VIII. REPORT ON A COLLECTION OF BRYOZOA FROM THE BAY OF BENGAL AND OTHER EASTERN SEAS.

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The collection of bryozoa here reported upon was sent me by Dr. Annandale, Superintendent of the Museum at Calcutta, India. It consists of bryozoa obtained, for the most part, at various points on the coast of India and from various depths in the Bay of Bengal and vicinity. Both shore and deep water species are included, the bathymetric range varying from a few to several hundred fathoms.

The specific identification is accompanied with one or two synonyms only, referring both to a description and a plate, the endeavour being simply to make the identification intended unmistakable. In case the plate referred to is not easily accessible, or in those instances in which new species are described, drawings are given together with a description. No attempt has been made to give a complete synonymy, the authority adopted being that of Miss Jelly (1889). Any departure from this has been chiefly on the authority of Waters, especially as given in his recent papers on the Red Sea (1909) and the Zanzibar (1913) faunas.

This collection contains representatives of forty-five genera and ninety-five species. Of these nine species and one variety are thought to be new to science. Two genera, *Kinetoskias* and *Farciminaria*, are of special interest, since not only are they from abyssal depths, but also while possessing undoubted characteristics of these two genera, the two species by which they are represented possess other characters which link them to other but probably related genera in a manner not hitherto shown. Considerable interest attaches to certain membraniporas found in brackish waters. Three such are considered new to science. Their membraniporidan character was early recognized but certain other characters were extremely puzzling, and it was not until the work of Stoliczka (1869) on *M bengalensis* was discovered that their true nature was revealed. Judging from the work done by Dr. Annandale on brackish water forms together with these river species of *Membranipora*, India abounds in brackish water variational forms of much interest.

Considerable difficulty has been encountered in this investigation since the writer has been unable in most cases to secure actual specimens for comparison. My thanks are specially due to Professor Trevor Kincaid in so cordially lending the facilities of

the Department of Zoology and of the Library of the University of Washington for the furtherance of this work.

List of Species treated.

1. *Aetea truncata*, Landsborough
2. *Synnotum aviculare*, Pieper.
3. *Catenaria lafontii*, Aud.
4. *Scrupocellaria cervicornis*, Busk.
5. ,, *jolloisii*, Aud.
6. ,, *pilosa*, Aud.
7. ,, *macandrei*, Busk.
8. *Canda retiformis*, Pourtales.
9. *Caberea lata*, Busk.
10. *Diploecium simplex*, Kirk.
11. *Bugula neritina*, Linn.
12. ,, ,, var. *minima*, Waters.
13. *Beania ostia*, sp. nov.
14. ,, *conferta*, MacG.
15. *Kinetoskias arabianensis*, sp nov.
16. *Farciminaria andamanensis*, sp. nov.
17. *Cellaria salicornoides*, Lamx.
18. *Farcimia oculata*, Busk.
19. *Flustra cribriformis*, Busk.
20. ,, *rizophora*, Ortmann.
21. *Membranipora cervicornis*, Busk.
22. ,, *curvirostris*, Hincks.
23. ,, *incrustans*, Waters.
24. ,, *lacroixii*, Aud.
25. ,, *perfragilis*, MacG.
26. ,, *simplex*, Busk.
27. ,, *tehuelcha*, D'Orb.
28. ,, ,, var. *intertuberculata*, Waters.
29. ,, *trifolium* var. *minor*, Hincks.
30. ,, *spinostoma*, sp. nov.
31. ,, *amoyensis*, sp. nov.
32. ,, *devinensis*, sp. nov.
33. ,, *hugliensis*, sp. nov.
34. *Megapora ringens*, Busk.
35. *Steganopora magnilabris*, Busk.
36. *Thalamoporella rozieri*, Aud.
37. *Smittipora abyssicola*, Smitt.
38. *Cribrilina radiata*, Moll.
39. ,, *punctata*, Hassall.
40. *Microporella ciliata*, Pallas.
41. ,, *distoma*, Busk.
42. ,, *impressa*, Aud.
43. ,, *malusii*, Aud.
44. ,, *yarraensis*, Waters.
45. *Porina tubulosa*, Norman.
46. *Tubucellaria cereoides*, Ell. and Sol.
47. *Schizoporella auriculata*, Hassall.
48. ,, *biaperta*, Michelin.
49. , *brunnescens*, Ortmann.
50. ,, *cecilii*, Aud.
51. ,, *linearis*, Hassall.
52. ,, ,, form *quincuncialis*, Hincks.
53. ,, *nivea*, Busk.
54. ,, *pertusa*, Esper.
55. ,, *dutertrei*, Aud.
56. ,, ,, var. *foliacea*, nov.
57. *Lepralia adpressa*, Busk.
58. ,, *depressa*, Busk.
59. ,, *feegeensis*, Busk.
60. ,, *turrita*, Smitt.
61. *Escharoides occlusa*, Busk.
62. *Petralia laccadivensis*, sp. nov.
63. ,, *vultur*, Hincks.
64. ,, ,, var. *armata*, Waters.
65. *Smittia landsborovii*, Johnston.
66. ,, *marmorea*, Hincks.
67. ,, *nitida*, Verrill.
68. ,, *trispinosa*, Johnston.
69. ,, ,, var. *producta*, Thornely.
70. ,, *latiavicularia*, Kirk.
71. *Retepora delicatula*, Busk.
72. ,, *porcellana*, MacG.

73. *Retepora punctiligera*, Ortmann.
74. *Reteporella minor*, Ortmann.
75. *Haswellia australiensis*, Haswell.
76. *Adeonella japonica*, Ortmann.
77. ,, *platalea*, Busk.
78. ,, *marginata*, sp. nov.
79. *Lagenipora costazii*, Aud.
80. ,, *tuberculata*, MacG.
81. *Holoporella aperta*, Hincks.
82. ,, *tridenticulata*, Busk.
83. ,, *mammillata*, Busk.
84 *Cupularia canariensis*, Busk.
85. *Crisia* sp?
86. *Filisparsa tubulosa*, Busk.
87. *Idmonea atlantica*, E. Forbes.
88. ,, *gracillima*, Busk.
89. *Entalophora raripora*, d'Orb.
90. *Lichenopora radiata*, Aud.
91. *Domopora truncata*, Jameson.
92. *Alcyonidium mytili*, Dalyell.
93. *Amathia semiconvoluta*, Waters.
94. *Zoobotryon pellucidus*, Ehrenberg.
95. *Pedicellina cernua*, Pallas.

ABBREVIATIONS USED IN TEXT-FIGURES.

av. avicularium.
av.ar. avicularian area.
av.zoe. avicularian zoœcium.
b.j. break joint.
ba.sp. basal spine.
chi.r. chitinous rim.
de.mus. degenerating muscle.
de.poly. degenerating polypide.
emb. embryo.
fer.zoe. fertile zoœcium.
l. lobe.
lat.sp. lateral spine.
mus. muscle.
nu.zoe. nutritive zoœcium.
oe. oœcium.
oe.zoe. oœcial zoœcium.
op. operculum.
op.r. opercular rim.
op.sp. opercular spine.
p. pore.
ped.av. pedunculated avicularium.
pl. plate.
pr. process.
pri.mo. primary mouth.
re.ele. reproductive elements.
ses av. sessile avicularium.
sh. sheath.
sp.av. spatulate avicularium.
st. stomach.
t.ba. tubular base.
um. umbo.
zoe. zoœcium.

CHEILOSTOMATA.

1. Aetea truncata, Landsborough.

Aetea truncata, Robertson, 1905, vol. 2, no. 5, p. 246, pl. iv, figs. 5, 6.

A mere fragment growing on a piece of shell together with other Bryozoa. Obtained on the Pearl Banks, Ceylon, depth unknown. This species seems to be a northern form which has strayed south. It is present as a shore form on the coast of Alaska, has been obtained on a holdfast at La Jolla, California, at a depth of two fathoms, and is reported from Zanzibar at eight fathoms.

2. Synnotum aviculare, Pieper.

Synnotum aviculare, Hincks, 1886, ser. 5, vol. 17, p. 257.
Synnotum aviculare, Robertson, 1905, vol. 2, no. 5, p. 286, pl. xiv, figs. 84, 85.

Mr. Waters (1913) criticises my identification of *S. aviculare* obtained from the coast of California, considering that the species there obtained is *S. contorta.* After examining the specimen from Madras Harbour I am the more inclined to the opinion that the California species is identical with the species in this collection and that both are *S. aviculare.* A piece of a colony growing with *B. neritina* obtained from Madras Harbour; also found at a depth of 6 to 8 fathoms, growing on cinder at the entrance to Palk Straits.

3. Catenaria lafontii, Audouin and Savigny.

Catenaria lafontii, Harmer, 1902, vol. xlvi, p. 305, pl. 17, fig. 49.

Obtained at three stations in Madras Harbour, dredged at from 6 to 8 fathoms; also at Mergui, Burma.

4. Scrupocellaria cervicornis, Busk.

Scrupocellaria cervicornis, Busk, 1852, pt. i, p. 24, pl. lxii.

Common in Madras Harbour at depths of from 4 to 6 fathoms, obtained also at the entrance to Palk Straits and at Mangalore, west coast of India.

5. Scrupocellaria jolloisii, Audouin and Savigny.

Scrupocellaria jolloisii, Waters, 1909, p. 132, pl. 10, figs. 5-10.

A common species in this vicinity obtained at several localities: Mangalore, Gaspar Straits, Malay Archipelago and Mergui, Burma. Also dredged at depths of from 30 to 24 fathoms off the Ganjam coast and at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) at depths of from 49 to 40 fathoms.

6. Scrupocellaria pilosa, Audouin and Savigny.

Scrupocellaria pilosa, Waters, 1913, p. 478, pl. lxviii. figs. 3, 4.

Found growing on cinder at depths of from 6 to 8 fathoms, at the entrance of Palk Straits.

7. Scrupocellaria macandrei, Busk.

Scrupocellaria macandrei, Busk, 1852, pt. i, p. 24, pl. xxiv, figs. 1-3.

Dredged at 31 fathoms at Mangalore, west coast of India.

8. Canda retiformis, Pourtales.

Canda retiformis, Waters, 1913, p. 479, pl. lxix, figs. 1, 2, 6.

Obtained at the Andamans growing on coral; also at station 287 (Arabian Sea, 21°8′30″ N. 65°47′ E.) and dredged at 34 fathoms in 81°16′ E., 6°01′ N.

9. Caberea lata, Busk.

Caberea lata, Busk, 1852, pt. i, p. 39, pl. xlix.

Obtained off Ganjam, east coast of Madras Presidency, at 24 to 30 fathoms.

10. Diplœcium simplex, Kirkpatrick.

Diplœcium simplex Kirkpatrick, 1888, ser. 6, vol. 1, p. 73, pl. vii, fig. 1.

Zoarium consisting of many branches composed of relatively short internodes, the whole forming bushy tufts 25 or 30 mm. in height. *Internodes* separated by chitinous joints which form in place of the two distal zoœcia of the internode, and consisting commonly of eight zoœcia although varying in number from four to twelve. *Branching* dichotomous. *Zoœcia* arranged in pairs, back to back, each pair at right angles to the preceding pair (Fig. 1), tubular, somewhat wider in the middle. Zoœcial wall delicately calcareous, and regularly porous. *Orifices* rounded above with a sinus on the lower margin. Oœcia porous, somewhat flattened, closed by the operculum, lower margin curved so that the orifice of the fertile zoœcium is larger than that of an ordinary zoœcium. In older parts of the colony the rim of the oœcia is somewhat thickened, due probably to increased calcification.

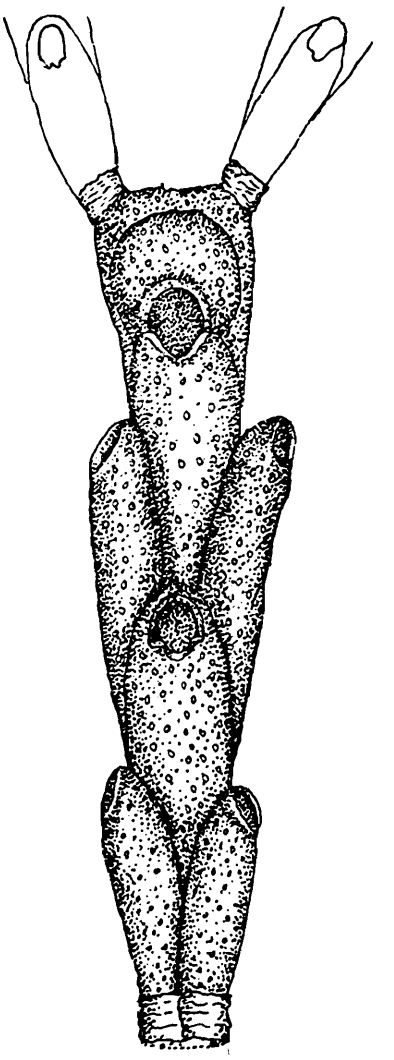

FIG. 1—*Diplœcium simplex* Kirk. × 40.

The species here identified differs slightly from that described by Kirkpatrick, notably in the greater size of internodes and in the shape of the oœcio-zoœcial orifice. The latter is thought to be an important difference, perhaps of specific value. For the present, however, these differences will be considered mere variations of the original species. This species is a puzzling one and it is doubtful, as Kirkpatrick remarks, just where it belongs in the present classification of the bryozoa.

Obtained at station 47, off mouth of Godaveri R., 5–6 fathoms. Probably dredged or taken in tangles, judging from the condition of the material. Miss Thornely reports this species from the Andamans at 17 fathoms.

11. Bugula neritina, Linnaeus.

Bugula neritina, Waters, 1909, p. 135, pl. xi, figs. 1-3.

Abundant in Madras Harbour, often growing in large masses with hydroids and other bryozoa; in one instance entangled in *Zoobotryon pellucidus*. Dredged at depths varying from 4 to 6 fathoms.

12. **Bugula neritina**, var. **minima**, Waters.

B. neritina, var. *minima*, Waters, 1909, vol. xxxi, p. 136, pl. ii. figs. 4, 7.

Small piece of a colony dredged at 31 fathoms, 21 miles S. W by W of Mangalore, west coast of India.

13. **Beania ostia**, sp. nov.

Zoarium forming a flat lace-like mass growing on old pieces of bone. *Zoœcia* boat-shaped, each connected with its neighbour by four tubes of approximately equal length (Fig. 2). *Aperture* occupying the whole or almost the whole of the front. Five short *spines* at the distal extremity. In a few instances there are but four spines, the margin between the second and fourth being raised, much curved and bounded by a strong chitinous rim.

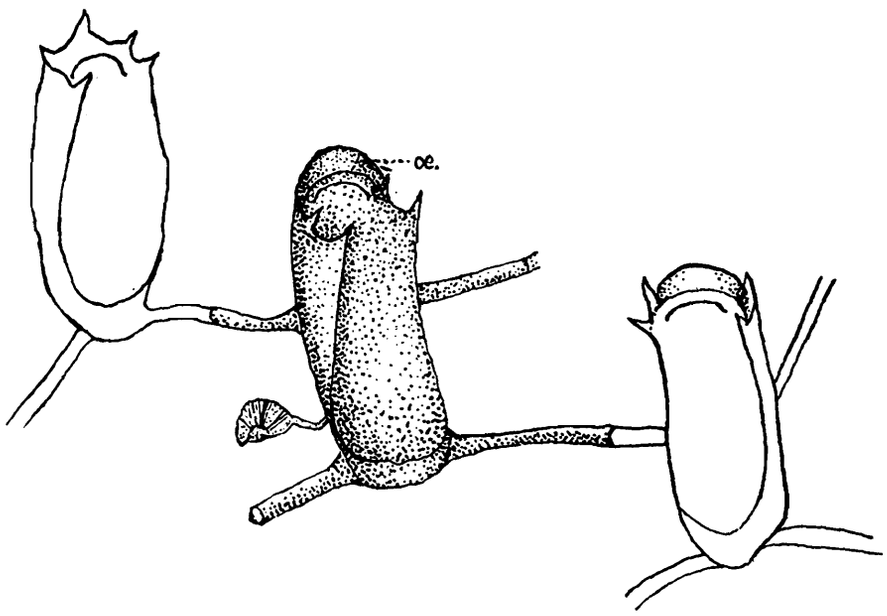

Fig. 2.—*Beania ostia*, sp. nov. × 50.

This is thought to represent the *oœcium* (*œ.*). In one instance only has an *avicularium* been found, although many zoœcia have been examined. Unfortunately the material became dry before it could be studied, and hence very brittle. On a few zoœcia there are indications of the remains of an avicularium but nothing that can be positively so regarded. *Avicularium* small, pedunculated, situated at one side near the base of the aperture.

Obtained at Gopalpore, east coast of India, dredged at depths of from 25 to 28 fathoms.

14. **Beania conferta**, MacGillivray.

Beania conferta, MacGillivray, 1886, vol. xxii, p. 130, pl. 1, fig. 5.

A minute quantity growing with *F oculata* on a worm tube, obtained at Gaspar Straits, Malay Archipelago.

15. Kinetoskias arabianensis, sp. nov.

Zoarium incomplete, consisting of a single stem with a few branches at the distal end and breaking into a number of rootlets at the attached end. The stem is composed of a number of radical tubes, and of zoœcia which are smaller and stiffer than the zoœcia of the distal branches, the two forming a stalk or stem which is probably flexible in the natural state but sufficiently rigid to hold the crown of branches two or more inches above the ocean-floor. That the substratum in which this specimen grew is similar to that usually described for *Kinetoskias* is shown by the globigerina and other shells, and grains of sand adhering to the finest rootlets. The branches at the distal end consist of zoœcia in two series, the zoœcia of each series forming an acute angle with the zoœcia of the other.

The adult or nutritive zoœcia (Fig. 3, A) are very long and may be considered to consist of two parts or regions, the zoœcia proper (*zoe.*) and the tubular base (*t.ba.*) more or less independent of the former, and into which the polypide does not extend. Indeed, the connection between it and the main body of the zoœcium is easily and frequently broken, in which case the tubular portion remains attached to the zoœcium from which it sprang, while the main portion is lost. Outlining each zoœcium and thus strengthening the rim is a chitinous border. At the point of union of the zoœcium proper and the basal prolongation, the chitinous rim is frequently bent inward forming a weakened place or break joint (*b.j.*). At the distal end of the zoœcium the chitinous margin grows thinner and there forms a blunt point. The wall of the zoœcium is delicate and transparent, the *orifice* is formed by the opening of a broadly semicircular lip bounded by a heavy chitinous bar. Both sessile and pedunculated *avicularia* occur. At the dorso-lateral angle of each zoœcium there is a sessile avicularium (*ses.av.*) with a mandible curved at the extremity and fitting into a chitinous groove. This avicularium is seated on a distinct area on the dorso-lateral wall to which the strong mandibular muscle is attached and which is outlined by a delicate rim (*C*, *av.ar.*). These avicularia frequently break off, in which case the area is exposed. On a few zoœcia only were frontal pedunculated avicularia found, attached to the lower inner margin (B, *ped.av.*). These have an extremely short peduncle, but the avicularia are relatively large. Through the transparent wall of the zoœcium the polypide is clearly visible especially in stained preparations. Within the zoœcium is found also a large and powerful muscular organ (A,B, *mus.*). This is composed of two groups of muscle fibres lying in the lower part of the zoœcium just above the tubular prolongation and spreading on two sides of the median line like two fans. Viewed from the front, the stomach of the contracted polypide is visible between the two groups of muscle fibres (A, *st.*).

In this colony there is but one fertile zoœcium. It arises as

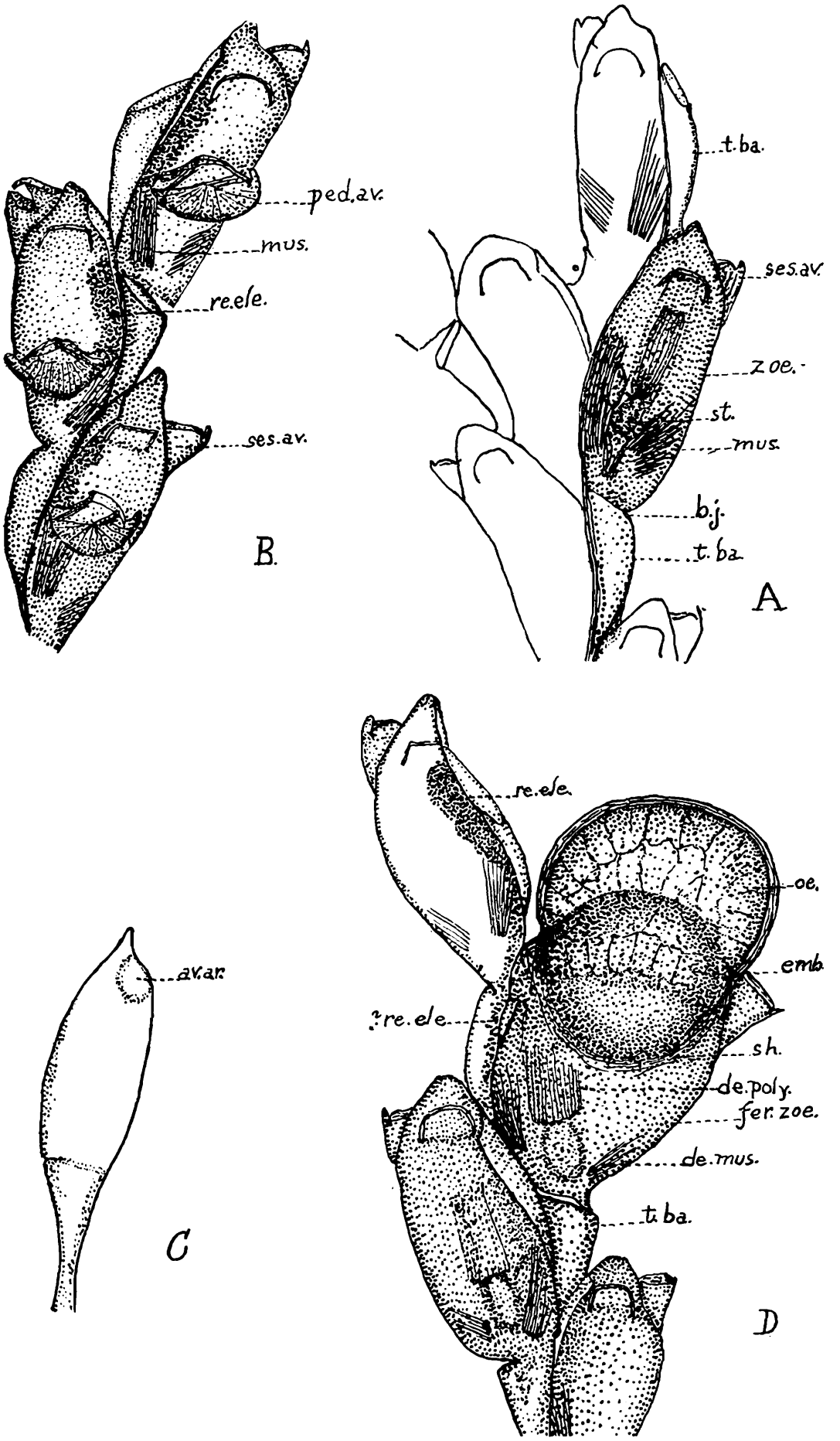

FIG. 3.—*Kinetoskias arabianensis*, sp. nov. × 40.

(*A*) Outlines of a few nutritive zoœcia showing detail in one.

(*B*) Three zoœcia possessing both pedunculated (*ped.av.*) and sessile avicularia (*ses.av.*).

(*C*) Dorsal surface of a zoœcium to show area from which a sessile avicularium has broken away (*av.ar.*).

(*D*) Three nutritive and one fertile zoœcia (*fer.zoe.*) to show especially the relative position and size of the latter, together with certain details: embryo (*emb.*), oœcium (œ.), sheath of embryo (*sh.*), degenerating polypide (*de. poly.*) and muscles (*de. mus.*).

do the nutritive zoœcia, and indeed is a transformed nutritive zoœcium. It also consists of two parts, a much enlarged zoœcium proper and a basal prolongation (Fig. 3, D). The zoœcium proper, again, consists of two parts. These may be distinguished by a difference in the texture of the wall, the lower half being membranous, the upper half being thickened and strengthened by delicate calcareous plates (*fer.zoe.*). The calcareous wall of the upper half is bulging and rounded and obviously forms a brood sac or *oœcium* (*oe.*). The dorsal and ventral walls of this zoœcium unite distally and are bounded by broadly rounded chitinous bars, one forming the distal edge of the dorsal wall, the other forming the distal edge of the ventral wall, the whole closing the mouth of the oœcium through which the developed embryo (*emb.*) or larva eventually escapes. That the chitinous rim of the ventral wall is homologous with the operculum of the nutritive zoœcia is obvious when the muscular attachment of each is studied. The chitinous opercula possess a rather broad expansion at each end to which the opercular muscles are fastened. The chitinous rim of the oœcium possesses a similar expansion at each end to which muscle fibres are attached, and whose action presumably serves to open the oœcium. Conclusive proof that the fertile zoœcium is a transformed nutritive zoœcium is afforded by the presence within the fertile zoœcium of the degenerating remains of a polypide (*de. poly.*) and of parietal muscles (*de. mus.*). Lying above these is the large opaque body of the embryo suspended in a membranous sheath (*sh.*) and only partially enclosed by the calcareous wall of the ovicell. Traces of reproductive elements were found in a few zoœcia (B, *re. ele.*), and in each case these resemble testis rather than ovary. In the zoœcium adjoining the oœcium, what is regarded as testis is also found and it is perhaps significant that similar tissue extends into the basal prolongation of this zoœcium (? *re. ele.*). In no case has undoubted ovary been apparent.

Obtained at station 193, Arabian Sea, 72°28′45″ E. 15°11′ N., dredged at 931 fathoms.

This interesting specimen was obtained at a depth of 931 fathoms or from a depth of over a mile and is therefore to be regarded as an abyssal form. Considerable difficulty has been encountered in the attempt to identify it because, while it possesses features undoubtedly allying it with *Kinetoskias*, it possesses others which differ markedly from any known species of that interesting genus and which relate it to another family, viz. the Cellulariidæ.

It is allied to *Kinetoskias* by its unique muscular organ coupled with the possession of articulated avicularia, and by its abyssal habitat. It is allied to the Cellularians by the possession of sessile avicularia and by the structure of its peduncle, while the unique structure of the oœcium is unlike that of any Cheilostomatous ovicell known to the writer save one, that of *Cellularia cirrata*, Busk (1884), to which the species under consideration is related if not identical.

According to the discussion of the genus *Kinetoskias* presented by Busk (1881), this genus was originally established to embrace two peculiar abyssal species of bryozoa first described by Danielssen in 1867, later more fully by Koren and Danielssen. Among the Challenger bryozoa, Busk (1884) describes two new species of this genus obtained in the North Atlantic, the one from a depth of 1526 fathoms, the other from 265 fathoms. The distinguishing mark of these four species is the strong "parietal muscle arising near the base of the zoœcium and passing obliquely backwards and upwards expanding in a fan-shaped manner to be inserted into its hinder wall to the height of about one-third or one-fourth of the zoœcium." To quote further, the author adds, "the action of this muscle must be to draw the entire zoœcium downwards and forwards, or in other words, to bend it on itself, and thus by the concurrent action in many zoœcia to curl the branches forwards; an action that has in fact been noticed by Koren and Danielssen in the living condition."

It is clearly shown in the various figures that this Arabian species possesses the Kinetoskian muscle developed to a greater degree than it is in any of the species heretofore described. It is seen to arise at two points near the base of the zoœcium proper and to spread out in two directions forming a double muscle, that portion lying toward the inner side of the zoœcium being somewhat more strongly developed than that lying toward the outer side. The four species hitherto described agree in the possession of pedunculated avicularia, one for each zoœcium. One of the puzzling things about the *K. arabianensis* was the apparent lack of these structures. After a close and painstaking search three zoœcia were found, each of which possessed one. Whether the rest of the material is mutilated in this respect it is impossible to say. The union between these avicularia and the margin of the zoœcia is extremely delicate and may have been broken, leaving no trace. Certain it is that no traces of their former presence are visible. It is further noted that in this species the pedunculated avicularia are attached to the inside border, whereas in other species reported they are attached to the outside border.

In the discussion mentioned above Busk makes a point of the structure of the peduncle, considering it to be a specialized, highly differentiated structure, formed by a coalescence of radicle fibres. In the species he describes, the peduncle consists of transparent, homogeneous tissue, homologous, according to that investigator, with an internode of a root fibre. In the Arabian species the peduncle is a more primitive structure, consisting as does that of some Bugulas, its near relatives, of an intermixture of root fibres and zoœcia, the former twisting about the somewhat rigid zoœcia for a considerable distance before the stem thus formed divides into several branches. One root fibre at least continues upward on the dorsal side of each branch, while at the base the main stem again divides into a few coarse fibres, these into smaller and

smaller branches, the finest rootlets clasping minute objects in the substratum.

In so far the characters of the *K. arabianensis*, while differing somewhat from other members of this genus, do not remove it from the family Bicellariidæ to which Kinetoskias and the Bugulas belong. The two characters remaining to be discussed, viz. sessile avicularia and the peculiar structure of the oœcium are both unknown in that family. The former is a distinguishing mark of the family Cellulariidæ, and except in a slight difference in position the sessile avicularia on the Arabian species are similar to the lateral avicularia found on such Cellularians as *Menipea* or *Scrupocellaria*.

The unique oœcium of this species reveals a wholly unexpected dimorphism previously unknown in either of the two families mentioned above and only rarely occurring in the Cheilostomes. The only other Cheilostomatous bryozoan which shows a similar condition is *Adeonella* and its congeners where a trimorphism exists, resulting in nutritive zoœcia, reproductive or oœcial zoœcia, and zoœcia transformed into avicularia. In *Crisia*, a Cyclostome, there is found a dimorphic condition quite similar to that which obtains in *K. arabianensis*, in which a zoœcium grows to an unusual size and takes on the reproductive instead of the nutritive function. Unlike the oœcium of *Crisia* which never assumes the nutritive functions, the species found in the Arabian Sea first performs the nutritive function, indicated by the presence of a polypide, and only secondarily assumes the oœcial function.

The oœcial condition most nearly resembling that shown by *K. arabianensis* is found in *Cellularia cirrata*, Busk (1884). "The oœcium," as Busk remarks, "is formed by an entire metamorphosed zoœcium, with a wide opening closed by a broad valve having a semilunar chitinous border." At first glance, the occurrence of oœcia so unusal in structure and yet so similar externally would lead one to suspect close relationship between *C. cirrata* and the present species. And indeed for a time the two were thought to be identical. This opinion was strengthened by the facts that both are abyssal and both come from regions geographically similar. Busk, however, makes no mention of internal structure, but remarks that the material was in poor condition and much curled. He evidently found no articulated avicularia and no parietal muscles, and the characters which his specimen disclosed justified him in placing it in the Cellulariidæ. However he expresses a doubt that he is correct and remarks that perhaps a new genus should be established to receive his species. The occurrence of this peculiar oœcium in these two species leads one to wonder if *C. cirrata* and the species from the Arabian Sea are identical, especially when one reflects that the curled condition upon which Busk remarks might be caused by the contraction of parietal muscles and at the same time might make the detection of these muscles impossible.

The facts in regard to the reproductive elements and the reproductive processes which have been ascertained through a study of this material reveal a curious parallel between it and *Crisia* and other Cyclostomes. In both, testis is abundant while ovary is apparently correspondingly scarce. Is it perhaps true, as has been shown for *Crisia*, that but few ova are produced, or that ova arrive at maturity in but one zoœcium, or in but few zoœcia? Again, since, the ovicells and embryos are of such size and character it seems probable that zoœcia destined to become ovicells are early set apart for that purpose, and likewise possible, as in the Cyclostomes, that the ova are produced in the growing tissues and become secondarily united with a zoœcium. Judging from the size of the embryos together with their small number, the supposition that embryonic fission may occur here is not improbable, and increases the interest in this species as an object of study.

16. Farciminaria andamanensis, sp. nov.

Part of a colony consisting of a long stem and numerous branches (fig. 4, A). Stem incomplete, made up of four rows of aborted zoœcia arranged around an imaginary axis, four sided, the corners strengthened by chitinous bars or modified root fibres, from the inner edges of which strong teeth project into the interior of the zoœcia, the four zoœcia in each group at the same level so that the stem has a segmented appearance. At the distal end the stem divides into two branches connected for a short distance by a filmy membrane. The segmented appearance continues for four or six segments above the first branches when the second branching occurs, and the zoœcia from this point contain polypides. The branches, at first biserial, soon become tri- or quadriserial, the zoœcia assuming an alternate arrangement (fig. 4, B).

Branches lose their segmentation, and the zoœcia face outwardly and laterally. *Zoœcia* elongated, area occupying the whole of the front. *Orifice* at the summit closed with a protruding lip. No spines and no avicularia. No oœcia have been observed. In older parts of the colony rounded or oval bodies occur which may be embryos. These are always found, when they occur, in the upper part of the zoœcium, sometimes in company with a degenerating polypide, again with a regenerating one. These are not brown bodies.

Considerable hesitation is experienced in placing this specimen in this genus since the zoœcia are not all arranged around an imaginary axis, as is usually described for *Farciminaria*, but simply folded, as it were, one or two middle rows projecting forward and the two lateral rows turned somewhat, so that the zoœcia when viewed from the front are seen in profile. So many characters, however, both of the zoœcia and of the zoarium as a whole, are Farciminarian that it seems to belong here rather than with any allied genus.

In the absence of spines, avicularia, and oœcia this species resembles *Farciminaria hexagona*, Busk (1884). That species, however, has six series of zoœcia facing around the branch, the two inner rows consisting of sterile zoœcia only. There is also considerable resemblance between it and *Farciminaria simplex*, MacGillivray (1886). The Australian species has a prominent oœcium, and both description and plate are so meagre that identification by their means alone seemed impossible.

Material obtained at the Andamans (1899).

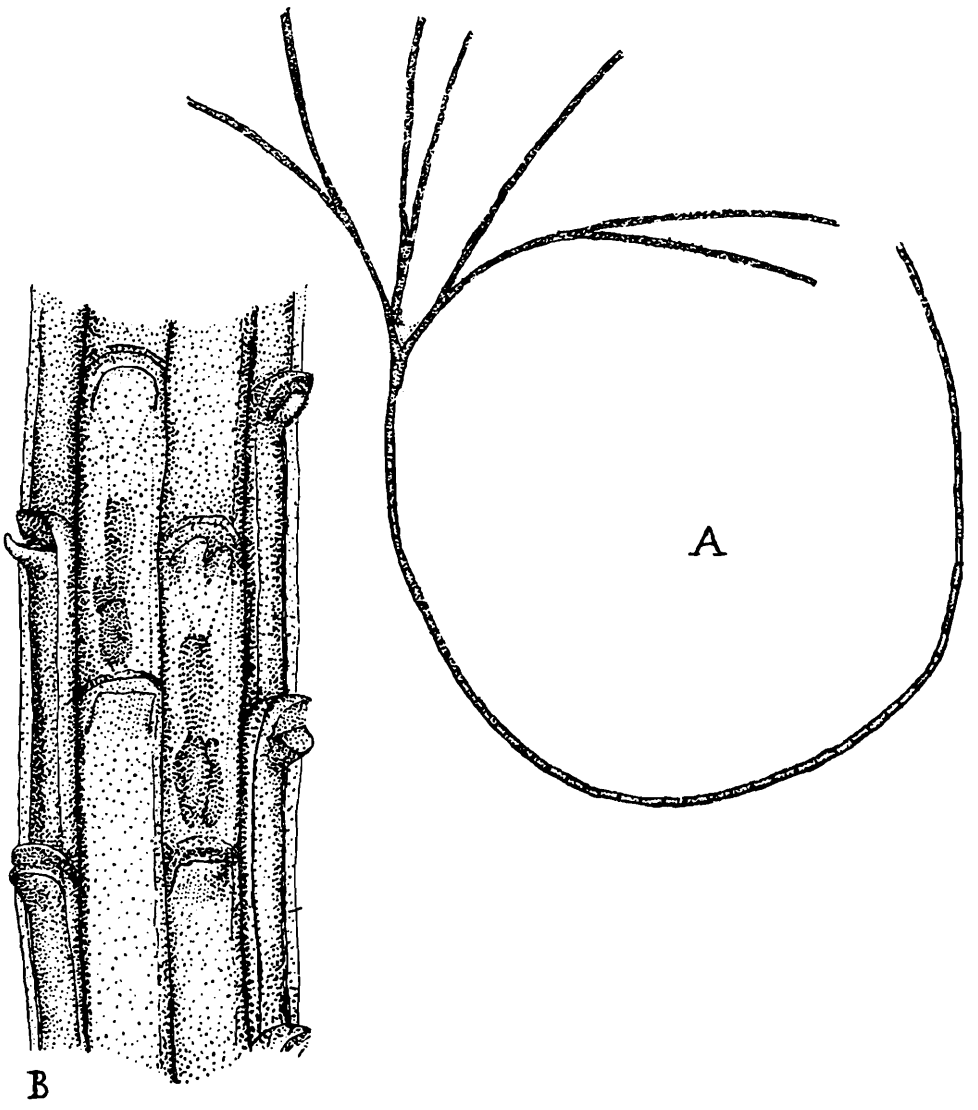

FIG. 4.—*Farciminaria andamanensis*, sp. nov.
A. Habit sketch. × 2.
B. A few zoœcia. × 50.

17. Cellaria salicornioides. Lamouroux.

Cellaria johnsoni, Hincks, 1880, p. 112, pl. xiii, figs. 9-12.

Obtained at one locality only, Santapilly, Madras (east coast).

18. Farcimia oculata, Busk.

Nellia oculata, Busk, 1852, pt. i, p. 64, fig. 6.

Extremely abundant, obtained at at least nine stations: Mergui; Palk Straits; Mangalore; Gaspar Straits; Ganjam coast; Ancutta Reef, Laccadives, Gopalpore.

19. Flustra cribriformis, Busk.

Carbasea cribriformis, Busk, 1884, vol. x, p. 50, pl. xxx.

Zoarium dry and in fragments, but fenestrated condition very apparent. Zoœcial characters agree with description as given by Busk. This material contained many embryos in various stages of growth. When full grown, the embryos hang suspended in a bag or membrane, the distal end shoved into the shallow oœcium while the larger portion extends into the zoœcium, about filling the upper half.

Obtained at Singapore.

20. Flustra rhizophora, Ortmann.

Carbasea rhizophora, Ortmann, 1890, p. 27, taf. i, fig. 24.

Dredged at 31 fathoms, 21 miles S.W by W of Mangalore, east coast of India.

21. Membranipora cervicornis, Busk.

Membranipora cervicornis, Busk, 1854, pt. ii, p. 60, pl. C, fig. 3.

Obtained at two stations at the entrance to Palk Straits, 3 miles N.N.W of Pt. Pedro, dredged in sand at from 6 to 8 fathoms.

22. Membranipora curvirostris, Hincks.

Membranipora curvirostris, Hincks, 1880, p. 153, pl. xx, figs. 5, 6.

Dredged off the Ganjam coast at from 24 to 30 fathoms.

23. Membranipora incrustans, Waters.

Membranipora incrustans, Waters, 1898, p. 686, pl. 47, fig. 13.

Obtained at entrance to Palk Straits and on Ancutta Reef, Laccadives.

24. Membranipora lacroixii, Audouin.

Membranipora lacroixii, Busk, 1854, pt. ii, p. 60, pl. 69, fig. 1.

Found growing on shells and pieces of bamboo at Puri beach, Orissa coast. Also growing on crab.

25. Membranipora perfragilis, MacGillivray.

Membranipora perfragilis, Hincks, 1884, ser. 5, vol. xiv, p. 278, pl. viii, fig. 4.

Abundant in this collection, being found at nine or ten stations: Madras; Mergui, on the Brig "Cassandra;" off Akyab, Arrakan coast at 17 fathoms; Puri beach and Black Pagoda, Orissa coast; Virkalay, Travancore coast; at Andamans Is.,; off Carwar and Molki, and Gopalpore. Also at stations 468 (Andaman Is., Port Blair Harbour); st. 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) at 49 to 40 fathoms, and st. 532 (Mergui Archipelago, 12°15′20″ N., 97°10′10″ E.), 62 fathoms.

26. Membranipora simplex, Busk.

Nellia simplex, Busk, 1852, pt. i, p. 19, pl. lxv, fig. i; pl. lxv (bis), fig. 3.

Obtained at Santapilly and at Madras.

27. Membranipora tehuelcha, D'Orbigny.

Membranipora tehuelcha, Robertson, 1908, p. 265, pl. 15, figs. 16, 17; pl. 16, fig. 18.

More or less abundant at Puri beach, Orissa coast on bits of wood, also at station 380 (off Akyab, Burma, 19°8′ N., 92°59′ E.), said to be dredged at 530 fathoms, but since the specimens were growing on sea weed this is thought to be doubtful. [The weed on which it grew commonly floats on the surface. *N. A.*]

28. Membranipora tehuelcha var. intertuberculata, Waters.

M. tehuelcha var. *intertuberculata,* Waters, 1898, p. 676, pl. 48, figs. 1, 2.

Obtained from two localities, Puri beach, Orissa coast and from tide pools at Kyouk-Phyu, Burma. In the adult stage this variety assumes a most fantastic appearance due to the elevated, folded, spinous walls. The tubercles are often more numerous and fantastic than represented by Waters, mere seasonal or environmental variations, probably, of this cosmopolitan species.

29. Membranipora trifolium var. minor, Hincks.

Membranipora trifolium var. *minor,* Hincks, 1885, ser. 5, vol. 15, p. 255, pl. viii, fig. 7.

Obtained at Mangalore at 31 fathoms, and at the Andamans; also off Ceylon at 703 fathoms, growing on shell.

30. Membranipora spinostoma, sp. nov.

Zoarium loosely incrusting a stem. *Zoœcia* irregularly quadrangular with a broad calcareous border crenulated on the inner margin (fig. 5, A). *Aperture* membranous, occupying the whole of the front. *Operculum* large, with a heavy chitinous rim, opening close to the calcareous border. The spinal adornment of operculum and area constitutes the unique feature of this species. Spines occur in three locations: (1) on the margin of the area, (2) on the operculum; (3) below and at each extremity of the operculum. *Spines* on the margin of the area, delicate, finely pointed, varying in number from 12 to 15 placed regularly, to a few at irregular intervals. *Spines* on the operculum (fig. 5, A, C) heavy, chitinous, arranged in two rows, alternate, at least six, usually eight in number, one springing from near the base of the operculum, the other about half way from the base, stiff, longer than the width of the operculum, directed upward or toward and beyond the distal border (C, *op.sp.*). Two *lateral spines* at the extremities of the opercular bar invariably present. These grow in sockets and are movable in two directions, upward and downward.

(A, B, C, *lat.sp.*). In their slenderness, length and mobility they resemble vibracula. In the space between these lateral spines or vibracula, other spines, from one to four in number, are sometimes found springing from the top of the area and extending stiffly downward. These are more or less inconstant being apparently easily broken.

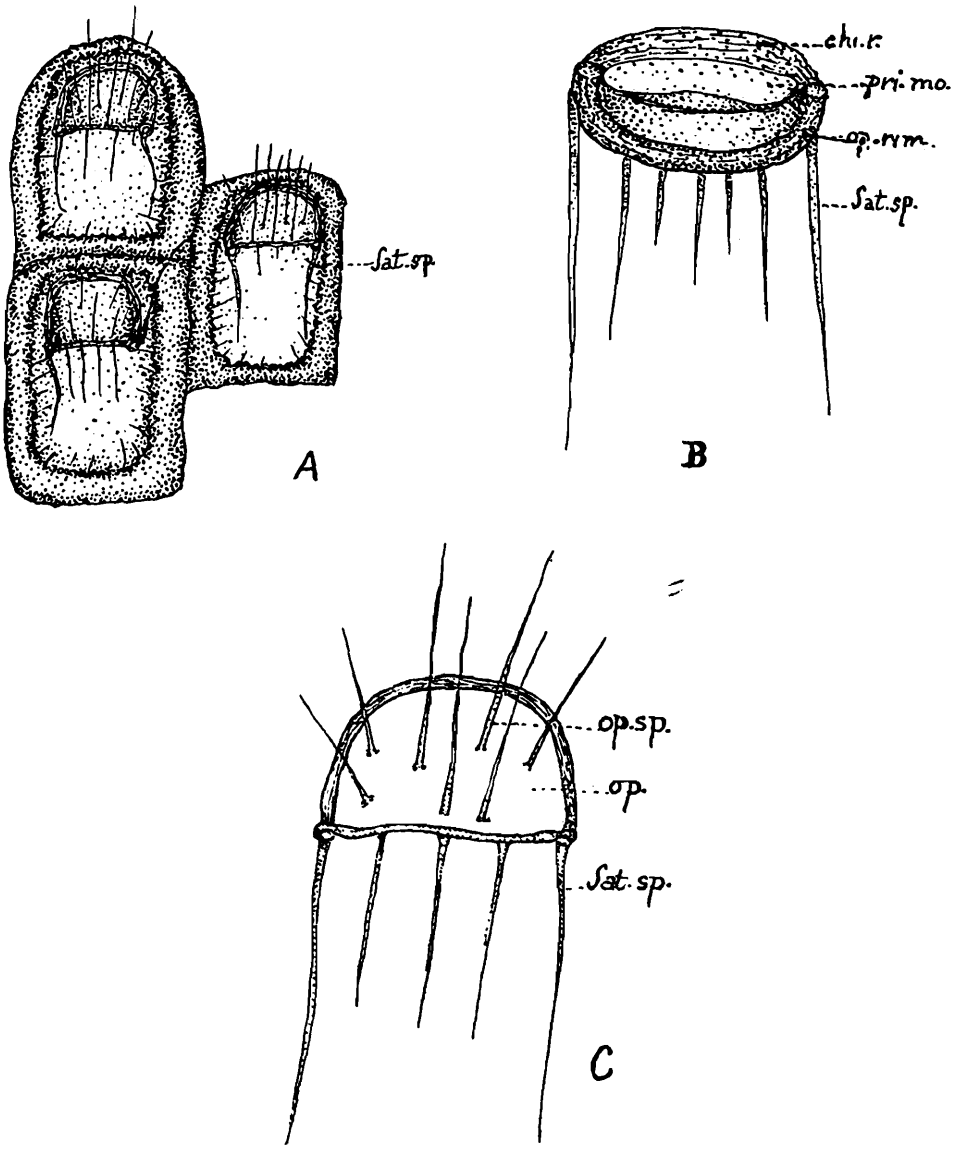

FIG. 5.—*Membranipora spinostoma*, sp. nov.
A. Three zoœcia, ×25.
B. Operculum thrown widely open showing the inner surface, primary mouth (*pri.mo.*) and chitinous rim above it. × 100.
C. A magnified view of operculum and opercular spines. × 100.

Obtained at station 352, Persian Gulf, 29°20′ N., 48°47′ E., at a depth of 13 fathoms.

The material upon which these observations are made is dry, hence brittle and difficult to study. The upstanding spines on the operculum serve to catch and hold debris, thus increasing this difficulty. In Figure 5, B, showing the operculum thrown back and revealing the inner surface, the primary mouth (*pri.mo.*)

seems to consist of a slit or opening under the operculum. Above and close to the calcareous margin is a rather broad, delicate, semi-chitinous rim (*chi. r.*) against which the spiny operculum closes. The space formed by the opening of the operculum constitutes a secondary mouth. Moreover the heavy operculum frequently tears away from the delicate membrane of the area, leaving an opening between operculum and area having the appearance of a mouth. This was confusing until, after soaking small pieces in oil for a few hours, then teasing on a slide, instances were found in which the operculum was thrown back and opened as in fig. 5, B. It is important that this species be examined further, either fresh or preserved in alcohol.

BRACKISH WATER MEMBRANIPORA.

The three species of *Membranipora* which follow belong to brackish-water forms similar to *Membranipora bengalensis* described by Stoliczka (1869). That investigator found this species in a tank of water only one-fifth as saline as sea-water. Later he found it distributed throughout that region of India known as the Sunderbans, incrusting old pieces of wood, or trunks of trees at the mouths of rivers and on the shores of salt lakes, but never in fresh water. In his description of this species, Stoliczka remarks that he has observed similar forms incrusting shells and fragments of wood in various places along the coast of Bengal Bay, but had not succeeded in obtaining specimens which were in a good state of preservation.

In this collection there are three species of Membranipora which have proved most puzzling until the description and plates of *M bengalensis* were obtained. These three species resemble each other and *M bengalensis* in several features: (1) in the loose connection existing between the zoaria and the substratum, and often between the zoœcia themselves; (2) in the possession of delicate chitinous rather than calcareous lateral walls, together with an extremely delicate calcareous wall over portions of the front of the zoœcia, (3) in the development, as a rule, of conspicuous spines which are highly characteristic and distinct for each species. Like *M bengalensis* also, all grow on wood more or less sodden or on shells of brackish-water mollusks.

31. **Membranipora amoyensis,** sp. nov.

Zoarium loosely incrusting a shell and in places forming bilaminar folds. *Zoœcia* large, quadrangular, alternate, separated by thickened lines (fig. 6). *Aperture* occupying more than half the front. *Operculum* semicircular, large, situated close to the top. Aperture surrounded by a calcareous margin from which project numerous small calcareous *spines*, 17 or 18, or perhaps 10 to 12, depending on the size of the zoœcium. On young zoœcia a single stout spine on each side at the upper angles. On older

zoœcia this spine becomes trifid, one branch usually extending outward, one upward and one downward. No *oœcia* have been found.

This species was obtained from Amoy, China. No other data given. The material incrusts a shell which is judged to be from water only slightly saline since, while calcareous, it is extremely soft and chalk-like and not of the ordinary marine type.

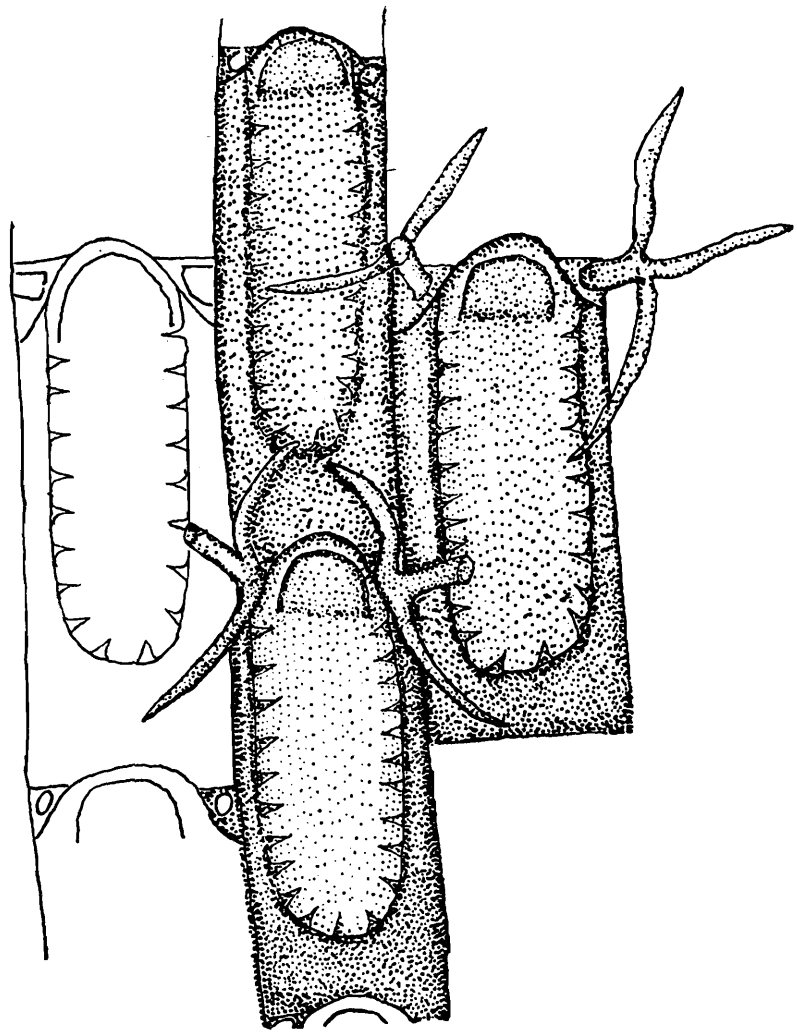

FIG. 6.—*Membranipora amoyensis*, sp. nov. ×90.

32. Membranipora devinensis, sp. nov.

Zoarium incrusting bark of sodden wood, loosely attached. *Zoœcia* elongated, sometimes of extreme length and connected together loosely (fig. 7). *Aperture* occupying almost all of the front, the margin beset with a large number of spines which meet across the front. *Operculum* semicircular, large at the top of the aperture. The portion of the zoœcium below the aperture covered with a delicate calcareous wall marked by two large pores. Sometimes two zoœcia form in the place of one, when each zoœcium possesses but one pore. In no case has a spine been found projecting from these pores. *Oœcium* small, projecting over the zoœcium above, almost to its pores.

Obtained on the Orissa coast at the mouth of the Devi river, Bay of Bengal, dredged at depths varying from 23 to 25 fathoms.

33. Membranipora hugliensis, sp. nov.

Zoarium growing in a single layer on chips of wood to which hydroid stems adhere and encircling these stems, where it forms small bilaminate expansions. *Zoœcia* elongated, aperture occupying three-fourths of the front or more, surrounded by a delicate calcareous border crenulated on the inner margin (fig. 8). The lower part of the front of the zoœcia covered with a calcareous layer. The distal portion of each zoœcium projecting over the zoœcium above almost to the crenulated margin of the aperture. Where the zoœcia are crowded, the aperture much reduced and may become almost circular. That part of the zoarium growing flat and single layered is without spines, while that part which climbs on the hydroid stems and sends out bilaminate folds, possesses many conspicuous basal spines. Usually each zoœcium in the spinous region possesses two or more spines situated on the calcareous layer of the front wall just below the aperture. In some cases where the zoœcia are narrowed below, but one process may occur, usually then in the middle of the lower front wall. In still other instances no spines occur on the double layered portion. These *spines* (*sp.*) are tall, hollow, tapering processes formed of a transparent membrane, and lined with a delicate epithelium

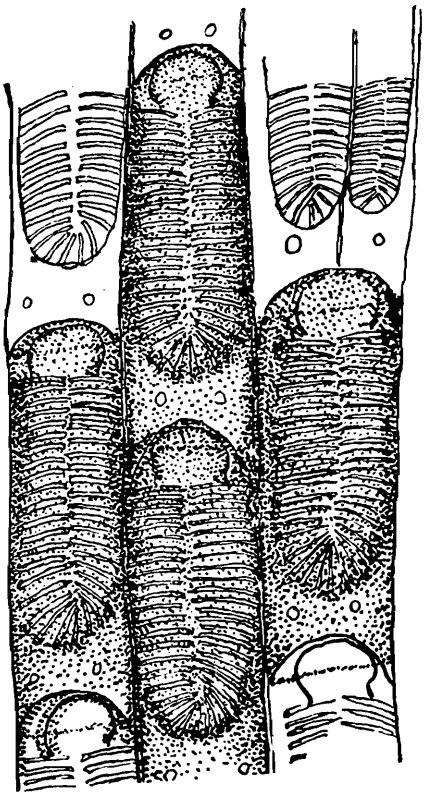

FIG. 7.—*Membranipora devinensis*, sp. nov. × 50.

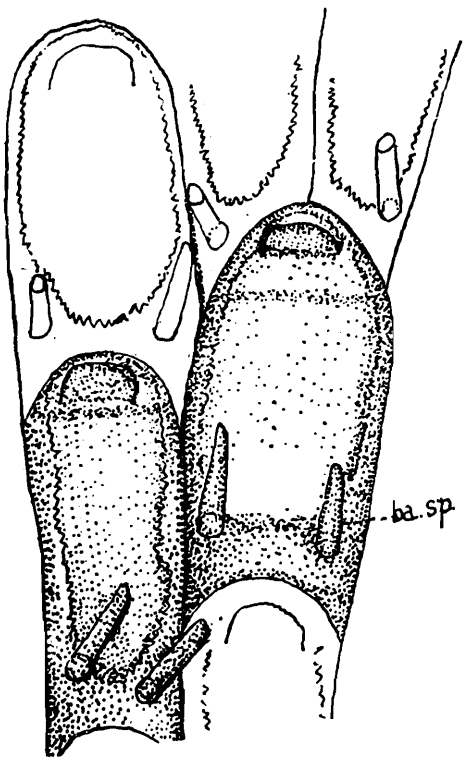

FIG. 8.—*Membranipora hugliensis*, sp. nov. × 90.

continuous with that of the parietal lining of the zoœcium. They are not articulated but bend easily, the membranous layer simply wrinkling on one side. No oœcia were found.

Obtained in considerable abundance at the mouth of the Hugli river, Bay of Bengal.

34. Membranipora ringens, Busk.

Megapora ringens, Hincks, 1880, p. 172, pl. xxii, fig. 1.

Obtained at entrance to Palk Straits, 3 miles N.N.W of Point Pedro, dredged at 6 to 8 fathoms. Incrusting a coral mass with sponge and other bryozoa.

35. Steganoporella magnilabris, Busk.

Steganoporella magnilabris, Busk, 1884, pt. xxx, p. 75, pl. xxiii, fig. 2.

Obtained at four rather widely separated localities showing that the species is abundant in the Bay of Bengal. Found at the Andamans growing over masses of coral; on Ancutta Reef, Laccadives; off Ceylon at 703 fathoms, and at station 384 (off C. Negrais, Burma, 16°0′ N, 93°37′ E.), dredged at 40 fathoms, growing over roots and debris.

36. Thalamoporella rozieri, Audouin.

Thalamoporella rozieri, Robertson, 1908, vol. 4, no. 5, p. 277, pl. 17, figs. 27, 28, 29.

Obtained at one locality only, Pedro Shoal, Palk Straits.

37. Smittipora abyssicola, Smitt.

Vincularia abyssicola, Smitt, pt. ii, p. 6, pl. i, figs. 60, 61.

Obtained at the entrance to Palk Straits, dredged at 6 to 8 fathoms, also at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.), dredged at 40 to 49 fathoms.

38. Cribrilina radiata, Moll.

Cribrilina radiata, Hincks, 1880, p. 185, pl. xxv, figs. 1-9.

Abundant in this collection. Obtained at Palk Straits, dredged at 6 to 8 fathoms; Andamans; Laccadives; Puri, Orissa coast; off Ceylon at 703 fathoms; off Gopalpore at 25 to 28 fathoms; at station 522 (Mergui Archipelago, 12°35′ 15″ N., 98° 16′ E.); at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.).

39. Cribrilina punctata, Hassall.

Cribrilina punctata, Hincks, 1880, p. 190, pl. 26, fig. 3.

Obtained at two points: off Gopalpore at 25 to 28 fathoms and in the Bay of Bengal at 15 to 30 fathoms.

40. **Microporella ciliata,** Pallas.

Microporella ciliata, Hincks, 1880, p. 206, pl. xxviii, figs. 1-8.

Abundant in this collection: obtained at Gopalpore at 24 fathoms; Palk Straits at 6-8 fathoms; Andamans, Bay of Bengal at 15 to 30 fathoms; at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) dredged at 40 to 49 fathoms.

41. **Microporella distoma,** Busk.

Adeonella distoma, Busk, 1884, pt. xxx, p. 187, wood cuts, 56, 57.

Rather widely distributed. Obtained at the Andamans, North Sentinal I., station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) dredged at 40 to 49 fathoms, at Cape Bluff dredged at 375 fathoms.

42. **Microporella impressa,** Audouin.

Microporella impressa, Hincks, 1880, p. 214, pl. xxvi, figs. 9-11.

Obtained off Ceylon, growing on a dead shell dredged at 703 fathoms.

43. **Microporella malusii,** Audouin.

Microporella malusii, Hincks, 1880, p. 211, pl. xxviii, fig. 11.

Dredged at 6-8 fathoms at the entrance to Palk Straits.

44. **Microporella yarraensis,** Waters.

Eschara lichenoidas, Busk, 1854, pt. ii, p. 90, pl. cvi, figs. 1, 2, 3.

Obtained 21 miles S.W by W. of Mangalore, west coast of India, dredged at 31 fathoms, growing on a shell.

45. **Porina tubulosa,** Norman.

Porina tubulosa, Hincks, 1880, p. 230, pl. xxxii, figs. 6-9.

Obtained at the Andamans and dredged at the entrance to Palk Straits at 6-8 fathoms.

46. **Tubucellaria cereoides,** Ellis and Solander.

Tubucellaria cereoides, Waters, 1907, p. 130, pl. xv, fig. 8.

A small piece of a colony about an inch in height obtained by the "Investigator" at the Andamans at 20 fathoms.

47. **Schizoporella auriculata,** Hassall.

Schizoporella auriculata, Hincks, 1880, p. 260, pl. xxix, fig. 4.

Dredged in the Bay of Bengal (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) at 15 to 30 fathoms, also at station 237 (Andaman Sea, 13°17′ N., 93°7′ E.) at 90 fathoms, at station 387 at 40 to 49 fathoms and off Ceylon at 703 fathoms. Obtained also at the Andamans.

These specimens conform to the description and plates given by Hincks except in a variation in position and size of avicularia.

Most of the zoœcia possess the avicularium just below the sinus. This is lacking in other instances but replaced apparently by another avicularium, somewhat larger usually, but placed somewhere else on the front wall, most generally on the lower part with mandible directed transversely. Occasionally both kinds of avicularia are found on the same zoœcium.

48. **Schizoporella biaperta,** Michelin.

Schizoporella biaperta, Hincks, 1880, p. 255, pl. xl, figs. 7-9.

Obtained at two stations at the Andamans.

Slight variations occur in these specimens differing from those described by Hincks. The oœcia possess two transparent areas on the front instead of an area with radiating lines. The mammillated avicularia possess a spatulated mandible, not a triangular one, as does the British species.

49. **Schizoporella brunnescens,** Ortmann.

Schizoporella brunnescens, Ortmann, 1890, p. 50, pl. 4, fig. 2.

Obtained on the Ceylon Pearl Banks, and Marble Rock, Mergui. Also at 11°33½′ N. and 98°20½′ E

50. **Schizoporella cecilii,** Audouin.

Schizoporella cecilii, Hincks, 1880, p. 269, pl. xliii, fig. 6.

Obtained at the Andamans.

51. **Schizoporella linearis,** Hassall.

Schizoporella linearis, Hincks, 1880, p. 247, pl. xxxviii, fig. 5.

Dredged at 31 fathoms 21 miles S.W by W off Mangalore; at 29 fathoms, off Carwar and Molki, off Ceylon; 26 miles W S.W of Honawar, at 28 fathoms, west coast of India.

52. **Schizoporella linearis,** Hassall, form **quincuncialis,** Hincks.

Schizoporella linearis, form *quincuncialis*, Hincks, 1881, ser. 5, vol. 7, p. 158, pl. ix, fig. 3.

A small colony growing on the inside of sea-urchin's test, obtained at "Investigator" stations 532 (Mergui Archipelago, 12°15′ 20″ N., 97°10′10″ E.) and 534 (Mergui Archipelago, 12°59′ N., 96°48′30″ E.).

53. **Schizoporella nivea,** Busk.

Schizoporella nivea, Busk, 1884, pt. xxx, vol. x, p. 163, pl. xvii, fig. 1.

Dredged at 6-8 fathoms at entrance to Palk Straits, 3 miles N.N.W of Pt. Pedro. Obtained also at Santapilly.

54. Schizoporella pertusa, Esper.

Lepralia pertusa, Hincks, 1880, p. 305, pl. xliii, figs. 4, 5.

Obtained at Santapilly, and dredged off Ganjam coast at 24-30 fathoms.

55. Schizoporella dutertrei, Audouin.

Mastigophora dutertrei, Hincks, 1880, p. 279, pl. xxxvii, fig. 2.

Dredged off Gopalpore at 25 to 28 fathoms growing on *Ostrea imbricata*. Obtained also at "Investigator" station 384 (off C. Negrais, Burma, 16°0′ N., 93°37′ E.).

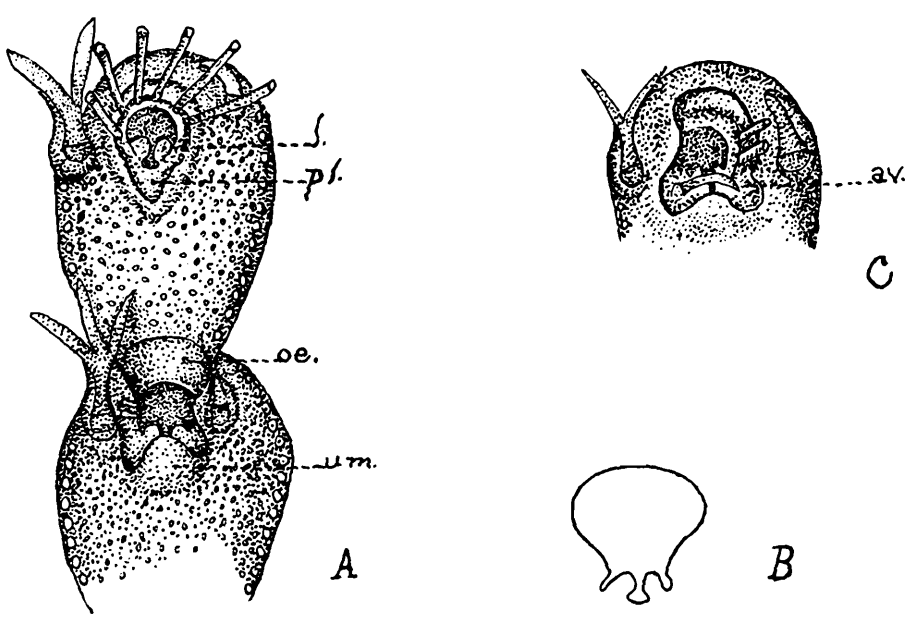

FIG. 9.—*Schizoporella dutertrei*, var. *foliacea*, nov.

A. Two zoœcia showing detail, × 40.
B. Operculum much magnified, × 90.
C. Distal portion of older zoœcium showing an avicularium (*av.*) on umbo below orifice, × 40.

56. Schizoporella dutertrei var. foliacea, nov.

Zoarium loosely attached to coral conglomerate. *Zoœcia* flat, surface finely porous. *Orifice* surrounded by a thickened calcareous border from which six or eight spines extend (fig. 9, A). Upper margin of orifice arched, lower margin with a deep narrow sinus which widens suddenly at the lowest part. *Operculum*, assuming the shape of the orifice, resembles a flat rounded plate with a handle (fig. 9, B). The zoœcial wall projecting on each side of the narrow neck or handle in two conspicuous calcareous lobes (fig. 9A, *b.*), the thickened border of the orifice uniting below into a flat triangular platform (*pl.*). In older zoœcia an umbo forms below the orifice (*um.*) hiding the stem-like portion of the operculum. Occasionally this umbo supports an avicularium (fig. 9 C, *av.*) with mandible directed horizontally. On each side of the orifice a sessile avicularium with mandible directed

upward. In at least one of these the mandible is prolonged into a branching process sometimes bifid, sometimes trifid, each branch assuming the form of a rather broad thin blade, reminding one of the wings of maple seed or of the membranous wings of an insect. The avicularium on the other side small, with a triangular mandible directed upward. *Oœcium* shallow, widely open, two or three spines on each side projecting in front of it (fig. 9, A, *œ.*).

Dredged at 25 to 28 fathoms off Gopalpore, Ganjam district, east coast of India.

57. Lepralia adpressa, Busk.

Lepralia adpressa, Busk, 1854, pt. ii, p. 82, pl. cii, figs. 3, 4.

Obtained at "Investigator" station 532, at 62 fathoms, Mergui Archipelago (12°15′ 20″ N., 97°10′ 10″ E.).

58. Lepralia depressa, Busk.

Lepralia depressa, Busk, 1854, pt. ii, p. 75, pl. xl, figs. 3, 4.

Many avicularia possess mandibles long and tapering, almost vibraculoid in character, others possess stout mandibles which terminate in a three parted process resembling the claws of a gallinaceous bird. Commonly the avicularia are similar to those represented by Busk.

Growing on a mass of conglomerate, dredged at 15 to 30 fathoms in the Bay of Bengal, and at 70 fathoms off Ceylon.

59. Lepralia feegeensis, Busk.

Lepralia feegeensis, Busk, 1884, pt. xxx, vol. x, p. 144, pl. xxii, fig. 10.

Loosely incrusting coral conglomerate obtained from coral reefs of Kilakarai, Ramnad district, G. of Manaar.

60. Lepralia turrita, Smitt.

Lepralia turrita, Smitt, 1873, pt. ii, p. 65, pl. xl, figs. 226, 228.

Dredged at 24 fathoms on the Ganjam coast, also at 6 to 8 fathoms at the entrance to Palk Straits. Obtained off Gopalpore, and at Galle, Ceylon.

61. Escharoides occlusa, Busk.

Lepralia occlusa, Waters, 1909, vol. xxxi, p. 152, pl. 14, figs. 1, 2.

A fine specimen obtained in Gaspar Straits, Malay Archipelago. Small, broken and somewhat imperfect specimens obtained at the Andamans and dredged at 112 fathoms off Port Blair, Andamans.

62. Petralia laccadivensis, sp. nov.

Material consisting of several small colonies incrusting sponge or small shells. Adult *zoœcia* with front wall rounded, porous.

heavily calcified, ornamented with numerous outstanding processes (Fig. 10). Orifice rounded above, possessing in young zoœcia three distinct denticles on the lower margin, the middle one forming a relatively broad mucro. Below the orifice a plain non-porous platform (*pl.*) which in older zoœcia tends to grow thicker and to extend up each side of the orifice to form the supports of small elevated, sessile, lateral avicularia (*av.*). Frequently one of these lateral avicularia is replaced by an elongated one of considerable size with spatulate mandible directed downward. (*sp.av.*). From the platform below the orifice there springs a tall process which may become bi- tri- or even quadrifid, almost completely obliterating the orifice (*pr.*). The tips of the branches of these frontal processes may acquire small rounded avicularia. Other processes of considerable height, usually tipped with an avicularium, may decorate any part of the front wall. *Oœcia* rounded, wall granular or pierced with minute pores.

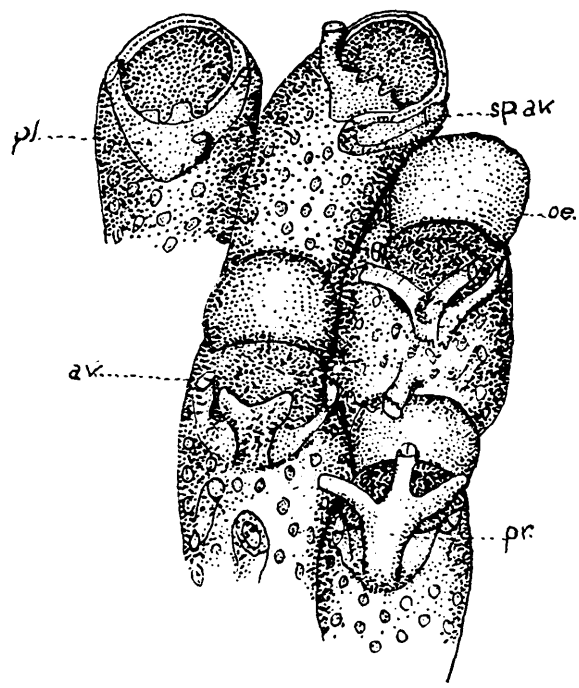

FIG. 10—*Petralia laccadivensis*, sp. nov. × 40.

A species easily recognized by the unusual number of fantastic processes scattered over the surface of the zoarium. Obtained at Ancutta Reef, Laccadives, at Santapilly, Madras, and dredged at 24 to 30 fathoms off the Ganjam coast.

63. **Petralia vultur**, Hincks.

Mucronella vultur, Hincks, 1882, (5), vol. x, p. 167, pl. viii, fig. 2.

Identification tentative since no comparison with identified specimens has been possible and since certain variations occur here not noted by Hincks. These consist chiefly of numbers of large avicularia found mainly in older parts of the colonies, with mandibles of much variety of form. The mandibles of these avicularia are sometimes long and narrow, sometimes duck-bill shaped, and others again are forked at the extremity. Material fairly abundant. Obtained off Gopalpore, Ganjam district, Madras Presidency, at depths varying from 24 to 30 fathoms; near Mangalore at 31 fathoms; also at Black Pagoda, Orissa coast, at 15 fathoms.

Other material found at Santapilly and at station 296 (Per-

sian Gulf, 26°4′ N., 56°2′ E.) in 47 fathoms, agrees with the description of *P. vultur* in most respects, but differs in showing a variable number of upstanding processes around the orifice, often a median triangular one and several smaller lateral ones, all of which may or may not support small avicularia. These it is thought are only of variational value.

64. Petralia vultur, var. armata, Waters.

Petralia vultur, var, *armata*, Waters, 1913, p. 518, pl. lxx, fig. 18.

Material loosely incrusting small oyster-shells dredged at 160 fathoms, Java Sea, Malay Archipelago (Eastern Telegraph Co.).

65. Smittia landsborovii, Johnston.

Smittia landsborovii, Hincks, 1880, p. 341, pl. xlviii, figs. 6-9.

Obtained near Puri, Orissa coast, and at Black Pagoda, Orissa coast, dredged at 15 fathoms.

66. Smittia marmorea, Hincks.

Smittia marmorea, Hincks, 1880, p. 350, pl. xxxvi, figs. 3-5.

Obtained at the Andamans and dredged at 40 to 49 fathoms at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.).

67. Smittia nitida, Verrill.

Smittia nitida, Hincks, 1881, ser. 5, vol. 7, p. 159, pl. x, fig. 5.

Obtained off Gopalpore, Ganjam coast, dredged at 24 fathoms.

68. Smittia trispinosa, Johnston.

Smittia trispinosa, Hincks, 1880, p. 353, pl. xlix, figs. 1-8.

This species rather widely distributed: obtained at the Andamans, the entrance to Palk Straits at 6 to 8 fathoms; Black Pagoda, Orissa coast, at 15 fathoms; off Gopalpore at 25 to 28 fathoms at station 532 (Mergui Archipelago, 12°15′20″ N., 97°10′10″ E.) at 62 fathoms.

69. Smittia trispinosa var. producta, Thornely.

Smittia trispinosa var. *producta*, Waters, 1909, p 173, pl, xvii, fig. 5.

Obtained at Santapilly and at station 528 (Mergui Archipelago, Elphinstone I., Port Maria).

70. Smittia latiavicularia, Kirkpatrick.

Smittia latiavicularia, Kirkpatrick, 1888, ser. 6, vol. 1, pl. x, fig. 3.

Obtained off the Ganjam coast, dredged at 24 to 30 fathoms.

71. Retepora delicatula, Busk.

Retepora delicatula, Busk, 1884, pt. xxx, vol. x, p. 124, pl. xxvi, fig. 3.

Obtained off the Ganjam coast, dredged at 24 to 30 fathoms, and at station 387 (off C. Negrais, Burma, 15°25′ N., 93°45′ E.) dredged at 40 to 49 fathoms.

72. Retepora porcellana, MacGillivray.

Retepora crassa, Busk, 1884, pt. xxx, vol. x, p. 115, pl. xxvi, fig. 10; pl. xxvii, fig. 3.

Obtained at 6°01′ N. 81°16′E. at 34 fathoms; also in the Bay of Bengal, dredged at 15 fathoms.

73. Retepora punctiligera, Ortmann.

Retepora punctiligera, Ortmann, 1890, p. 35, taf. ii, fig. 24.

Obtained off Gopalpore, Ganjam coast, dredged at 24 to 30 fathoms.

74. Reteporella minor, Ortmann.

Reteporella minor, Ortmann, 1890, p. 37, taf. ii, fig. 28.

Obtained at station 532 (Mergui Archipelago, 12°15′20″ N., 97°10′10″ E.) in 62 fathoms.

75. Haswellia australiensis, Haswell.

Haswellia australiensis, Busk, 1884, pt. xxx, vol. x, p. 172, pl. xxiv, fig. 8.

Obtained off Port Blair at 112 fathoms, also dredged at 8 fathoms in 136° E., 10′ S., and at 49 fathoms in 142° E., and 8′ S.

76. Adeonella japonica, Ortmann.

Adeonella japonica, Ortmann, 1890, p. 54, taf. iv, fig. 11.

Obtained at Santapilly and at station 464 (S. of Ceylon, 6°2′ 30″ N., 81°29′ E.) in 52-68 fathoms.

77. Adeonella platalea, Busk.

Adeonella platalea, Busk, 1884, pt. xxx, vol. x, p. 184, pl. xxi, figs. 4, 4*a* and text figure 50.

Fine specimen obtained at Mergui, Burma.

78. Adeonella marginata, sp. nov.

Zoarium consisting of numerous flat strap-like branches, two or more inches in height. Mode of attachment not known, the material consisting of fragments only. To the naked eye each fragment or branch is seen to consist of a somewhat flattened middle portion with a border or margin of large zoœcia forming irregularly radiating lines. The two surfaces of each branch are

almost exact duplicates of each other. This may be seen readily if one inspects the margins, and especially a cross section of a branch. As is characteristic of this genus, the zoœcia are polymorphic consisting of three kinds of individuals: 1, the ordinary nutritive zoœcia (fig. 11, A and B, *nu. zoe.*), 2, the oœcial zoœcia (B, *oe. zoe.*), 3, the avicularian zoœcia (B *av. zœ.*). The middle portion of each branch is occupied by six or eight rows of nutritive zoœcia regularly alternate (A, *nu. zoe.*). Bordering these on each side are two or more rows of large reproductive zoœcia, and outside these a row of large avicularian zoœcia.

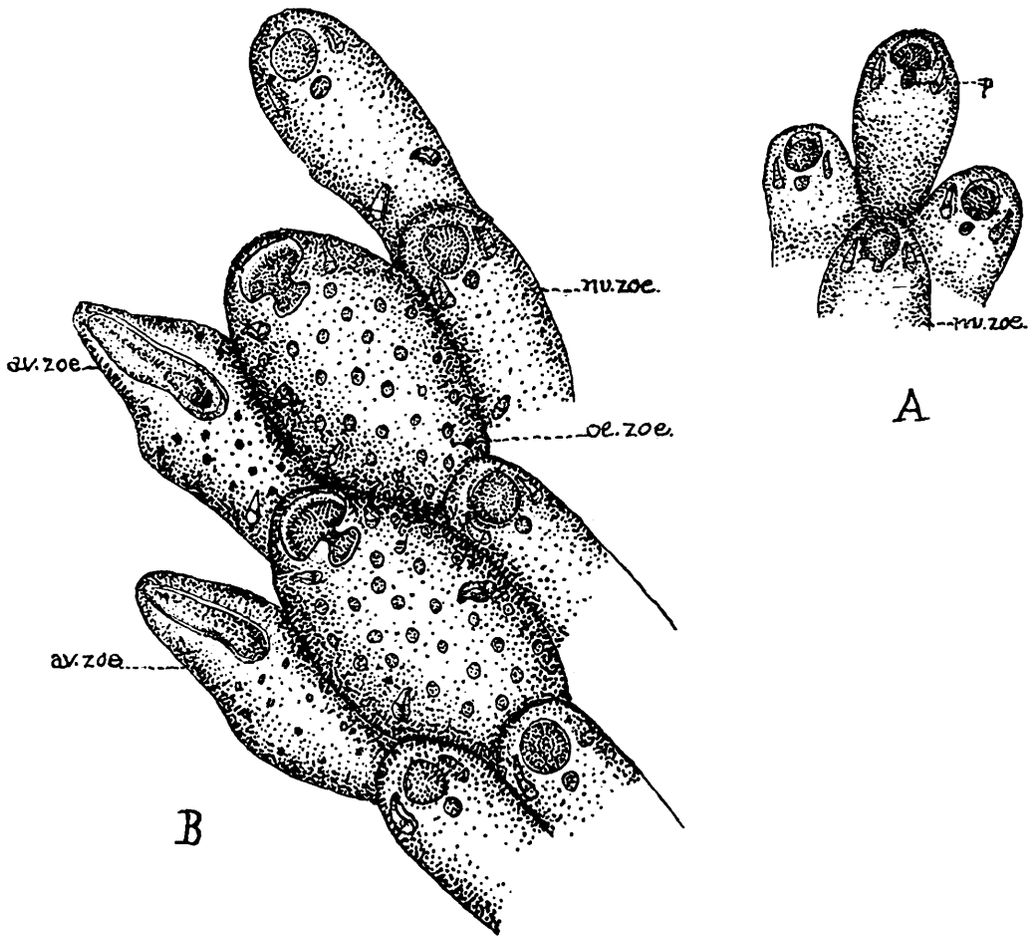

FIG. 11.—*Adeonella marginata*, sp. nov. × 40.
A. Four young zoœcia in middle portion of a branch.
B. To show the three kinds of zoœecia on the margin of the colony.

At the tips of the branches, the young nutritive zoœcia (fig. 11, A) are more than half immersed although the whole of the outline may be detected while the matrix is thin. Front wall hyaline, non-porous. *Orifice* round with a deep wide sinus, the upper edges of which soon close to form a large pore (*p.*). On each side of the pore an avicularium with triangular mandible directed upward. Lower down, somewhat to one side of the median line, another avicularium with mandible directed transversely (B). In older zoœcia avicularia increase in number and with increase in calcification may increase or decrease in size.

Even nutritive zoœcia tend to become larger as they approach the margin (B, *nu. zoe.*). A relatively small number of zoœcia attain a very large size (B *oe. zoe.*), whose wall becomes highly calcified and porous. These are the reproductive zoœcia characteristic of this genus. The outermost row of the margin consists of zoœcia which function only as avicularia (*av. zoe.*); mandible directed obliquely upward and outward.

Dredged at 65 fathoms near Mergui Archipelago, station 535 (13°4′30″ N., 96°44′ E.).

79. Lagenipora costazii, Audouin.

Cellepora costazii, Hincks, 1880, p. 411, pl. lv, figs. 11-14.

Found quite commonly, incrusting stems of seaweed: Mangalore, off Carwar and Mulki, at Cheval Paar, Colombo; dredged at 10-15 fathoms at Seven Pagodas, Madras, and at 34 fathoms by the "Investigator" at 6°01′ N., 81°16′ E.; also dredged off Gopalpore at 28-25 fathoms and Ganjam at 25 fathoms.

80. Lagenipora tuberculata, MacGillivray.

Lagenipora tuberculata, MacGillivray, 1882, p. 209, pl. 156, figs. 1, 2.

Identification tentative. Material obtained at two localities growing on coral conglomerate: Laccadives, and dredged at 34 fathoms by the "Investigator" in 6°01′ N. and 81°16′ E.

81. Holoporella aperta, Hincks.

Holoporella aperta, Waters, 1909, p. 161, pl. 18, figs. 20-23.

Dredged at 24-30 fathoms off the Ganjam coast.

82. Holoporella tridenticulata, Busk.

Cellepora tridenticulata, Busk, 1884, pt. xxx, vol. x, p. 195, pl. xxix, fig. 5.

Obtained at Cinque Island, Andamans, "Investigator"; also near Puri, Orissa coast.

83. ? Holoporella mammillata, Busk.

? Cellepora mammillata, Busk, 1854, pt. ii, pl. cxx, figs. 3, 4, 5.

In most points this species agrees with the description given by Busk, but this identification considered somewhat doubtful. Common, found at depths ranging from 15 fathoms to 703 fathoms at eight stations in the Bay of Bengal.

84. Cupularia canariensis, Busk.

Cupularia canariensis, Busk, 1859, vol. 7, p. 66, pl. 23, figs. 6-9.

Several colonies of various sizes obtained at the Andamans. The largest colony is about 11 mm. in diameter and 2 mm. high at the apex. The others vary from 8 to 5 mm. in diameter. The

material is dry, but it is thought to have contained living colonies when collected.

CYCLOSTOMATA.

85. Crisia sp.

Material consists of several fragments of *Crisia* which contain no ovicells, hence impossible to identify. Obtained off Ganjam coast at 24 to 30 fathoms, also from Gaspar Straits, and from station 152 (11½ miles S. 83° W of Colombo Lt., Ceylon) at 26½ fathoms.

86. Filisparsa tubulosa, Busk.

Filisparsa tubulosa, Waters, 1910, p. 235, pl. xxv, figs. 16, 17.

Obtained in Gaspar Straits growing with *F. oculata*.

87. Idmonea atlantica, E. Forbes.

Idmonea atlantica, Hincks, 1880, p. 451, pl. lxv, figs. 1-4.

Obtained in Gaspar Straits and at station 47 (off mouth of Godaveri R., Bay of Bengal) in 5-6 fathoms.

88. Idmonea gracillima, Busk.

Idmonea gracillima, Ortmann, 1890, p. 60, pl. iv, fig. 26.

Beautiful specimen obtained 4 miles south of Ganjam at 25 fathoms.

89. Entalophora raripora, d'Orbigny.

Pustulopora proboscidea, Busk, 1886, pt. 4, vol. xvii, p. 19, pl. lv, fig. 1.

Several colonies obtained at Santapilly, also at station 152 (11½ miles S. 83° W of Colombo Lt.) at 26½ fathoms.

90. Lichenopora radiata, Audouin.

Lichenopora radiata, Hincks, 1880, p. 476, pl. lxviii, figs. 9, 10.

A single colony growing on the inside of a shell obtained by the "Investigator" at station 384 (off C. Negrais, Burma, 16°0′ N., 93°37′ E.) in 40 fathoms.

91. Domopora truncata, Jameson.

Domopora truncata, Hincks, 1880, p. 485, lxiii, figs. 5-9.

A single specimen growing on a mass of coral conglomerate obtained at entrance to Palk Straits, 3 miles N.N.W of Point Pedro, in 6 to 8 fathoms.

CTENOSTOMATA.

92. Alcyonidium mytili, Dalyell.

Alcyonidium mytili, Hincks, 1880, p. 498, pl. lxx, figs. 2, 3.

Obtained at Puri beach, Orissa coast, growing on twigs.

93. Amathia semiconvoluta, Lamouroux.

Amathia semiconvoluta, Waters, 1910, p. 243, pl. 24, fig. 6.
Amathia connexa, Busk, 1886, pt. 1, vol. 17, p. 35, pl. 6, fig. 3.

Obtained at Karachi.

94. Zoobotryon pellucidus, Ehrenberg.

Zoobotryon pellucidus, Reichert, 1869.
Bowerbankia biserialis, Hincks, 1887, ser. 5, vol. xlx, p. 309, pl. 9, fig. 6.

Obtained in abundance in Madras Harbour where it was collected by Dr. Annandale at four stations. As Reichert remarks, this species seems to be distributed throughout the warm seas. The writer can bear witness to its presence in the warm waters of the north Pacific ocean, from which region it has not hitherto been reported. Specimens have been sent me from Hokkaido, Japan, and from Honolulu, Hawaiian Islands. In the summer of 1905 it occurred in abundance in San Diego Bay, California. There, in water 10 or 12 feet deep, it grew in luxuriant masses of a green tint, the whole resembling clumps of freshly cut hay.

ENTOPROCTA.

95. Pedicellina cernua, Pallas.

Pedicellina cernua var. *glabra*, Hincks, 1880, p. 565, pl. lxxxi, figs. 1-3.

Obtained at Puri beach, Orissa coast, growing on twigs.

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