Zooecia long and elliptical with thick margins and separated by furrows. Gymnocyst well developed, showing calcareous striations with a broad calcareous tubercle and a chitinous spine connected to tubercle. Cryptocyst evanescent, vestigial with granulations and minute tubercles projecting into opesia (Fig. 1 m). Apertural field slightly reduced by cryptocyst, opesia oval. Operculum membrani-porine with thick chitinous margins (Fig. 1 o). Avicularia and ovicells absent.

Remarks: The structure of the spine, about which no details are given in Mawatari's (1956) text, is interesting. The spine has a very broad calcareous base which is continuous with the gymnocyst. The chitinous spine (Fig. 1 n) arises from

this base and is easily distinguished by the presence of a constriction. Borg (1931) noticed the presence of zooecia with two opercula, two polypides and two proximal spines in *Membranipora crustulenta*. In the present specimens also this feature is noticeable (Fig. 1 m), such duplication of polypides and opercula occurring in zooecia which precede the bifurcation during colony formation. In the nature of the operculum certain differences are noticed. Operculum here is membraniporine with thick margins contrary to what Borg and Mawatari have noticed in their materials. Differences in the shape and size of the zooecia are noticed here also. The striking differences in the nature of zooecia prompted Borg to create different varieties of *Membranipora crustulenta* now proposed under *Electra*. He gave the name *Membranipora crustulenta* var. *arctica* for specimens collected from the arctic region, and *Membranipora crustulenta* var. *fossaria* for specimens obtained from the brackish waters of the coasts of Britain and Netherlands. The present specimens are collected from the Mattancherry Channel where the influence of sea water is considerable. Since the present form resembles closely the figure given by Mawatari and because the presence of chitinous opercula differentiates the present form from *Electra crustulenta* sub sp. *artica*, this is retained under this taxon.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Arctic (Borg, 1931; Hensen, 1962), Bering Sea, Nunivak Is., Nash Harbour, Alaska and South to Dillion Beach, California (Osburn, 1950), Japan (Mawatari, 1956).

Electra crustulenta sub sp. *borgii* sub sp. nov. (Fig. 1 p, 2 a)

Occurrence : Nine colonies were collected from the glass panels used for the study of fouling organisms at the Cochin Harbour during December, 1964.

Measurements : Zooecium L - 400 μ , l - 230 μ .

Salient features : Encrusting. Colonies form thin layers over the glass panels appearing as pale whitish circular patches. Quincuncially arranged zooecia, very slightly calcified. Distal region of preceding zooecium slightly overarches proximal part of succeeding one. Gymnocyst absent. Cryptocyst vestigial (Fig. 1 p). Operculum chitinised. Cyphonautes present. Ancestrula single.

Remarks : The less calcified zooecia and the vestigial nature of the cryptocyst make the identification of this species rather difficult. The arrangement of the first zooecium developed from ancestrula is very similar to that found in *E. crustulenta* collected from Cochin. The operculum is well chitinised and could be distinguished as distinct brown structures on dry specimens. The absence of spines of any kind, gymnocyst as well as cryptocystal spinules separate the present form from *E. crustulenta*. The simplicity of the zooecial structure itself seems to give the present form considerable distinction. It is interesting in this connection to recall certain observations made by Borg (1931) while examining the specimens of *Membranipora crustulenta* from Dujino. Borg (1931) remarked that the degree of calcification in the specimen he examined was rather moderate, weaker than in any other specimens of *M. crustulenta* he had examined. The slightly elevated border of the apertural area was hardly or not at all granulated. The cryptocyst was often almost entirely lacking and formed a narrow rim inside the border of the apertural area. There was no trace of any spine or even of any calcareous protuberance proximal to the apertural area. Hence the present form treated as a new sub species of *Electra*

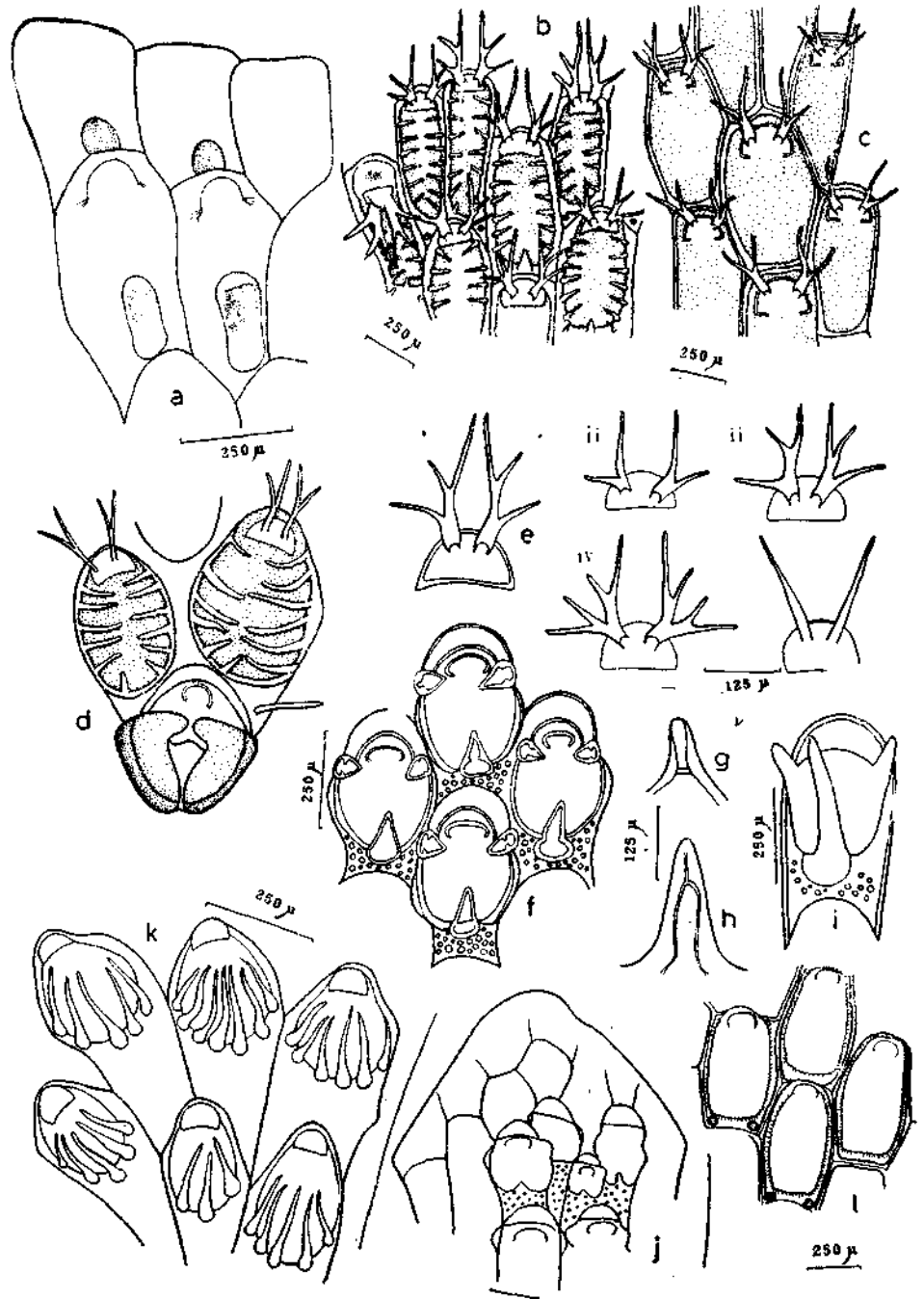


Fig. 2 a. *E. crustulenta*-rim of a colony showing the simple nature of the developing zooecial walls; b-c: *E. bengalensis* (Stoliczka) - b. portion of a colony showing the details of zooecia, c. zooecia without marginal spines, d. ancestrula, e - v. opercula with varied spines; f - j: *E. indica* sp. (Continued on facing page)

crustulenta and is named as *E. crustulenta* sub sp. *borgii*, after Borg who has studied almost every aspect of the morphology of *E. crustulenta*.

A very interesting association has been noticed between this species and a folliculinid. Several folliculinids are seen in close association with the zooeccial walls, especially at the corners (Pl. I A, B).

Type locality : Cochin (Lat. 9°58'N, Long. 76°17'E).

Holotype : Two colonies kept in the reference collections of the Indian Ocean Biological Centre, Cochin.

Paratype : Three colonies kept in the reference collections of the Marine Biological Laboratory, Trivandrum.

Electra bengalensis (Stoliczka) 1869, new combination (Fig. 2 b - e, i - v)

Thornely 1907, 186.

Electra anomala Osburn 1950, 36.

Occurrence : Collected in large numbers from test panels immersed in the environs of Cochin during the pre-monsoon (February-May) periods of 1964, 1965 and 1966.

Measurements : Zooeccium L - 630 μ , I - 295 μ .

Salient features : Encrusting, colonies white in colour, reaching large dimensions. Zooecia delicate, rectangular with adjacent rows arranged in alternate fashion and separated by distinct grooves. Gymnocyte moderately developed proximally. Opesia elongate oval with a very vestigial proximal cryptocyst. Three spines present at distal end, one above median line of operculum, the other two lateral. Six to eight pairs of basally jointed rarely branching slender spines overarch frontal membrane (Fig. 2 b). Operculum large, quite distinct from the frontal membrane, chitinised at border. A pair of long forked (once, twice or thrice) spines ornament the operculum (Fig. 2 c).

Remarks : This form agrees in all but one respect with *Electra anomala* figured and described by Osburn (1950). Only difference noticed is in the nature of the opercular spines. Osburn noticed in this specimens opercular spines with a single bifurcation but in the present material the opercular spines of some zooids have undergone branching of the second or even third order. Simple spines have also been noticed (Fig. 2 e i, ii, iii, iv, v). In live specimens with the opercula open the spines which they bear are seen parallel to the frontal membrane, a fact which testifies to the flexibility of the spines.

Osburn (1950) has made the following observation: "from the middle of the front surface of the operculum arises a pair of very elongate, bifurcate chitinous

nov. - f. portion of a colony showing the details of zooecia, g. lateral tubercle, h. proximal tubercle, i. a zooeccium with an elongated tubercle, j. growing rim of a colony, k. *Electra* sp. - portion of a colony showing the details of zooecia, and l. *Conopeum reticulum* (Linnaeus) - portion of a colony showing the details of zooecia.

spines which extend far over the base of the distal zooecium, this anomalous condition is without parallel to the writer's experience." This anomalous condition, together with the spinous adornment of the marginal region, are the characters which give specific distinction for this species. Stoliczka (1869) who described *M. bengalensis* noticed the same type of opercular spines arising from the lower lip. However, this observation was corrected subsequently by Thornely (1907) who stated that the spines arise from the operculum and when the operculum is opened fully the spines occupy the peculiar position which confused Stoliczka. In numerous colonies of this species examined during the present study spines on the operculum were invariably present in all zooecia. The absence of marginal spines is a usual occurrence and this observation agrees well with those of Thornely (1907) and Osburn (1950). Osburn has observed numerous colonies possessing zooecia with and without marginal spines. So it is evident that Osburn was in fact examining specimens of *E. bengalensis* for *E. anomala* does not vary in any character from *E. bengalensis*. Osburn seems to have overlooked Stoliczka's and Thornely's papers.

Present study has revealed that the ancestula of this species is single, this is the only dependable character to distinguish *Electra* from *Membranipora*. Ryland's suggestion (1966) is followed here and the species has been transferred to the genus *Electra*. Mawatari (1965) also feels that *E. anomala* is synonymous to *M. bengalensis*.

Previous records from Indian waters : Stoliczka (1869) recorded this species from Bengal and Thornely (1907) reported it from Snod Island, Arabian Sea (Menon and Nair, 1967).

Distribution : The only record of this species from a locality outside Indian waters is that of Osburn (1950), who recorded it from Balboa, Pacific Coast of Panama. This species frequently attached on to glass and wooden panels used for the study of fouling in the Cochin Harbour during the pre-monsoon period when the salinity in this brackish environment attained that of the adjoining sea.

***Electra indica* sp. nov. (Fig. 2 f - j)**

Occurrence : Fifteen colonies encrusting on algal fronds were collected from Kovalam on 24-12-1963. A second lot of twenty colonies encrusting on algal fronds was collected from the same locality on 3-6-1964.

Measurements : Zooecium L - 440 μ , l - 265 μ .

Salient features : Zoaria encrusting on algal fronds. Zooecia of uniform shape with uncalcified basal wall. Opesia oval, gymnocyst well developed proximally, provided with well defined pores. Three tubercles occupy zooecial margin, of which one occupies proximal median point and the other two the distal region on either side of the operculum. Median tubercles in young zooecia long and spinous (Fig. 2 j). All these tubercles connected with a transparent membrane which has two lateral flanks (Fig. 2 f) and distal extensions of this membrane forming a hood-like structure (Fig. 2 f). Cryptocyst present but not tuberculate.

Remarks : The peculiar proximal process on the gymnocystal margin is a character which according to Mawatari (1965) partly suggests the position of the present form *Electra*. The hood-like extension at the distal end of the zooecium is

not a forerunner of the ovicell since it is developed even in immature zoecia. The ancestrula is single.

The salient features of the present form are the swollen distal part of the zoecium, the large pores of the gymnocyst and the well developed tubercles. From a study of the available literature it seems that the Genus *Electra* established by Lamouroux in 1816, based on the form *Flustra verticillata* Solander, now includes about 14 recent species and varieties. The only species which *E. indica* resembles is *Electra biscuta* Osburn (1950). Osburn, in *E. biscuta* noticed that the gymnocyst is usually very limited in extent, but can occupy one fourth or more of the zoecial length, the cryptocyst is smooth or slightly granulated, there is a strong arching of the distal walls on the dorsal side and spines of three kinds : (1) a set occupying the lateral sides of the operculum over arching the opesia, when fully developed; (2) two stout conical distal spines opposite the distal end of the operculum; and (3) a transverse series of short and stout conical spines projecting forward in a row proximal to the opesia on the gymnocyst. The number of the last kind of spines varied from 1 to 5. Osburn was doubtful about the generic status of his species, but he wrote "the absence of coecia and avicularia and the presence of a gymnocyst, mural spines and thin lateral walls without dietellae, suggest the genus *Electra* though there is little resemblance in appearance to any other of that genus." An attempt to treat the form under consideration close to *E. biscuta* is vitiated by the presence of pores on the gymnocyst and the lesser development of the tubercles in *E. indica*. Regarding the presence of a hood-like structure, Osburn's remark that "the distal wall is strongly arched forward on the dorsal side" suggests a lesser developed hood-like structure in *E. biscuta*. In certain colonies of *E. indica* proximal gymnocystal tubercles have attained a spinous nature as a result of their elongation and tapering. It seems that this difference between the tubercles is the result of growth and of age. Based on the differences noticed the present form is described as a new species *Electra indica* and can be defined as follows:

Encrusting zoecia more or less of uniform shaped with a swollen distal portion. Opesia oval, well developed proximal gymnocyst porous. Three tubercles on the zoecial margins, one proximal and two disto-lateral connected by a transparent membrane. Cryptocyst smooth. Ovicells absent.

Type locality : Kovalam Beach, Trivandrum.

Holotype : One colony encrusting on an algal frond kept in the reference collection of the Indian Ocean Biological Centre, Cochin.

Paratype : One colony kept in the collection of the Marine Biological laboratory, Trivandrum.

Electra sp. (Fig. 2 k)

Occurrence : A single colony encrusting on an algal frond was collected from Mandapam on 23-9-1965.

Measurements : Zoecium L μ 490-, I - 250 μ .

Salient features : Encrusting. Zoecia pear-shaped. Opesia oval. Spines present, spine number varies from 3 to 7, elongated, arranged along proximal and

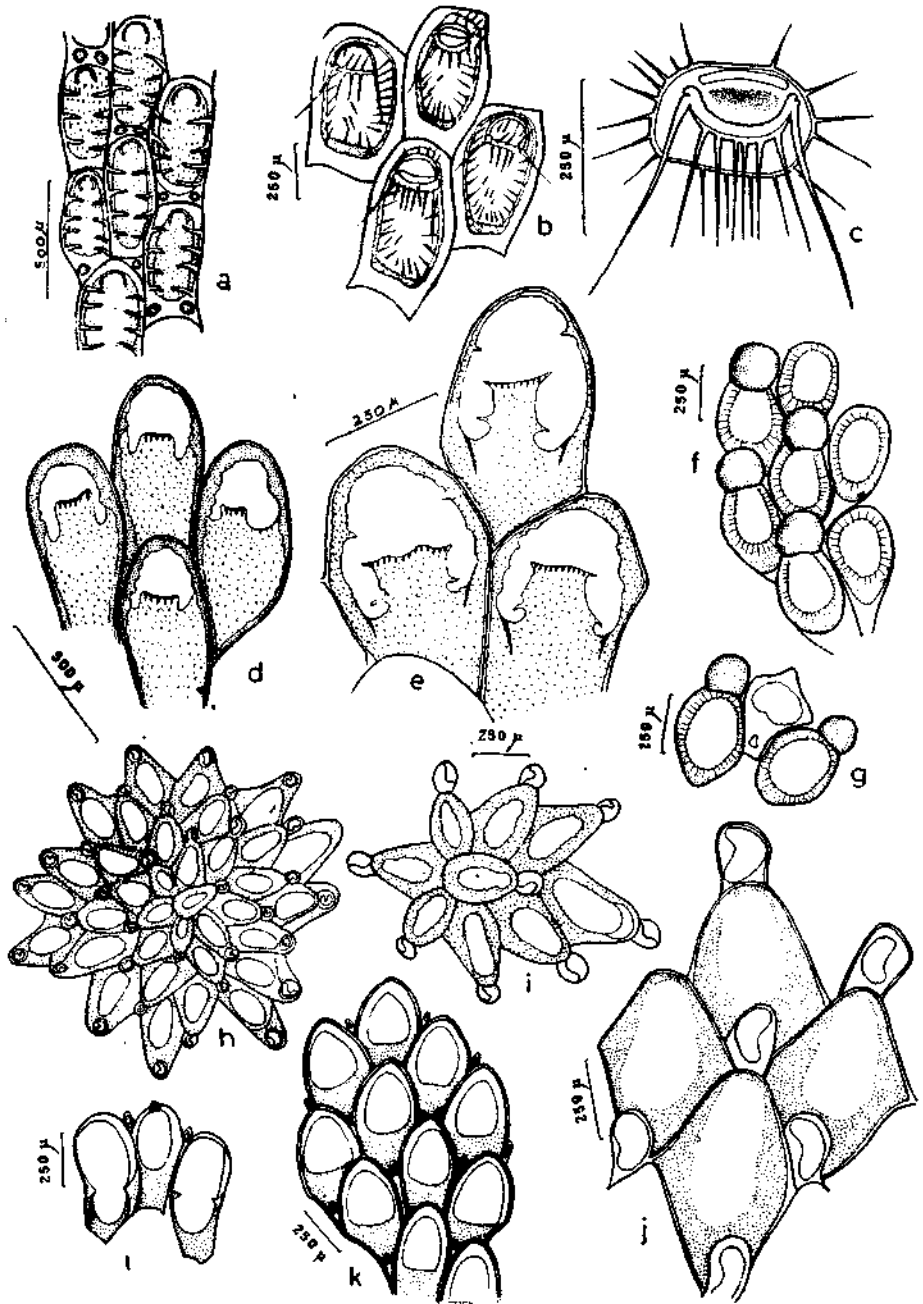


Fig. 3 a. *Conopeum commensale* Kirkpatrick and Metzelaar - portion of a colony showing the details of zooecia; b, c: *C. eriophorum* (Lamx.) - b. portion of a colony showing the details of zooecia, c. operculum, d. *Caleschara levinseni* Harmer - portion of a colony showing the details of zooecia, e. *C. mexicana* Osburn - portion of a colony showing the details of zooecia; f, g: (Continued on facing page)

proximo-lateral portions of the extensive gymnocyst, overarching the opesia. Operculum membraniporine (Fig. 2 k). Avicularia and ovicells absent.

Remarks: Although the shape of the opesium resembles that of *E. biscuta* Osburn the present form differs from all other species of *Electra* hitherto described in the very peculiar arrangement of the marginal spines.

The spines are less calcified than in other species and are so fragile that they may be easily lost during handling.

Nevertheless, the well developed gymnocyst and the marginal spines doubtlessly support the present generic placing. Bearing in mind the wide variations that are known to occur in the genus and pending a scrutiny of the type materials of the different species of *Electra* the present form is not assigned to any species.

Conopeum Gray, 1848

Conopeum Harmer 1926, 210; Osburn 1950, 30.

Encrusting, with a gymnocyst possessing two triangular depressions. Sometimes gymnocyst is lacking. Tuberculated cryptocyst extends from the entire margin. No avicularia, ovicells or pore-chambers.

Conopeum reticulum (Linnaeus) 1767 (Fig. 2 l)

Conopeum reticulum Harmer 1926, 211; Osburn 1950, 31.

Occurrence: This species was seen epizoic on the carapace and appendages of the swimming crab *Portunus pelagicus* caught off Cochin. The colonies are white encrustations with an uneven margin.

Measurements: Zooecium L - 490 μ , 1-210 μ .

Salient features: Encrusting. Zooecia quincuncial, chitinous outline distinct. Shape of zooecia variable, but generally longer than wide, very much elongated in certain cases. Gymnocyst present. Tuberculated cryptocyst developed all round with subsequal tubercles projecting into opesia. Small tubercles also present in proximal region of cryptocyst. Opesia elongate-oval. Proximal region of the opesia sometimes broader than the distal region. Membraniporine operculum occupies three-fourth of distal region. A pair of rounded prominences present on proximal corners of certain zooecia (Fig. 2 l).

"The triangular depressions sometimes roofed over and converted into a pair of rounded eminences" (Hincks, 1880) are clearly recognisable at the proximal corners of certain zooecia of the present material (Fig. 2 b). Kirkpatrick and Metzelaar (1922) considered these to be vestigial zooecia. Certain zooecia showed distortions owing to the uneven nature of the substratum. Such distorted zooecia are comparatively longer than normal ones with deeper cryptocysts.

Crassimarginatella kumatae (Okada) - f. portion of a colony showing the details of zooecis, g. two fertile zooecia and a vicarious avicularium; h - j: *Cupuladria indica* Cook - h, a single colony, i, central zooecia, j, four enlarged zooecia; k, l: *Antropora erecta* Silen - k, portion of a colony showing the details of zooecia, and l, vicarious avicularia.

Previous records from Indian waters: Bay of Bengal, Chilka Lake, Arabian Sea (Annandale, 1912; Menon and Nair, 1967).

***Conopeum commensale* Kirkpatrick and Metzelaar, 1922 (Fig. 3 a)**

Marcus 1939, 126; Osburn 1950, 30.

Occurrence : Three colonies encrusting on a polychaete tube were collected from the sub-tidal level at Kovalam.

Measurements : *Zooecium* L - 520 μ , i - 250 μ .

Salient features : Encrusting. Colonies brownish in hue. Zoecia arranged quincuncially, separated by distinct calcareous lines. Gymnocyist present, occasionally with one or two proximal tubercles. Cryptocyst narrow, furnished with minute calcareous spinules extending into opesia. Marginal spines distinctly present, mural in character. Frontal membrane studded with very minute, transparent spinules arranged uniformly. Operculum with a thick marginal sclerite (Fig. 3 a). No avicularia or ovicells.

Remarks: The only difference noticed from the forms described by Kirk. and Metz. (1922) is the presence of delicate spines arising from the gymnocyist. Very delicate marginal spines are easily lost during handling of the material and many zoecia of even the same colony may not possess them. The cryptocystal characters resemble very much those of *Electra crustulenta*. Marcus (1939) has given a description and discussed the range of variations seen in the specific characters of this tropical species. In his figure he has drawn proximal tubercles, which are shown in Osburn's (1950) figures also. The tubercles are present in many zoecia in the present instance. Kirkpatrick and Metzelaar did not observe the presence of ectocystal spinules (spinules on the frontal membrane) but Osburn (1950) saw them in the material sent to him by Dr. Hastings from the type locality. Thus it is evident that the ectocystal spinules may also be lacking in the zoecia.

Conopeum commensale comes very close to *Conopeum eriophorum* (Lamx.) in the presence of spinules on the gymnocyist. Perhaps these are the only two species in the family *Membraniporidae* where spinules occur on the frontal membrane. The absence of tubercles distinguishes *C. eriophorum* from *C. commensale*. A closer scrutiny of the type materials may reveal whether a splitting was necessary or not.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Widely distributed in the warm waters.

***Conopeum eriophorum* (Lamouroux) 1816 (Fig. 3 b, c)**

Membranipora spinastoma Robertson 1921, 47.

Conopeum eriophorum Harmer 1926, 212.

Occurrence : One colony was found encrusting on *Murex* sp. obtained from a dredge haul off Cochin at a depth of 210 m.

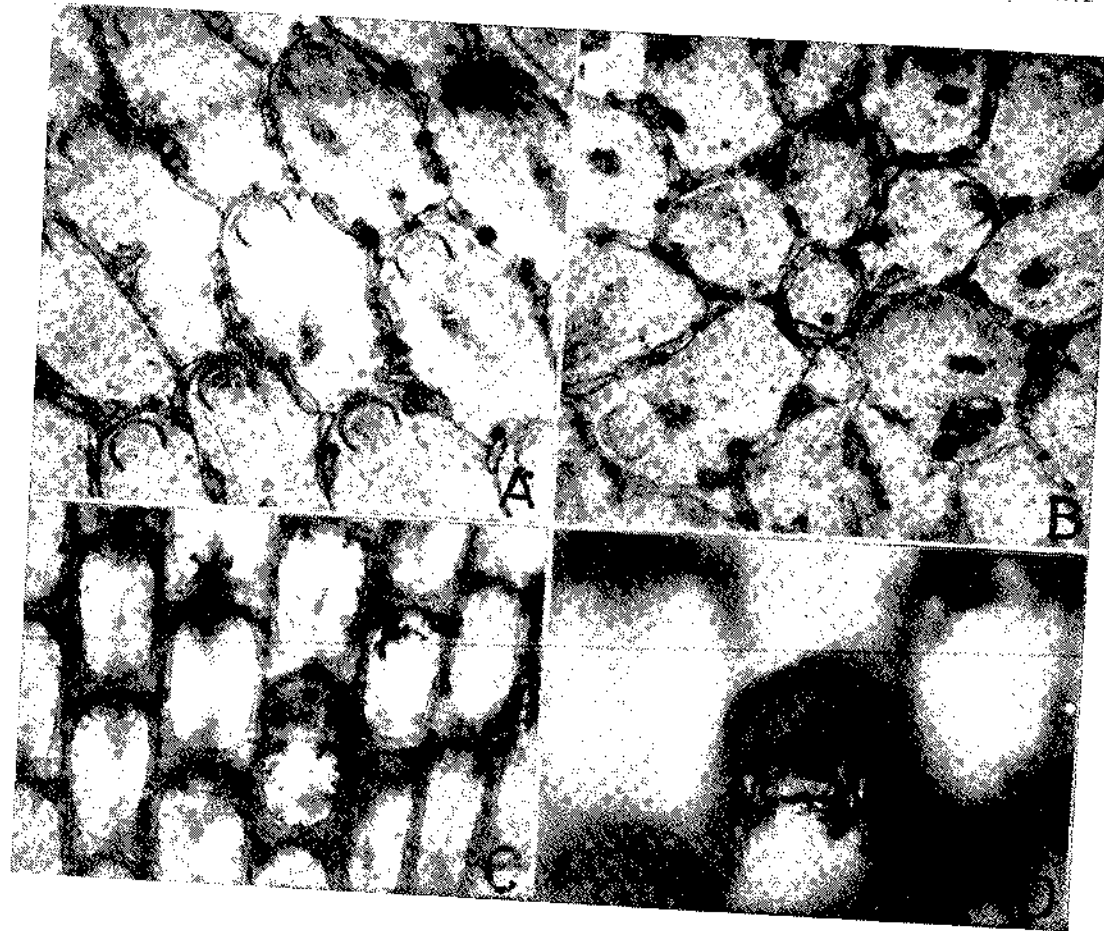


PLATE I. A, B. *Electra crustulenta* sub sp. *borgii* nov. (x 100) and C, D. *Alderina arabiatensis* sp. nov. (x 50 and x 100 respectively).

Measurements : Zooecium L – 530 μ , l – 325 μ .

Salient features : Encrusting, zooecia deep and quinconcial or sometimes quadrangular. Frontal membrane covers entire surface. Gymnocyst absent. Operculum large, broad occupying nearly three-fourth of distal margin. Rim of operculum heavily chitinised (Fig. 3 c). Three types of spines discernible on the zooecium those over the operculum, those occupying rim of frontal membrane and two large spines on proximo-lateral corners of operculum (Fig. 3 b). Spines on rim of frontal membrane long and delicate, arising and from a chitinous line. Those on the operculum arranged in two rows, a proximal row of 3 spines and a distal row of 4; spines of distal row comparatively longer and stronger. Circle of spines present around the operculum, arising from a chitinised base. Third type of spines long and slender, movably placed in sockets on lateral corners of operculum. Well developed cryptocyst present in old zooecia.

Remarks : According to Harmer (1926), the zooecia occur in distinct longitudinal lines or with the zooecia of the adjacent rows at the same level. However, in the present form the zooecia are arranged in quincunx. Harmer's figure does not show the crenulations of the inner margin. The long, slender, mobile spines present in the lateral corners of the operculum in the present specimens are more bristle-like as shown by Robertson and not spinous as drawn in Harmer's figure. The present specimens are noteworthy in the possession of very delicate haphazardly arranged spines on the frontal membrane, not mentioned by Robertson. The cryptocyst mentioned by Harmer is present and seems to have been overlooked by Robertson. A conspicuous feature in the present form is the spinous adornment in the form of a ring around the operculum. The chitinous rim present in the distal margin of the orifice comes into view when the operculum is open.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Australasian (Lamourox, 1816); Aru Is., Saleyar, south of Celebes west of north end of New Guinea, Makasser Strait (Harmer, 1926); Persian Gulf (Robertson, 1921).

Caleschara Mac Gillivray, 1880

Caleschara Harmer 1926, 221; Osburn 1950, 103.

Entire surface occupied by frontal membrane. Operculum membraniporine. Spines absent. Extensive cryptocyst tubercular and extending around the opesia, proximal region produced into a median "steganoporelliform process" (Harmer, 1926), which may be free distally or united with the lateral cryptocyst. Trifoliate opesia. Opsiules complete if median process units with lateral cryptocyst. Avicularia absent. Large entozooecial ovicells. Uniporous septula present.

Caleschara levinseni Harmer, 1926 (Fig. 3 d)

Occurrence : Two colonies encrusting on stones were collected from material dredged from a depth of 138 m.

Measurements : Zooecium L – 660 μ , l – 325 μ .

Salient features : Encrusting colonies brownish in hue. Zooecia arranged in longitudinal rows. Frontal membrane cover the entire surface. Operculum mem-

braniporine. Gymnocyst wanting. Tuberculated cryptocyst extends around the opesia, proximally they invade three fourth of the opesia, the median process extending from the centre. Opesia trifoliate. Median process convex and raised distally giving it the appearance of a polypide tube. Cryptocyst only moderately developed at the lateral portions. Opesiules little elongated and extend towards sides of median process (Fig. 3 d). Ovicell not noticed.

Remarks: The presence of spinules on the later edge of the cryptocyst is not of common occurrence. The zooecia are arranged in distinct longitudinal rows. The median processes are not symmetrically placed in some zooecia examined in the present material. A close resemblance is noticed between the present material and the figure and description of *C. mexicana* given by Osburn (1950). Osburn created *C. mexicana* based on its smaller size and its possession of horizontal spinules on the process and opesicular borders. Harmer has observed that the size of the zooecia varies and the strongly developed proximal part of the cryptocyst which is produced into a median process is "provided with spinules on its internal edges, occasionally wanting (in some of the zooecia of the colony)." Harmer has not noticed 'a pair of larger spinules in the position of the cordelles' (Osburn, 1950).

The present record of this species from a depth of 138 m extends the bathymetric distribution of this species. Harmer could collect the species only from 0-62 m.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Kei Is., south of Mindanso, South Halmaheirs, Darios Is., Amirante Is., Japan, Singapore and Seychelles (Harmer, 1926).

***Caleschara mexicana* Osburn, 1950 (Fig. 3 e)**

Occurrence : A single colony, epizoic on *Canopeum reticulum* was collected from the material dredged out from a depth of 50 m off Quilon.

Measurements : Zooecium L - 420 to 520 μ , l - 310 to 375 μ .

Salient features: Encrusting. Zoarium forms a unilaminar flat, glistening white encrustation over the substratum. Zooecia arranged in longitudinal rows, separated by thin denticulate mural rims. Zooecia elliptical, but often vary from normalcy. Gymnocyst wanting. Cryptocyst well developed, extending moderately, laterally and distally. Proximal region of cryptocyst extend into aperture as a flat, somewhat coarse, horizontal lamina, raised at distal end and provided with spines and spinules. Two comparatively long spines occupy latero-distal corners of horizontal lamina. Two small spines are present on lateral side of aperture, at position of cardelles. Opesia partly trifoliate, opesiules small, their proximal and lateral sides bordered by the cryptocyst with spinules (Fig. 3 e). Avicularia and ovicells not noticed.

Remarks : Osburn has stated that "this species appears to be rather close to *C. levinseni* Harmer (1926) but that species is evidently larger (Harmer merely states zooecia large) and appears to lack the horizontal spinules of the process and opesicular borders" (Osburn, 1950).

During the present study it was possible to collect specimens which belonged to both the above species. It seems probable that the spinules on the horizontal

lamina and on the mural rim are very characteristic of this species. The length of the zooecia are slightly higher than those Osburn observed in his material. Osburn noticed the presence of "subglobular tubercles" at the proximal corner of the specimens, but they are absent in these specimens. Nevertheless, Osburn (1950) says that the tubercles may be wanting. Therefore, the inclusion of the present form in this species is justifiable.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Mazatlan, Mexico and Panama (Osburn, 1950).

Crassimarginatella Canu, 1900

Crassimarginatella Harmer 1926; Silen 1941, 23.

Frontal membrane occupies entire front of zooecia. Gymnocyst slightly developed or vestigial. Cryptocyst narrow, spines absent. Vicarious avicularia with rounded mandibles, calcareous bar complete or incomplete. Ovicells hyperstomial or vestigial.

Crassimarginatella kumatae (Okada) 1923 (Fig. 3 f - g)

Crassimarginatella kumatae Harmer 1926, 224; Silen 1941, 24.

Occurrence : Two colonies, encrusting on a polychaete tube were collected from materials dredged off Quilon at a depth of 137 m.

Measurements : Zooecium L - 620 μ , l - 300 μ .

Salient features : Encrusting. Zoarium appears as a whitish patch, slightly raised from substratum. Zooecia oval, rarely showing any variation in shape. Gymnocyst slight, conspicuous on proximal region. Opesia oval. Cryptocyst well developed with granulation and small tubercles projecting into opesia (Fig. 3 f) Vicarious avicularia present, very rare, with triangular rostrum and well developed cryptocyst. Glistening white and granulated ovicells present (Fig. 3 g).

Remarks : Though the present specimens come close to the diagram and description of *Crassimarginatella kumatae* given by Silen (1941) they present certain differences with regard to the shape and size of the vicarious avicularia, characters which are considered important for the species. They are distinctly oval in Silen's figure whereas in the present material the distal half is triangular. Further, the size of the vicarious avicularia in the present specimens is nearly the same as the size of the autozooids, whereas Silen noted them as just half the size of the autozooida. If the presence of this peculiar avicularia proves to be a consistent feature in this form through the examination of more material it may well suggest that this form be separated as a new species, a consideration in which Mawatari (1965) also agrees. The position of the vicarious avicularia, however, agrees with what Silen has stated in the text.

In all other respects the present specimens agree with *Crassimarginatella kumatae* hence they are tentatively referred to that species.

Previous records from Indian waters: Arabian Sea (Menon and Nair, 1967).

Distribution: Straits of Korea (Okada, 1923); Japan, Bonin Is. (Silen, 1941).

FAMILY : *Cupuladriidae* Lagaaij, 1952

Cupuladria Canu and Bassler, 1919

Capuladria Osburn 1950, 33.

Discoïd and free zoarium with rhombic zooecia arranged in radial rows. Vibraculum present at distal end of each zooecium. Well developed cryptocyst, depressed opesia which may be oval, round or quadrangular. Opesia sometimes invaded by processes from basal margin of cryptocyst. Ovicells probably wanting.

Cupuladria indica Cook, 1965 (Fig. 3 h - j)

Occurrence : Twenty seven colonies were collected from dredgings conducted at 68 m and 42 m off Cochin and Beypore. The main constituents of the dredged materials were shell fragments and gravel sand.

Measurements : The diameter of the colonies ranges from 1.5 to 9 mm.

Zooecium : L - 430 μ , 1 - 350 μ .

Salient features : Zoaria saucer-shaped. Zooecia on convex side of zoarium. Rim of colony crenulated (Fig. 3 i) Concave side of colony tuberculated bearing thin ridges which radiate from a central point and branch at region of basal part of vibracula, a median ridge always extending to distal tip. Ancestrula single first two daughter zocids placed at an obtuse angle to ancestrula hence centre is generally triaxial, first axis passing through distal proximal extension of ancestrula and other two axes diverging from primary axis. Centre of colony appears as eight-rayed star (Fig. 3 i). Primary and first two secondary zooecia generally smaller than those of rest of colony. Central zooecia closed by lamina at level of cryptocyst. Cynocyst present, but very narrow. Cryptocyst uniformly tuberculated and descending. Oval opesia deep (Fig. 3 i). Vibracula invariably present in all zooecia, with small and distinct auricular projections on one side. Ovicells absent.

Remarks : Twenty five among the 27 colonies had small sand particles in the central region of the concave side of the zoarium, which indicates that the ancestrula attaches to a sandy substratum. The absence of such sand particles in the other two colonies might be owing to the sloughing off of the sand grains, as noted by Evelise and Marcus (1962) in *C. canariensis*.

The gymnocyst is usually very narrow and slightly crenulated. The uniformly tuberculated cryptocyst is very extensive in the seven central zooecia. Usually the central zooecia are covered with irregular lamina. An interesting fact noticed regarding the auricular projection was that they always alternate in the succeeding rows of zooecia starting from the centre of the colony.

Even though a wide range of substrata have been attributed, the present material was collected from substrata where shell fragments and gravel sand predominate. There were about ten colonies in each 500 cc of dredged material which shows that the number of colonies is not abundant in this habitat.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Mergui Archipelago (Hincks, 1887); Gulf of Aden (Silen, 1942) as quoted by Cook (1965).

FAMILY : *Hincksinidae* Canu and Bassler, 1927

***Antropora* Norman, 1903**

Antropora Harmer 1926, 232; Silen 1941, 43; Osburn 1950, 51.

Frontal membrane occupies almost entire front, gymnocyst reduced or vestigial. Well developed cryptocyst present proximally extending around entire opesia. Opesia depressed because of the steep descent of the cryptocyst. Adventitious avicularia paired, sometimes arranged so as to face one another on distal border of preceding zooecium. Vicarious avicularia with rounded mandibles occasionally present. Vestigial ovicells present, endozooecial.

***Antropora erecta* Silen, 1941 (Fig. 3 k, l)**

Occurrence : Several colonies were collected off Cochin from a dredge collection at 65 m depth.

Measurements : Zooecium L - 500 μ , l - 260 μ .

Salient features : All colonies collected were encrusting on molluscan shells. Zooecia broadest in middle and slightly tapering both ways. Gymnocyst not discernible. Cryptocyst extensive proximally, extending about a third of the distance towards distal and less developed laterally. Cryptocyst steep, hence opesia very much depressed and occupying anterior half. Opesia more or less triangular, or egg-shaped. Vivarious, paired, slightly raised avicularia present with thin pointed portions directing distally and occupying lateral position of zooecia (Fig. 3 k). Large vicarious avicularia present with very enlarged rostrum and extensive cryptocyst proximally (Fig. 3 l).

Remarks : The present specimen agrees remarkably well with Silen's (1941) description and figures of *A. erecta*, though slight variations probably of an ecotypic nature are noticeable. The distal ends of the zooecia of the present form are slightly pointed, whereas rounded in Silen's figures. The slight crenulation seen at the distal edge of the cryptocyst in the present specimens is not shown in Silen's figure. Further, there is no reference regarding this in the text. The majority of the zooids possess two, rarely one anteriorly directed vicarious avicularia which are invariably placed at the junction of adjacent zooecia. A large vicarious avicularium with a well developed proximal cryptocyst and a nearly rounded rostrum seen in the present specimens is neither shown in Silen's figures nor mentioned in the description. Silen's (1941) modified definition based on the adventitious avicularia that "Distally to all or most anthozooids one single or a pair of laterally arranged, small, pointed avicularia, which in some (or all?) species are vicarious", seems to be applicable in the present case. The fact that the present specimens are encrusting on shells is particularly noteworthy, since Silen found his specimens growing erect. *Antropora erecta* is described as "erect, branching, and has the structure of a cylinder surrounding a cavity, which is open at the ends of the branches." He, however,

feels that the erect nature might probably be owing to the fact that the substratum on which the specimen encrusted might have been destroyed later leaving an erect colony. All the colonies collected during the course of the present study were encrusting and not erect as noted by Silen. Mawatari (1965) has the following comments

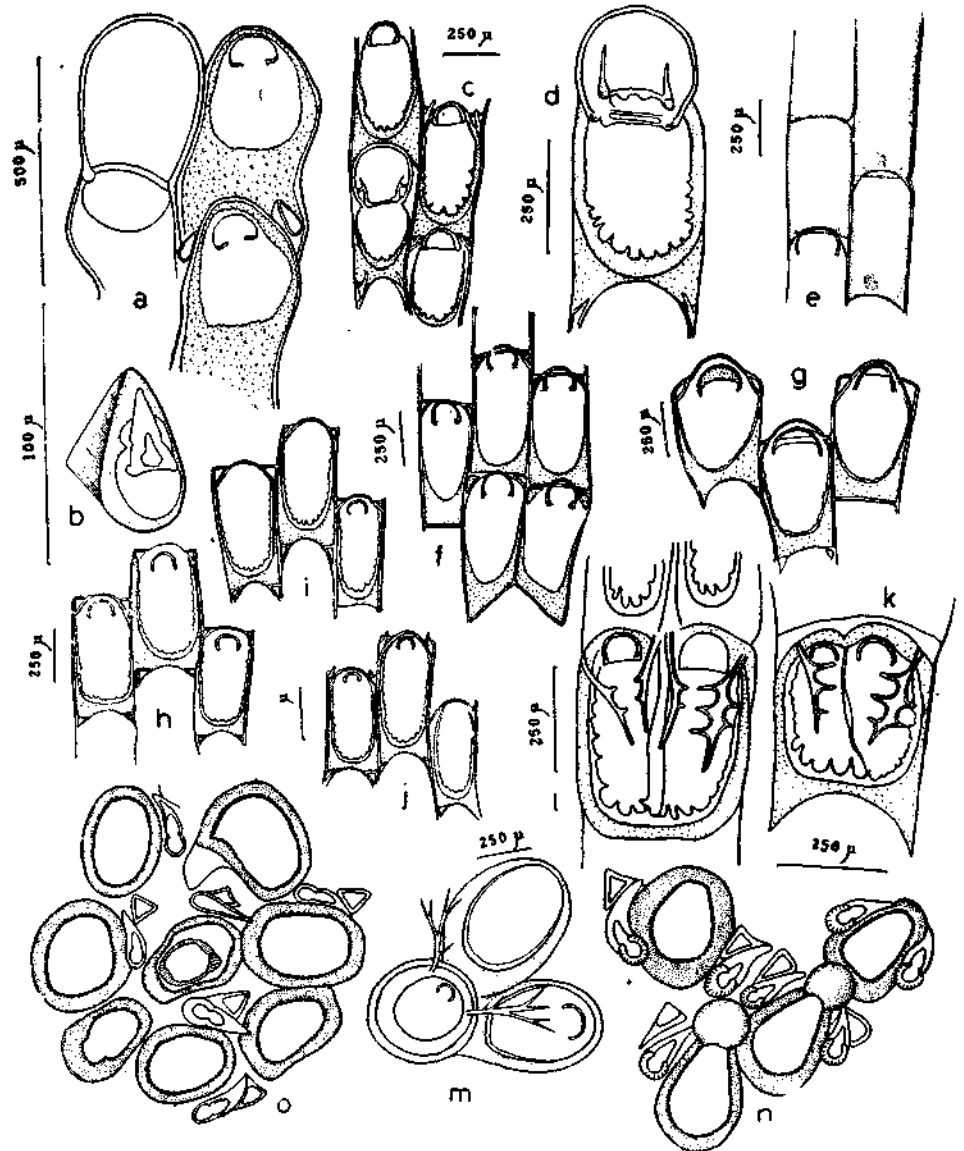


Fig. 4 a, b. *Antropora granulifera* (Hincks) - a. portion of a colony showing two zoecia and a vicarious avicularium, b. adventitious avicularium; c - m. *Alderina arabianensis*. sp. nov. - c. portion of a colony showing the details of zoecia, d. a fertile zoecium, e - i. zoecia at different stages of growth, m. ancestrula with two daughter zoecia; n, o: *Parellisina curvirostris* (Hincks) - n. fertile, zoecia and o. centre of a colony showing the details of zoecia and the ancestrula.

to make in this connection "as a number of encrusting colonies of *A. erecta* were also found in Japan, the erect nature of his form seems to be rather rare."

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Bonin Is., Pacific (Silen, 1941).

***Antropora granulifera* (Hincks) 1880 (Fig. 4 a, b)**

Antropora granulifera Osburn 1950, 52; Mawatari 1952, 262.

Occurrence : Three colonies were collected from dredged materials obtained from a depth of fifty metres off Cochin.

Measurements : Zooecium L - 400 μ , l - 260 μ .

Salient features : Encrusting on shells. Zoaria (preserved in alcohol) yellowish brown. Size of zooecia increases towards margin of colony. Zooecia arranged in longitudinal rows where substratum is smooth. Mural rim thin and corrugated. Walls heavily calcified. Gymnocyte wanting. Cryptocyst well developed, descending distally, highly tuberculated, invading slightly proximal border frequently straight but may be arched. Adventitious avicularia paired, placed at sides of zooecia distally. Slightly elevated rostra of the avicularia directed distally in a slanting manner towards median line (Fig. 4 a). The Mandible triangular and pointed (Fig. 4 b). Operculum membraniporine with a main marginal sclerite. Vicarious avicularia rare. Rostrum rounded distally, more than half the length of zooecium (Fig. 4 a). Two condyles present, to which attach ends of strongly calcified basal sclerite of mandible. No ovicell noticed. Spines wanting.

Remarks : This form agrees with the description of *Antropora granulifera* (Hincks) given by Harmer. He stated that the zooecia are separated by shallow grooves, but the zooecia in the present material do not seem to be separated by grooves. The length of the rostrum of the vicarious avicularium which Harmer found to be less than half the length of the zooecia is not applicable in this case (Fig. 4 a). The rostra of the adventitious avicularia are directed straight distally in certain cases. In this point the present form differs from what Thornely (1912) has observed in her material from Sri Lanka, where she found "the rostra directed towards one another." But based on Harmer's statement that "the avicularia vary in position, some being paired and transverse, especially in the more peripheral zooecia while others occur at the side of the opesia, the rostra having a distal direction." It seems that these differences are not much specific importance.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Distributed in warmer waters.

FAMILY : *Alderinidae* Canu and Bassler, 1927

***Alderina* Norman, 1903**

Alderina Osburn 1950, 59.

Entirely membranous frontal wall, crenulated side walls. Spines absent, nodular processes may be present, avicularia absent. Dietellae present. Ovicells usually single ribbed or with a depressed area.

Alderina arabianensis sp. nov. (Fig. 4 c - m; Pl. I C, D)

Occurrence: Several colonies were collected from glass panels used for the study of fouling organisms in Ernakulam Channel. This species attached readily on glass test panels, immersed in the environs of Cochin during the pre-monsoon period (February-May) of 1964, 1965 and 1966 (Menon and Nair, 1967 a).

Measurements : Zooecium L - 530 μ , l - 230 μ .

Salient features : Encrusting. Colonies flat and disc-like. Zooecia elongated, quadrangular, distal portion of preceding zooecium slightly overarches proximal portion of succeeding one. Aperture occupies three-fourth of front narrow distally. Gymnocyst present, slightly extensive proximally. Cryptocyst with spinules, size of spinules decreasing at distal portion of cryptocyst (Fig. 4 c). On disto-lateral corners of zooecium bordered at point of origin by two triangular areas are two spines which may be simple or branched (Fig. 4 k, l). Ovicells hyperstomial and ribbed (Fig. 4 d) Ancestrula possesses a pair of branched spines (Fig. 4 m).

Remarks: During colony formation it was noticed that triangular calcareous borders develop first and the spines develop subsequently. In young zooecia no spines are discernible (Fig. 4 e-h) even though the triangular areas are present. In older colonies towards the centre, spines are well developed, and colonies 25 days old collected during February contained zooecia with the distal spines branched many times (Fig. 4 k, l). These spines extend from the distal region up to the proximal end.

Ovicells are light brown in colour project well above the frontal plane of the zooecium as rounded helmets and are slightly sunk into the proximal region of the succeeding zooecium (Pl. I C, D). They occupy nearly one fifth of the zooecium distally. On the ectoecium frontally there are two ribs extending from the proximal region and tapering distally. These two are connected by a horizontal rib proximally (Fig. 4 d, Pl. I D). At the points where the lateral ribs join the horizontal one, there are two rounded projections. The opening for the escape of the embryo could be distinguished by the presence of a thickened rectangular frame with a transparent inner portion.

Ancestrula invariably bears a pair of branched spines distally (Fig. 4 m). Zooids were noticed with double polypides with an incomplete partition. These features occurred only in zooecia preceding a bifurcation (Fig. 4 j).

The isalient features of the present form are the simple or branched spines placed at the disto-lateral corners of the zooecium and the hyperstomial and complicately ribbed ovicells. As far as can be ascertained the genus *Alderina* Norman, contains not less than four recent species, of which the present form resembles *Alderina smitti* Osburn, 1950. It differs from *A. smitti* in the presence of branched spines placed at the disto-lateral corners of the zooecium and in the conspicuously ribbed ovicells. Mawatari (1965) states that "the peculiar ribbed ovicells and distal spines may indicate this form not to be identical with *Alderina smitti*." Based on the differences noticed the present form is designated as a new species *Alderina arabianensis* and can be defined as follows:

Zooecia elongated, quadrangular, distal portion of preceding zooecium slightly overarches proximal region of succeeding one. Aperture occupies three-fourth of the front. Gymnocyst slightly extensive proximally. Cryptocyst with

spinules. Simple or bizarre branched spines placed at disto-lateral corners of zooecium, bordered at point of origin by triangular areas. Hyperstomial and ribbed ovicells. Ancestrula with a pair of branched spines.

Parellisina Osburn, 1940

Parellisina Osburn 1949, 1; 1950, 75.

This genus was erected by Osburn (1940) to include those species, formerly listed under *Membranipora* and *Calloscra* in which the avicularium is always associated with a heterozooecium or kenozooecium. The avicularium chamber is proximal to that of the kenozooecium and separated from it by a vertical wall.

Parellisina curvirostris (Hincks) 1862 (Fig. 4 n, o)

Parellisina curvirostris Osburn 1940, 361; 1950, 75; Mawatari 1952, 271.

Occurrence : Two colonies were collected from shell remains dredged off Quilon from a depth of 137 m.

Measurements : Zooecium L - 550 μ , 1 - 400 μ .

Salient features : Encrusting on shells. Size of zooecia varies usually small in central part of colony, size increasing towards periphery. Arrangement of zooecia arranged in longitudinal rows, with shallow grooves separating them. Gymnocyte vestigial, spines absent, opesia rounded or oval, when oval wider proximally. Steep, tuberculate and well calcified cryptocyst descend to opesia. Cryptocyst may or may not be extensive proximally. Paired adventitious avicularia present at distal sides of zooecia. Avicularium with slightly acute rostrum moderately raised distally and directed transversely inwards to zooecia. Triangular space present by side of rostrum distally. Ovicells present (Fig. 4 o), hyperstomial, half of which raised from surface. Distal region of the fertile zooecia raised and thickened. Only one vicarious avicularium (?) noticed near the ancestrula of one colony (Fig. 4 n).

Remarks : Though some differences are evident the present specimens seem to agree with the figure and description of *Parellisina curvirostris* given by Osburn (1950). The shape of the kenozooecium is in close conformity with what Osburn (1950) has described. These spaces are slightly sunk and the region directed to the proximal part of the avicularia is usually extended in certain cases. In one instance, it was noticed that the rim of the triangular space of the kenozooecium bore very small tubercles. The kenozooecium is separated from the avicularium by a vertical wall. The size and shape of the kenozooecia show variations. The rostrum of the avicularium which is placed transversely inwards is invariably raised from the zooecial plane distally in the present specimens. The cryptocyst of the avicularia is strongly calcified. The structure of the cryptocyst of the autozooecium is very similar to that of *Ellisina curvirostris* Harmer. A single vicarious avicularium (?) was noticed in one colony placed near the ancestrula. The solitary representation of the vicarious avicularium is an interesting feature. The structure of this vicarious avicularium is very much similar to the ancestrula of the colony.

Previous records from Indian waters : Arabian Sea (Menon and Nair, 1967).

Distribution : Enjoys a wide distribution.

NOTES ON GEOGRAPHICAL DISTRIBUTION

Limited knowledge of the faunistic composition of the polyzoans of the Indian Ocean makes any detailed consideration of the distributional aspects of the various species extremely difficult. The observation of Vigeland (1958) that "owing to the frequently doubtful determination of the various tropical species as well as defective knowledge of their actual occurrence, it is hardly possible to give any reliable estimate of their geographical distribution, whether as relates to the Bryozoa in general or within any definite region" is noteworthy in this connection.

TABLE 1. Geographical distribution of 15 species of Polyzoa recorded from the southwest and southeast coasts of India

Species	Cosmopolitan except Polar waters	Circum-tropical	European Atlantic	Indian waters	Sri Lanka	Indo-Australian Archipelago	N. E. Pacific (Pacific Coast of N. America)	S. W. Pacific (Pacific Coast of S. America and Galapagos)	N. W. Atlantic (Atlantic Coast of N. America)	Atlantic Coast of Africa and Maderia
<i>Membranipora membranacea</i>	+									
<i>M. savartii</i>	+									
<i>M. amoyensis</i>				+						
<i>Electra crustulenta</i>				+			+			+
<i>E. bengalensis</i>				+			+			
<i>Conopeum reticulum</i>	+									+
<i>C. commensale</i>				+						
<i>C. eriophorum</i>				+		+	+			
<i>Caleschara levinsenii</i>				+		+				
<i>C. mexicana</i>				+					+	
<i>Crassimarginatella kumatae</i>				+						
<i>Cupuladria indica</i>				+						
<i>Antropora erecta</i>				+						
<i>A. granulifera</i>				+	+					
<i>Parellisina curvirostris</i>		+	+	+		+		+	+	

It is clear from Table 1 that there is similarity in the polyzoan fauna of the Indo-Australian Archipelago and the Pacific with that of the Indian Ocean. There is a free inter-change of water through the Malay region and the straits of Malacca (Sewell, 1948). This free inter-change of water between the two oceans would naturally result in a free transport of both larvae and adults through drift material, etc. The similarity in the fauna may be owing to this. The cosmopolitan distribution of species like *Membranipora membranacea*, *Membranipora savartii* and *conopeum reticulum* all of which have been previously recorded from ships or floating structures explains that navigation and other artificial transport like drift material, floating sea weeds, etc. play an important role in the dispersal of colonies of these forms. But survival in the case of artificial distribution of colonies is primarily dependent on temperature and those eurythermal species may be able to spread over wide areas of the oceans.

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