I. THE HYDROIDS OF THE INDIAN MUSEUM

I.—The Deep-Sea Collection.

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INTRODUCTORY

This paper contains a first instalment of the description of the extensive collection of Indo-Malayan Hydroids in the Indian Museum, Calcutta. To the Trustees of the Museum, represented by Dr. Nelson Annandale, Superintendent of the Museum, I desire to tender my thanks for his kindness in entrusting to me the identification of the collection.

Notwithstanding the unadvisedness of adopting a bathymetrical line of demarcation in dealing with so mobile a group as the Hydroida, in which many species occur at exceedingly variable depths, this instalment confines itself to those forms which have been found in the deeper waters of the Indian seas, and for these reasons: Few littoral specimens were present in the collections received from the Indian Museum, and it is deemed better to leave over the description of such forms until additional shore and estuarine collecting—undertaken by Dr. Annandale—shall have made this section of the collection more representative. On the other hand the deep-sea collection seems to be already fairly complete.

Along with the deep water species I have recorded a few specimens, chiefly from the neighbourhood of the Andaman Islands, regarding which no indication as to the depth at which they were obtained was given. But it appeared more fitting, since they belong to the same series of collections as the deep Andaman specimens, to consider them here rather than with the shallow water forms.

GENERAL NOTES ON THE COLLECTION.

Morphological.—Under this head little of special interest has to be recorded. I must note, however, the occurrence, in the only species of *Aglaophenia* found in the collection, of a peculiar and distinctive gonosome. This appears to be a modified type of corbula in which the protective leaflets, which are arranged in two tiers, bristle outwards from the body of the gonosome, while the gonangia are covered in and protected by delicate plates of chitin (see p. 16, pl. iv, fig. 7).

Notice has been taken of the more patent minimal variations which occur in the various forms, in the hope that the more stable defining of species may be thus forwarded.

In describing the parts of the Plumularidæ I have adopted in addition to the general term 'nematophore,' originally used to signify the organ as a whole, the Hincksian names sarcotheca and sarcostyle to differentiate the chitinous protection from its fleshy content. Since 'nematophore' has been and still is used in the wide sense indicated above, it seems to me impracticable to restrict its meaning to the perisarc of the organ only, as advocated by Nutting (1900, p. 13), in spite of the fact that it has been loosely used in this way by systematists. There is the less reason to regret the impossibility, on account of the inappropriateness of the name as applied to a chitinous protection. Nor does it seem wise to complicate the terminology of the subject by the introduction of such terms as nematotheca and dactylothèque for a portion already sufficiently and excellently designated sarcotheca.

Distribution.—From the bathymetrical point of view the collection is interesting as indicating for the first time the aspect of the Hydroid fauna of the deeper Indian waters. A Sertularian and an epizoic Campanularian share the honour of having been dredged at the greatest depth, 1,343 fathoms, from beyond which exceedingly few Hydroids have ever been obtained. As they have already been recognised in shallow water—the former, *Idia pristis*, from 5 fathoms (Jäderholm, 1903) to 38 fathoms (Borradaile, 1905), the latter, *Campanularia corrugata*, from 7 fathoms (Thornely, 1904) to 40 fathoms (Campenhausen, 1896)—their bathymetrical range is an extraordinarily wide one, comparable to that of *Sertularella tricuspidata*, which occurs from almost the shore to 1,375 fathoms (Bonnevie, 1899).

As to geographical distribution, the collection increases the recognised Hydroid fauna of Indian seas by eleven species and that of Malaysia by two. Four of these are described as new to science[1]; while the remainder of the new Indian records show, in the main, extensions in the range of Malaysian or Australasian species. Of the total of twenty-four species and varieties recorded, four occurred in the Malay Archipelago; while of the twenty from Indian waters, twelve of the species have been previously found in the Australo-Malayan region.

So far as can be judged from a very limited collection, the affinity of the deep-sea Indian hydroid fauna is, as one would expect from general considerations of faunal distribution, most markedly with that of the South Pacific.

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[1] A preliminary note on these new forms has appeared in the *Ann. Mag. Na. Hist.* (8), vol. iii, pp. 524—528 (1909).

Table showing the species recorded in this paper, with their distribution.

	Indian Ocean.	Madagascar to Cape Colony.	Malaysia.	Australasia.	N. Pacific.	Atlantic.
Eudendridæ—						
Eudendrium sp. (p. 3)		..	×			..
Bougainvillidæ—						
Bougainvillea sp. (p. 4) ..		..	×			
Campanularidæ—						
Campanularia corrugata, Thornely (p. 4) .. .	×	×	×		..	×
,, (?) *spinulosa*, Bale (p. 5)	..	..	*	×	×	..
,, sp. (p. 6) ..	×			..		..
Hebella crateroides, Ritchie (p. 6)	*			..		..
Thyroscyphus vitiensis, M.-Turner. (p. 7)	×	×	×	..		
Lafoëidæ—						
Lafoëa gracillima (Alder) (p. 8) ..	*	..		×	×	×
,, *serrata*, Clarke (p. 9)	×	×				×
Sertularidæ—						
Cryptolaria operculata, Nutting (p 9)			*	..	×	..
Sertularella polyzonias, v. *cornuta*, Ritchie (p. 10)	*	×		×		×
Idia pristis, Lamx. (p. 11) ..	×	..	×	×		×
Diphasia mutulata (Busk) (p. 12) .	×	..	..	×		
,, *thornelyi*, Ritchie (p. 13)	*	..		..		
Plumularidæ—						
Antenella secundaria (Linn.) (p. 14)	*	×	×	×		×
Aglaophenia septata, Ritchie (p. 15)	*					
Lytocarpus annandalei, Ritchie (p. 17) ..	*		..			
,, *pennarius* (Linn.) (p. 19) ..	*		×		×	
,, *philippinus* (Kirchen) (p. 20)	×		×	×		×
,, *phœniceus* (Busk) (p. 21) .	×		×	×	×	
Halicornaria balei (M.-Turn.) (p. 22)	×					
v. *flava*, Nutting (?) (p 23) .	*				×	
,, *gracilicaulis* (Jäderh.) (p. 23)	*	×	×		×	
,, *hians*, v. *profunda*, Ritchie (p. 24)	*		..	×		

N.B.—(1) A * indicates a new record for region.
(2) Where varieties only are recorded the distribution of the species as a whole is shown.

SYSTEMATIC ACCOUNT OF THE COLLECTION.

GYMNOBLASTEA.

Family EUDENDRIDÆ.

Eudendrium, sp. indet.

A few small and dilapidated specimens little over 1 cm. high, with no trace of hydranths. While the trophosome might very

well be that of *E. ramosum* (Linn.), we prefer, considering the absence of the hydranths, to leave it unnamed.

LOCALITY: On *Epizoanthus* sp. from the Malay Archipelago; depth 160 fathoms.

Family BOUGAINVILLIDÆ.

Bougainvillea, sp. indet.

A single colony occurs in the collection, and as it is probably a young form (it is only 7 mm. high) it cannot be specifically identified. It agrees with *B. ramosa* (Van Beneden) in several points, for its hydrocaulus is fascicled at the base, is not simple, and has been attached by a delicate hydrorhiza, while the hydranths bear from 9 to 13 tentacles. No ringing is present on the hydranth-bearing branches, but a definite kink occurs just where they leave the stem. From *B. ramosa*, however, the specimen differs greatly in size and in the fact that the hypostome of the hydranth is flattened rather than sharply conical.

A single very immature gonosome arises from one of the branches.

LOCALITY: Growing on the type specimen of *Scalpellum sociabile*, Annandale, from Bali Straits (Java), Malay Archipelago; depth 120 fathoms.

CALYPTOBLASTEA.

Family CAMPANULARIDÆ.

Campanularia corrugata, Thornely.

Thornely, L. R., 1904, p. 114, pl. i, fig. 2.
Billard, A., 1907 (2), p. 341, fig. 1.

Many calycles of this species spring from stolons creeping on specimens of *Idia pristis*. In all respects they agree with Miss Thornely's description and figures, except that, like Dr. Billard's examples, they are of much smaller growth, and possess in some cases a more corrugated hydranthophore. In well-preserved specimens a very delicate partition exists beneath the base of the hydranth, separating the cavity of the hydrotheca from that of the stalk.

Detailed measurements show that these Indian specimens are on the whole somewhat smaller than those recorded from Madagascar and Natal (see references below):—

Hydranthophore, length	0·25—0·63 mm.
Hydrotheca, length	0·91—1·22 ,,
,, diameter	0·49—0·53 ,,

Considering the variations which occur in these Indian examples as regards the size and shape, the ringed or smooth condition of the hydrotheca, and the presence of corrugations on the peduncle, I am of opinion that the characters relied on by myself in distinguishing *C. mutabilis*, Ritchie (1907 (2), p. 504), from this

species are untrustworthy, and that the two forms are specifically identical. Nor is there any point by which *Lafoëa magna*, Warren (1908, p. 343), can be separated from Miss Thornely's species. These names therefore, *Lafoëa magna*, Warren, and *C. mutabilis*, Ritchie, must be regarded as synonyms of *C. corrugata*, Thornely.

LOCALITY: Climbing on *Idia pristis* obtained by the R.I.M.S. "Investigator," at Station 312, lat. 16° 56′ 15″ N., long. 92° 35′ 00″ E. (off Lower Burma); depth 1,343 fathoms.

Distribution.—Recorded from the Indian Ocean: Ceylon (Thornely, 1904), Madagascar (Billard, 1907 (2)), Natal (Warren, 1908); and from the tropical Atlantic: Cape Verde Islands (Ritchie, 1907 (2)).

C. corrugata has been found at other localities from which, however, it has not been recorded as such. Armstrong (1879, p. 101, pl. xi) figures what is undoubtedly a colony of this species climbing over *Halicornaria plumosa*, and he describes the hydrotheca as the gonosome of the Plumularian. His specimens were found in "30 to 40 fathoms, Cape Comorin, S. of India, and in 10 to 15 fathoms, off Cheduba Island, coast of Arrakan." Campenhausen (1896, pl. xv, fig. 3) figures, without mentioning, hydrothecæ of this species on an unidentified Plumularian (apparently *Halicornaria gracilicaulis* (Jäderholm)) which was found in the littoral zone off Ternate. This occurrence extends the distribution of *C. corrugata* into the South Pacific.

Campanularia (?) *spinulosa*, Bale.

Bale, W M., 1888, p. 756, pl. xii, figs. 5—7.

Two minute colonies, each 6 mm. high, have been assigned to this species. The stem of one shows a trace of fasciculation of the type figured by Bale for this species, an offshoot from the base of one of the branches growing downwards along the original stem. The hydrothecæ are exceedingly delicate and have in most cases collapsed so completely that the character of the margin is altogether obscured. In the cases where the bicuspid teeth were visible they seemed to be somewhat less pointed than in Bale's figure. The pedicels taper slightly upwards and are generally annulated throughout, bearing from 6 to 16 rings; but sometimes a long pedicel occurs with rings only at top and bottom. The hydranth has about 14 long tentacles.

Measurements.

Hydrotheca, length	0·77—0·84 mm.
,, diameter	0·28 ,,
Stem, diameter of single tube	0·13 ,,

As it is impossible in the absence of the gonosome to determine with precision the generic position of this species, I have retained for it the name given it by Bale. It seems probable, however, that it is either an *Obelia* or a *Gonothyræa*, for its trophosome is scarcely distinguishable from that of gonosome-bearing specimens

from New Britain, recorded by Miss Thornely (1899, p. 454) as *Gonothyræa longicyatha*.

LOCALITY : Found growing on the type specimen of *Scalpellum sociabile*, Annandale, from Bali Straits (Java), Malay Archipelago ; depth 120 fathoms.

Distribution.—Bale's specimens were found at Port Jackson, East Australia ; Nutting has recorded the species from Maui, one of the Hawaiian Islands (Nutting, 1905, p. 943).

Campanularia, sp. indet.

A few specimens growing upon a type specimen of *Scalpellum squamuliferum* were in so poor condition that I have not ventured to name them. They are Campanularians with stems (up to 12 mm. high) which are generally unbranched, although occasionally smaller replicas of the main stem spring from it. The stem is topped by a hydrotheca with exceedingly delicate walls which have collapsed so thoroughly that nowhere was the margin visible. On this account the structure of the rim, an important diagnostic character, could not be observed.

The general structure of the recognisable portions of the specimens is similar to that of a gigantic *Clytia johnstoni*, Alder: stems with about 15 rings at the base, and about 3 below the hydrotheca, the median portions being smooth except where regeneration has occurred. Hydrothecæ similar to those of *Clytia johnstoni* in shape, and in the minute structure of the base, remainder unrecognisable. No gonosome is present.

Measurements.

Stem, diameter	0·11—0·17 mm.
Hydrotheca, depth, *circ.*.	0·98—1·19 ,,
,, maximum diameter, *circ.*	0·70 ,,

LOCALITY : Growing on *Scalpellum squamuliferum*, Weltner, from the Andaman Islands ; depth 271 fathoms. Marine Survey collection. Reg. No. 1197/10.

Hebella crateroides,[1] Ritchie.

(Pl. iv, fig. 1.)

Ritchie, J., 1909 (2), p. 524.

This form occurs in abundance on specimens of *Lytocarpus phœniceus*. A creeping hydrorhiza meanders over the posterior portions of the stem and branches of the Plumularian, sending off here and there a hydrotheca or gonotheca. The hydrothecæ are small and colourless, often asymmetrical in shape, with firm walls, marked in some cases by exceedingly faint corrugations, and gracefully everted round the margin. The hydranthophore is not distinctly indicated, for the hydrotheca gradually diminishes in diameter from the margin until the hydrorhiza is reached, except for a slight bulging about the middle. In some cases (as in pl. iv,

[1] κρᾶτηρ = a cup.

fig. 1) a single joint traverses the stalk, but this is due to fracture and subsequent regeneration; in normal specimens no joint occurs, and only a delicate film separates the cavity of the hydrotheca from the common cavity of the colony. The hydranth has about 6 to 8 tentacles.

Gonosome.—The gonangia are borne on short and indefinite stalks, and are at least three times as large as a hydrotheca. They are roughly cylindrical in shape, and have walls circled by faint and irregular corrugations. In the earlier stages of development an opercular plate ("deckenplatte") at the end of the blastostyle, closes in the top of the gonangium, but, as development proceeds, this disappears and the perisarc folds outwards, forming a gracefully everted margin. The developing medusæ, three in number in each gonangium, are roughly spherical, but the state of preservation was so imperfect that details could not be observed. The manubrium is large, and four stout tentacles are present ere the medusa is set free.

Measurements.

Hydrotheca, length ...	0·36—0·39 mm.
,, diameter at mouth	0·18—0·21 ,,
Gonangium, length	1·01—1·23 ,,
,, maximum diameter	0·36—0·43 ,,

From *Hebella calcarata* (A. Agassiz), which it approaches, this species differs in its hydranth, which has only seven instead of about sixteen tentacles, and in its hydrotheca, which has neither the cylindrical shape nor the marked bulging towards the base characteristic of the other species, and which, moreover, shows no traces of a strong chitinous septum at the base. From *H. lata*, Pictet (1893, p. 40, pl. ii, figs. 34, 35), it is distinguished by having fewer tentacles, by its much smaller size, and by the more obconical shape and everted margin of its hydrotheca.

LOCALITY: Growing on *Lytocarpus phœniceus*, dredged 8 miles west of Interview Island, Andaman Islands, depth 270—45 fathoms.

Type in the Indian Museum, Calcutta.

Thyroscyphus vitiensis, Marktanner-Turneretscher.

Markt.-Turner., G., 1890, p. 210, pl. iii, fig. 10.

Two small fragments which appear to me to represent this species occurred with other odd colonies from the Andamans. They are only 12 mm. high, portions of young colonies, but even so they show considerable variation in the length and diameter of the internodes. In one fragment, which is strongly geniculate, they are from 1·5 to 1·9 mm. long, and 0·15 mm. in diameter; in the other, while the length remains similar, the diameter is 0·32 mm. The hydrothecæ measure from 0·98 to 1·12 mm. in height, and 0·66 mm. in diameter at the mouth. The hydranths, which are exceedingly dumpy when contracted, appear to have about 26 to 30 tentacles.

The colonies described by Miss Thornely (1904, p. 113) as young specimens of *Campanularia juncea* seem to me, as to Dr. Billard, indistinguishable from this species.

LOCALITY: Andaman Islands, 1899; 60 fathoms.

Distribution.—Thyroscyphus vitiensis is an Indo-Pacific species, recorded from the Malay Archipelago (Markt.-Turn., 1890), from various localities in the neighbourhood of Madagascar (Billard, 1907 (2)), from Ceylon (Thornely, 1904), and from the Andamans (present record).

Family LAFOEÏDÆ.

Lafoëa gracillima (Alder).

Alder, J., 1857, p. 39, pl. vi, figs. 5, 6; as *Campanularia gracillima*.
Allman, J. G., 1888, p. 34, pl. xvi, figs. 2, 2*a*; as *Lafoëa fruticosa*.
Bonnevie, C., 1899, p. 64, 65, pl. v, fig. 2*a*.

Three small colonies were found growing on the spine of a Cidarid Sea-Urchin. The colonies are less complex and less bushy than are normal specimens, and the largest is only 15 mm. high, without a single branch; but it was not to be expected that colonies placed on so movable a foundation should attain typical robustness of development. The compound stem is of the rhizocaulom type, and the structure of a hydrotheca is typical, a solitary twist separating it from the stem, while the upper surface is strongly convex and the lower, although it is considerably straighter than in British specimens, also tends to curve parallel to the upper profile. These characters make certain the identity of the specimens with *L. gracillima*, notwithstanding that the dimensions of the hydrothecæ are much greater, and the minute structure as a whole is more robust, than in typical examples of that species. In those respects the Indian examples approach a variety, *benthophila*, collected by the Scottish National Antarctic Expedition, south of the South Orkneys, at a depth of 1,775 fathoms (Ritchie, 1909 (1), p. 76); and since the present examples also have been dredged from deep water it may be that the unusual robustness in minute structure is correlated with the unusual depth at which the specimens existed.

For comparison the sizes of var. *benthophila* and of a typical form are given alongside those of the Indian specimens :—

	Indian Museum specimen.	Antarctic var. *benthophila*.[1]	North Sea typical specimen.[2]
Hydrotheca, length including hydranthophore	0·87—0·95mm.	0·87—1·01mm.	0·57—0·76mm.
Hydrotheca, diameter at mouth	0·20—0·24 ,,	0·21—0·25 ,,	0·11 ,,
Diameter of a single tube of stem	0·11 ,,	0·16 ,,	0·10 ,,

[1] Mentioned in the table in the *Supplementary Report on the Scotia Hydroids* as a "Coat's Land specimen." The locality, as shown by the bearings, is considerably nearer to the South Orkneys than to Coat's Land.

[2] Specimen from lat. 58° 34′ N., long. 0° 47′ E., in my collection.

LOCALITY: Growing on the spine of a Cidarid Sea-Urchin dredged from Station 358 of the R.I.M.S. "Investigator," lat. 15° 55′ 30″ N., long. 52° 38′ 30″ E. (Arabian Sea, near the Gulf of Aden); depth 585 fathoms.

Distribution.—(See Hartlaub, 1905, p. 594.) A species of world-wide range recorded from the North Pacific (Marktanner-Turneretscher, 1890; Nutting, 1899; Torrey, 1902); the North Atlantic Ocean (Hincks, 1868, etc.); the South Atlantic Ocean (Allman, 1888; Hartlaub, 1905; Jäderholm, 1905; Ritchie, 1907 (1)); the Arctic Ocean (Bergh, 1887); the Antarctic Ocean (Ritchie, 1909 (1)); South Australia (Bale, 1884). The species has not hitherto been recorded from Indian seas.

Lafoëa serrata, Clarke.

Clarke, S. F., 1879, p. 242, pl. iv, fig. 25.
Hartlaub, C., 1905, p. 595, fig. Q².

Represented in the collection by only a few specimens which agree in dimensions with the typical examples recorded by Billard from the coasts of Spain.

Measurements.

Hydrotheca, length of adnate portion	0·22—0·27 mm.
,, ,, free ,,	0·25—0·29 ,,
,, diameter at mouth	0·063–0·077 ,,

LOCALITY: Creeping on *Sertularella polyzonias* var. *cornuta*, from 8 miles west of Interview Island, Andaman Islands; depth 270—45 fathoms.

Distribution.—A widely distributed species recorded from the east and west sides of the North Atlantic (Billard, 1907 (1); Clarke, 1879); from the Straits of Magellan (Hartlaub, 1905); and from the Indian Ocean (Zanzibar, Billard, 1907; Gulf of Manaar, Thornely, 1904; Andamans, present record).

Family SERTULARIDÆ.

Cryptolaria operculata, Nutting.

Nutting, C. C., 1905, p. 947, pl. iii, fig. 4; pl. x, 12—14.

Colonies of this species much more complete than those found by Professor Nutting occur in the collection. Although now somewhat broken, the largest colony when pieced together reaches a height of about 20 cm. It has a thick fascicled stem, 3 mm. in diameter at the base, of a pale brown colour, and terminating in a flattened basal expansion. From the stem arise strongly fascicled, gnarled branches (2 mm. in diameter), which bear off-shoots to the fifth or sixth degree. Although they lie roughly in one plane, little regularity pervades the arrangement or structure of the

branches, and, especially in the older parts of the colony, anastomosis between branches, or even between two neighbouring colonies occasionally takes place.

As regards the characters of the hydrotheca there is little to be added to Nutting's description. If the expansion at the base of the polyp be taken as indicating the bottom of the hydrotheca, since no perisarcal structure marks the boundary between the hydrotheca and the common cavity, then about half of the hydrotheca is adnate to the branch, and about half free, at least on those portions where fascicling has not obscured the relations of parts. The operculum is, as Nutting surmised, similar in structure to that in the genus *Stegopoma*.

The hydranths are large and fusiform, similar in shape to Hincks's figures of those of *Halecium halecinum* (Hincks, 1868, pl. 42, fig. *b*). They are crowned by about eleven tentacles and are moored to the hydrotheca by strands of cœnosarc projecting from a basal expansion.

No gonosome was observed.

Measurements.

Hydrotheca, length adnate		0·50 mm.
,,	,, free	0·49—0·56 ,,
,,	diameter	0·17—0·21 ,,

LOCALITY: Malay Archipelago; depth 160 fathoms. Marine Survey collection. Reg. No. 8416/6.

Distribution.—*C. operculata* has been recorded hitherto only from "between the islands of Molokai and Maui, 138 fathoms," Hawaiian Islands (Nutting).

It is of interest to note that dwelling within the tubes of very many of the stems, even those in which the polyps are quite fresh, having apparently been alive when the specimen was obtained, are minute tentacled polychæte worms.

Sertularella polyzonias (Linnæus), var. *cornuta*, Ritchie.

(Pl. iv, fig. 2.)

Ritchie, J., 1909 (2), p. 525.

From two localities come colonies which I record as a variety of *S. polyzonias*. Their habit differs considerably from the lax growths of var. *gracilis*, Kirchenpauer, which occur on the coasts of Britain, for the stem is thicker and more definite, and the branches alternate more regularly. There is nothing however to distinguish the minute characters of the hydrothecæ from those of some of the many forms of *S. polyzonias*, their shape approaching most closely, perhaps, that figured by Hartlaub (1900, Taf. v, fig. 5) from Juan Fernandez. On the whole, the facies of the trophosome approaches

that of var. *robusta*, Kirchenpauer (1884), from the Cape of Good Hope.

The gonangia are characteristic. While they have the elongate-ovate shape and the strong corrugations of typical specimens, they are surmounted by four stout spines lying cross-wise, in a plane at right angles to the long axis of the gonangium. This character has given its designation to the variety.

Measurements.

Hydrotheca, length of adnate portion	0·25—0·39 mm.
,, ,, free portion	0·25—0·28 ,,
,, greatest diameter	0·22—0·28 ,,
,, diameter at mouth	0·17—0·20 ,,
Gonangium, length	1·37 ,,
,, greatest diameter	0·59 ,,
,, length of "horns"	0·22 ,,

LOCALITIES: (*a*) Andaman Islands; depth 490 fathoms; Reg. No. 64/7; (*b*) 8 miles west of Interview Island, Andaman Islands; depth 270—45 fathoms.

Type in the Indian Museum, Calcutta.

Distribution.—World-wide, but although the species has been recorded from the Red Sea (Kirchenp., 1884), from off Australia (Bale, 1884), and from Natal (Warren, 1908), it has not hitherto been found in Indian seas.

Idia pristis, Lamouroux.

Lamouroux, J V F., 1816, p. 200, pl. v, fig. 5.
Allman, J G., 1888, p. 85, pl. xxxix.

A clump of many colonies—the larger about 7 cm. high—alone represents this species. The clump is the centre of a life-association of much variety: about the base were corallines, and coral skeletons; intertwined with the hydroid stems were at least two species of Alcyonarians; while over the colonies themselves meander a creeping Polyzoon and a hydroid recorded above,—*Campanularia corrugata*.

My observations as to the structure of polyp and hydrocaulus confirm those of Billard (1907, p. 351), for, contrary to Allman's description (1888, p. 86), I can find no trace of an interior chamber containing a diverticulum of the base of the polyp.

LOCALITY: Collected by the R.I.M.S. "Investigator" at Station 312, lat. 16° 56′ 15″ N., long. 92° 35′ 00″ E., off Lower Burma; depth 1,343 fathoms.

Distribution.—The records of this species have been recently brought together by Billard (1907, p. 352). Its centre of distribution appears to be in the Indo-Pacific region, for it has been found on the east coast of Australia, among the East Indies, off the Malay Peninsula, and in the Indian Ocean. A solitary record—that

of the "Challenger"—from off Bahia, in Brazil, indicates its presence in the Atlantic Ocean.

Diphasia mutulata (Busk).

(Pl. iv, fig. 3.)

Busk, G., 1852, p. 391; as *Sertularia mutulata.*
Bale, W. M., 1884, p. 101, pl. ix, figs. 6—9.

A few small specimens of this species were growing on a sponge. They are only about 10 mm. in height and are unbranched, whereas Busk's type was 3 inches high and bore irregular branches; but the minute structure corresponds with Busk's rather meagre description. The colonies, which are of delicate texture, are faintly tinged with brown. The hydrothecæ are in pairs, sub-opposite on the proximal portion, but on the same level in the distal part of a colony. Occasionally too, nodes, though indistinguishable at the base of a specimen, are discernible towards its tip. The hydrothecæ are deep and narrow; their distal free portion projects at right angles to the stem, its length being equal to about $\frac{1}{3}$ that of the adnate portion. The aperture faces upwards and slightly outwards, is elliptical in shape, broader than deep, bounded on the adcauline side by a straight margin, on the abcauline by a gentle curve. An operculum is present, hinged to a thickening of perisarc on the free edge of the adcauline wall. Within the hydrotheca is a prominent intrathecal ridge, projecting from the mid portion of the abcauline wall and curving strongly upwards. The lateral portions of this partition can be traced for a considerable distance along the walls of the hydrotheca, but its general limit is strongly defined by a thickened edge.

No gonosome was present.

Measurements.

Hydrotheca, length of free portion [1]	0·15—0·21 mm.
,, ,, adnate portion	0·45—0·52 ,,
,, diameter of free portion	0·20 ,,
,, ,, adnate portion	0·10 ,,
,, breadth of aperture from side to side	0·27 ,,
Distance between hydrothecæ	0·08—0·14 ,,

Locality: Growing on a sponge from the Andaman Islands, 1899; depth (?) 490 or 60 fathoms.

Distribution.—Previously recorded from Torres Straits (Busk, 1852); Port Molle (Bale, 1884); off Galle, off Negombo, and in the Gulf of Manaar (Thornely, 1904); Suez docks and Suez Bay (Thornely, 1908).

[1] Measured along adcauline wall.

Diphasia thornelyi,[1] Ritchie.

(Pl. iv, figs. 4, 5.)

Ritchie, J., 1909 (2), p. 525.

Several delicate, unbranched colonies, with non-fascicled stems were found growing about the "root"-masses of *Lytocarpus pennarius*. They are small (the largest only 16 mm. high), spring from a simple stolon, show no traces of nodes, and bear hydrothecæ from the base upwards. The hydrothecæ vary much in their position relative to one another. They are biserial and lie in the same plane, and although in most cases they are alternate or sub-alternate, rarely an opposite arrangement is simulated.

A hydrotheca is deep and narrow, with the inner edge adnate to the stem for practically its whole length, except for a short horizontal knobbed ledge upon which the adcauline operculum is hinged. The cavity of the hydrotheca is divided into two parts by a short upturned ridge which projects from the abcauline wall midway between the base and margin. Proximal to this hooked intrathecal ridge the wall of the hydrotheca suddenly becomes much thicker (up to 60 μ), and is continued thus till the next hydrotheca is reached. The outer wall of the distal half of the hydrotheca curves gently outwards and upwards, and almost parallel to the outer wall, and terminating at the base in a thickened ridge, runs the partition which separates the cavity of the hydrotheca from that of the stem. The margin is smooth and rimmed, a border being formed by a well-marked line which runs parallel to the lateral edges of the hydrotheca. The aperture, which faces somewhat towards the stem, forms an arc of a circle, its outer border being rounded, while its adcauline side, bounded by the horizontal ledge on which the operculum rests, is straight. The distal portion of the hydrotheca, as a whole, assumes the appearance of a bracket projecting from the stem. The operculum is a single, strong, adcauline disk, which rests on a thickened ledge.

Gonosome.—The gonothecæ arise from immediately beneath the hydrothecæ, and are without stalks. They are ovate in shape but are somewhat asymmetrical, a bulge occurring on the shoulder towards the stem. The aperture is cylindrical, placed on a short neck, and the distal half of the gonangium is ornamented with scattered but prominent spines.

Measurements.

Hydrotheca, length	0·38—0·45 mm.
,, breadth	0·11—0·14 ,,
,, diameter of aperture from side to side	0·21 ,,
Gonangium, length	0·64 ,,
,, maximum diameter	0·32 ,,

[1] This species has been named in honour of Miss Laura R. Thornely whose paper on the Hydroids collected by Professor W. A. Herdman off Ceylon has added much to our knowledge of the Indian members of the group.

A form of *D. mutulata* was figured by Miss Thornely (1904, pl. ii, figs. 6*A*, 6*B*, p. 118), and was described as having hydrothecæ which are " smaller and less prominent [than on other *D. mutulata* specimens] and sometimes sub-alternate, and the gonothecæ on these have only a few spines near the top and are of smaller size." This form appears to me to belong to the species described above. Miss Thornely's specimens were found in the neighbourhood of Ceylon.

LOCALITY : Growing on the root-like masses at the base of *Lytocarpus pennarius*, Andaman Islands. Collected by J Wood-Mason.

Type in the Indian Museum, Calcutta.

Family PLUMULARIDÆ.

Antenella secundaria (Linnæus).

Linnæus, C., 1788-1793, p. 3854 ; as *Sertularia secundaria.*
Pictet, C., and Bedot, M., 1900, p. 27, pl. vi, fig. 7 ; as *Plumularia secundaria.*

Only a few small colonies of this species occur in the collection. The characteristic minute sarcotheca which lies in the angle behind the hydrotheca is clearly present ; the architecture differs in no detail from that of Atlantic specimens of this well-known species.

No gonangia are present.

It is not without considerable hesitation that I have transferred this well-known species from *Plumularia* to Allman's genus, *Antenella*. But, while it seems absurd to place in distinct genera, forms the minute structures of which are so similar as are those of *Plumularia catharina* and *Antenella secundaria*, yet it is sufficiently clear that the simple hydroclade-stem is characteristic of a considerable number of species, and therefore as a matter of systematic convenience it appears reasonable that *Antenella* should be retained as a separate genus, or at least as a sub-genus of *Plumularia*, until the classification of the Eleutheroplean Plumularians has been placed on a basis more satisfactory than that which at present holds.

Recent synonyms.—I am unable to find any character in Dr. E. Warren's description and figures of *Antenella natalensis*, Warren (1908, p. 318), which could separate it from the Linnean species recorded above. *A. natalensis* is obviously a synonym of *A. secundaria.*

In 1904 Miss Thornely described from Indian seas specimens of *Antenella gracilis*, Allman (1877), which " resemble the branches of *M*[*onostæchas*] *quadridens* exactly " (p. 121). These specimens, through the kindness of Miss Thornely and Professor W A. Herdman, I have been allowed to examine. They differ from *A. gracilis*, as described and figured by Allman, in possessing an exceedingly minute postcalycine sarcotheca, while in Allman's species the superior median sarcotheca not only does not lie exactly in the angle between hydrotheca and internode, but it is equal in size to

the other median sarcothecæ. The specimens are examples of *Antenella secundaria*, not of *A. gracilis*.

LOCALITY: Climbing over *Sertularella polyzonias* var. *cornuta*, from 8 miles west of Interview Island, Andaman Islands; depth 270—45 fathoms.

Distribution.—A. secundaria is a widely distributed though rather uncommon species, recorded from the Mediterranean Sea (Heller, 1868; Mark.-Turner., 1890); from the Atlantic Ocean, southwards from the shores of Britain (Hincks, 1868, as *Plumularia catharina* var.), and the Bay of Biscay (Pictet and Bedot, 1900; Billard, 1907 (1)) to the Azores (Billard, 1907), Madeira (Jäderholm, 1903), the north-west coast of Africa, and the Cape Verde Islands (Billard, 1907 (1)). Outside the Atlantic area it has been found in Indo-Pacific seas, from Natal (Warren, 1908, as *A. natalensis*), Ceylon (Thornely, 1904, as *A. gracilis*), Andaman Islands (present record), the Moluccas (Pictet, 1893), from Bass' Strait and Williamstown in Australia (Busk, 1852, and Bale, 1884, as *Plumularia campanula* var.[1]), and from Japan (Stechow, 1907 and 1909).

Aglaophenia septata,[2] Ritchie.

(Pl. iv, figs. 6, 7.)

Ritchie, J., 1909 (2), p. 526.

A single imperfect colony, 65 mm. high, with a straight, fascicled, unbranched stem, was obtained at a great depth near the Andamans. The anterior tube of the fascicle is alone divided into internodes, which are separated by faint nodes, are of uniform lengths, and bear each a process upon which a hydroclade is set.

The hydroclades are biserial, lying in two planes which meet at an acute angle on the anterior side of the stem. They are alternate, project from the stem at an angle of 40°—45°, and are about 8 mm. long (the longest being 11 mm.). The hydroclades are divided into regular thecate internodes each of which is partitioned by numerous strongly marked septa. Four septa generally spring from the posterior wall of the hydrotheca: a small one near the base of the supracalycine sarcothecæ, two from the middle of the hydrotheca, and the fourth from a postero-basal position. In addition, three project from the anterior wall of the internode proximal to the hydrotheca: of these the distal is very characteristic for it is tilted upwards, and, as in *Lytocarpus annandalei* of this report, traverses the base of the median sarcotheca, cutting off its cavity from that of the internode, but for a hole which allows of the passage of the cœnosarc.

The hydrothecæ are rather distant, almost triangular in lateral aspect, very narrow at their base, and widening greatly towards

1 The identification of *P. campanula* var. with the above species is due to the researches of Dr. Billard who has examined Busk's type specimens in the British Museum (Billard, 1909).

2 Septata—referring to the specific characters shown by the number and arrangement of the internodal septa.

the top. The margin has a prominent anterior tooth flanked by four distinct sinuations on each side. No intrathecal ridge exists, but the posterior wall bends inwards forming a rectangular bracket just above the base of the hydrotheca. The supracalycine sarcothecæ are large, almost cylindrical in shape, with a wide aperture, and an internal ridge projecting from a fold in their posterior wall. They slightly overtop the margin of the hydrotheca. The mesial sarcotheca is short, only about two-fifths the length of the anterior profile of the hydrotheca, to which it is altogether adnate except for a spout-like tip. Its cavity is interrupted by two processes: a button of chitin projects into it from the wall of the hydrotheca a short distance before the sarcotheca becomes free, and a septum, already described in connection with the internodal ridges, traverses its proximal end.

Three cauline sarcothecæ occur on each stem internode. Two of these are large, resembling the mesial sarcotheca in shape, and have a posterior internal ridge: the first lies on the anterior and near the proximal end of the internode, the other lies on that side of the hydroclade-bearing process which faces the centre of the stem, while the third sarcotheca is a mere perforation with slightly raised lips on the anterior of the process itself.

Gonosome.—Attached to the colony itself there occurred no reproductive body, but, entangled amongst the fibres at its base, a kind of corbula was found. This, in all probability, was really part of the colony, for no other Plumularian was contained in the same bottle, nor, in fact, were other Plumularians dredged at the same station. I shall describe it here on the supposition that gonosome and trophosome are one, a supposition which the similarity of their minute structures makes a virtual certainty.

The main body of this peculiar type of corbula consists of a hollow cigar-shaped portion within which lie six spherical reproductive masses in varying stages of development. Along the sides of this cylinder run two tiers of protective leaflets. Both the rows in the lower tier contain about 10 narrow, tubular leaflets armed with up to 16 or 18 nematophores, arranged biserially. In the two higher rows 8 or 9 leaflets are present, but they are more strongly developed and more irregular in shape than the others, frequently broadening out into leaf-like form. They, too, bear marginal nematophores but the biserial arrangement is less definite and the position of the sarcothecæ less regular. In structure the sarcothecæ correspond exactly to those which occur on the stem internodes.

All the leaflets stand away from the gonangia-bearing cylinder, and all are recurved, those of the upper tier more markedly than those of the lower. The lower surface of the cylinder, that is, the part corresponding to the keel of a typical corbula, bears longitudinal chitinous ridges—prolongations of the bases of the lower leaflets. On the upper side the gonangia are protected by delicate plates of chitin, some of which arise between the bases of the leaflets of the upper tier and bend inwards over the gonangia, while others

project from chitinous ridges stretching across the top of the cylinder from the bases of the leaflets.

Measurements.

Tube of fascicle, diameter	0·21—0·27 mm.
Stem internode, length	0·55—0·63 ,,
,, ,, diameter	0·17—0·18 ,,
Hydroclade internode, length	0·63—0·64 ,,
Hydrotheca, depth	0·39—0·43 ,,
,, diameter at mouth	0·25—0·28 ,,
"Corbula," length	4 ,,
,, greatest diameter	0·59 ,,

LOCALITY: Andaman Islands; depth 490 fathoms. Reg. No. 64/7.

Type in the Indian Museum, Calcutta.

While the general aspect of this species approaches that of *Thecocarpus*, I have placed it in the genus *Aglaophenia* on account of the gonosome, the protecting portions of which form a structure resembling a complex, open corbula, from the bases of the leaflets of which hydrothecæ are absent.

By the gonosome and by the shape and positions of the internodal septa in the hydroclades, together with the shape of the hydrotheca, this species may be distinguished from the other members of the genus.

Lytocarpus annandalei,[1] Ritchie.

(Pl. iv, figs. 8—10.)

Ritchie, J., 1909 (2), p. 527.

This species is formed for a single colony obtained at one of the deepest stations from which the "Investigator" obtained Hydroids. The colony, which is of a very dark brown colour, is unbranched, 63 mm. in height, with a rigid stem which is fascicled for its whole length, and is traversed by several pale constrictions slanting from behind downwards and forwards—such as occur in the species of *Thecocarpus*. Only the anterior tube, which does not possess nodes, bears hydroclades. These rest upon a short process from the stem, are close-set (separated by 0·5 mm.), alternate, and are divided into regular thecate internodes.

The hydrothecæ are closely approximated, deep, and rudely ovate in outline. Their aperture faces upwards and outwards, at an angle of about 45° with the stem; their profile is convex in the lower half, concave in the upper, while their margin bears a single prominent anterior tooth, and on each side four sinuations, of which

[1] I have pleasure in naming this species after Dr. Nelson Annandale, Superintendent of the Indian Museum, whose enthusiasm has done much for the advancement of our knowledge of the Invertebrate Zoology of India.

those second from the anterior tooth are somewhat larger than the others. The mesial sarcotheca is large, adnate for more than half the height of the hydrotheca, but with a scoop-shaped extremity free. The supracalycine sarcothecæ are very large, reach just above the margin of the hydrotheca, and possess a huge aperture. They are cylindrical in shape but for a constriction about midway, which is associated with an internal ridge traversing part of their cavity from the posterior wall.

The intrathecal ridge is little evident. Where present it is short, and projects into the lumen of the hydrotheca from a knob of chitin which terminates an angular in-bending of the posterior wall, situated a short distance above the floor of the cavity. The bases of the two sides of the angle are marked by well-defined ridges projecting from the posterior of the hydrotheca into the cavity of the internode, while a third posterior ridge arises just above the bases of the supracalycine sarcothecæ. Another shorter ridge projects backwards into the proximal portion of the internode from its anterior wall. Two important and characteristic chitinous thickenings are associated with the mesial nematophore: one is a simple knob, projecting forwards from the hydrotheca wall into the nematophore cavity near its mid point, the other is a sinuous septum traversing the base of the sarcotheca and isolating its cavity from that of the internode, except for a small opening through which the sarcostyle passes. Occasionally from the convex surface of this hook-like septum a small chitinous ridge projects backwards (see lower hydrotheca, pl. iv, fig. 9).

Two large scoop-shaped sarcothecæ lie on the hydroclade-bearing tube at the base of each hydroclade, one proximal to the process on which the hydroclade rests, the other supero-lateral, on the side of the process which faces inwards. The process itself bears a small, anterior, tubular sarcotheca.

Gonosome.—A few structures, apparently phylactocarps, are present, although unfortunately they are immature, or have lost their gonangia. They replace hydroclades on the lower portion of the stem, and are obviously morphological modifications of these, for they are divided into internodes each of which bears three regularly-arranged, scoop-shaped sarcothecæ—one median and proximal, the others lateral and distal, in a pair (pl. iv, fig. 10). Each internode corresponds to a thecate internode, without the hydrotheca. No hydrotheca occurs on the proximal internode of the phylactocarp. No gonangia are present, but, as in other species, they no doubt assume the positions of the missing hydrothecæ.

Measurements.

Hydroclade-bearing tube, diameter	0·21 mm.
Hydrocladial internode, length	0·48 ,,
Hydrotheca, depth	0·35 ,,
,, diameter at mouth	0·21 ,,
Phylactocarp, length of internodes	0·27 ,,

LOCALITY: R.I.M.S. "Investigator" Station 241, lat. 10° 12′ N., long. 92° 20′ 30″ E., between the Andaman and Nicobar Islands; depth 606 fathoms.

This is a very well-defined species, easily distinguished by the peculiar arrangement of its internodal ridges, by its large sarcothecæ, and by the sinuous margin of its hydrothecæ.

Type in the Indian Museum, Calcutta.

Lytocarpus pennarius (Linnæus).

(Pl. iv, fig. 11.)

Linnæus, C., 1758, p. 813; as *Sertularia pennaria.*
Allman, J G., 1883, p. 42, pl. xiv; as *L. secundus*, Kirchenpauer.[1]

This species is represented by a solitary much-weathered colony 56 cm. long, with a large basal mass of matted rhizoids; and by a few unattached branches. While the specimens agree with Allman's description, the following additional observations have been made. The hydroclades spring alternately from the anterior tube of the fascicle, and sometimes reach a length of 18 mm., three times the recorded length of those in the "Challenger" collection. The hydroclade-bearing process is accompanied by three large, scoop-shaped sarcothecæ, two of which are anterior—one on the process, the other proximal to it—while the third lies on the inner side of the angle between process and stem.

The hydrothecæ agree closely with the description of Marktanner-Turneretscher (1890, p. 273). The margin bears a prominent anterior tooth, and about four indefinite sinuations on each side. The intrathecal ridge is short, slants upwards, and often terminates in a prominent knob, while the internodal ridges are much more insignificant than those in Allman's figures. The mesial sarcotheca is adnate for little more than half the height of the hydrotheca and a connection exists between the distal portion of its cavity and that of the hydrotheca. The supracalycine sarcothecæ are asymmetrical, that on the side of the hydrotheca facing inwards towards the centre of the stem being very large and bowl-shaped, while the other has a diameter scarcely half that of its fellow (pl. iv, fig. 11). This difference may in part account for the discrepancy between the sizes of the sarcothecæ as figured by Kirchenpauer (1872) and by Allman, the latter having figured the hydrotheca from the stem side, the former from the opposite. Notwithstanding, however, the hydrothecæ of our specimens, as did those of Marktanner-Turneretscher, agree more closely with Kirchenpauer's diagnosis of *Aglaophenia crispata* than with that of *A. secunda*, to which Allman referred his specimens.

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[1] The identity of the "Challenger" specimens with the Linnean species has been established by Billard (1908, p. 3) after comparison of the former with the Linnean type specimen in the British Museum.

A few branches of a specimen also occur in the collection in an unlabelled bottle. The hydrothecæ of these differ from those described above in being slightly more closely approximated, in possessing more distinct internodal and intrathecal ridges, larger cauline sarcothecæ, a longer mesial sarcotheca jutting out more strongly from the hydrotheca, and a margin rising into a broad lobe on each side. They differ also somewhat in size,—see table below. The branches bear phylactocarps with sometimes as many as 14 nematoclades. The gonangia spring from near the bases of the nematoclades and are broadly ovate.

Measurements.

	Andamans specimen.	Unlabelled fragments.
Hydroclade internodes, length	0·28 mm.	0·22 mm.
Hydrotheca, depth	0·27 ,,	0·22 ,,
,, diameter at mouth	0·14 ,,	0·13 ,,
Gonangium, length		0·64 ,,
,, greatest diameter		0·49 ,,

LOCALITY: Andaman Islands (collected by J Wood-Mason, Marine Survey).

Distribution.—A distinctively Indo-Pacific species; recorded from the South Sea, China Sea, Pelew Islands, by Kirchenpauer (1872); from the Philippine Islands by Allman (*loc. cit.*), from Singapore by Marktanner-Turneretscher (*loc. cit.*), and now from Indian waters.

Lytocarpus philippinus (Kirchenpauer).

Kirchenpauer, G. H., 1872, pp. 29, 45, pls. i, ii, vii, fig. 26; as *Aglaophenia philippina.*

Nutting, C. C., 1900, p. 122, pl. xxxi, figs. 4—7.

A specimen in fragmentary condition represents this species. The minute structures are altogether similar to those of previous descriptions, but there is considerable variation in insignificant details. Thus while the lateral margin is, more generally perhaps, a single large lobe, as in Marktanner-Turneretscher's figure of a specimen from the Red Sea (1890, pl. vi, fig. 15), sometimes it is divided into two distinct waves as in a Madagascar specimen figured by Billard (1907, fig. 18, p. 377). There are also considerable differences in the size of the embayment which separates the anterior tooth of the hydrotheca from the median sarcotheca.

Measurements.

Hydrocladial internode, length	0·27 mm.
Hydrotheca, width of lower portion	0·10—0·13 ,,
,, ,, mouth	0·13 ,,
Mesial sarcotheca, length	0·27 ,,
,, ,, ,, of free portion	0·08 ,,
Supracalycine sarcotheca, length	0·17 ,,

LOCALITY: Karachi. Specimen from Karachi Museum. Reg. No. 8210/9.

Distribution.—The geographical range of this species is extraordinarily wide for a form so large—one, therefore, unlikely to be transported readily from one locality to another far distant. It has been found in the South Pacific Ocean, amongst the Society Islands (Tahiti; Jäderholm, 1903). Thence it spreads along the east coast of Australia (Pt. Stephens, Pt. Denison, Moreton Bay; Bale, 1884, 1888) through Torres Straits (Kirkpatrick, 1890) to the East Indies (Pictet, 1893; Weltner, 1900) and South China Sea (Kirchenpauer, 1872).

In the Indian Ocean it has occurred off Karachi (Jäderholm, *l. c.*; and present record), and off the African coast in the neighbourhood of Madagascar (Billard, 1907 (2)). Ranging thence through the Red Sea (Mark.-Turner., 1890; Thornely, 1908) and the Mediterranean (Mark.-Turn., *l. c.*) it finally makes its appearance in the Atlantic, in the northern portion of which it has been recorded from Panama, Jamaica (Nutting, 1900), and Bermuda Islands (Congdon, 1907), and in the southern from Bahia (Nutting, *l. c.*).

Lytocarpus phœniceus (Busk).

Busk, G., 1852, vol. i, p. 398; as *Plumularia phœnicea.*
Bale, W M., 1884, p. 159, pl. xv, figs. 1—5; pl. xvii, figs. 1—4; pl. xix, fig. 31; as *Aglaophenia phœnicea.*

A magnificent example of this species, 19 cm. high, with a spread of 10 cm., was obtained in deep water off Interview Island. The stalk is expanded at the base, and for 10 cm. upwards is destitute of branches, but, beyond this, luxuriant growth occurs. The macroscopic and microscopic structures agree admirably with previous descriptions, while of the many forms assumed by this exceedingly variable species the hydrothecæ of the specimens before me approach most closely those figured by Bale (1884, pl. xv, fig. 1) from specimens originally described by Busk from Torres Strait. They differ, however, in having less pronounced internodal septa, and in having the median sarcotheca tilted further upwards, this latter feature having been singled out by Marktanner-Turneretscher (1890, p. 276) in specimens from the Indian Ocean. A very evident second aperture is present on the superior interior surface of the lateral sarcothecæ.

Measurements.

Hydrocladial internode, length	0·25 mm.
Hydrotheca, diameter at mouth[1]	0·11 ,,
Median nematophores, length	0·15—0·18 ,,

LOCALITY: Eight miles west of Interview Island, Andaman Islands; depth 270—45 fathoms.

Distribution.—An Indo-Pacific species, which has been recorded from (1) Northern Pacific Ocean (Japan; Mark.-Turn., 1890, Stechow, 1907 and 1909: Hawaiian Islands; Nutting, 1905); (2) China Sea (Amoy; Mark.-Turn., *l.c.*); (3) East Coast of Australia (Port Denison; Bale, 1884); (4) North Coast of Australia (Port Darwin; Bale, *l.c.*: Torres Strait; Busk, 1852, Kirkpatrick, 1890); (5) East Indies (? Singapore; Kirchenpauer, 1872, as *Aglaophenia rostrata*); (6) Indian Seas (Mark.-Turn., *l.c.*: Ceylon, 7—10 fms.; Thornely, 1904: Andaman Islands, present record).

Halicornaria balei (Marktanner-Turneretscher).

(Pl. iv, fig. 12, var.)

Marktanner-Turneretscher, G., 1890, p. 272, pl. vii, figs. 19, 20; as *Aglaophenia balei.*

A very few fragmentary colonies of this species were found projecting from a sponge. One agrees closely with the original description, but it is a fragment only 13 mm. in height, and from the delicacy of its structures appears to be a young specimen. Few differences, and these of no specific value in a genus where considerable variation is the rule, distinguish our specimens from the Red Sea examples. Thus the median lobe of the hydrotheca is less long and less pointed, and occasionally a second indistinct lobe appears on the margin; the median sarcotheca is somewhat longer, reaching clear of the edge of the hydrotheca; the hydrotheca is less markedly tilted forward; and in our specimens the opening at the base of the hydrotheca, through which the cœnosarc passed, is bordered by sharp chitinous spines, projecting into the hydrotheca cavity, which in profile give a pectinated appearance to the base of the cup. Probably the basal pecten was overlooked by Marktanner-Turneretscher, as it is difficult to be distinguished until the cœnosarc has been removed. The upper margin of the intrathecal ridge, viewed from in front, is seen to be rudely pectinated.

Although the gonosome is absent, the characters of the trophosome warrant the transference of this species from *Aglaophenia* to the genus *Halicornaria*. It is closely related to *H. hians*, Busk, 1852, from which it is to be distinguished by the strong convexity of its median sarcotheca (apparently a constant character), by its deeper hydrotheca, and by the position of the intrathecal ridge

[1] Measured in the direction of the hydrocladial axis.

which is situated at a greater distance from the base of the hydrotheca.

Measurements of parts are placed, for the sake of comparison, alongside those of the variety recorded below.

LOCALITY: Andamans, 1899; 60 fathoms.

H. balei, var. *flava*, Nutting (?).

(Pl. iv, fig. 12.)

Nutting, C. C., 1905, p. 955, pl. xiii, figs. 11, 12, as *Halicornaria flava*.

The remaining fragments of this species belong to colonies more robust in build, but with similar minute characters. Variations in the number and prominence of the lateral lobes occur here also, the large lateral lobe being sometimes accompanied by a smaller. The variety differs from the type however with regard to the compression of its hydrothecæ, for in the former they are so closely set that the lower part of the mesial sarcotheca of one depresses the upper margin of the hydrotheca immediately below it.

I am unable to find characters sufficient to separate Professor Nutting's *Halicornaria flava* from the compressed variety of *H. balei*, a species which, since he considered the chitinous projection within the mesial sarcotheca to be unique for the genus, Nutting had apparently overlooked. In our specimens, however, the stem nodes are irregular, bearing varying numbers of hydroclades, and in addition to the two sarcothecæ at the front of the base of each hydroclade, a third is situated behind.

Measurements.

	F. *typica*.	V. *flava*.
Stem, diameter	0·13 mm.	0 35 mm.
Hydroclade internodes, length	0·32 ,,	0·22—0·24 ,,
Hydrotheca, depth, base to topmost point	0·25 ,,	0·22 ,,
,, width, wing to wing	0·20 ,,	0·21 ,,

LOCALITY: Andamans, 1899; 60 fathoms.

Distribution.—The species has been recorded only from the Red Sea (Mark.-Turn.); from the Bay of Bengal (present record) and from the Hawaiian Islands (Nutting, 1905).

Halicornaria gracilicaulis (Jäderholm).

Jäderholm, E., 1903, p. 299, pl. xiv, figs. 3, 4; as *Lytocarpus gracilicaulis*.

A graceful species represented by a few fragments protruding from a sponge. Although in an early stage of development the stem is already fascicled, and bears a single branch. The unjointed basal portion of the branch, to which Jäderholm refers, was indistinguishable, for although a length in our specimens is destitute of

hydrothecæ or hydroclades, it is divided by faint nodes into four internodes each of which bears a single median sarcotheca on its anterior surface.

The minute characters of the hydrothecæ agree exactly with those given by Jäderholm. It is worthy of note that in some of the hydrothecæ the internodal septa at the base of the supracalycine nematophores and opposite the intrathecal partition are much more strongly developed than Jäderholm's figure shows, while a third septum is occasionally visible stretching across the thecate internode close to its proximal end. One end of this septum rests on a knob of chitin projecting from the abcauline wall of the internode. In these details our specimens vary somewhat as did those described by Billard (1907 (2), p. 366).

The gonosome is not present but through its occurrence in specimens described by him Billard transferred the species from *Lytocarpus* to *Halicornaria.*

Measurements.

Hydroclade, length	1—3	mm.
,, internode, length	0·29—0·33	,,
Hydrotheca, diameter	0·91	,,
,, ,, of mouth, side to side	0·11—0·13	,,
,, ,, ,, back to front	0·08—0·10	,,

LOCALITY: Andaman Islands, 1899; 60 fathoms.

Distribution.—This species has seldom been recorded, but its distribution appears to be Indo-Pacific, for it has been found off South Japan (Jäderholm, 1903); at Ternate, in Oceania (figured by Campenhausen, 1897, pl. xv, fig. 3); on the south-east coast of Africa, at Macalonga and Mozambique (Billard, 1907 (2)); and the present record adds it to the fauna of India.

Halicornaria hians, Busk, var. *profunda*, Ritchie.

(Pl. iv, figs. 13, 14.)

Bale, W M., 1884, p. 179, pl. xiii, fig. 6; pl. xvi, fig. 7, *H. hians*, typicus.

Ritchie, J., 1909 (2), p. 528.

The longest of the few colonies in the collection was only 4 cm. in height, with monosiphonic, unbranched stem, divided into internodes bearing generally two, occasionally three, alternate hydroclades. Each hydroclade is divided into thecate internodes twice as long as broad near the stem, but gradually becoming longer and more slender as they recede from it, until at the distal end of a hydroclade their length may be to their breadth as four to one.

The hydrothecæ are deep, with a margin divided on each side into three lobes, of which the superior and the median are the

sharpest and the most pronounced, and an aperture lying at an angle of about 30° with the axis of the hydroclade. A stout intrathecal ridge, running backwards to the middle of the lumen, where it ends in an upturned thickening, marks the position of an anterior fold in the hydrothecal wall. Small chitinous points surround the opening through which the hydranth connects with the common cœnosarc. The mesial sarcotheca is very variable, its early stage, as seen in young colonies or on the distal ends of some hydroclades, closely resembling that of *H. variabilis*, Nutting (1900, p. 127, pl. xxxiii, fig. 7), for it stops considerably short of the intrathecal ridge; while in its mature state it is adnate almost to the lip of the hydrotheca, projecting beyond the margin as a short free spout. Its most marked character in all stages is the concavity of its profile, and there is always present, more or less strongly developed, an internal chitinous projection almost on the level of the base of the hydrotheca. The supracalycine sarcothecæ are small, not reaching to the margin of the hydrotheca, almost oval in outline, with a solitary wide superior aperture. The cauline sarcothecæ are three in number, two on the stem anterior to the hydroclade and one posterior, almost in the angle above the hydroclade. In shape they resemble the supracalycine sarcothecæ—none are bilobed, nor have any two apertures.

Gonosome.—The gonangia, a funnel- or flask-like form of which has been described by Stechow (1907, p. 200; 1909, p. 102, pl. vi, fig. 17), are present in numbers. They are unprotected and are borne on very short stalks, one at the base of each hydroclade. In shape they are saucer-like, convex beneath, concave above, and appearing as perfect disks when viewed from the anterior of the colony.

Measurements.

	Mature colony.	Young colony.
Hydroclade internode, length .	0·35—0·42 mm.	0·39—0·43 mm.
,, ,, diameter at base ..	0·11—0·17 ,,	0·07—0·10 ,,
Hydrotheca, depth from base to highest teeth	0·28—0·29 ,,	0·25—0·27 ,,
,, diameter of lower portion	0·14—0·15 ,,	0·11—0·12 ,,
,, vertical diameter of mouth	0·20—0·21 ,,	0·17—0·18 ,,
Gonangium, diameter of disk.	up to 0·38 ,,	

LOCALITY: Andaman Islands, 1899; 60 fathoms.

Distribution.—Previously recorded from Torres Strait (Busk. 1852: Kirkpatrick, 1890).

Type of variety in the Indian Museum, Calcutta.

Remarks.—This variety is distinguished from the typical form as figured by Bale, by the greater length of the thecate internodes compared with their diameter, the greater depth and more erect posture of the hydrothecæ (to the former of which characters the name of the variety alludes), and the greater distance which separates the intrathecal septum from the base of the hydrotheca. The less

prominent nature of the marginal teeth, and the smaller size of the colonies are variations of little significance. There is a similarity between this variety and some of the stages of *H. variabilis*, Nutting (1900, p. 127), but the latter species possesses very large bilobed cauline sarcothecæ.

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