

EXOTIC HYDROIDS IN THE COLLECTIONS OF THE RIJKSMUSEUM VAN NATUURLIJKE HISTORIE AND THE ZOOLOGICAL MUSEUM AT AMSTERDAM

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With 10 textfigures

In the course of 1944, whilst engaged with the revision of the collections of Hydroids in the Rijksmuseum van Natuurlijke Historie at Leiden and the Zoological Museum at Amsterdam, I had the opportunity to study a considerable number of Hydroids from the tropical and subtropical parts of the three large oceans. No report has up to the present time been published on these Hydroids, although many specimens are of considerable interest. The present paper contains the results of the study of these samples, which were kindly put at my disposal by Prof. Dr. H. Boschma and Prof. Dr. L. F. de Beaufort. I also wish to express my sincere thanks to Mrs. W. S. S. van der Feen née van Benthem Jutting and Miss Dr. Jos. Th. Koster for their assistance in providing me with material.

List of the species

Tubulariidae: *Tubularia larynx* Ell. et Sol., 1786; *Tubularia* spec.

Halocordylidae: *Halocordyle disticha* (Goldfuss, 1820); *Halocordyle disticha* (Goldfuss, 1820) var. *australis* (Bale, 1884).

Clavidae: *Cordylophora caspia* (Pall., 1771); *Corydendrium parasiticum* (L., 1767); *Campaniclava clionis* Vanhöffen, 1910; *Campaniclava cleodora* (Gegenbaur, 1854).

Bougainvilliidae: *Leuckartiara vestita* (Wright, 1859) forma *nana* (Le-loup, 1932).

Eudendriidae: *Eudendrium capillare* Alder, 1856.

Haleciidae: *Halecium halecinum* (L., 1758); *Halecium beanii* (Johnst., 1838); *Halecium houvillei* Billard, 1934.

Campanulinidae: *Stegolaria geniculata* (Allman, 1888).

Lafoeidae: *Lafoea benthophyla* Ritchie, 1909; *Hebella calcarata* (L. Agas-

siz, 1862); *Hebella calcarata* (L. Agassiz, 1862) var. *contorta* Marktanner, 1890; *Scandia mutabilis* (Ritchie, 1907).

Syntheciidae: *Synthecium megathecum* Billard, 1924.

Sertulariidae: *Thyrosocyphus fruticosus* (Esper, 1788-1830); *Idiella pristin* (Lamx., 1816); *Diphasia digitalis* (Busk, 1852); *Dynamena cornicina* McGrady, 1858; *Dynamena quadridentata* (Ell. et Sol., 1786); *Sertularella gayi* (Lamx., 1821) var. *parva* Billard, 1925; *Sertularella neglecta* D'A. W. Thomps., 1879; *Sertularella indivisa* Bale, 1881; *Sertularella crassicaulis* Heller, 1868; *Sertularella mediterranea* Hartlaub, 1901; *Sertularella quadridens* (Bale, 1884); *Sertularella subdichotoma* Kirchenp., 1884; *Sertularia distans* (Lamx. 1816); *Sertularia elongata* Lamx., 1816; *Sertularia bispinosa* (Gray, 1843); *Sertularia operculata* L., 1758; *Dymella articulata* (Pall., 1766).

Plumulariidae: *Kirchenpaueria pinnata* (L., 1758); *Antennella sibogae* Billard, 1911; *Plumularia setacea* (L., 1758); *Plumularia spiralis* Billard, 1911; *Nemertesia antennina* (L., 1758); *Nemertesia perrieri* (Billard, 1901); *Nemertesia tetrasticha* (Meneghini, 1845).

Aglaopheniidae: *Halicornaria longirostris* (Kirchenp., 1872); *Lytocarpus phoeniceus* (Busk, 1852); *Lytocarpus philippinus* (Kirchenp., 1872); *Lytocarpus filamentosus* (Lamarck, 1816); *Monoserius fasciculatus* (Thornely, 1904); *Thecocarpus formosus* (Busk, 1850); *Thecocarpus giardi* Billard, 1907; *Aglaophenia pluma* (L., 1758); *Aglaophenia dichotoma* (M. Sars, 1857); *Aglaophenia latecarinata* Allman, 1885; *Aglaophenia parvula* Bale, 1881; *Aglaophenia rathbuni* Nutting, 1900; *Aglaophenia divaricata* (Busk, 1852); *Aglaophenia cupressina* Lamx., 1816.

Campanulariidae: *Campanularia johnstoni* Alder, 1856; *Laomedea striata* (Clarke, 1907); *Laomedea longicyatha* (Allman, 1877); *Laomedea bicuspidata* (Clark, 1875); *Laomedea bicuspidata* (Clark, 1875) var. *tenuis* nov. var.; *Laomedea sargassi* Broch, 1913; *Laomedea loveni* Allman, 1859; *Laomedea* spec.

The specimens from the Zoological Museum at Amsterdam are indicated as such under the heading "Localities". All the other specimens belong to the collections of the Rijksmuseum van Natuurlijke Historie. This also applies to the specimens from the Dana Expedition, which were received from Dr. J. J. Tesch who studied the Pteropoda of this expedition.

Tubularia larynx Ellis & Solander, 1786

Locality: Gulf of Naples, G. Stiasny (no. 263). One colony of \pm 5 cm height on *Mytilus*, together with *Laomedea loveni* Allm.

The present colony consists of unbranched hydrocauli, rising from a

distinct, creeping hydrorhiza. There are no substantial differences from polyps collected in the North Sea, with which I have compared the Mediterranean specimens. There are no distinct rings on the thin periderm of the hydrocaulus, which shows no longitudinal stripes. The apical part of the hydrocaulus is distinctly swollen, the hydranth is separated from this slightly conical swelling by a distinct annular constriction. The hydranths have long and dense clusters of gonophores, which occasionally are branched. Each gonophore has three distinct tentacular rudiments near the apex; the clusters are sometimes slightly longer than the basal tentacles.

Distribution. It is impossible to give the exact area of distribution of this widely scattered species. Moreover, *T. larynx* is exceedingly variable and has been described and redescribed by many authors under a variety of names. Fenchel (1905) gives a critical review of a number of *Tubularia*'s described up to 1905 and has made it acceptable that at least 15 "species", hitherto considered as different species and mentioned under different names, are synonymous with *T. larynx*. The area of distribution extends from 75° N to at least 34° S, or, if *Tubularia kerguelensis* Studer, 1879, is synonymous with *T. larynx*, which seems very probable, to about 50° S. Since 1905 another large number of *Tubularia*'s has been introduced into literature, several of which show great resemblance to *T. larynx*. Fraser (1938), e.g., has described *Tubularia integra* (p. 26, pl. 5 fig. 24) which is almost certainly identical with *T. larynx*, so that this species may also have been found in the tropical East-Pacific. The description of *T. integra*, as that of many other species of the genus *Tubularia*, is very short and the synonymy can only be given after a study of the type specimens. Although *T. larynx* has a remarkably wide distribution, its main area of occurrence is in the boreal parts of the Atlantic. Along the coasts of Great Britain, Ireland and Western Europe it is very common, whilst it penetrates into the Mediterranean; from the Naples area it has previously been recorded by Stechow (1919).

***Tubularia* spec.**

Locality: Beira, South Africa, M. Weber (Collection Zoological Museum Amsterdam).

Badly preserved specimens of a *Tubularia*, covered by *Laomedea*, are present in the above mentioned collection. They cannot be identified with certainty.

***Halocordyle disticha* (Goldfuss, 1820)**

Locality: Mar Morto near Cape Miseno, Naples, G. Stiasny, June 1934 (no. 264). Several up to 12 cm high colonies with gonophores in various stages of development.

The stalks of the polyps of the present colony normally are annulated throughout their entire length; the periderm of several stalks, however, only shows distinct annulations near the base and closely under the hydranth. Such stalks are found between the entirely annulated pedicels on the same colony. As a rule more rings are developed than in the var. *australis* (Bale). The pedicels have a length of 0.5-2.0 mm; the polyps are \pm 1.0 mm long.

Halocordyle disticha (Goldfuss, 1820) var. **australis** (Bale, 1884)

Localities:

Senegal, West Africa, depth 15 fms., A. Vermeulen (Collection Zoological Museum Amsterdam). Three large colonies, varying in height between 10 and 18 cm.

Reunion Rock, Isipingo near Durban, H. Engel, October 28, 1938 (Collection Zoological Museum Amsterdam). One small colony on a worm tube, together with a number of Algae covered by *Dynamena quadridens* (Ell. & Sol.).

The colonies from Senegal each consist of a large number (\pm 25) of hydrocauli, rising from an indistinct and twined mass of hydrorhiza fibres. As a rule these hydrocauli are monosiphonical throughout their entire length, but sometimes the basal part of a hydrocaulus is covered by secondary tubes, which may also support the sidebranches. The hydranths are found directly on these sidebranches, or on their secondary ramifications. The hydrocauli have a few distinct rings above each sidebranch; the periderm has a very dark, almost black colour. The hydranths of the Senegal colonies are in a very bad condition, no gonophores could be observed.

The colony from Durban consists of a creeping, \pm 0.6 mm thick, dark brown stolon, from which rise a number of 15-20 mm high hydrocauli, which also have a dark brown periderm. The primary sidebranches have thin, white coloured periderm; they are provided with a terminal hydranth and have each 2 or 3 secondary, polyp bearing pedicels. The stalks of the hydranths have a distinct but thin periderm, terminating some distance under the hydranth, and have a large number of rings, sometimes separated by short smooth or wrinkled parts of periderm, differing in this respect from the Senegal colonies, where only some basal annulations are found on the pedicels. The hydranths are in good condition, the very youthful gonophores are found some distance above the basal tentacles.

The var. *australis* of the widely distributed *Halocordyle disticha* may differ from the typical species by its production of free medusae, whilst the typical form is assumed to have fixed gonophores (Stechow, 1923, 1924; Hargitt, 1924). This fact, however, requires closer investigation; the annulation of the pedicels, originally used by Bale (1884) to separate his "*Pennaria australis*" from "*Pennaria Cavolinii*" (= *Halocordyle disticha*), seems to be extremely variable (Pictet, 1893; Leloup, 1937, 1937a).

The geographical distribution of *Halocordyle disticha* has been discussed in a previous paper (Vervoort, 1941); the species and its variety are widely distributed in the tropical and subtropical parts of the Atlantic, Indian and Pacific Oceans. The species has recently been recorded from Puerto Cabello, Venezuela (Leloup, 1937), the tropical East-Pacific (Galapagos Islands and Costa Rica, Fraser, 1938, under the name *Pennaria tiarella*). It has previously been recorded from Senegambia by Leloup (1937) and from the coast of Natal by Warren (1908).

***Cordylophora caspia* (Pallas, 1771)**

Cordylophora lacustris Allman, 1844, p. 330.

Cordylophora albicola Kirchenpauer, 1861, p. 284, pl. 9 figs 12-14.

Cordylophora americana Leidy, 1870, p. 113.

Cordylophora fluviatilis Hamilton, 1883, p. 419.

Cordylophora whiteleggei Von Lendenfeld, 1886, p. 97, pl. 6 figs. 11, 12.

?*Cordylophora dubia* Hargitt, 1924, p. 468.

Locality: Mouth of the Koeboe river, West Borneo, H. A. Lorentz, July 31, 1909 (Collection Zoological Museum Amsterdam). A large number of 5-7 cm high colonies with many male and female gonophores. Together with some hydrocauli of *Laomedea bicuspidata* (Clark) var. *tenuis* nov. var.

The present colonies have erect hydrocauli, rising from indistinct hydro-rhiza fibres, monosiphonical over the greater part of their length, but sometimes covered by a few secondary tubes in the basal part. There are many hydranths, originating directly from the hydrocaulus or the main branches; in many colonies the sidebranches of the hydrocaulus are branched for a second time, the hydranths are found principally on the secondary ramifications in such colonies. I have been unable to find differences between the present East Indian material and colonies present in the Collections of the Rijksmuseum van Natuurlijke Historie at Leiden and the Zoological Museum at Amsterdam from a variety of brackish water localities in the Netherlands. The hydrocauli of the colonies from West Bornea are almost black; in the Dutch colonies the periderm of the hydrocauli has a light, horny colour. There are no differences in the shape of the hydranths and the gonophores, which occur in large numbers on the stalks of the polyps. The structure of the colony agrees with a form described by P. Schulze (1921) as forma *typica*.

Finlay (1928) records colonies of a hydroid, which he refers to *Cordylophora fluviatilis* Hamilton, from the Esk River, Hawke's Bay, on New Zealand, a brackish water locality which shows some resemblance to the Bornean locality. *C. fluviatilis*, as has also been shown by Briggs (1931), cannot be separated from *C. caspia*. Hargitt (1924) describes a species of

the genus *Cordylophora* from the Philippines as *C. dubia*; although the exact localities where the specimens were collected are very vaguely mentioned, at least some of the colonies which he describes are from marine or brackish localities as they were found together with fragments of *Eudendrium* and *Obelia* (= *Laomedea*). Hargitt's newly described species is founded on rather obscure characteristics (the more slender stems, smaller hydranths and clearly different gonangia); it is almost certainly identical with *Cordylophora caspia*. It seems probable that at least a part of the material described by Von Lendenfeld (1886) and later on mentioned by Whitelegge (1889), collected in the Sydney region, Australia, was found in a brackish water locality (cf. Briggs, 1931).

The geographical distribution of *Cordylophora caspia* is extraordinary wide; the localities, however, are scattered. It has been recorded from many more or less brackish localities in Europe; it has also been found at some places in Egypt, China, the United States, Brazil, Argentine, Australia and Tasmania. Torrey (1902) has described a hydroid under the name of *Bimeria franciscana*, which shows some resemblance with *Cordylophora caspia*; Leloup (1932) has recently described specimens, which are attributed to the same species, from a number of Indian localities. In some of the localities mentioned by Leloup (e.g., Saugor Island, mouth of the river Hooghly) his specimens of *Bimeria franciscana* may have been found in brackish water. Torrey's species, which was only shortly described and very fragmentarily figured, needs a closer investigation.

***Corydendrium parasiticum* (Linnaeus, 1767)**

Localities:

Gulf of Naples, G. Stiasny, August, 1924 (no. 15). Two well developed colonies of 5 and 8 cm height. Gonophores in various stages of development are present; the larger colony with a distinct, polysiphonical hydrocaulus, which at its base has a diameter of 2-3 mm.

Gier no. 9, Exped. 18, 0° 14' N, 104° 04' E, 13-16 fms., July 2, 1908 (no. 809). Several fragments of a colony, partly covered by a sponge. Only very mutilated hydranths are present. No gonophores.

I have carefully compared the mediterranean specimens with Ritchie's (1907) detailed description of *Soleniopsis dendriformis*; I have been unable to trace any substantial difference and both species are certainly identical. According to Ritchie *C. parasiticum* is said to produce free medusae, which statement is certainly due to a mistake. In the textbook of Delage and Hérourard (1901), to which Ritchie refers, the authors state that the free medusae of *Corydendrium parasiticum* are unknown, which is certainly true, as no free medusae at all are produced by the latter species! Boone

(1938) recently described a hydroid as *Corydendrium splendidum* from the Hawaiian Islands. Although the exact systematical position of this species is not quite certain, it does not belong to the genus *Corydendrium*. A revision of the various species of the latter genus seems necessary as a comparatively large number of species has up to the present time been attributed to it, generally founded on slight differences. Fraser (1938), for instance, described a hydroid as *Corydendrium flabellatum*, which is very closely related to, or probably even is identical with *C. parasiticum*; both description and drawing of Fraser's species are insufficient to recognize it with absolute certainty. The various members of the genus *Corydendrium* are found in tropical and subtropical parts of the Atlantic, Pacific and Indian Oceans; Kramp (1935) described a *Corydendrium* as *C. dispar* from the Danish waters. The geographical distribution of the species cannot be stated as long as their systematical relationship remains uncertain (cf. Vervoort, 1941).

Campaniclava clionis Vanhöffen, 1910

Localities:

Dana Expedition, Sta. 4003, X, 8° 26' N, 15° 11' W, 100 m wire, March 9, 1930, on *Euclio balantium* (Rang) (no. 667).

Dana Expedition, Sta. 4005, III, 13° 31' N, 18° 03' W, 50 m wire, March 12, 1930, on *Euclio balantium* (Rang) (no. 668).

Dr. J. J. Tesch drew my attention to small colonies of Hydroida, occurring on Pteropod shells, collected during the Dana Expeditions and sent to him for identification. Dr. Tesch kindly put the material on which hydroids occurred at my disposal so that I could study three species of hydroids occurring on at least five different species of Pteropoda (*Campaniclava clionis* Vanhöffen, *C. cleodorae* (Gegenbaur) and *Laomedea striata* (Clark)). Of these three species *Campaniclava clionis* is most plentifully represented; besides the specimens from Dana stations 4003 and 4005, which have been mentioned above, I have seen specimens from the following Atlantic localities: Sta. 1118 (35° 41' N, 2° 54' W); Sta. 1159 (17° 55' N, 24° 35' W); Sta. 1160 (15° 50' N, 26° 32' W); Sta. 1163 (12° 59' N, 32° 49' W); Sta. 1165 (12° 11' N, 35° 49' W); Sta. 1166 (10° 16' N, 40° 41' W); Sta. 1168 (9° 30' N, 42° 41' W); Sta. 1171 (8° 19' N, 44° 35' W); Sta. 3981 (19° 16' S, 1° 48' W); Sta. 4006 (15° 31' N, 18° 05' W). All specimens were found on *Euclio balantium* (Rang); at Sta. 1118 some additional colonies were found growing on *Euclio pyramidata* (L.). The colonies cover both sides of the Pteropod shells and richly bear gonophores.

The geographical distribution of *Campaniclava clionis* has been discussed by Kramp (1922). The species seems to be very common on *Euclio balantium* in the tropical Atlantic from 21.5° N to 19.5° S, its area of distribution extending from the coast of West Africa to at least 44.5° W. It has also been recorded from the Indian Ocean (33° S, 58° E) and it was once found near the Marquesas Islands in the Pacific Ocean. A further study of the Pteropods from numerous Dana stations, which up to the present time have remained uninvestigated, may reveal its presence in many more samples and may considerably extend its present area of distribution.

***Campaniclava cleodora* (Gegenbaur, 1854)**

Dana Expedition, Sta. 1118, III, 35° 41' N, 2° 54' W, 100 m wire, September 22, 1921, on *Euclio cuspidata* (Bosc) (no. 666).

Dana Expedition, Sta. 3932, IX, 11° 35' S, 49° 45' E, 300 m wire, December 20, 1929, on *Euclio cuspidata* (Bosc) (no. 758).

The species seems to be comparatively common on the Pteropod *Euclio cuspidata* (Bosc). It was originally recorded from the Strait of Messina by Gegenbaur (1854); Kramp (1922) records it from the same Pteropod in the Atlantic Ocean, between 43° 10' N and 15° S, extending from the coast of West Africa to 34.5° W. One locality in the Indian Ocean is mentioned by Kramp, viz., 10° S, 104° E. The area of distribution may prove to be much larger after more material of *Euclio cuspidata* has been studied. In the present specimens the colonies are found on both sides of the Pteropod shells, just as in Kramp's specimens. No gonophores are present.

***Leuckartiara vestita* (Wright, 1859) forma *nana* (Leloup, 1932)**

Locality: Inhaca, South Africa, C. J. van der Horst (Collection Zoological Museum Amsterdam). One small, creeping colony on a fragment of a sponge.

The present colony consists of a number of unbranched hydrocauli, rising immediately from the distinct hydrorhiza, which is partly covered by the tissue of the sponge on which it grows. The hydrocauli, which each support one hydranth, as well as the hydrorhiza, are covered by a distinct, brown periderm, almost smooth on the hydrorhiza, but much wrinkled on the pedicels, with some distinct rings at the base and under each hydranth. The hydranths are more or less cup-shaped, narrowed at the base and scarcely separated from the pedicel. The periderm of each pedicel continues as a thin, smooth, almost hyaline sheath on the body of the hydranth, enveloping its whole basal part and also covering the base of the tentacles.

On the hydranth and on the tentacles it terminates rather abruptly. There are 15-20 tentacles, placed in one distinct row but varying considerably in length; the peridermal sheath covers them for about $\frac{1}{2}$ to $\frac{1}{3}$ of their total length. The distal part of some tentacles sometimes is slightly swollen, although an accumulation of nematocysts could not be observed. The proboscis is distinct and conical. The periderm of the colony is not incrustated with sand or other particles, but generally it is smooth. Several hydranths are infested by larvae, apparently of Pynogonida. Such hydranths are slightly larger than the other, normally developed hydranths; they have a loose and spacious peridermal cover. The length of their tentacles is slightly reduced. The normally developed hydranths vary in length between 0.70 and 0.80 mm; the pedicel has a diameter of 0.15-0.20 mm.

The old genus *Bimeria* contained species which were mainly characterized by the fact that no free medusae were produced; free planulae are liberated directly from fixed gonophores. The species formerly brought to the genus *Perigonimus* produce free medusae. The genotype of the latter genus, *Perigonimus muscoides* M. Sars, 1846, produces a *Bougainvillia* medusa; *Perigonimus* consequently becomes a synonym of *Bougainvillia*, the latter name having priority. A number of species producing pandeid medusae and which were formerly brought to the genus *Perigonimus* are now ranked in the genus *Leuckartiara* Hartlaub (cf. Rees, 1938); this genus contains both hydroids and medusae. Although Rees originally intended to bring to *Leuckartiara* only those species which produce free pandeid medusae, it seems advisable to include also a number of species with fixed gonophores, formerly brought to *Bimeria* and by several authors ranked under *Perigonimus*. *Bimeria* may be used as a subgeneric name to distinguish such species which have fixed gonophores.

The small form of *Leuckartiara vestita* has so far been found along the west coast of South America (Calbuco in Chile), in the eastern part of the Mediterranean, in the Gulf of Mannar and in the antarctic region (cf. Leloup, 1932). The typical form is comparatively common along the coasts of the British Islands and in the Irish Sea; it is also recorded from the Indian Ocean. It seems very likely that colonies with a shape intermediate between both forms will sooner or later be found.

Eudendrium capillare Alder, 1856

Localities:

Gier no. 9, Exped. 18, 0° 14' N, 104° 04' E, 13-16 fms., July 2, 1908 (no. 813). One small colony with female gonophores on alcyonarians.

Gier no. 12, Exped. 5, 4° 41' S, 113° 02' E, 15.5-17.5 fms., October 8, 1908 (no. 814).

One small sterile colony of 20 mm height and fragments of a much smaller specimen. Hydranths strongly contracted.

The present colonies have a creeping hydrorhiza from which the stalks of the hydranths or the short hydrocauli originate. The hydrocauli are maximally about 20 mm long, they have a terminal hydranth and bear a number of secondary hydranths, the pedicels of which leave the hydrocauli at an almost right angle and have some distinct basal rings. The periderm of the hydrocauli and hydrorhiza is vigorously developed and has a light horny colour; the periderm on the pedicels of the hydranths is much thinner. The hydranths are of the *Eudendrium* type, with a large, in expanded condition almost trumpet-shaped proboscis and 24-26 tentacles, placed in one distinct row. The periderm of the stalks terminates rather abruptly beneath each hydranth. One colony has female gonophores, which have the usual shape; they are placed on slightly obliterated hydranths. The normally developed hydranths have a maximal length of 500-600 μ , their diameter varies from 375 to 450 μ . The pedicels are about 150 μ in diameter.

The distribution of *Eudendrium capillare* is almost cosmopolitan; it has been recorded many times in the tropical parts of Indian and Pacific Oceans. It was recorded from the Philippine region by Nutting (1927), whilst it was very probably also collected in the Paleleh region (North Celebes) during the Snellius Expedition (Vervoort, 1941). It is now recorded from two additional East Indian localities, viz., near the Lingga Archipelago and in the Java Sea.

Halecium halecinum (Linnaeus, 1758)

Locality: Adriatic, without exact locality, from the collection of S. R. Lenormand (no. 501). Eight large, about 15 cm high colonies without gonothecae.

Although the dried colonies are in a bad condition, the shape of the hydrothecae leaves little doubt about their identity. The colonies are distinctly feather-shaped; the ramification has taken place in one plane. The distinct, erect hydrocaulus reaches at the base a diameter of about 3 mm. The species has previously been recorded from the Adriatic (Split region) by Broch (1933).

Halecium beanii (Johnston, 1838)

Localities:

Faux Cape, near Cape Bojador, West Africa, A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). Three small, monosiphonical, 13-15 mm high colonies on *Sertularella crassicaulis* Heller. No gonothecae are present.

Ambon, collection M. M. Willemsz Geeroms, 1931 (Collection Zoological Museum Amsterdam). One small colony of 13 mm height on a worm tube. No gonothecae are present.

The Atlantic colonies have many renovated hydrothecae, the margin of which is distinctly oblique and not perpendicular to the longitudinal axis of the thecae, representing the type which is normally found in boreal waters. These secondary hydrothecae vary considerably in length, viz., 150-375 μ , their diameter is about 135 μ . The same characteristics are shown by the East Indian colony. Here the hydrocaulus is also monosiphonical and composed of slender internodia, each provided with an unstalked, lateral hydrotheca, representing the type which in Northern waters commonly occurs at the base of colonies of *Nemertesia antennina* and *N. ramosa*. There are many secondary hydrothecae, which are slightly more slender than those of the preceding colony; the margin of the hydrothecae is not perpendicular to the longitudinal axis of the theca. At the place where the secondary thecae are fixed into the primaries, the margin of the primary hydrothecae shows a row of fine, chitinous tubercles on the internal surface.

Pictet (1893) described and figured a species of *Halecium* as *H. halecium* forma *minor*. A careful study of his description shows that he studied specimens of *H. sessile*, a species of common occurrence in Indo-Pacific waters. Leloup (1932) attributed a number of specimens of a *Halecium* from Madras Harbour to the form described by Pictet. Although Leloup's description is extremely short and drawings unfortunately are not given in his paper, his specimens almost certainly belong to a small form of *Halecium beanii*; the photograph of that species illustrating his report gives very few details, but it shows that the shape of the secondary hydrothecae is as in the present specimens.

Halecium beanii has been recorded several times from the tropical and subtropical parts of the Atlantic and Pacific Oceans; recently Fraser (1938) recorded the species from the tropical zone of the East Pacific.

***Halecium liouvillei* Billard, 1934 (fig. 1)**

Halecium liouvillei Billard, 1934, p. 227, fig. 1 no. 1; Leloup, 1937, p. 94, fig. 2.

Locality: Cape Blanco, West Africa, 11-35 fms., A. Vermeulen (Collection Zoological Museum Amsterdam). Numerous colonies without gonothecae at the base of a large *Nemertesia antennina* colony.

The present colonies of this rare species have distinct and straight hydrocauli, giving off sidebranches, which may branch for a second time. The hydrocauli are composed of distinct articles, separated from each other by distinct, oblique internodes. The periderm of the hydrocaulus is thick and yellow, just above each septum some annulations of the periderm can be observed; they have, however, never the character of rings. The maximal height of the hydrocauli is 32 mm. In most of the colonies the hydrocauli

are monosiphonical throughout their length, but some of the larger colonies show a polysiphonical structure of the basal parts, as secondary tubes sometimes cover the internodes of the hydrocaulus. Each article has a lateral apophysa, carrying the hydrotheca and the hydranth. The apophysa for the hydrotheca is pressed aside by the apophysa which carries the following article, which follows the preceding article in a straight line, resulting in a very straight hydrocaulus with laterally arranged hydrothecae. The side-

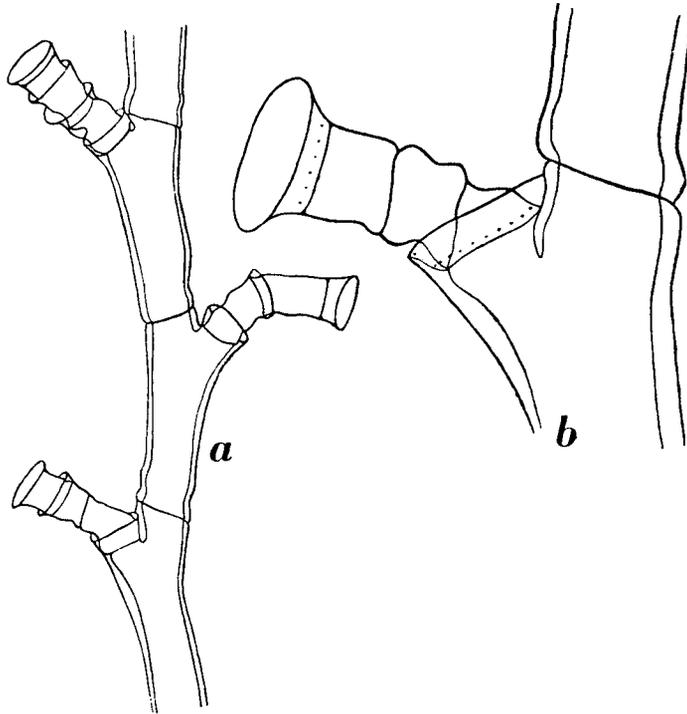


Fig. 1. *Halcium liouvillei* Billard, Cape Blanco, W. Africa, 11-35 fms., A. Vermeulen.
a, part of a colony with three renovated hydrothecae; b, single hydrotheca.
a, $\times 45$; b, $\times 75$.

branches leave the hydrocauli at an almost right angle; their first article has a large number of annulations at its base and is situated on an apophysa of a hydrotheca. The primary hydrothecae are unstalked and have conical walls, the margins are not bent outwards, so that the primary hydrothecae are not trumpet-shaped. They have a distinct diaphragm and a row of small, internal chitinous tubercles some distance above that diaphragm. The opening of the thecae has a slightly oblique position. The number of

renovated hydrothecae generally is large, 2-5 are normally present. They are slightly trumped-shaped as the distal margins are bent outwards; the basal chamber, which is very large, has a number of annulations near the base. The renovated thecae also have a distinct diaphragm with a row of small chitinous tubercles some distance above each diaphragm. In some cases the basal chamber is very long, reaching almost the same length as an article of the hydrocaulus.

Measurements:

Length of the articles of the hydrocaulus	600-675 μ
Diameter of the articles of the hydrocaulus	180-195 μ
Diameter of the primary hydrotheca	135-210 μ
Length of the secondary hydrotheca	190-600 μ
Diameter of the secondary hydrotheca	180-200 μ

Halecium liouvillei has so far only been found along the west coast of Africa; Billard (1934) records the species from Agadir, Morocco; Leloup (1937) mentions colonies from Madreporaria, Lamellibranchia and *Nemertesia ramosa* along the coast of Rio d'Oro (24° 29' N, 15° W and 24° 13' N, 15° 44' W, depth 12-17 fms.).

Stegolaria geniculata (Allman, 1888) (figs. 2, 3)

Locality: Kwandang Bay, Celebes, 400-500 fms., J. W. van Nouhuys, April 20, 1914 (Collection Zoological Museum Amsterdam). Numerous fertile colonies, reaching a maximal height of 9 cm, with contracted hydranths and distinct gonothecae. All colonies perfectly preserved.

The present colonies consist of a large number of 2-9 cm high hydrocauli, rising from a small, disk-shaped mass of hydrorhiza fibres. The hydrocauli are much and irregularly branched; the branches, however, are mainly arranged into one plane, so that the colonies are flabelliform. The basal parts of the hydrocauli and the main sidebranches are polysiphonical, the higher parts, however, show the original, monosiphonical structure. The hydrothecae are long and tubular, their distal parts bend slightly outwards. Each theca is fused with the hydrocaulus for about $\frac{2}{3}$ of its total length, the hydrocaulus between the successive hydrothecae is bent in zigzag-fashion, so that a geniculated pseudo-hydrocaulus is formed and each theca of the monosiphonical parts of the colonies seems to originate from the adcauline wall of the preceding theca. The hydrothecae are arranged in one plane, they are alternately bent to the left or the right side of the colony. The originally monosiphonical hydrocaulus is very soon covered by secondary tubes in the basal parts of the colonies, so that the apical parts of the hydrothecae only are free. The sidebranches, which are found closely under

a cauline hydrotheca, are also covered by secondary tubes. The basal parts of the hydrocauli as well as that of the sidebranches may attain a considerable diameter (3-4 mm). The hydrotheca, at the base of which the sidebranch is found, is fused with the abcauline wall to the branch, so that it appears to be almost axillary; the basal part of that theca, however, is densely enveloped in the secondary tubes. As a rule no hydrothecae are

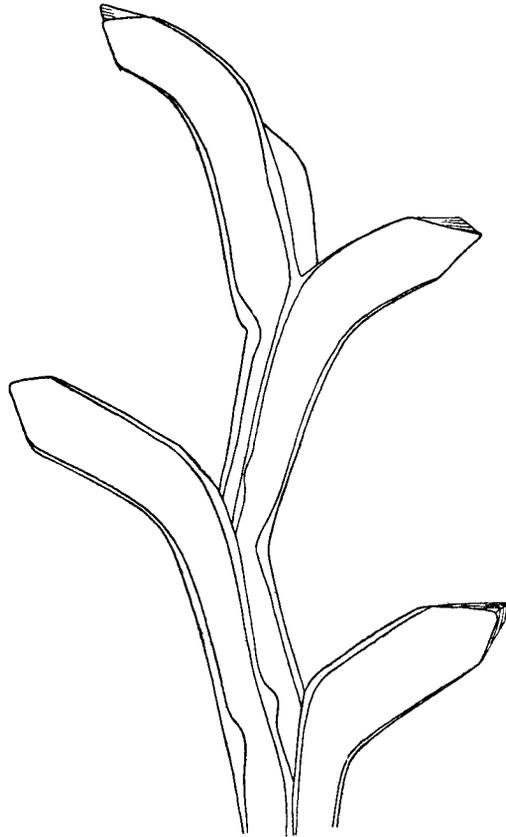


Fig. 2. *Stegolaria geniculata* (Allman), Kwandang Bay, Celebes, 400-500 fms., J. W. van Nouhuys, April 20, 1914. Terminal part of a colony with hydrothecae. $\times 50$.

found on the secondary tubes; all hydrothecae of one colony are more or less distinctly arranged into one plane. In the basal parts of the colonies the apical parts of the thecae still emerge from the thick cover of secondary tubes, so that apparently the hydrothecae, by constant renovation, have been able to lengthen their distal portion; no transversal or longitudinal lines have been observed on such hydrothecae. The periderm of the hydrothecae is

comparatively thin and transparent, so that the contracted polyps can easily be seen. There is no basal diaphragm in the thecae, but a well marked abcauline thickening of the periderm of the internal thecal wall indicates the limitation between theca and stolon. The periderm of the hydrocauli has a dark brown colour. Each theca is provided with a roof-shaped closing apparatus of the type also observed in the genus *Stegopoma*. Two opposite,

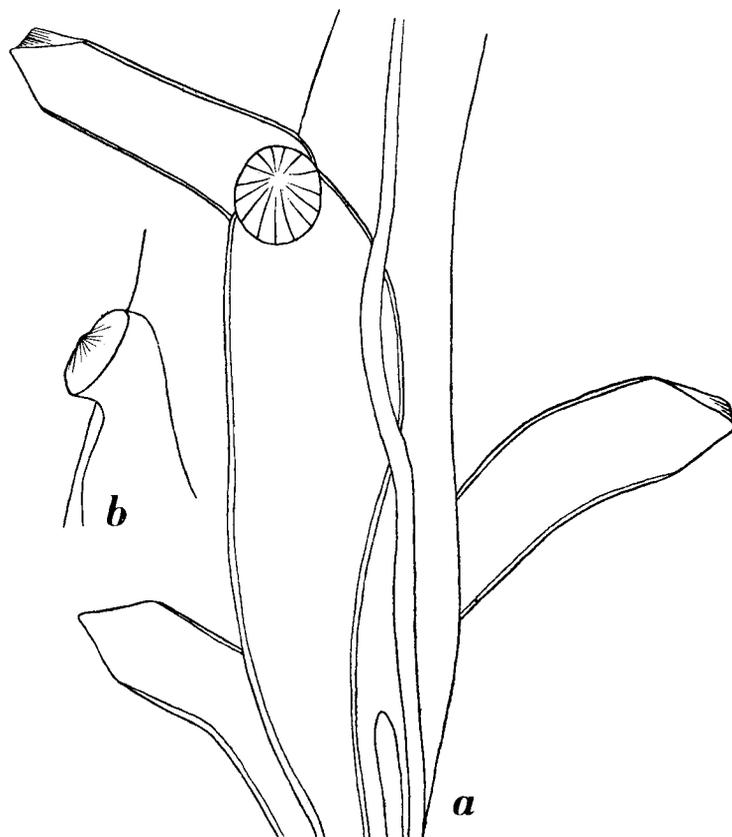


Fig. 3. *Stegolaria gemiculata* (Allman), Kwandang Bay, Celebes, 400-500 fms., J. W. van Nouhuys, April 20, 1914. a, part of a colony with gonotheca; b, aperture of the gonotheca in lateral view. a, b, $\times 65$.

triangular parts of the apical thecal wall are comparatively stiff and support two semicircular, thin parts of the thecal wall, which act as closing plates. On these closing plates longitudinal lines of thickened periderm can be observed. As the apical portion of the thecae appears to be comparatively fragile, the closing apparatus is easily obliterated. The total length of the

thecae varies from 900 to 1200 μ , the diameter from 160 to 225 μ . The successive hydrothecae of one side are separated by a space of 600-700 μ . The hydranth has 12-14 tentacles.

Allman (1888), in his original description of *Cryptolaria geniculata*, describes and figures elongated, sack-shaped bodies on the surface of the hydrocauli, which he took to be the gonothecae. These tubes were provided with a rather short, tubular neck. The colonies of *Stegolaria geniculata* are usually covered by worm-tubes and Foraminifera, a fact to which Totton (1930) has also drawn attention. It seems very probable that the bodies described by Allman represent such tubes, the more so as undoubted gonothecae are present in the Kwandang Bay material. These gonothecae are elongated, sack-shaped and strongly adnate, they are placed on the younger parts of the colonies between the hydrothecae. They are, however, not always arranged in the same plane as the hydrothecae and sometimes are covered by secondary tubes so that they are very difficult to observe. They are about $1\frac{1}{2}$ times as long as the hydrothecae and provided with a short, tubular neck with a circular opening. The opening can be closed by a thin lamella with triangular, thickened sectors, which form a conical roof over the opening. The extreme margin of the gonotheca is slightly thickened. I could study microscopical slides of the gonothecae¹⁾, so that I can describe the structure of the gonophores in some details. Both female and male gonophores are found on the same colony. The large, female gonothecae seem to contain a single, small gonophore of styloid type, containing only two eggs. As the gonophores which I studied were rather young, it is probable that many more gonophores are found in the spacious gonothecae at a more advanced stage of development. The male gonophores, many of which are found in each male gonotheca, so that they fill the whole cavity of the gonotheca, are also of simple structure (styloid type); they contain many spermatozooids. Several gonothecae are in the act of setting free their products, so that the reproductive phase seems to be in full swing.

The genus *Stegolaria* was introduced by Stechow (1913, p. 137) for *Cryptolaria geniculata* Allman and *C. operculata* Nutting, 1906. The genus appears to be closely related to *Stegopoma* Levinsen, 1893, the type of which is *Lafoea plicatilis* M. Sars, 1863. The gonothecae of *Stegopoma*, however, are described to resemble the hydrothecae, with the same roof-shaping closing apparatus, they are only much larger. The exact systematical relationship of the two genera cannot be solved as long as the gonothecae of the majority of species of both genera remains unknown. The differences

1) I am much indebted to Miss K. Neumann for making these microscopical slides.

in the shape of the closing apparatus of the gonothecae of *Stegolaria geniculata* and *Stegopoma plicatile* are certainly insufficient to maintain a generic distinction.

The geographical distribution of the species of the genus *Stegolaria* is very badly known (cf. Totton, 1930, p. 154), their main area of occurrence seems to be the tropical part of Indian and Pacific Oceans. *Stegolaria geniculata* has so far only been recorded off Matuka, Fiji Islands, at a depth of 315 fms.

***Lafoea benthophyla* Ritchie, 1909**

Locality: Positano, Gulf of Salerno, Italy, G. Stiasny, April 1927 (no. 806). Many creeping and partly erect colonies on the spines of the Echinoderm *Stylocidaris affinis* (Phil.). Gonosome not observed.

The present colonies consist largely of creeping stolons, covering the primary spines of the Echinoderm, occasionally forming erect, up to 25 mm long, rhizocaulomic colonies, consisting of 5-7 fused tubes with hydrothecae. The hydrothecae leave the stolons at an angle of 60°-80°, they are directed upwards. In shape they approximate *Lafoea gracillima* very closely, but they are about twice as long and have a much larger opening. They are shortly stalked, each stalk consists of 2-3 very indistinct spirally coils. In this respect they differ markedly from *L. gracillima* f. *elegantula* Broch, where the hydrothecae have much longer stalks, consisting of 5-8 distinct spirally coils. The length of the hydrothecae with stalks varies between 900 and 1100 μ , the diameter is about 200 μ . The majority of the hydrothecae has a number of renovations near the margin; Ritchie (1909) has also drawn attention to the ring of fine, chitinous tubercles at the base of the cavity of the hydrotheca; such rings are distinctly visible in the Mediterranean specimens. There are no differences between the hydrothecae of the creeping and of the erect parts of the colony. Ritchie (1910) considers *L. benthophyla* as simply a variety of *L. gracillima*, the much greater dimensions are said to be mainly due to the considerable depth from which specimens were obtained. Ritchie's original specimens were collected in the Antarctic zone near the South Orkneys at a depth of 1775 fms.; additional specimens are recorded by Ritchie (1910) from a depth of 585 fms. (Arabian Sea, near the Gulf of Aden) and by Stechow (1925) from a depth of 1134 m (1° 49' N, 45° 29.5' E, near the coast of East Africa). Leloup (1937a) records specimens from shallow waters of French Indochina; the present Mediterranean specimens were apparently also collected at moderate depth. Both Ritchie (1910) and Stechow (1925) also record specimens from the spines of Cidarid Echinoderms.

Lafoea benthophyla has so far only been recorded from the antarctic zone of the Pacific and Indian Oceans, the Arabian Sea, and the Bay of Nha Trang, French Indochina. It is recorded here for the first time from the Mediterranean.

***Hebella calcarata* (L. Agassiz, 1862)**

Laodicea calcarata L. Agassiz, 1862, p. 350.

Lafoea calcarata, A. Agassiz, 1865, p. 122, figs. 184-194.

Lafoea scandens Bale, 1888, p. 758, pl. xiii fig. 16-19.

Hebella cylindrata Marktanner, 1890, p. 214, pl. iii fig. 15.

Hebellopsis scandens, Vervoort, 1941, p. 197.

Localities:

Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). One well developed colony on *Sertularia distans* Lamx. No gonothecae are present.

Balikpapan, Borneo, collection W. J. Tissot van Patot (Collection Zoological Museum Amsterdam). A large number of hydrothecae rising from a hydrorhiza creeping on *Thyrosocyphus fruticosus* (Esper). Gonothecae are not present.

Gier no. 12, Exped. 3, 4° 25' S, 114° 31' E, 11-13 fms., October 4, 1908 (no. 821). One creeping colony on *Syntheicum megathecum* Billard, without gonothecae.

Although the shape of the hydrothecae of each colony varies rather considerably, the material can be divided into two different types. The first type, represented by the Cape Blanco and the Gier colonies, in the shape of the hydrothecae agrees with Marktanner's *Hebella cylindrata*. The hydrothecae of the colonies of this type are almost cylindrical, with an average length of 0.60 mm and a diameter of about 0.18 mm. The walls of the thecae are perfectly smooth, the margin is slightly bent outwards and occasionally provided with a number of renovations. The basal part of the hydrotheca is rounded, the stalk is generally short and separated from the theca by a distinct but very thin lamelliform diaphragm, which is thickened at the place of attachment to the thecal wall, so that a ring of thickened periderm is formed there. The hydrothecae are arranged in pairs or groups of three along a thin, creeping hydrorhiza. The colonies of the second type in the shape of the hydrothecae agree with Marktanner's figure of *Hebella calcarata* (l.c., pl. iii fig. 16). Although the thecae of this type have nearly the same length as those of the colonies mentioned above, they are much more slender; the basal portion of each hydrotheca, however, is distinctly ventricose, the extreme basal part is rounded and separated from the pedicel by a thin diaphragm and a slightly thickened peridermal ring. The hydrothecae are not completely symmetrical, but usually the upper half of the theca shows a slight bend. The margin is very slightly bent outwards and usually a number of concentric circles, indicating renovation of the theca, are

present. The opening of the thecae is not absolutely perpendicular to the longitudinal axis of the theca. Both types of colonies are present without gonothecae. Bale (1915), after a comparison of American specimens of *Hebella calcarata* with the form described previously by him as *Lafoea scandens*, has united both species and has drawn attention to the rather considerable variations in the shape and dimensions of the hydrothecae. *Lafoea cylindrica* Von Lendenfeld, 1884, is very closely related to the present species; the form described from Ambon by Pictet (1893, p. 41, pl. ii fig. 36) as *Hebella cylindrica* certainly is identical with *H. calcarata*. A definite judgment as to the systematical relationship of Von Lendenfeld's species as well as a number of other species of the genera *Hebella* Allman, 1888, *Hebellopsis* Hadži, 1913, and *Croatella* Hadži, 1915, cannot be made until the gonothecae of these species are known and the development of the gonophores has been studied.

Hebella calcarata has a wide distribution in tropical and subtropical parts of Atlantic, Indian and Pacific Oceans. Billard (1906a) records the species from the coast of West Africa; it was found in the waters of the Netherlands East Indies by the Snellius Expedition (Vervoort, 1941).

***Hebella calcarata* (L. Agassiz, 1862) var. *contorta* Marktanner, 1890**

Locality: Gier no. 9, Exped. 9, 4° 47' N, 99° 04' E, 38-43 fms., June 9, 1908 (no. 977). One small colony on *Idiella pristis* (Lamx.), without gonothecae.

This form is characterized by the shape of the hydrothecae (cf. Marktanner, 1890, pl. iii fig. 17; Leloup, 1937a, fig. 17). It seems to be a rather common form, epizoic on sertularian hydroids, especially *Idiella pristis* (Lamx.), in East Indian and Australian waters. It is almost certainly identical with Nutting's *Hebella spiralis* (1927, p. 208, pl. 40 figs. 4-6) recorded from the Philippine region. The gonothecae of this characteristic form are still unknown.

***Scandia mutabilis* (Ritchie, 1907)**

Locality: Ambon, collection M. M. Willemsz Geeroms, 1913 (Collection Zoological Museum Amsterdam). Numerous hydrothecae on the hydrocaulus of *Lytocarpus philippinus* (Kirchenp.). No gonothecae are present.

The present specimens agree with Ritchie's description of *Campanularia mutabilis* (1907, p. 504, pl. xxiii figs. 3-5). The pedicels of the hydrothecae are comparatively long, their periderm is wrinkled, without showing distinct rings. The hydrothecae vary considerably in length, viz., 1.35-1.95 mm; the diameter of the hydrothecae is about 0.75 mm. Most of the hydrothecae contain perfectly preserved hydranths.

Scandia mutabilis seems to be comparatively common on large hydroids in the tropical and subtropical waters of the Atlantic, Indian and Pacific Oceans. Fraser (1938a, 1938b) recently recorded the species from the tropical East Pacific (Galapagos Islands and the coasts of Mexico, Panama, Ecuador and Colombia).

Synthecium megathecum Billard, 1924

Sertularia tubitheca Pictet, 1893, p. 51, pl. ii figs. 44, 45.

Sertularia tubitheca Von Campenhausen, 1896, p. 309.

Synthecium megathecum Billard, 1924, p. 648; 1925, p. 130, pl. vii fig. 2, textfig. vi; Leloup, 1937a, p. 32, fig. 21.

Locality: Gier no. 12, Exped. 3, 4° 25' S, 114° 31' E, 11-13 fms., Oct. 4, 1908 (no. 821). One colony of 30 mm height and some fragments of 2-5 mm, without gonothecae.

Although the present colonies have no gonothecae, the large hydrothecae prove their identity with the form described by Billard as *Synthecium megathecum*. The colony is densely covered by *Hebella calcarata* (L. Agassiz).

Synthecium megathecum has so far only been found in the waters of the Netherlands East Indies and near Caûda on the coast of French Indochina (Billard, 1925; Leloup, 1937a); in the first mentioned area it seems to be widely distributed as it is recorded from many localities by the Siboga Expedition (Makassar Strait, Celebes Sea, Halmahera Sea, Banda Sea, Timor Sea, Sawoe Sea, Flores Sea and Bali Sea). It is now recorded for the first time from the Java Sea. It is probable that several authors who mention *Synthecium tubithecum* (Allman, 1877) studied specimens of *S. megathecum*, so that the latter species may have a much greater distribution in Indian and Pacific waters (cf. Billard, 1925, p. 132).

Thyroscyphus fruticosus (Esper, 1788-1830)

Locality: Balikpapan, Borneo, Collection W. J. Tissot van Patot (Collection Zoological Museum Amsterdam). Three fragments of 2-4 cm height with young (male?) gonothecae, the whole colony densely covered by *Hebella calcarata* (L. Agassiz).

Only fragments of this species, which seems to be comparatively common in the East Indian seas, are present. The species has been most accurately described by Spletstösser (1929). The gonothecae, which are young and immature, are elongated ovate, with a smooth surface; they are rounded at the top and are not provided with a ring of thickened periderm there. The length of these probably male gonothecae varies from 1.1 to 1.4 mm, the diameter is about 0.52 mm.

Idiella pristis (Lamouroux, 1816)

Localities:

Gier no. 4, Exped. 10, 5° 40' S, 109° 21' E, 29 fms., Jan. 21, 1907 (no. 978). Four colonies of ± 25 mm height. No gonothecae are present.

Gier no. 9, Exped. 9, 4° 47' N, 99° 04' E, 38-43 fms., June 18, 1908 (no. 977). Three colonies of \pm 20 mm height, without gonothecae, covered by *Hebella calcarata* var. *contorta* Markt.

Gier no. 9, Exped. 18, 0° 14' N, 104° 04' E, 13-15 fms., July 2, 1908 (no. 984). Two colonies of 20 mm height without gonothecae but with partly contracted hydranths.

Gier no. 10, Exped. 1, 6° 07' S, 107° 55' E, 12-13 fms., August 5, 1908 (no. 981). One colony of \pm 20 mm height on a shell fragment.

Gier no. 12, Exped. 3, 4° 25' S, 114° 31' E, 11-13 fms., October 4, 1908 (no. 982). Several small colonies and a number of fragments, all without gonothecae. Hydrothecae with contracted polyps.

Gier no. 12, Exped. 5, 4° 41' S, 113° 02' E, 15.5-17.5 fms., October 8, 1908 (no. 983). Fragments of a colony of \pm 12mm height, without gonothecae. Hydranths partly expanded.

Gier no. 12, Exped. 7, 3° 42' S, 110° 42' E, 17 fms., Oct. 10, 1908 (no. 979). Several colonies of \pm 30 mm height and a number of smaller colonies and fragments. Fixed with a distinct, creeping hydrorhiza on a sponge, no gonothecae are present.

Fak Fak, New Guinea, 30 fms., off the coast, C. S. J. Palmer van den Broek, September 19, 1908 (no. 226). A number of \pm 10 cm high colonies with a large number of mature gonothecae along the hydrocauli. The colonies are attached to large Balanids by strong hydrorhiza fibres.

Off Bahia, Brazil, 10 fms., J. S. A. Kroon, March 10, 1896 (no. 985). Two fragments of a colony, 13 and 5 mm high, without gonothecae.

Off Ampenan, West coast of Lombok, 13 fms., G. F. Tydeman, May, 1909 (Collection Zoological Museum Amsterdam). Several fragments of a \pm 6 cm high colony, consisting of three branched hydrocauli rising from a creeping hydrorhiza. Numerous gonothecae are found along the hydrocauli.

Idiella pristis is a very common species in tropical and subtropical waters of Indian and Pacific Ocean; it has been recorded from a large number of localities in the Netherlands East Indian, Philippine, Australian and Japanese regions. It has also been found along the tropical Atlantic coasts of America (Dry Tortugas, Florida and off Bahia) (Leloup, 1935; Allman 1888).

Diphasia digitalis (Busk, 1852)

Locality: Gier no. 12, Exped. 3, 4° 25' N, 114° 31' E, 11-13 fms., Oct. 4, 1908 (no. 798). Several unbranched, up to 10 mm high colonies rising from a creeping hydrorhiza and one branched, 30 mm high colony; all colonies without gonothecae. The hydrothecae have contracted polyps.

The present specimens agree with the descriptions of this tropical species. It seems to be comparatively common in tropical Indian and Pacific waters, but it has also been recorded from several tropical Atlantic localities (Florida, Bahama region, West Indies and off Bahia, Nutting, 1904).

Dynamena cornicina McGrady, 1858

Locality: Sargasso Sea, 34° N, 38° W, F. A. Frederiks, December 3, 1872 (no. 203). Several unbranched, up to 10 mm high colonies on Sargasso weed. No gonothecae are present. Together with *Laomedea sargassi* Broch.

The present colonies have the hydrothecae arranged in pairs, each article of the hydrocaulus bears a single pair of hydrothecae. The hydrocaulus is supported by a few basal articles which have no hydrothecae; the articles are separated by straight septa. The last supporting article is separated by an oblique septum from the first hydrotheca bearing article. The hydrothecae have no intrathecal peridermal teeth as have been mentioned by Leloup (1935).

The extraordinary wide geographical distribution of *D. cornicina* has been discussed by Billard (1925) and Leloup (1935); the species is very common in tropical and subtropical parts of the three large oceans and in the Mediterranean; it regularly occurs on *Sargassum*, together with *Lao-medea sargassi* Broch and *Aglaophenia latecarinata* Allman.

Dynamena quadridentata (Ellis & Solander, 1786)

Locality: Reunion Rock, Isipingo near Durban, H. Engel, October 28, 1938 (Collection Zoological Museum Amsterdam). A large number of 1-3 mm high colonies with a creeping hydrocaulus on Algae. No gonothecae are present.

Warren (1908) and Billard (1925) very carefully described the typical form of *D. quadridentata*. The hydrothecae of the present colony are arranged in groups of two or three pairs of hydrothecae, as has also been figured by Billard (1925, textfig. xlii). In the Durban colonies two successive clusters of hydrothecae normally constitute a complete hydrocaulus, the length of the space between these two clusters of hydrothecae varies between 150 and 300 μ . The distinct, creeping hydrorhiza has the reticulated structure described by Warren (1908, p. 312).

Billard (1925) and Leloup (1935) have discussed the wide geographical distribution of *D. quadridentata*. The species is commonly distributed in the tropical and subtropical regions of the three large oceans, mainly occurring on Algae, but it has also been found on Porifera and Hydroida. Specimens from the Durban area were previously mentioned by Warren (1908).

Sertularella gayi (Lamouroux, 1821) var. **parva** Billard, 1925

Locality: North Coast of Celebes, on Menado-Kwandang cable, dredged from a depth of \pm 750 m by S. S. Telegraaf, September 1908, collected by J. W. van Nouhuys, bottom temperature \pm 53° F. (Collection Zoological Museum Amsterdam). A large number of monosiphonous colonies, reaching a maximal height of 30 mm. No gonothecae are present.

Billard (1925) has described a small variety of *Sertularella gayi*, the present colonies agree in every detail with Billard's account. The monosiphonous, irregularly branched hydrocauli rise from creeping, dark brown hydrorhiza fibres. Each hydrocaulus is broken up into long and slender

internodes, particularly long in the basal parts of the colonies and slightly decreasing in length in the higher parts of the colonies. The internodes are separated by oblique septa, which are sometimes very indistinctly marked; each internode has one hydrotheca, alternately directed to the left or to the right side of the hydrocaulus, which, between the hydrothecae, is curved in zigzag-fashion. The shape of the hydrothecae agrees with Billard's drawing (1925, textfig. x); there are 2 or 3 distal annulations, distinctly marked on the adcauline surface of the theca and almost obsolete on the abcauline side. There are four marginal teeth, separated by rounded, shallow incisions, into which the four closing flaps of the operculum are attached.

Measurements:

	Specimen from the Siboga Exp. (Billard, 1925)	Present specimens from the N. coast of Celebes
Diameter of the hydrocaulus	155-245 μ	150-180 μ
Length of the space between two successive hydrothecae	665-785 μ	660-750 μ
Length of the abcauline part of the hydrotheca	365-400 μ	400-450 μ
Diameter of the hydrotheca near the opening	225-245 μ	195-230 μ

This peculiar form of *S. gayi* has so far only been recorded from two localities in the waters of the Netherlands East Indies by the Siboga Expedition (Sta. 150, Halmahera Sea, $0^{\circ} 06' N$, $129^{\circ} 07'.2 E$; Sta. 259, near the Kai Islands, $5^{\circ} 29'.2 S$, $132^{\circ} 52'.5 E$), in both localities it was collected at a considerable depth (1089 and 487 m respectively). It is recorded here for the first time from the Celebes Sea. The typical form has a vast area of distribution in the Atlantic and Pacific Oceans, mainly in the boreal and subtropical Atlantic, but it has also been found in the tropical Atlantic and Pacific and in the Mediterranean (cf. Nutting, 1904; Jäderholm, 1904; Billard, 1925).

Sertularella neglecta D'A. W. Thompson, 1879

Localities:

Australia, exact locality unknown, from the collection of J. G. Agardh (no. 391). Several ± 12 mm high hydrocauli without gonothecae.

Queenscliff, Australia, F. von Müller, 1903 (no. 766). A number of up to 25 mm high colonies, rising from a creeping hydrorhiza on *Gelidium*. No gonothecae are present.

Encounter Bay, South Australia, L. G. M. Baas Becking & J. Reuter, March 21, 1936 (no. 392). Two fragments of 15 and 25 mm height with the characteristic gonothecae.

The colonies from Encounter Bay bear gonothecae, which agree with the second type described by Bale (1884, p. 111). The gonothecae are found near the end of the sidebranches, they are slender and have small apical teeth of nearly equal length. *Sertularella neglecta* is rather common in Australian waters, it sometimes occurs in large numbers on seaweeds.

***Sertularella indivisa* Bale, 1881**

Sertularella indivisa Bale, 1881, p. 24, pl. xii fig. 7; 1915, p. 287.

Sertularella solidula Bale, 1881, p. 24, pl. xii fig. 9.

Sertularella variabilis Bale, 1888, p. 764, pl. xv, figs. 5-9.

Sertularella Sieboldi Kirchenpauer, 1884, p. 49, pl. xvi figs. 5, 5a.

Sertularella Mulleri Kirchenpauer, 1884, p. 49, pl. xvi figs. 7, 7a-b.

Locality: Australia, exact locality unknown, from Frank, 1860 (no. 208). Numerous colonies with gonothecae on Algae.

The hydrocauli of the present colonies generally are monosiphonical and reach a maximal length of 2-3 cm; several colonies, however, have short secondary tubes which cover the basal part of the hydrocaulus. These hydrocauli have sidebranches, placed at irregular intervals and originating from a short apophysis closely under a hydrotheca. The present colonies differ from those generally described by the much longer internodes, which sometimes are 1.5 times or twice as long as the hydrothecae, whilst short internodes are generally mentioned. The species, however, is very variable, so that the difference in the length of the internodes may be of slight importance. The colonies were dried and later on preserved in alcohol; the condition of the hydrothecae does not permit a detailed description.

Sertularella indivisa seems to be a common species in Australian waters; it has also been found in Japanese waters (Bale, 1915; Stechow, 1909). Kirchenpauer (1884), under the name of *Sertularella Sieboldi*, described a hydroid which is certainly identical with Bale's *S. indivisa*; the locality (Cuba) certainly is erroneous and probably is a mistake for some Japanese locality.

***Sertularella crassicaulis* Heller, 1868 (fig. 4)**

Locality: Faux Cape, near Cape Bojador, West Africa, A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). Fragments of a \pm 6 cm high colony on fragments of shells, the basal parts covered with some colonies of *Halecium beanii* (Johnst.).

The present colonies differ from *Sertularella polyzonias* (L.) mainly by the mode of growth and the shape of the hydrocaulus. The independently growing hydrocaulus of the present colony reaches a maximal height of 60 mm, bearing alternately arranged sidebranches in two opposite rows,

so that the colony must have been feather-shaped. The most striking difference from *S. polyzonias*, however, is that in the present colony the hydrocaulus is polysiphonical, in the highest parts only it has maintained its original, monosiphonical structure. In the basal and middle parts of the

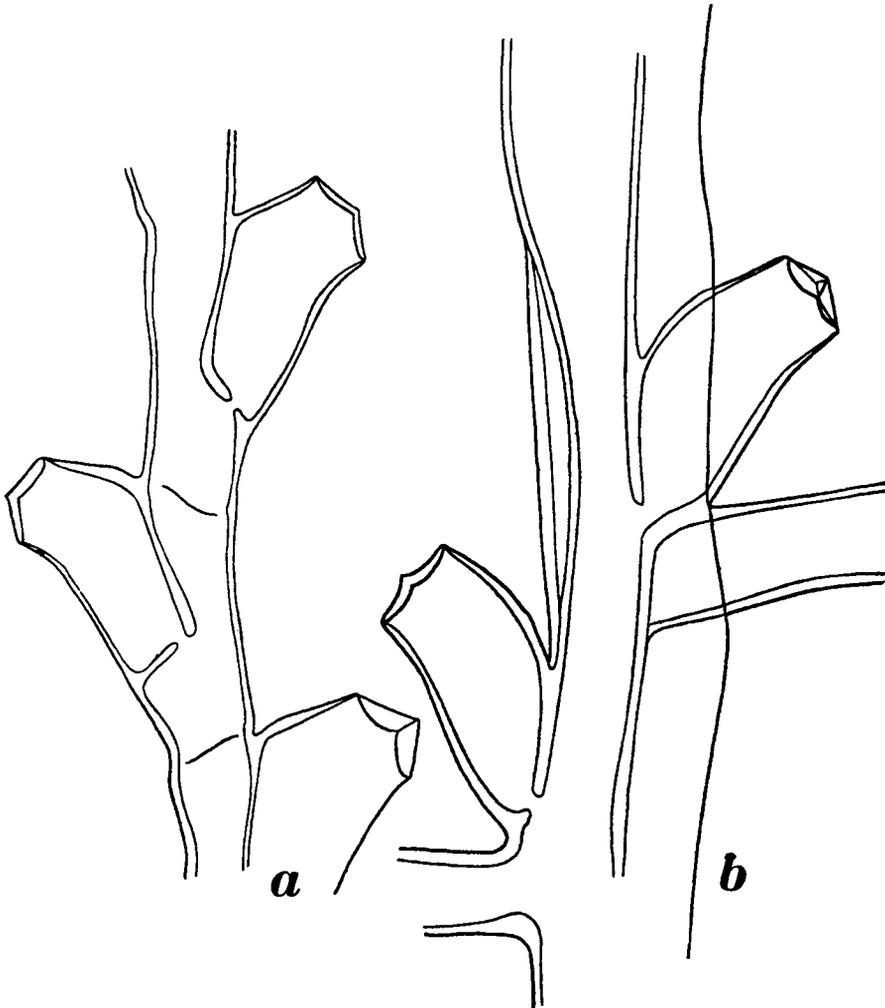


Fig. 4. *Sertularella crassicaulis* Heller, Faux Cape, near Cape Bojador, W. Africa, A. Vermeulen, 1966. a, three hydrothecae in a monosiphonical part of the colony; b, basal part of a colony. a, b, $\times 40$.

hydrocaulus secondary tubes have fused with the primary tube, forming a more or less solid, ± 1 mm thick hydrocaulus, from which only the apical parts of the cauline hydrothecae emerge. The hydrocaulus seems to be

broken up into internodes, separated by indistinct, slightly oblique septa. The arrangement in internodes is very indistinct in the monosiphonical and invisible in the polysiphonical parts. Each internode carries one hydrotheca, the cauline hydrothecae as well as those of the sidebranches are arranged in two opposite rows. The internodes are about 1.5 times as long as the thecae. The sidebranches originate from the main tube beneath a theca, they are arranged in two rows; two hydrothecae are found between two sidebranches on the same side, each theca is found in the axil of a sidebranch. In the basal parts of the colony there is only a short space separating two successive hydrothecae, so that the sidebranches appear to be nearly opposite. The sidebranches are about 20 mm long; they are generally unbranched, but sometimes they have a short secondary branch. The hydrothecae resemble those of *S. polyzonias* very closely. Their external surface is perfectly smooth, the margin has four rather small teeth, separated by rounded incisions. The length of the free adcauline part of the theca is about half the total length. Stechow (1919) figures a specimen of *Sertularella crassicaulis* with very long and acute teeth along the margin of the theca; in a later paper (Stechow, 1923, fig. Z) the same specimen is figured with much smaller and less acute marginal thecal teeth.

Measurements:

Total length of the hydrotheca	600-675 μ
Length of the free adcauline part	225-300 μ
Diameter of the opening	285-350 μ

Sertularella crassicaulis has so far only been recorded from the Mediterranean (Adriatic and Naples area, Heller, 1868; Stechow, 1919, 1923), where the species seems to be comparatively rare. It is recorded here the first time from the Atlantic.

***Sertularella mediterranea* Hartlaub, 1901**

Locality: Mediterranean, without exact locality, from the collection of J. A. Schultes (no. 511). Several \pm 6 cm high colonies with numerous gonothecae.

The structure of the colonies of the present species agrees with that of the boreal *S. polyzonias* (L.) forma *typica* Broch. There is no distinct main stem, but the hydrocaulus is much and irregularly branched. The hydrothecae are alternately arranged in two opposite rows along the main stem and the sidebranches. Hydrocaulus and sidebranches are broken up into distinct internodes, which have about the same length as the hydrothecae; the internodes are separated by almost transverse septa. The periderm of the basal parts of some internodes is sometimes distinctly wrinkled,

without distinct rings; between the successive hydrothecae the hydrocauli or branches are bent in zigzag-fashion. The general shape of the hydrothecae agrees with that of *S. polyzonias*; the free adcauline part of the hydrotheca is about 1.5 times as long as the fused part and makes an angle of 45° with the branch. The opening of each theca is provided with 4 marginal teeth of equal length, separated by distinct rounded incisions. These incisions are slightly deeper than usually found in *S. polyzonias*. The opening of the theca is perpendicular to the longitudinal axis of the theca. In these last two characteristics the present specimens differ from drawings of this species by Stechow (1923, fig. D' a). Moreover, Stechow's drawing of *S. mediterranea* differs considerably from Hartlaub's figures of that species (pl. v figs. 10, 11 & 15), with which the present specimens are in close agreement; another drawing of this species in Hartlaub's paper (l.c., pl. v fig. 16) approaches Stechow's type: I could not find specimens with hydrothecae as figured by Stechow in the present material. The hydrothecae have three intrathecal teeth, attached to the internal thecal wall at a small distance beneath the margin. Normally there is one median, adcauline tooth and two lateral, more or less abcauline teeth; all these teeth are well developed and easily visible through the peridermal wall of the theca. The place and the development of the various intrathecal teeth, as well as the development of the marginal teeth varies slightly. Several hydrothecae show a more or less distinct annular constriction at some distance below the margin.

The gonothecae are comparatively large and egg-shaped, their maximal diameter lies at some distance above the middle of the length. They are very shortly stalked and attached to the internodes, at a small distance below a hydrotheca. Each gonotheca has about 5-8 annular constrictions, which are distinctly visible on the basal part of the gonothecae but almost disappear on the terminal portion. The top of each gonotheca has a small, circular opening, surrounded by four distinct teeth of variable size. The shape of the gonotheca agrees closely with Stechow's drawing (1923, fig. C'), except for the presence of 4 apical teeth, whereas Stechow figures 5 teeth.

Measurements:

Total length of the hydrotheca	580-660 μ
Length of the free adcauline part	385-460 μ
Diameter of the opening of the hydrotheca	200-230 μ
Total length of the gonotheca	1850-2000 μ
Maximal diameter of the gonotheca	900-1100 μ

Sertularella mediterranea has a wide distribution in the western Mediterranean (Stechow, 1923); it has also been found in Atlantic and Pacific waters along the coasts of West and South Africa and Madagascar. Leloup

(1937a) recently recorded the species from the Bay of Nha Trang in French Indochina as *Sertularella polyzonias* var. *mediterranea*.

Sertularella quadridens (Bale, 1884)

Locality: Gier no. 9, Exped. 18, 0° 14' N, 104° 04' E, 13-16 fms., July 2, 1908 (no. 761). Two small colonies of 25 mm height, without gonothecae.

Although the shape of the hydrothecae of the present colonies agrees with specimens collected in the Netherlands East Indies by the Snellius expedition, the structure of the colonies differs markedly. In the colonies from the Gier Expedition there is a distinct, erect hydrocaulus, rising from a small patch of hydrorhiza fibres. The alternately arranged sidebranches are placed in two opposite rows, so that the shape of the colony is featherlike. There are 2 or 3 hydrothecae between two successive sidebranches on the same side. Normally there are no articles in the sidebranches, but occasionally 1 or 2 septa are found. As the shape of the hydrothecae agrees in detail with the Snellius specimens (cf. Vervoort, 1941, p. 214, fig. 5), they need no further description. All hydrothecae are provided with well preserved, contracted hydranths with a large abcauline cul-de-sac.

Sertularella quadridens is widely distributed in tropical Pacific and Indian waters (cf. Vervoort, 1941); it was found by the Siboga Expedition in the Ceram Sea, Arafoera Sea and Sawoe Sea; the Snellius Expedition recorded the species from the Sulu Sea near the Sulu Islands. It is also recorded now from the South China Sea near the Lingga Archipelago.

Sertularella subdichotoma Kirchenpauer, 1884 (fig. 5)

Sertularella subdichotoma Kirchenpauer, 1884, p. 46, pl. xvi figs. 1-1b; Totton, 1930, p. 188.

Locality: Timara, New Zealand, H. Suter, 1896 (no. 9). Many up to 80 mm high colonies with many gonothecae.

Under the name of *Sertularella subdichotoma* I have provisionally arranged a large number of colonies in the collection of the Rijksmuseum van Natuurlijke Historie, which differ in several respects from the description of *Sertularella divaricata* (Busk, 1852), which is generally considered as a synonym of *S. subdichotoma*. The colonies consist of irregularly branched, monosiphonical hydrocauli, rising from a tuft of irregularly twisted and intertwined hydrorhiza fibres. The hydrocauli are monosiphonical throughout their entire length and are divided into internodia, separated by slightly oblique constructions of periderm; no distinct septa, however, are present. The hydrocauli and main branches are bent in zigzag-fashion, with a hydrotheca at each bend; the sidebranches are placed on the hydrocauli closely under a hydrotheca. The number of hydrothecae on each internode varies slightly;

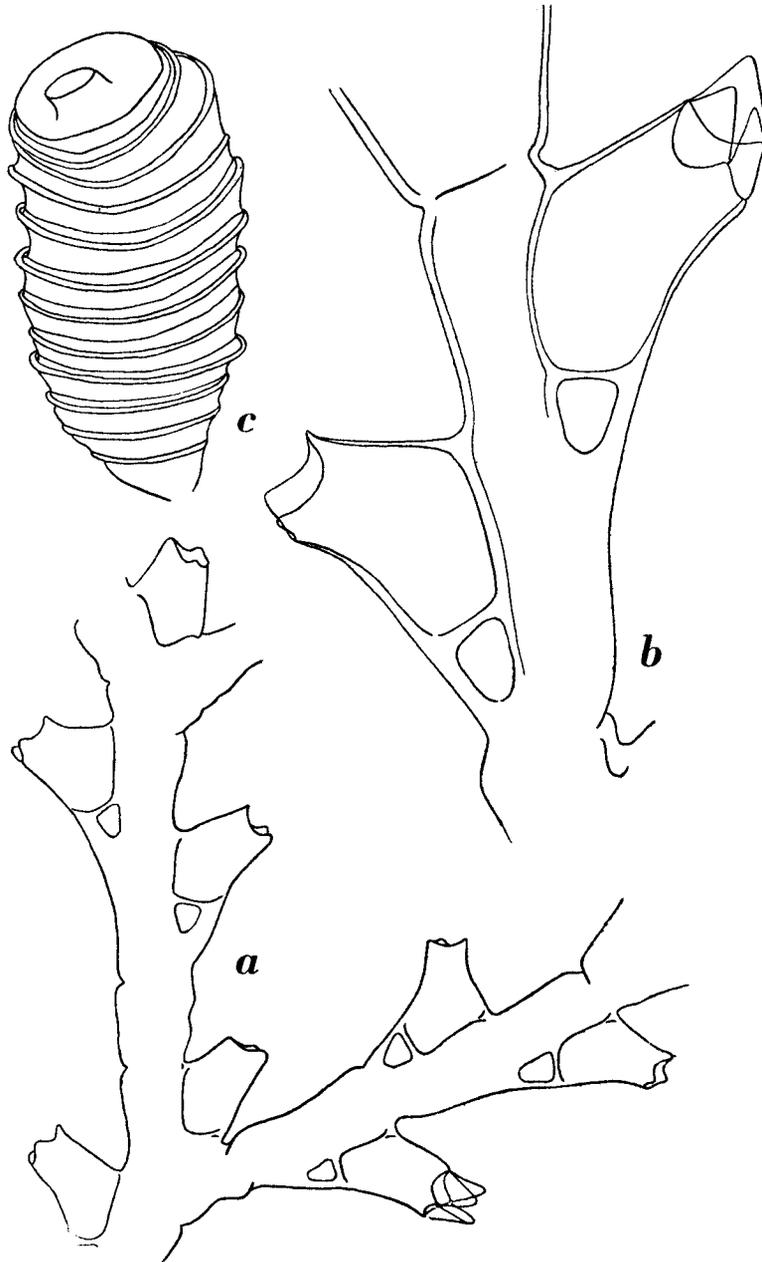


Fig. 5. *Sertularella subdichotoma* Kirchenp., Timara, N. Zealand, H. Suter, 1896.
a, part of a colony showing the arrangement of the hydrothecae; b, some hydrothecae;
c, gonotheca. a, $\times 46$; b, $\times 100$; c, $\times 45$.

usually there are 2 or 3 on the internodes of the hydrocauli and only one on the internodes of the sidebranches. These sidebranches generally are short and are of equal length (± 10 mm), they are arranged in two more or less opposite rows, so that the colonies are feather-shaped. Several colonies have very elongated basal sidebranches, directed upwards and running parallel with the main stem and reaching the same length; such long sidebranches assume the character of hydrocauli if they are provided with short secondary branches. The periderm of the hydrocauli has a light horny colour. The hydrothecae are of the *Sertularella* type, with 3 marginal teeth, one median adcauline and two lateral teeth. The teeth are distinct and separated by rounded incisions; the length varies slightly within the same colony. The closing apparatus consists of 3 triangular plates, fixed in the circular incisions, forming a conical, roof-shaped lid when closed. The free adcauline part of the hydrotheca is slightly shorter than the fused part, the angle between that free part and the branch varies between 90° and 60° . Each hydrotheca seems to be placed on a prominent apophysis, which shows a triangular cavity; such cavities are not found at the base of the axillary thecae. Usually three hydrothecae are found between two successive sidebranches on the same side. The upper parts of the hydrocauli occasionally have developed into tendrils, sometimes connecting the hydrocauli of one or various colonies or giving rise to new hydrocauli.

The gonothecae are found on the hydrocauli at the base of the hydrothecae. They are strongly adnate and slightly compressed, variable in shape. They are elongated egg-shaped, with 10-14 distinct annular constrictions and an equal number of circular, peridermal rings, distinctly produced above the surface of the gonothecae; although no free frill is produced. The peridermal rings are angular at the margin. On the adcauline side of the gonotheca a distinct bend is present; the constrictions and rings are invisible there. The apical part of each gonotheca is truncated, so that the first circular peridermal ring forms a slightly produced frill round the flattened part of the theca. The opening of the theca is placed at the top of a short, conical tube-like neck, in most of the gonothecae placed slightly eccentrically. I have only observed conical tubes and never the trumpet-shaped necks figured by Bale (1914, pl. ii figs. 1-9) for the gonothecae of *S. divaricata*.

Measurements:

Total length of the hydrotheca	290-330 μ
Length of the fused adcauline part	170-220 μ
Length of the free adcauline part	150-200 μ
Total length of the gonotheca	1150-1400 μ
Maximal diameter of the gonotheca	700-800 μ
Diameter of the opening	150-185 μ

Kirchenpauer (1884, p. 46, pl. xvi figs. 1, 1a, 1b), in his description of *Sertularella subdichotoma*, mentions two localities from which specimens came to his notice, viz., Bass Strait and Magellan Strait. No distinct type is fixed by Kirchenpauer; Hartlaub (1901), who had the opportunity to study Kirchenpauer's material, gives a general description of Kirchenpauer's species, taken from the specimens from both localities. Hartlaub seems to have been unable to decide whether Kirchenpauer's colonies belonged to one and the same species. Later authors (cf. Bale, 1914), in spite of Hartlaub's hesitation, considered both types of colonies as identical. Bale (1888) at first considers *S. subdichotoma* as simply a variety of *Sertularia divaricata* Busk, 1852 (*Sertularella divaricata* var. *subdichotoma*), in later papers he seems to be even inclined to consider both species as specifically identical. It is impossible at present to give the exact synonymy of *Sertularella divaricata* (Busk) and *S. subdichotoma* (Kirchenpauer). Totton (1930) had the opportunity to study the type specimens of both species but unfortunately he failed to give new descriptions. *Sertularella divaricata* (*Symplectoscyphus divaricatus*) is a species with a fascicled hydrocaulus; it is said to be closely related to *Sertularella subarticulata* (Coughtrey, 1874). Totton (l.c.), after a study of Kirchenpauer's specimens of *S. subdichotoma*, found that Kirchenpauer's drawings of that species were made after Australian specimens (Bass Strait) and he has selected these Australian specimens as the holotype of *C. subdichotoma*. No complete description of the latter species is given, but according to Totton's account it has a non-fascicled, monosiphonical hydrocaulus, the gonotheca has no free frills and the aperture is situated at the top of a very short and wide tube. Bale (1914) has described many Australian colonies from various localities which he attributed to *S. divaricata*, he also drew attention to the considerable differences in the shape of the colonies and the gonothecae. All colonies described by that author have monosiphonical hydrocauli, the gonothecae have trumpet-shaped tubes of various diameter. Bale's specimens very probably do not belong to *S. divaricata*, which is described to have a fascicled stem; they differ from the present colonies in the shape of the gonothecae. It is impossible to reach a definite decision as long as no accurate, new descriptions of *S. divaricata* and *S. subdichotoma* have been published. *S. divaricata* as described by Bale (1914) shows distinct differences from the present colonies, they certainly do not belong to one species. The colonies from Timara very probably represent the form figured by Kirchenpauer; it may be necessary to substitute a new specific name for the Australian specimens described by Bale.

***Sertularia distans* (Lamouroux, 1816)**

Locality: Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). One colony of \pm 15 mm height, covered with *Laomedea* and *Hebella*.

The colonies agree with specimens figured and described by Billard (1906, p. 187, fig. 10; the specimens represented in fig. 11 and described on p. 191 were later on attributed to a new species, *Dynamena dubia* Billard, 1922). The colony is slightly branched, the sidebranches are more or less dichotomously arranged; they are very slender and are broken up into internodes, separated by oblique septa. The hydrothecae are arranged in pairs along the branches, each internode normally has two pairs. The hydrothecae are almost tubular, consisting of a free and a fused portion. The fused part is slightly shorter than the free part but distinctly wider. On the frontal part of each internode both hydrothecae of one pair are fused, but on the back of that internode they appear to be distinctly separated. The free hydrothecal part is directed obliquely upwards and aside. When the colony is seen in frontal aspect the free part of the theca makes an angle of \pm 60° with the internode and an angle of 30°-40° when seen from aside. The opening of each theca is always provided with a large number of renovations (cf. Billard, 1907, fig. 10c). The distal part of the hydrotheca is very delicate and consequently it is easily damaged. The opening of each theca has two more or less distinct lateral teeth and no ad- or abcauline median tooth. The closing apparatus consists of two semi-circular flaps; the adcauline flap is slightly roof-shaped.

The geographical distribution of the typical form of *Sertularia distans* or its variety (*S. distans* var. *gracilis* Hassall = *S. gracilis* Hass.) has not yet been settled. *S. distans* seems to be a comparatively rare species, found in the tropical Atlantic along the coast of Africa; recently Leloup (1938) has recorded specimens from the Sagami Bay, Japan. The distribution of *S. distans* var. *gracilis* seems to be much wider, although it is sometimes very difficult to distinguish between the typical form, the var. *gracilis* and a number of closely related, small sertularians. The var. *gracilis* is known from the coasts of the British Islands, Ireland, the coasts of Portugal, along the Atlantic coasts of Africa, the Sargasso Sea, the coasts of Massachusetts, the Mediterranean and a number of localities in the Indian Ocean (cf. Billard, 1925; Leloup, 1937a).

***Sertularia elongata* Lamouroux, 1816**

Localities:

Port Phillip, Australia, from the collection of S. R. Lenormand (no. 862). A number

of ± 7 cm high, unbranched colonies rising from a creeping hydrorhiza on Eelgrass, together with many Bryozoa. Some gonothecae are present.

Kent Group, Bass Strait, Australia (no. 863). A large number of up to 6 cm high colonies with many gonothecae, growing on Algae.

Queenscliff, Australia, October 18, 1899 (no. 209). A large number of up to 8 cm high colonies on seaweeds, covered with numerous gonothecae.

Queenscliff, Australia, F. von Müller, 1903 (no. 861). A large number of up to 6 cm high colonies with many gonothecae on *Gelidium*, together with *Sertularella neglecta* Thoms.

The present colonies belong to a luxurious form, with many bipinnate hydrocauli. The periderm has a dark, horny colour. The colonies were dried and later on softened and preserved in alcohol; they do not lend themselves for a detailed description.

Sertularia elongata is a common species in Australian and New Zealand waters, where it is found in large quantities on seaweeds. It has never been recorded from the waters of the Netherlands East Indies.

***Sertularia bispinosa* (Gray, 1843)**

Locality: West coast of New Zealand, from the collection of J. G. Agardh (no. 397). Several fragments of ± 8 mm height, without gonothecae, on *Gelidium*.

The characteristic hydrothecae are found in pairs on the articles of the hydrocauli; they are strictly opposite and nearly tubular in appearance, the margin is provided with two lateral, abcauline teeth of slightly unequal length. The gonothecae are found on the articles, inserted directly beneath a pair of hydrothecae.

As the preceding species *S. bispinosa* seems to be mainly restricted to Australian and New Zealand waters, it is, however, less common in the former than in the latter region. It is also mainly found on seaweeds.

***Sertularia operculata* Linnaeus, 1758**

Localities:

Kent Group, Bass Strait, Australia (no. 865). A large tuft of hydrocauli with numerous gonothecae, forming a dense and intertwined mass of a yellow-brown colour.

Cape Blanco, West coast of Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). A large number of hydrocauli forming a dense, yellow coloured mass. The hydrothecae contain contracted hydranths. No gonothecae are present. Together with many colonies of *Aglaophenia dichotoma* (M. Sars).

Coast of West Africa, probably collected near Faux Cape, near Cape Bojador, A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). A large and beautifully developed colony on an Ascidian, with a rich additional fauna of Gastropoda, Cirripedia and Bryozoa. No gonothecae are present; on some of the hydrocauli small colonies of *Plumularia setacea* (L.) are present.

Tafel Bay, South Africa, 5-8 fms., M. Weber, July 23, 1894 (Collection Zoological Museum Amsterdam). A fragment of a colony with contracted polyps and without gonothecae.

Sertularia operculata has a wide distribution in tropical and subtropical waters of Atlantic and Pacific Oceans, occasionally penetrating into boreal waters. It is particularly common along the Atlantic coast of Africa and in Australian and New Zealand waters; it has, as far is known, never been found in the waters of the Netherlands East Indies. Fraser (1938) recently the coast of Peru).

recorded the species from the East Pacific (Lobos de Afuera Islands along

***Dymella articulata* (Pallas, 1766)**

Localities:

Mossel Bay, South Africa, F. Kraus, 1860 (no. 227). A number of 5-6 cm high colonies, rising from a creeping hydrorhiza. Gonothecae are not present.

Cape Colony, South Africa, C. F. Kraepelin & H. Holm, 1861 (no. 113). Several 5-6 cm high colonies with creeping hydrorhiza. No gonothecae are present.

Knysna, South Africa, M. Weber (Collection Zoological Museum Amsterdam). Four colonies, varying in height between 25 and 55mm, one of the colonies with mature female gonothecae.

The Knysna colonies are in good condition, the other colonies were apparently dried and later on preserved in alcohol. A description of the Knysna colonies is given below. There is one large colony of 55 mm height, richly bearing gonothecae, which is detached from the hydrorhiza, to which three smaller colonies are still attached. The hydrorhiza is thick, its diameter varies from 0.8 to 0.9 mm, the periderm is brown. The hydrocauli of all colonies are very distinct and straight, they differ from the sidebranches by the larger diameter (0.8 mm) and the dark, horny colour. Each hydrocaulus has two opposite rows of hydrothecae, the thecae are alternately or subalternately arranged. The hydrocauli as well as the sidebranches are divided into internodia by straight septa; on the hydrocaulus there are generally three pairs of hydrothecae on each article. The sidebranches are placed in two opposite rows, so that the colonies have a feather like appearance. The sidebranches are arranged in pairs of two opposite branches, one internode has a single pair of sidebranches, rising from a pair of apophysae, placed between the first and second pair of hydrothecae. The sidebranches, which in the present colony are not branched for a second time, are about 10-20 mm long and differ from the hydrocaulus by their almost complete transparency. Their articles normally have 4 pairs of opposite hydrothecae, arranged in two rows along the branch, but this number may vary from 2 to 5 pairs. The hydrothecae are nearly completely sunken into the branch, only a small portion of the adcauline wall has remained free from the branch. The length of that free part varies slightly, in some cases it may be wholly reduced, probably as a result of damage. The opening of the theca is parallel to the longitudinal axis of the branch, the margin has no teeth, although the

margin of some thecae, probably also as the result of damage, shows some slight prominences.

The gonothecae all face the same side of the colony. They have a short stalk, which springs from the base of a hydrotheca of the main stem or of the sidebranch. They are elongated egg-shaped, truncated at the top and there show a large, circular opening, bordered by a distinct neck. In mature gonothecae that neck carries a chitinous ring on its internal surface, set with a number of chitinous tubercles. The outer surface of the gonotheca is nearly completely smooth, although Ritchie (1909, fig. 6b) figures a number of distinct, annular constrictions.

Dymella articulata bears some resemblance to *Thuiaria tetracythara* (Lamx.), from which it differs by the much larger gonothecae (in *T. tetracythara* they are about 1.1-1.2 mm long) and the less prominent hydrocaulus of the latter species. The hydranths of *T. tetracythara* have a cul-de-sac, which is not present in the genus *Dymella*. The hydrocaulus of *T. tetracythara* is slightly thicker than the sidebranches, which are usually branched. These branches are not arranged in opposite pairs, but they are arranged along the nodes of the hydrocaulus, which is twisted in zigzag-fashion. In *T. tetracythara* the hydrocaulus is monosiphonical in many colonies, but it may become polysiphonical by the presence of secondary tubes, which fuse with the hydrocaulus in its basal part. The collection of the Rijksmuseum van Natuurlijke Historie contains a specimen of *T. tetracythara* labelled "North Sea", without indication of a date or collector. After comparison with duplicates of *T. tetracythara* from the Siboga Expedition, present in the collection of the Rijksmuseum, the above mentioned specimen proved to be identical with the East Indian colonies from the Siboga. The specimen is almost certainly wrongly labelled, as *T. tetracythara* is only known from the tropical Pacific and Atlantic Oceans.

Dymella articulata has its main distribution in tropical and subtropical Atlantic waters, it seems to be a common species along the South African coast. Occasionally it penetrates into boreal regions, so that it is also met with in the North Sea and in the Irish Sea.

Kirchenpaueria pinnata (Linnaeus, 1758)

Locality: Oude Kraal, on the west side of Cape Point, South Africa, H. Engel, November 28, 1938 (Collection Zoological Museum Amsterdam). Ten colonies of \pm 9 mm height, hydrothecae with expanded, well preserved hydrants. No gonothecae are present.

Although all colonies are sterile, there is little doubt about their identity. They all have a distinct, monosiphonical hydrocaulus, which has distinct

periderm of a light horn colour, broken up into distinct articles, separated by slightly oblique joints. Each article carries a distinct apophysa on its lower half, in the axil of which there is a much reduced sarcostyl, the theca of which is almost completely reduced. The apophysa is separated from the first supporting article of the hydroclade by a slightly oblique joint. The apophysae, as also the hydroclades, are arranged in two opposite rows, the colonies have a delicate, feather-like appearance. The first supporting article of the hydroclade is very short and carries no hydro- or sarcothecae. All other articles of the hydroclade are hydrothecate and have about the same length; they are separated by oblique joints. All these articles have a hydrotheca at about half their length, placed on a conspicuous apophysa. The hydrotheca is cup-shaped, with almost cylindrical walls, the adcauline wall is fused for about $\frac{2}{3}$ of its length with the internode. There are two sarcostyles on each article, one at the base of the apophysa which carries the hydrotheca, and one almost in the axil of the adcauline thecal wall and the internode. No septa are present in the internode. The large hydranth present in most of the thecae has about 15 tentacles.

Measurements :

Length of the internodes of the hydrocaulus	400-560 μ
Diameter of the articles of the hydrocaulus	135-165 μ
Length of the articles of the hydroclades	345-390 μ
Diameter of the articles of the hydroclades	75-90 μ
Total length of the hydrotheca	100-115 μ
Diameter of the hydrotheca	129-140 μ

The measurements show that the African specimens belong to the forma *typica* Broch, 1918; although the colonies are slightly smaller than those from boreo-Atlantic waters, they show complete structural conformity.

Kirchenpaueria pinnata is mainly an Atlantic species; along the coast of South Africa it also penetrates the tropical western part of the Indian Ocean. A second species of the genus *Kirchenpaueria* (*K. unilateralis* (Ritchie, 1907)) is found along the South African coasts; the present specimens, however, distinctly belong to the first mentioned species. *K. pinnata* is exceedingly common along the coasts of the British Islands, the coast of France, the Atlantic coast of Spain and the coast of Portugal, penetrating for to the south. It has also been found in the Mediterranean.

***Antennella sibogae* Billard, 1911**

Locality: Off Ampanan, on the west coast of Lombok, 13 fms., G. F. Tydeman, May, 1909 (Collection Zoological Museum Amsterdam). Two colonies, reaching a maximal height of 30 mm. One of the colonies with some empty gonothecae.

The present colonies agree in detail with Billard's (1913) description

and figures. They consist of 15-30 mm long, unbranched pseudohydrocauli, rising from a dense tuft of fine hydrorhiza fibres. All hydrocauli are broken up into distinct internodes, separated by very oblique septa. At the base of each pseudohydrocaulus some supporting articles are present, which are separated by more or less distinct transverse septa. These supporting articles have scattered sarcothecae and bear no hydrothecae; the last supporting article distally has an oblique septum, which separates it from the first hydrothecate article. These hydrothecate articles have large hydrothecae, which agree in shape with Billard's figures and description (l.c., textfig. II, p. 10), and a number of sarcothecae. There is an unpaired, median sarcotheca on the apophysis which carries the hydrotheca, whilst on each side of the hydrotheca, at about $\frac{1}{3}$ of its length, a pair of flanking sarcothecae is found. On each side of the hydrotheca one of the flanking sarcothecae is found on the end of a distinct processus; this sarcotheca does not reach the thecal border, a much shorter sarcotheca is found in the axil of the processus. In addition there are two pairs of sarcothecae on the article above the theca. As the length of the part of the article found above the theca varies slightly, the basal pair of sarcothecae on it may occasionally be found almost at the border of the hydrotheca, the second pair is found at a short distance somewhat higher on the article. On the first or the first two hydrothecate articles, immediately following the supporting articles, 3 pairs of sarcothecae may occasionally be found. The present colonies only differ from the Siboga specimens described by Billard by the presence, in some of the internodes, of a transverse septum, situated between the first and second pair of supracalcine sarcothecae. Such a transverse septum is found in only one or two internodes of each pseudohydrocaulus, its development varies considerably. The gonotheca was figured by Billard (l.c., textfig. 3); there are four basal sarcothecae.

Antennella sibogae has so far only been recorded from two localities in the waters of the Netherlands East Indies, viz., Obi Strait, north of Poeloe Damar (Sta. 144) and Sapeh Bay, Flores Sea, $8^{\circ} 30' S$, $119^{\circ} 07'.5 E$. In addition it was recorded by the Siboga Expedition from the Sibutu Passage, Philippine region ($5^{\circ} 11'.2 N$, $119^{\circ} 35'.4 E$, Sta. 94).

Plumularia setacea (Linnaeus, 1758) (fig. 6)

Localities:

Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). A number of 8 mm high colonies, with gonothecae, at the base of an *Aglaophenia pluma* colony.

West Africa, probably from Faux Cape, near Cape Bojador, A. Vermeulen, 1906 (Collection Museum Amsterdam). Three colonies varying in height between 5 and 13 mm on hydrocauli of *Sertularia operculata* L. on a large Ascidian.

I have carefully compared the African specimens with colonies from the North Sea area, where the species is very abundant; I have been unable, however, to find substantial differences. The colonies from Cape Blanco have the alternating hydrocladia arranged in two rows; they are placed in one plane. The hydrocladia have hydrothecate and intermediate articles, the former bearing a hydrotheca slightly above the middle of its length, a pair of

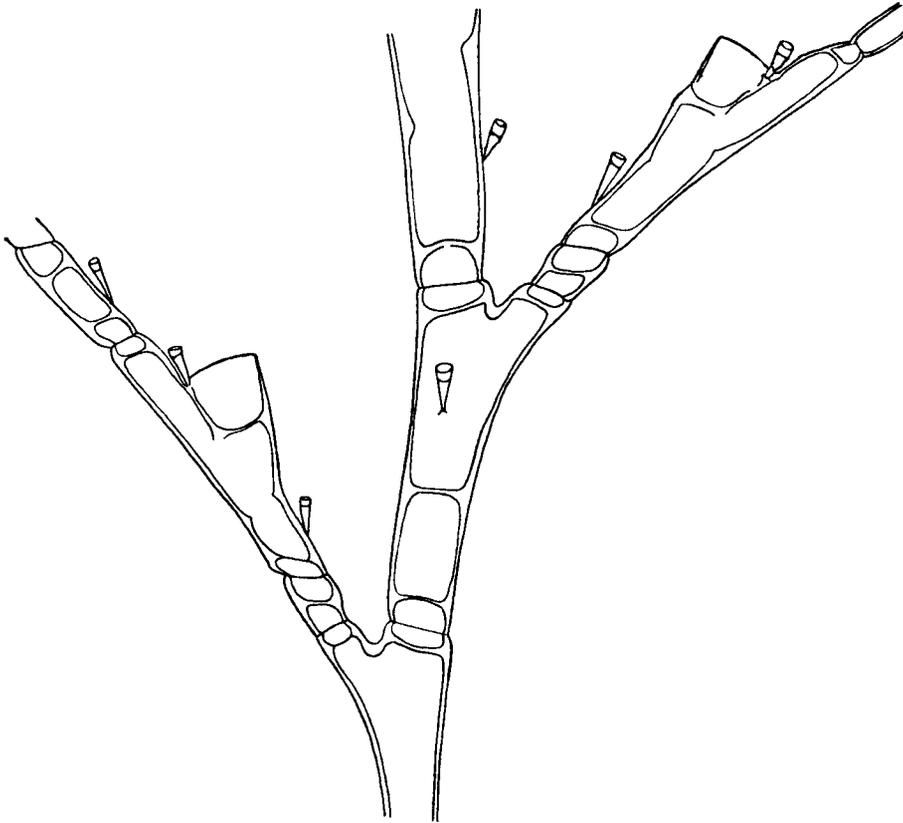


Fig. 6. *Plumularia setacea* (L.), W. Africa, probably Faux Cape, near Cape Bojador, W. Africa, A. Vermeulen, 1906. Basal part of a colony. $\times 100$.

flanking sarcothecae close to the margin of the hydrotheca, and an unpaired, median sarcotheca on the proximal part of the article; the latter with a single sarcotheca. The article is about 2-3 times as long as the hydrotheca, so that these colonies belong to the forma *typica* Broch, 1918. The gonothecae of the Cape Blanco colonies, of which both the females and the males are present, are arranged on apophysae which support the hydrocladia. The female gonothecae are found on the basal portion of the hydrocaulus, the male

gonothecae occur chiefly on the higher parts. They are elongated egg-shaped, with a narrow, tapering neck; the female gonothecae are slightly larger than the males. All gonothecae are mature.

The three remaining West African colonies, probably collected near Cape Bojador, differ from those mentioned above by the presence of scattered sarcothecae along the articles of the hydrocaulus and the presence of complete septa in the articles of the hydrocaulus and hydrocladia. These septa, which are indicated by thickenings of the periderm in the preceding colonies, are usually found in the basal part of the articles; the articles of the hydrocaulus sometimes have one or two additional septa (cf. fig. 6). The hydrothecate articles are about 2-3 times as long as the hydrotheca.

P. setacea appears to be almost cosmopolitan, although the species seems to be absent from the arctic and antarctic regions. It is very common in tropical, subtropical and boreal Atlantic waters, but it has also been recorded from many localities in tropical and subtropical parts of the Pacific and Indian Oceans. Leloup (1937a) recently recorded the species from French Indochina; Fraser (1938) mentions specimens collected in the East Pacific. In tropical Pacific waters, however, a number of small Plumularians are found which, in absence of the gonothecae, cannot readily be distinguished from *P. setacea*, e.g., *Plumularia strictocarpa* Pictet, 1893, and *P. setaceoides* Bale, 1881.

***Plumularia spiralis* Billard, 1911**

Locality: Off Ampenan, on the west coast of Lombok, 13 fms., G. F. Tydeman, May, 1909 (Collection Zoological Museum Amsterdam). One colony of 7 cm height and some fragments. No gonothecae are present.

This characteristic species was accurately described by Billard (1913, p. 49, textfig. xlv). A comparison of Billard's account and the measurements in his paper with the present specimens show that they belong to the typical form with relatively long internodes and short hydrothecae.

Measurements:

	Specimens from the Siboga Expedition (Billard, 1913)	Present specimens
Length of the hydrothecate articles	380-540 μ	360-420 μ
Diameter distal part hydrothecate articles	40-50 μ	45-70 μ
Total length of the hydrotheca	70-80 μ	60-75 μ
Diameter of the opening of the hydrotheca	80-95 μ	75-90 μ

Plumularia spiralis has so far only been recorded from the waters of the East Indian Archipelago by the Siboga Expedition (Billard, 1913): Flores Sea (Sta. 65a, near Tanah Djampeah; Sta. 66, south of Salajar);

Sibutu Passage (Sta. 93); Pacific Ocean near the Talaut Islands (Sta. 133); Ceram Sea (Sta. 164, south of Salawatti); Banda Sea (Sta. 248, near the Watoebela Islands; Sta. 258, near the Kai Islands); Timor Sea (Sta. 282, near Noesa Besi). Its bathymetrical range seems to extend from 8 to 400 m depth.

Nemertesia antennina (Linnaeus, 1758)

Localities:

Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). Six large, up to 30 cm high colonies, at their base with a large mass of hydrorhiza fibres, covered by Porifera. No gonothecae are present.

Rio d'Oro, West Africa, A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). Two fragments of \pm 10 cm height, not provided with gonothecae.

The hydrocaulus of the present specimens is comparatively slender, reaching a maximal diameter of 600 μ , and is non-fascicled. There are verticils of 5 apophysae each in the lower parts of the colony and of 4 apophysae in the higher parts. The apophysae of a following verticil are placed in such a fashion, that each apophysa falls in the space left by those of the previous verticil, so that the double number of vertical rows of apophysae is present. Each apophysa has a reduced, unpaired sarcotheca (mamelon) and 4 stalked, two-chambered sarcothecae. The hydrocladia are heteromerously segmented; they have one or two supporting articles, separated by oblique joints. The hydrothecae, found on the hydrothecate articles are of the usual type, comparatively large, with an unpaired sarcotheca on the apophysae and a pair of movable sarcothecae near the margin. The hydrothecate article is separated from the following, intermediate article by a transverse, or slightly oblique joint, it bears a single, unpaired, two-chambered sarcotheca near its proximal end. An oblique joint separates that intermediate article from the following, hydrothecate article. The specimens agree with a form described by Bedot (1927) as forma *robusta*.

Nemertesia antennina is an Atlantic species, mainly restricted to boreal and subtropical parts of that Ocean. Along the west coast of Africa it penetrates comparatively far to the south. Fraser (1938a), in a paper on East-Pacific Hydroida, has described a number of *Nemertesia*'s of extremely doubtful character. As the descriptions of Fraser's species are short and incomplete and his drawings very bad, a reexamination of his material certainly is necessary to establish the affinity of his "species". It seems probable, although it is by no means certain, that the wellknown Atlantic species may be represented amongst Fraser's material, so that its range of distribution may be much larger.

Nemertesia perrieri (Billard, 1901)

Locality: Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). One large colony of 22 cm height, without gonothecae.

The present large colony consists of a large number of unbranched, canaliculated hydrocauli, rising from a dense mass of hydrorhiza fibres and partly fused at the base. In the basal parts the hydrocauli have verticils of apophysae, each with 5 apophysae, whilst in the higher parts of the colonies that number is reduced to 4. The hydrocaulus generally is very strongly developed and reaches a diameter of 1050 μ , in this respect differing considerably from colonies of *N. antennina* from the same locality, in which the hydrocaulus is much thinner. The apophysae are slightly longer than those found in *N. antennina*, but they have the same number of sarcothecae. The hydrocladia are much more slender than those of *N. antennina*; they consist of hydrothecate and intermediate articles. The basal article of each hydroclade is a supporting article, provided with a two-chambered sarcotheca and is much shorter than the other intermediate articles; it is separated from the following, hydrothecate article by an oblique joint. The hydrothecate articles carry, besides the hydrotheca, a proximal and two flanking sarcothecae near the margin of the hydrotheca; all sarcothecae are two-chambered. The following article, an intermediate article, is separated from the preceding hydrothecate article by a slightly oblique, almost straight septum, distally that article has an oblique septum. The intermediate article invariably carries 2 stalked, two-chambered sacrothecae, placed at about $\frac{2}{3}$ and $\frac{1}{3}$ of its length.

Measurements:

Total length of the hydrocladia	9 mm
Diameter of the articles of the hydrocladia	65-75 μ
Length of the hydrothecate articles	255-345 μ
Length of the intermediate articles	240-300 μ

Nemertesia perrieri has so far only been found in subtropical Atlantic waters (e.g., Canary Islands and the west coast of Spain and Africa); it seems to be a comparatively rare species.

Nemertesia tetrasticha (Meneghini, 1845)

Locality: Adriatic, exact locality unknown, from the collection of S. R. Lenormand (no. 502). Several up to 10 cm high hydrocauli, sparingly branched, without gonothecae.

Nemertesia tetrasticha differs from *N. ramosa* Lamx. mainly by the shape of the gonothecae, but in spite of the absence of the gonosome in the present specimens I have brought them to the former species. The hydrocaulus

is monosiphonical over nearly its total length, the basal part of some hydrocauli only shows a canaliculated structure. The hydrocladia, however, are not strictly arranged in opposite pairs; the long apophysae on which the hydrocladia are placed are not strictly opposite. As in *N. antennina* and *N. perrieri* each apophysis has one unpaired, median sarcotheca and three stalked, two-chambered sarcothecae. The hydrocladia, which have an average length of ± 10 mm, are homomerously segmented, each long and slender article has a single hydrotheca, a proximal unpaired and 2 lateral two-chambered sarcothecae, the latter close to the margin of the hydrotheca. No distal sarcothecae are found on the hydrocladia, a condition which has also been mentioned by Stechow (1923).

Nemertesia tetrasticha is mainly restricted to the Adriatic, although it also may have been found in the Naples area and near Madeira (cf. Stechow, 1919).

Halicornaria longirostris (Kirchenpauer, 1872)

Localities:

Queenscliff, Australia, October 18, 1899 (no. 210). Numerous up to 8 cm high colonies, without gonosome.

Australia, without indication of an exact locality or a collector (no. 246). A fragment of 3 cm length, consisting of a short hydrocaulus with some short hydrocladia. This fragment was identified by E. Stechow.

The colony from Queenscliff agrees with Bale's description of the non-parasitic form of *Halicornaria longirostris*, mentioned by him as var. *thompsoni* (Bale, 1881). The monosiphonical hydrocaulus reaches a maximal height of 8 cm and is slightly branched at its base. The hydrocladia are found on the upper part of the hydrocaulus only, so that the length of the part that bears hydrocladia amounts to 3 or 4 cm; the hydrocladia have a total length of ± 8 mm. They are divided into internodia by slightly oblique septa, which are scarcely visible in the basal hydrocladia. Each internode carries a single hydrotheca, the characteristic structure of which agrees with Bale's (1884) and Marktanner's (1890) descriptions and figures. The basal part of each tuft of hydrocauli is densely covered by colonies of Porifera and Bryozoa. The species is of common occurrence in Australian waters.

Lytocarpus phoeniceus (Busk, 1852)

Localities:

Balikpapan, Borneo, from the collection of W. J. Tissot van Patot (Collection Zoological Museum Amsterdam). Fragments of a large colony without gonosome.

Kwandang Bay, Celebes, 400-500 fms., J. W. van Nouhuys, April 20, 1914 (Collection Zoological Museum Amsterdam). Two young colonies of ± 60 mm height, without gonosome.

Billard (1913) has described East Indian specimens of this tropical and variable species, with which the specimen from Balikpapan generally agrees. The fragments show that the basal part of the hydrocaulus had a diameter of ± 3 mm. The hydrocladia have no septa, but the internodes are marked agrees with Billard's figure (l.c., textfig. ix), the margin of the hydrotheca shows three more or less developed teeth on each side; the left and right thecal border are not symmetrical, but generally one side is more produced. The development of the marginal teeth varies much when hydrothecae from various hydrocladia of the colony are compared. The median sarcotheca is comparatively long, reaching the level of the centre of the opening of the hydrotheca, it curves slightly inwards. The lateral sarcothecae, directed forwards and upwards, project above the margin of the thecae. There are two incomplete septa in each internode, one at about half the length of the theca and one near the base of the thecal cavity. The colony has a violet colour, which is probably caused by the presence of symbiotic (?) algae in the soft parts. The colonies from Kwandang Bay differ from the preceding colonies by the light horn colour; the soft parts of these colonies are devoid of algae. The hydrocladia, which are slightly longer than in the preceding colony, are divided into slender internodia by oblique septa; no other septa can be observed in the internodes. The lateral sarcothecae are rather long, much longer than in the colony from Balikpapan; they are directed forwards and slightly upwards, their length is the same as that of the free part of the median sarcotheca. The hydrothecae are in a bad condition, so that the margin could not be observed in detail.

Lytocarpus phoeniceus is an entirely Indo-Pacific species, which is particularly common in the waters of the East Indies; there is only a single Atlantic record (Rioja, 1906), which according to Billard (1913) relates rather to *Halicornaria montagui* (Billard, 1912) than to *L. phoeniceus*. The Siboga Expedition recorded the species from many localities in the eastern part of the Malay Archipelago (Billard, 1913), distributed over nearly all the seas of that area.

***Lytocarpus philippinus* (Kirchenpauer, 1872)**

Localities:

Gier no. 12, Exped. 3, 4° 25' S, 114° 31' E, 11-13 fms., October 4, 1908 (no. 867). Several small, young colonies, which reach a maximal height of 10 mm, rising from a creeping hydrorhiza. Median and lateral sarcothecae comparatively short, the lateral sarcothecae reaching the margin of the hydrotheca. Gonosome absent.

Gier no. 12, Exped. 5, 4° 41' S, 113° 2' E, 15.5-17.5 fms., October 8, 1908 (no. 866). Fragments of a large colony, the hydrothecae with contracted hydranths. The gonosome is not present.

Balikpapan, Borneo, from the collection of W. J. Tissot van Patot (Collection

Zoological Museum Amsterdam). One small, 15 mm high colony at the base of an *Aglaophenia cupressina* colony. The gonosome is not present.

Ambon, from the collection of M. M. Willemsz Geeroms, 1913 (Collection Zoological Museum Amsterdam). Fragments of several high colonies without gonosome.

The young colony from Balikpapan consists of a monosiphonical, dark brown hydrocaulus, rising from a creeping hydrorhiza. The hydrocaulus is not broken up into articles, but it bears apophysae, on which the hydrocladia are placed. The apophysae are found on the frontal surface of the hydrocaulus, they are alternately directed to the left or the right side of the colony; the comparatively short hydrocladia are directed upwards and forwards in the basal part, but gradually bend outwards, so that the colony has a feather-like appearance. Each apophysis has 3 distinct, large sarcothecae, of which two are almost axillary and one is placed on the frontal part of the apophysis. Some distance above that last mentioned sarcotheca there is a reduced sarcotheca (mamelon). The hydrocladia are broken up into articles; the septa, however, are very thin and indistinct, their presence is indicated by constrictions of the periderm. In the present young colonies each hydroclade has a maximum of 10 articles. The shape of the hydrothecae and sarcothecae is as figured by Billard (1913, fig. lxii). Each article has two incomplete septa. The margin of the hydrotheca has one lateral, slightly prominent tooth and a rather strong median tooth. The median sarcotheca reaches the level of the median tooth; the lateral, almost tubular sarcothecae project above the margin of the hydrotheca. The colonies collected at 4° 41' S, 113° 02' E by the Gier Expedition differ from the other colonies by the long median and lateral sarcothecae. No internodal septa are present. The sarcothecae contain a sarcophore with large nematocysts, 400 μ long and 30-45 μ in diameter; 3 to 7 nematocysts may be present in each sarcotheca.

Lytocarpus philippinus has an enormous distribution in tropical and subtropical Atlantic, Pacific and Indian Oceans (cf. Ritchie, 1910; Billard, 1913; Stechow, 1923), according to Billard (1913) it is represented in the Atlantic Ocean and in the Pacific and Indian Oceans by different forms, the Pacific form also penetrates the Mediterranean. In the Malay Archipelago the species is very common (Vervoort, 1941), especially in the eastern part, where it was recorded from a number of localities by the Siboga and Snellius Expeditions (Billard, 1913; Vervoort, 1941). The Gier Expedition now records the species from the Java Sea.

***Lytocarpus filamentosus* (Lamarck, 1816)**

Locality: Cape of Good Hope, South Africa, C. F. Kraepelin & H. Holm, 1861 (no. 213). Numerous colonies, varying in height between 8 and 15 cm. The gonosome is not present.

The present colonies all have a distinct, strongly fascicled hydrocaulus, which is much and irregularly branched, at its base reaching a diameter of ± 7 mm. The hydrocladia are found on the higher parts of the hydrocaulus, the length of that part varies from 2 to 4 cm. The hydrocladia have a length of 5-8 mm. The hydrothecae as well as the structure of the colonies have been most accurately described by Marktanner-Turneretscher (1890) as *Aglaophenia fusca* Kirch. and *Lytocarpus patulus* Kirch. The species seems to be mainly restricted to the South African region, where it is found both on the Atlantic and on the Pacific side (cf. Stechow, 1925).

***Monoserius fasciculatus* (Thornely, 1904)**

Localities:

Gier no. 9, Exped. 18, $0^{\circ} 14' N$, $104^{\circ} 04' E$, 13-16 fms., July 2, 1908 (no. 881). One fragment of 10 cm height with many phylactocarpia.

Bay of Batavia, on muddy soil, depth 5 fms., C. Ph. Sluiter (Collection Zoological Museum Amsterdam). Fragments of a ± 25 cm high colony without gonosome.

Soenda Strait, brought up by the cable dredge during reparations of the Anjer-Kalianda cable, bottom temp. $80^{\circ} F$., J. W. van Nouhuys, Dec. 15, 1908 (Collection Zoological Museum Amsterdam). One large, 40 cm high colony and a fragment of 15 cm height. The large colony with many phylactocarpia.

Monoserius fasciculatus has been most accurately described and figured by Billard (1913, p. 83, pl. v figs. 41, 42, textfig. lxxvii). The present specimens agree with that description and need not be described in detail here. The species bears a close resemblance to *M. pennarius* (L.) (= *Aglaophenia secunda* Kirch.), from which it differs by the structure of the colony, the shape of the lateral sarcothecae and the phylactocarpia. In *M. fasciculatus* the branches, which are densely set with alternating hydrocladia, are arranged in a spiral, so that the colony is sympodically branched, the spirally coiled main stem is thus formed by the basal portions of the various pinnae, whilst in *M. pennarius* there appears to be a scorpoid arrangement of the branches, all directed towards the same side of the colony and springing from a straight and conspicuous main stem, also formed by the basal parts of the pinnae. A similar type of ramifications is occasionally met with in the genus *Schizotricha* Allm. The internodia of the hydrocladia in *M. fasciculatus* have lateral sarcothecae on each side, placed close to the border, both sarcothecae are small and have the same size, in *M. pennarius* one of the lateral sarcothecae (that facing the internal side of the colony) is nearly twice as large as the other sarcotheca. The phylactocarpia in *M. fasciculatus* have a fully developed hydrotheca near the base; such a hydrotheca is apparently absent in *M. pennarius*, at least it has not been figured by Allman (1883) in his drawing of *Lytocarpus secundus* (= *Monoserius pen-*

narius). In the present, fertile colonies there are 5-6 gonothecae in each phylactocarpium.

Monoserius fasciculatus has so far only been recorded from the tropical Indian and Pacific Oceans (cf. Vervoort, 1941), in the Malay Archipelago it is very probably a common species in moderately deep water (8-100 m) as the present localities as well as those from where it was recorded by the Siboga and Snellius Expeditions are distributed over the whole East Indian Archipelago. *M. pennarius* is also an Indo-Pacific species; the area of distribution of that species seems to be larger (cf. Ritchie, 1910), although records of *M. fasciculatus* may be included under those of *M. pennarius*. A careful comparison of both species and an accurate description of their differences is necessary.

Thecocarpus formosus (Busk, 1850) (fig. 7)

Thecocarpus formosus, Billard, 1907, p. 378, textfigs. 19, 20.

Aglaophenia parasitica Warren, 1908, p. 332, pl. xlviii figs. 28-32, textfig. 17.

Localities:

Cape of Good Hope, South Africa, H. B. van Horstok (no. 44). A large number of hydrocauli, varying in height between 4 and 6 cm, rising from a tangled mass of hydrorhiza fibres and algae. No corbulae are present.

Cape of Good Hope, South Africa, F. Kraus, 1869 (no. 43). Several 7 cm high hydrocauli, rising from a tangled mass of hydrorhiza fibres. Colonies with many corbulae.

Cape of Good Hope, South Africa, without indication of a collector or date (no. 235). Several fragments of a colony without corbulae. This specimen was studied and identified by E. Stechow.

Cape of Good Hope, South Africa, C. F. Kraepelin & H. Holm, 1861 (no. 214). A very large number of colonies, varying in height between 4 and 7 cm, richly bearing corbulae. The hydrocauli are fused to small or larger tufts, the basal parts of which are covered by colonies of Bryozoa and many incrusting Algae.

Mossel Bay, South Africa, F. Kraus, 1860 (no. 41). A number of \pm 9 cm high hydrocauli rising from Balanids. No corbulae are present.

Labrador, without indication of a collector, a date or an exact locality (no. 55). Some colonies of 7 cm height rising from some twisted hydrorhiza fibres. No corbulae are present.

Mediterranean, without accurate locality, F. Cantraine (no. 53). A number of 8 cm high hydrocauli with a small number of hydroclades. The basal portion of the colony invested by colonies of Bryozoa. No corbulae are present.

Knysna, on the south coast of Africa, M. Weber (Collection Zoological Museum Amsterdam). One colony of \pm 15 mm height, the basal part of which is not present. No corbulae are present.

The Knysna colony only is in good condition and will be described in detail below. The hydrocaulus, which has a diameter of 300 μ , is broken up into short, 240 μ long articles, separated by rather indistinct septa. Each article has a short, broad apophysis, alternatingly pointing to the left or the right side of the colony, they support \pm 8 mm long hydroclades; the

colony has a rigid, feather-like appearance. Each apophysa has a large, axillary sarcotheca, whilst two more sarcothecae are placed on the frontal surface of the apophysa. The basal one of the last mentioned two sarcothecae is small, the other has about the same shape and length as the axillary sarcotheca. The hydroclades are divided into distinct internodes, separated by distinct, transverse septa. Each internode carries a hydrotheca, flanked

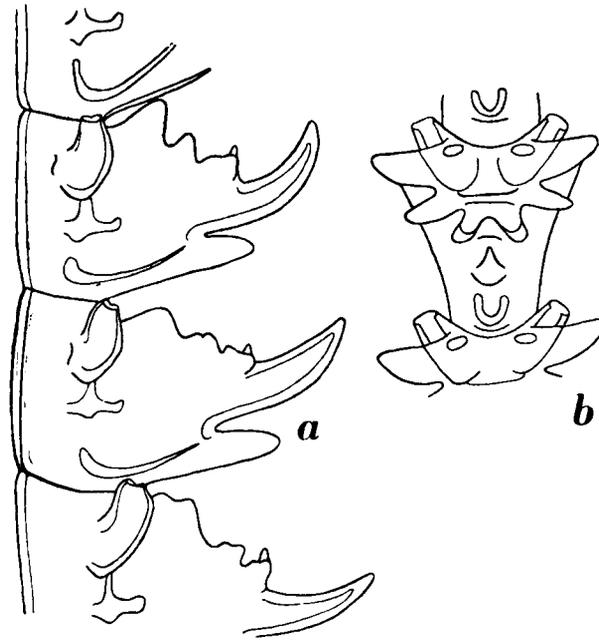


Fig. 7. *Thecocarpus formosus* (Busk), Knysna, S. Africa, M. Weber. a, part of a hydrocladium with hydrothecae in lateral view; b, hydrothecae in frontal view.
a, b, $\times 75$.

on each side by a tubular sarcotheca; the apical internode of each hydroclade has an apical, spiniform projection which carries an additional, tubular sarcotheca (cf. Billard, 1907, fig. xix A). The hydrotheca is very large and has a very characteristic shape. The margin has 13 teeth, the unpaired, median tooth is slightly curved towards the interior of the theca; there are 6 other teeth on each side. The 2nd, 4th, and 6th tooth of each side are curved outwards, the 3rd and 5th are small and curved inwards. The outwardly curved teeth increase in size, so that the most adcauline (6th) tooth is very large and almost triangular. The frontal part of the hydrotheca below the unpaired tooth is produced into an acutely pointed process which is curved upwards. The median sarcotheca has fused with the frontal part of

the theca for about half its length; it detaches itself from the thecal wall closely under the curved processus. The free part which varies slightly in length, is gutter-shaped over its entire length. The lateral sarcothecae have a circular, lateral opening corresponding with the cavity of the hydrotheca, which can distinctly be seen when the theca is viewed from above. At the base of the lateral sarcothecae there is a distinct septum, projecting some distance into the cavity of the theca, sometimes also dividing the article into two parts of nearly equal length. In many internodes that septum does not reach the opposite wall. The development of the teeth along the thecal border varies considerably. They differ much in length and are sometimes divided into two smaller teeth. The length of the curved incisor-processus also varies much but it always projects for a considerable distance above the margin of the theca.

Measurements:

Length of the internode of the hydroclades	210-270 μ
Total length of the hydrotheca	225-255 μ
Diameter of the opening of the theca	150-180 μ
Length of the curved processus	165-220 μ

Warren (1908) described a hydroid from the Natal coast as *Aglaophenia parasitica*, occurring there in large masses on coralline algae. In my opinion Warren's *Aglaophenia parasitica* cannot be separated from *Thecocarpus formosus* (Busk). The chief differences between them is the shape of the corbulae and the parasitic habit of *A. parasitica*. Warren, in his description of the gonosome of *A. parasitica*, failed to describe the hydrotheca, present at the base of each leaflet (cf. Billard, 1907, textfig. xx), but a small lateral leaflet is mentioned and figured by that author. The absence of the hydrotheca in Warren's description and figures seems to me due to inaccurate observation, as the highly transparent hydrotheca is easily overlooked and the number of sarcothecae at the base of that theca may give the impression of a small, additional branch. The parasitic habit of *A. parasitica* does not seem to be beyond discussion. It seems probable that in *Thecocarpus formosus*, as in *Halicornaria longirostris*, there occurs a non-parasitic as well as a parasitic form, although this is by no means proven. Totton (1930), after a reexamination of the (lecto)type of *T. formosus*, found a small rooting mass at the base of the hydrocaulus, indicating a parasitic habit.

The range of distribution of *Thecocarpus formosus* seems to be mainly restricted to the Atlantic and Pacific waters round South Africa (Cape of Good Hope, Algoa Bay, Mossel Bay, Madagascar), although the species has also been recorded from the Indian Ocean (Ceylon) and the Mediterranean. According to Bale (1884) it has also been recorded from Australian and

New Zealand waters by Allman; I have been unable, however, to verify Bale's statement. A closely related species, which shows much conformity with *T. formosus*, *Thecocarpus rostratus* (Bale, 1924), occurs in the New Zealand area. The record of the Labrador locality must be taken with extreme doubt, as *T. formosus* has so far never been recorded from the Northern Atlantic, so that the above mentioned locality most probably is erroneous.

***Thecocarpus giardi* Billard, 1907**

Locality: Cape of Good Hope, C. F. Kraepelin & H. Holm, 1861 (no. 215). Several large, up to 20 mm high colonies, without gonothecae.

Although the present colonies have no gonosome, there is little doubt about their identity, as they agree in detail with the accurate description by Billard (1907). The strong, polysiphonical hydrocaulus reaches a maximal diameter of 8 mm, the basal portion, however, is invested by a colony of Porifera. Billard has carefully described the structure of the spirally twisted hydrocaulus and the arrangement of the sidebranches and hydroclades. Each internode of the hydroclades has a single hydrotheca, which has 7 teeth along its border. There are 3 lateral teeth on each side and one median tooth which is divided into a scarcely visible internal tooth and a comparatively large external tooth, reaching slightly above the level of the other marginal teeth. There is a faint indication of a thecal septum at the base of the thecal cavity. The lateral teeth may be divided into two smaller teeth, the development of the lateral teeth varies considerably in hydrothecae of one colony. Billard has also described the gonosome, which is not present in the South African specimen.

Thecocarpus giardi has so far only been recorded from Madagascar (Fort Dauphin, Billard, 1907), it is recorded here for the first time from South Africa.

***Aglaophenia pluma* (Linnaeus, 1758) (fig. 8)**

Localities:

Mediterranean, without indication of an exact locality or a collector (no. 52). Several colonies with corbulae on *Halidrys siliquosa*.

Adriatic, without accurate locality, from the collection of S. R. Lenormand (no. 500). Several up to 20 mm high colonies with corbulae on *Cystoseira*.

Knysna, on the south coast of Africa, M. Weber (Collection Zoological Museum Amsterdam). One large colony of 50 mm height and a smaller, 12 mm long colony, both without gonosome.

Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). One colony of 30 mm height, at the top only provided with hydroclades. No corbulae are present.

Salisbury Island, Durban Bay, H. Engel, October 28, 1938 (Collection Zoological Museum Amsterdam). One colony of 11 mm height without gonosome.

All colonies which have come under my notice belong to the forma *typica* Bedot, 1919 (cf. Broch, 1933). Because of the great variability of the present species some of the above mentioned colonies will be described in

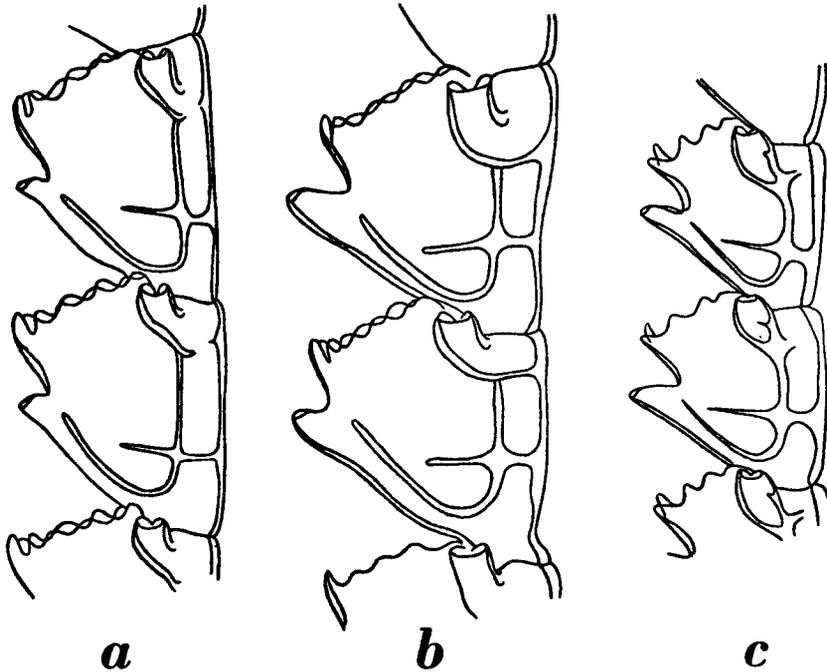


Fig. 8. *Aglaophenia pluma* (L.). a, part of a small colony from Knysna, S. Africa, M. Weber; b, part of a larger colony from Knysna, S. Africa, M. Weber; c, part of a colony from Salisbury Island, Durban Bay, H. Engel, Oct. 28, 1938. All figures show the hydrothecae in lateral view. a, b, c, $\times 65$.

some detail. The colonies from Knysna differ from Bedot's (1919) description by the great length of the part of the hydrocaulus which is devoid of hydroclades. The length of that part amounts to 35 mm in the large and 7 mm in the smaller colony. It consists of a number of articles, separated by transverse, sometimes very indistinct septa, without hydrothecae or nematothecae. These joints have a thick, brown periderm. The last of these supporting joints distally has an oblique and proximally a transverse septum, it is followed by a joint separated by an oblique septum on each side, and carrying a nematotheca. The structure of the rest of the colony agrees with Bedot's description. The hydroclades are few in number and have about 5 internodes

with hydrothecae, in which the contracted hydranths are still present. The hydrothecae (figs. 8a, b) on each side have a distinct median tooth and 4 lateral teeth. The adcauline tooth may be completely hidden between the lateral sarcothecae. The median sarcotheca covers more than half the length of the frontal wall of the theca, the free abcauline part of the wall varies from 35 to 40 % of the total length of the theca. There is a distinct internal thecal septum; the small colony has one distinct (basal) septum in the internode, in the large colony two internodal septa have developed, one basal and one at the base of the lateral sarcotheca. The internodes are comparatively long when compared with colonies from the Adriatic and measured by Broch (1933).

Measurements:

	Small colony	Large colony
Total length of the internode (I)	300-330 μ	270-350 μ
Depth of the hydrotheca (T)	300-310 μ	260-310 μ
Length of the free abcauline wall of the theca (n)	105-120 μ	90-135 μ
Diameter of the hydrotheca (B)	180-200 μ	230-250 μ

The hydrothecae of the Cape Blanco colonies generally agree with those of the colony from Knysna, although the development of the thecal teeth varies much. Several hydrothecae have almost triangular lateral teeth, whilst in other hydrothecae these teeth are rounded or sometimes even truncated at the top. The unpaired frontal tooth is sometimes curved towards the interior of the theca and then almost hidden between the first two lateral teeth or almost straight and then distinctly visible. An unpaired, adcauline tooth sometimes has developed instead of the last pair of lateral teeth. There are two internodal septa, one at the base of the article and one near the thecal septum; each septum is complete.

The colonies from the Durban Bay have a short supporting hydrocaulus, maximally 3 mm long. The shape of the hydrothecae differs from that of the Knysna colonies by the reduction of the adcauline (4th) pair of lateral teeth, which pair even may be completely obsolete. The other marginal teeth are acute and separated by triangular incisions. The thecal septum is distinct, the internode has two distinct septa, one at the base of the lateral sarcotheca and one at the same level as the thecal septum. The length of the lateral sarcotheca varies slightly; in some hydrothecae it does not reach the thecal border, in other hydrothecae it projects for a slight distance above that border.

A careful reexamination of the specimens from the Snellius Expedition (Vervoort, 1941, p. 232), described as *Aglaophenia elongata* (Menegh.), has shown that these colonies also belong to *A. pluma* forma *typica*. A re-

description of these specimens will be given in a supplementary report on the hydroids collected during that expedition.

The geographical distribution of *A. pluma* is extremely wide. Although its main area of distribution is in the tropical and subtropical parts of the three large Oceans, it penetrates far into the boreo-Atlantic region, where it is found along the French coast and the coasts of the British Islands. It is distributed through the whole Mediterranean, common along the West, South and East African coast, distributed through the Indian Ocean and comparatively common in the Malay region. It is sometimes difficult to distinguish *A. pluma* and its many varieties from *A. elongata* (Menegh.). Fraser (1938, 1938b) shortly described and figured two more species of the genus *Aglaophenia*, which probably represent varieties of *A. pluma*, viz., *Aglaophenia praecisa* (p. 57, pl. 13 fig. 64) and *A. prominens* (p. 142, pl. 21 fig. 12), so that the species may also be found in the East Pacific.

***Aglaophenia dichotoma* (M. Sars, 1857)**

Localities:

Cansado Bay, West Africa, A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). Many tangled colonies, forming a large tuft, without gonosome.

Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). One small colony of about 10 cm height without corbulae.

The present specimens agree with the accurate description of *Aglaophenia dichotoma* given by Marktanner (1890, under the name of *A. tubiformis*). The shape of the hydrothecae shows that they belong to the forma *typica* Broch, 1933. It is unnecessary to give a redescription of this well-known species. Ritchie (1907) mentions specimens which resemble the present specimens rather closely as far as the shape of the hydrothecae is concerned. The structure of the colony differs slightly. Ritchie's specimens seem to have a more or less erect, somewhat feather-shaped appearance, the hydrocaulus is more or less distinct; the present specimens are profusely and dichotomously branched, the hydrocaulus has the same diameter over its entire length.

The distribution of *A. dichotoma* seems to be mainly Atlantic, where it is found in the tropical and subtropical parts. It is also found in the Mediterranean, moreover it penetrates into boreal regions, so that it is also found along the Atlantic coast of France and along the coast of the British Islands.

***Aglaophenia latecarinata* Allman, 1885**

Locality: Sargasso Sea, 34° N, 38° W, F. A. Frederiks, December 3, 1872 (no. 186). A number of 12 mm high colonies, rising from a creeping hydrocaulus, fixed on *Sargassum*. No corbulae are present.

The species is very common in the western tropical and subtropical Atlantic, where it is mainly found on Sargasso weed; it occasionally occurs on other floating objects or on Gorgonids. Together with *Sargassum* it is distributed over a large area in the Atlantic, going as far east as the Açores (Leloup, 1935).

***Aglaophenia parvula* Bale, 1881 (fig. 9b)**

Localities:

Cape of Good Hope, without indication of a collector or date (no. 33). Several colonies, maximal height 10 mm, on Algae. Corbulae are present.

Cape of Good Hope and Kamp Bay, South Africa, from the collection of F. T. Kützing (no. 507). A large number of 12 mm high colonies with corbulae on *Gelidium*.

Cape of Good Hope, South Africa, C. F. Kraepelin & H. Holm, 1861 (no. 212). A large number of 10 mm high colonies on *Gelidium*, with many corbulae.

Although the present species is closely related to *Aglaophenia pluma*, it differs in the shape of the marginal teeth of the theca. There are 9 long and acute marginal teeth, one of which is unpaired and placed on the frontal part of the theca. There are four teeth on each side of the margin. The frontal teeth and those of the last pair of lateral teeth are curved towards the cavity of the theca; the remaining teeth are curved outwards. They are separated by deep, rounded incisions. The median sarcotheca does not reach the level of the unpaired median tooth. The cavity of the hydrotheca has a distinct septum, which is also visible in the internode.

Aglaophenia parvula is found in tropical and subtropical parts of the Atlantic and Pacific Oceans. It occurs along the west coast and south coast of Africa and in the Australian waters, where it is chiefly found on Algae.

***Aglaophenia rathbuni* Nutting, 1900, (fig. 9a)**

Locality: Off Bahia, Brazil, 10 fms., J. S. A. Kroon, March 10, 1896 (no. 752). One mutilated colony of 45 mm height, at the base covered by a sponge.

The present colony consists of a number of hydrocauli, monosiphonical throughout their entire length. The higher parts of these hydrocauli are broken up into articles, separated by oblique, indistinctly marked septa; the basal parts have no division into internodia. Each internodium of the hydrocaulus has an almost distal apophysis, which carries the hydroclade. Each apophysis has three sarcothecae, two are laterally arranged and are nearly axillary, the remaining sarcotheca is placed on the frontal aspect of the apophysis and has a reduced sarcotheca (mamelon) in its proximity. The apophysae and the hydrocladia are alternately directed to the right and the left side of the colony; they also project forwards. The colony has a rigid, feather-like appearance. The hydrocladia are divided into internodes,

the septa are indistinct. The hydrothecae are placed on a rather prominent apophysa, their longitudinal axis makes an acute angle with that of the internode, and a considerable portion of the adcauline wall of the theca is not fused with the internode. The border of the hydrotheca has three pairs of lateral teeth, which are almost triangular in shape and are separated by deep, triangular incisions. The development of the marginal teeth varies

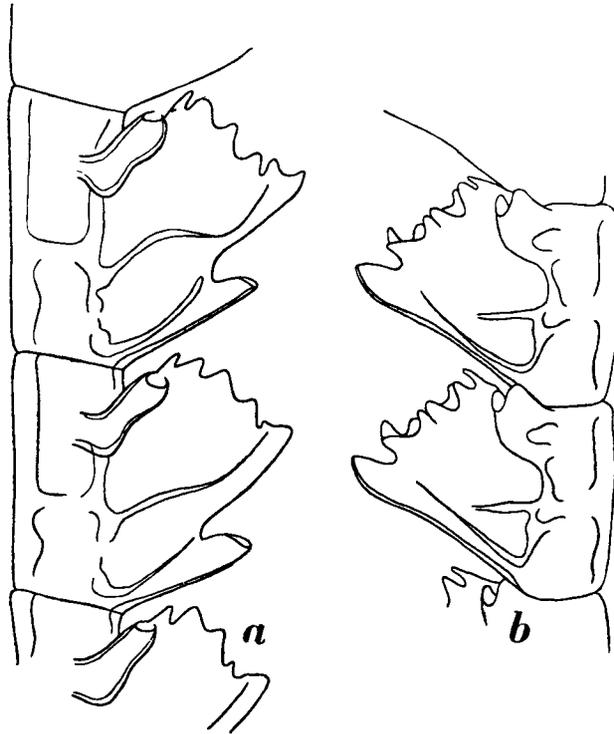


Fig. 9. a, *Aglaophenia rathbuni* Nutting, off Bahia, Brazil, 10 fms., J. S. A. Kroon, March 10, 1896. b, *Aglaophenia parvula* Bale, Cape of Good Hope, S. Africa. Both figures show a part of a hydrocladium with hydrothecae in lateral view. a, b, $\times 90$.

slightly. Moreover, there is a well marked adcauline and an abcauline median tooth. The frontal part of the hydrotheca carries a well marked carina, running from the base of the median sarcotheca to the level of the abcauline tooth, so that the last tooth seems to be bifid; the length of the free part of the carina as well as that of the abcauline tooth varies considerably. The median sarcotheca is short, it covers about half the frontal wall of the theca. Its free, canaliculated part is about $\frac{1}{3}$ of its total length. The cavity of the hydrotheca by a very oblique septum is divided into two parts; at

the adcauline end of the thecal septum there is a strong internodal septum, running straight through the internode. There is another, much less distinctly marked and incomplete septum at some distance below the first mentioned septum, and another, also incomplete septum near the base of the lateral sarcothecae. The lateral sarcothecae are tubular, they do not project above the margin of the hydrotheca.

Measurements:

Total length of the hydrotheca	300-330 μ
Diameter of the hydrotheca	150-170 μ
Length of the articles of the hydroclades	310-330 μ
Diameter of the articles of the hydroclades	100-120 μ

The various hydrothecae are closely set; the margin of a theca reaches above the septum separating two articles and almost touches the median sarcotheca. The sarcothecae on the apophysae of the internodes of the hydrocaulus are not described by Nutting (1901), but he mentions a mamillate, perforated area at the base of the hydroclades. *A. rathbuni* was recorded by Nutting (l.c.) off Caravellos on the coast of Brazil, no other records have since appeared in literature, so that the species probably has a very restricted area of distribution.

***Aglaophenia divaricata* (Busk, 1852)**

Localities:

Encounter Bay, South Australia, from the collection of J. G. Agardh (no. 396). One small, 12 mm high colony on *Gelidium*. No corbulae are present.

Queenscliff, Australia, F. von Müller, 1903 (no. 756). A large, \pm 15 cm high colony with many ramifications. The hydrocaulus has at its base a small tuft of hydrorhiza fibres. No corbulae are present.

Aglaophenia divaricata has been accurately described several times by various authors, so that a detailed description is unnecessary. The present specimens agree closely with Bale's description (1884, p. 162), the specimens from the Encounter Bay generally agree with his description of the var. *mccoyi* (Bale, 1881), from which they differ by the monosiphonical hydrocaulus. This may be largely due to the youthful state of the colonies, as the characteristic shape of the hydrothecae and the long median sarcotheca leaves little doubt about the identity. The colonies from Queenscliff have a much and irregularly branched, polysiphonical hydrocaulus, which is composed of a few tubes, so that it is comparatively slender. It agrees with the typical form described by Bale; the hydrothecae invariably have short median sarcothecae, slightly protruding over the margin of the thecae (cf. Bale, 1884, pl. 15 fig. 8) or slightly shorter. There are 4 pairs of marginal teeth, which differ much in development, the last pair is almost completely hidden

between the short, lateral sarcothecae. Each theca has a more or less distinct intrathecal septum. *Aglaophenia divaricata* seems to be a common species in Australian and New Zealand waters, where it is found in large quantities on various Algae.

***Aglaophenia cupressina* Lamouroux, 1816**

Localities:

Ambon, on coral reefs, A. Zippelius, beginning of 1828 (no. 505). Numerous up to 15 cm high colonies with many corbulae.

Timor, on coral reefs off the coast, A. Zippelius (no. 395). Several large, up to 20 cm high colonies with many corbulae.

Poeloe Saboloh coral reef, off the north coast of Timor, August 9, 1908 (Collection Zoological Museum Amsterdam). One colony of 11 cm height, without corbulae.

Balikpapan, Borneo, W. J. Tissot van Patot (Collection Zoological Museum Amsterdam). Fragments of a large colony and some smaller colonies of ± 9 cm height. Ambon, Collection M. M. Willemsz Geeroms, 1913 (Collection Zoological Museum Amsterdam). Several small colonies of ± 9 cm height on worm tubes, some corbulae are present. One large colony of 20 cm height, together with *Lytocarpus philippinus* (Kirchenp.), also with many corbulae.

In a previous paper (Vervoort, 1941) I have discussed the geographical distribution of this species. It is a very common species in shallow waters and on the coral reefs of the Netherlands East Indies.

***Campanularia johnstoni* Alder, 1856**

Locality: Gulf of Naples, G. Stiasny, 1924 (no. 4). A large colony covering a twig. Many mature and empty gonothecae are present.

The present colony consists of a creeping mass of hydrorhiza fibres, covering a twig of 10 cm length and a diameter of 3 mm. The hydrothecae rise from the creeping fibres and have a pedicel of maximally 10 mm length. These pedicels in most cases are unbranched, but sometimes they have a slight apophysa, bearing a shortly stalked hydrotheca. Broch (1935) has extensively treated the variability of the present species and drawn attention to the difference in the shape of the hydrothecae. The thecae of the present specimen agree with his description of the forma *typica* Broch, 1933. The hydrothecae are slender and slightly cup-shaped, reaching a length of 740 μ , with a maximal diameter of 460 μ ; the periderm is very thin. The number of marginal teeth varies between 10 and 14, they are more or less rounded and not distinctly crenel-shaped. The gonothecae arise directly from the hydrorhiza, they are rarely found on the stalks of the hydrothecae. They have 8-10 well developed annular rings.

Campanularia johnstoni has an almost world wide distribution, although

it has its chief occurrence in southern Atlantic waters. It does not penetrate into Arctic waters; in the Mediterranean it is comparatively common. From the Naples area it was previously recorded by Stechow (1923).

Laomedea striata (Clarke, 1907)

Localities:

Dana Expedition, Sta. 1162, III, 13° 35' N, 30° 11' W, 300 m wire, November 6, 1921, on *Cuvierina columnella* (Rang) (no. 948).

Dana Expedition, Sta. 3932, IX, 11° 35' S, 49° 45' E, 300 m wire, December 20, 1929, on *Diacria trispinosa* (Les.) (no. 949).

Dana Expedition, Sta. 3999, V, 3° 45' S, 10° 00' W, 300 m wire, March 2, 1930, on *Diacria trispinosa* (Les.) (no. 700).

Dana Expedition, Sta. 4005, VI, 13° 31' N, 18° 03' W, 100 m wire, March, 12, 1930, on *Diacria trispinosa* (Les.) (no. 701).

Dana Expedition, Sta. 4006, III, 15° 31' N, 18° 05' W, 300 m wire, March 13, 1930, on *Diacria trispinosa* (Les.) (no. 950).

Laomedea striata is a very common species on the Pteropod *Diacria trispinosa* (Les.), covering both sides of the shell. A large percentage of the hitherto studied specimens of that Pteropod in the Dana collections are covered with the hydro- and gonothecae of *Laomedea striata*. On *Cuvierina columnella* (Rang) the species is much less common, I have only seen a single specimen of that Pteropod covered by a small colony of *L. striata*. *Laomedea striata* was originally described by Clarke (1907) from the eastern part of the Pacific Ocean (0° 34' N, 117° 15'.8 W and 7° 12'.5 S, 84° 09' W); although the occurrence on shells of Pteropods is mentioned, there is no exact reference to the species on which it was found. Kramp (1922), after a study of a large material of the two above mentioned Pteropods, found it a common species in the tropical parts of the Atlantic and Indian Oceans. In the Atlantic its area of distribution extends from 27° 03' N to 31° 16' S, from the east coast of Africa to South America and the West Indies; in the Indian Ocean it is found between 11° 35' S—38° 50' S and 24° E—50° E, moreover it was recorded from 23° S, 72° E and 25° 50' S, 102° 50' E. *Laomedea striata* shows a striking resemblance to *L. pelagica* (Van Breenmen) (= *L. gracilis* (M. Sars, 1851)).

Laomedea longicyatha (Allman, 1877)

Locality: Ambon, collection M. M. Willemsz Geeroms, 1913 (Collection Zoological Museum Amsterdam). Two small colonies of \pm 9 mm height on worm tubes. Mature and young gonothecae are present.

The hydrothecae of the present specimen vary between 900 and 950 μ

in length. The gonothecae are slightly larger ($1000-1200\ \mu$), with a more or less distinct apical neck and a large circular opening. The margin of the hydrotheca is very thin and transparent, so that the dentation is rather difficult to observe.

Laomedea longicyatha has a wide distribution in tropical and subtropical waters of the Indo-Pacific regions. It was found in the Ambon region by Pictet (1893) and has since been recorded from various localities in the

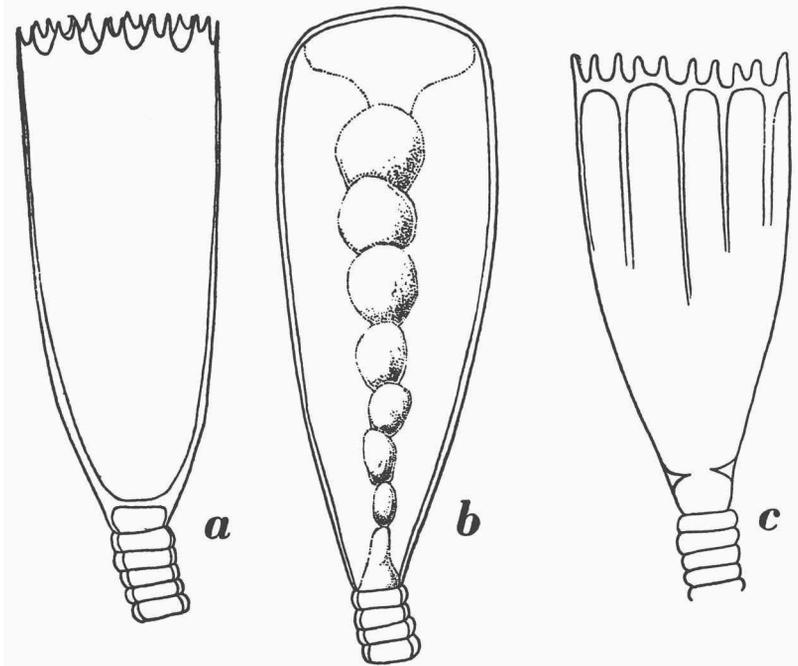


Fig. 10. a, b, *Laomedea bicuspadata* (Clark), Cape Blanco, W. Africa, 11-35 fms., A. Vermeulen, 1906. a, hydrotheca; b, gonotheca. c, *Laomedea bicuspadata* (Clark) var. *tenuis* nov. var., mouth river Koeboe, W. Borneo, H. A. Lorentz, July 31, 1909, hydrotheca. a, b, c, $\times 115$.

Malay Archipelago. Fraser (1938) records the species from a number of localities in the tropical East Pacific.

***Laomedea bicuspadata* (Clark, 1875) (figs. 10a, b)**

Locality: Cape Blanco, West Africa, 11-35 fms., A. Vermeulen, 1906 (Collection Zoological Museum Amsterdam). A number of up to 30 mm high, polysiphonical colonies with many gonothecae, together with *Halecium liouvillei* at the base of a *Nemertesia perrieri* colony.

The polysiphonical hydrocauli are much and irregularly branched. At the

base they reach a maximal diameter of 1.5 mm, here they are composed of many tubes, the main sidebranches are also polysiphonical. The hydrothecae are found on the sidebranches or originate from the main stem, in which case their stalks spring from between the accessory tubes of the primary hydrocaulus. The hydrothecae are comparatively large, 675-750 μ long and have a diameter of 210-260 μ . They are almost cylindrical, with a very small basal chamber, separated from the cavity of the theca by a thin, membranaceous diaphragm, which in most of the thecae has a slightly oblique position, although it is nearly straight in other thecae. The margin of the hydrotheca is provided with 9-11 large teeth, separated from each other by distinct and deep, rounded incisions. Each tooth at its top has a rather deep, semicircular incision, so that each large tooth is divided into two sharply pointed, lateral teeth, each of which has a triangular lamelliform projection, projecting into the cavity of the theca. This peculiar condition of the thecal teeth has accurately been figured by Hummelinck (1936, fig. 7). The theca appears to be polygonal at a section some distance below the margin of the theca. There are no longitudinal stripes on the external surface of the theca. The pedicels vary in length, they have $\frac{1}{4}$ - $\frac{1}{5}$ of the length of the hydrotheca and are annulated throughout their entire length.

The gonothecae are found on short annulated stalks in the axil of the pedicels of the thecae. They are elongated conical to almost cylindrical of shape, in young gonothecae the top is rounded, mature gonothecae are truncated at the top. They contain about 8 gonophores, apparently developing into free *Obelia* medusae. The length of the gonotheca varies from 750 to 830 μ , the diameter is 275-300 μ .

The geographical distribution of *L. bicuspidata* seems to be almost worldwide, although the localities from which the species was recorded are scattered: Mediterranean (Cete, Adriatic), India (Chandipore, Chilka Lake), Malay region (Ambon, Bali), New Britain, Australia, Hawaii, Panama region and the East coast of America (Beaufort, Woods Hole, Rhode Island, Long Island, Bonaire, Aruba) (cf. Hummelinck, 1936). It also penetrates into boreal regions, where it has been found along the North Sea coast of Belgium and the Netherlands. From the Atlantic, Pacific and Indian Oceans various forms have been described, e.g., *L. spinulosa* var. *minor* Leloup, 1932, and *L. bicuspidata* var. *picteti* Leloup, 1932, the exact relationship of which with the typical *Laomedea bicuspidata* is not yet clear.

***Laomedea bicuspidata* (Clark, 1875) var. *tenuis* nov. var. (fig. 10c)**

Laomedea spinulosa var. *minor* p.p. Leloup, 1935, p. 26.

Laomedea spinulosa var. *minor* Hummelinck, 1936, p. 55, fig. 8 g-h, l.

Locality: Mouth of the Koeboe river, West Borneo, H. A. Lorentz, July 31, 1909 (Collection Zoological Museum Amsterdam). Several small hydrocauli on *Cordylophora caspia* (Pall.), consisting of some hydrothecae only. No gonothecae are present.

The present small colony differs from the typical *L. bicuspidata* by the inferior length of the hydrothecae and the development of the marginal teeth. Each theca is distinctly and very regularly polygonal on transverse section below the margin; there appear to be about 10 planes, each of which is produced into a prominent spine. The planes of the hydrotheca are separated by distinct, thickened edges, while the whole of the thecal border also appears to be thickened. All marginal teeth are separated by deep, rounded incisions. Each of the 10 large teeth is divided into two lateral teeth by a deep, semicircular incision, almost as deep as the other marginal incisions, so that the thecal border at first sight seems to have 18-20 small teeth. Each small tooth has a distinct carina, protruding into the cavity of the theca and running downwards for a small distance on the internal surface of the theca. The hydrothecae are $\pm 875 \mu$ long, with a diameter of 150-170 μ . They are placed on short, annulated pedicels. In the present colonies these hydrothecae are placed on ± 5 mm long, monosiphonical hydrocauli, which originate from a creeping hydrorhiza. In addition there are some hydrothecae on slightly longer stalks, also rising from that hydrorhiza.

The present variety probably represents a brackish water form of *L. bicuspidata*. Dr. P. Wagenaar Hummelinck collected specimens of this variety in the brackish water of the Lac, on the east coast of Bonaire, West India, which were described by Leloup (1935), together with specimens from other localities in the West Indies, as *L. spinulosa* var. *minor*. Hummelinck (1936), after reexamination of the colonies mentioned by Leloup, described and figured the different forms of the margin of the hydrothecae of the colonies ascribed by Leloup to the var. *minor*. The above mentioned specimens from the Lac are also figured (Hummelinck, 1936, fig. 8 g-h, 1), the specimens from which the drawing was taken are still present in the collection of the Rijksmuseum (no. 295); after reexamination they proved to be identical with the colonies on *Cordylophora* from Borneo. The material from the Lagoen on the east coast of Bonaire and also included by Leloup in his var. *minor* belongs to the typical form of *L. bicuspidata*; these colonies have also been figured by Hummelinck (1936, fig. 8 r-s, v). No gonothecae of this variety have been described up to the present time.

Laomedea sargassi Broch, 1913

Locality: Sargasso Sea, 34° N, 38° W., F. A. Frederiks, December 3, 1872 (no. 203). Several colonies without gonothecae on *Sargassum*, together with *Dynamena cornicina* McGrady, reaching a height of 10 mm.

The hydrothecae are in a bad condition, they agree, however, with the description of this species by Nutting (1915, as *Obelia hyalina*). The gonothecae are not present. *Laomedea sargassi* is commonly found on Sargasso weed, together with *Aglaophenia latecarinata* and *Dynamena cornicina* McGrady; with the latter species it agrees almost completely in its area of distribution. It has been found in tropical and subtropical parts of the Atlantic, from the west coast of Africa to the West Indian Islands. It has also been found in the Mediterranean (Naples area), in the Suez Canal and near Ceylon (cf. Leloup, 1935). Fixed on *Sargassum* it may cover considerable distances and may even be transported into boreal regions.

Laomedea loveni Allman, 1859

Locality: Gulf of Naples, G. Stiasny (no. 263). A large number of up to 13 mm high colonies on *Mytilus*, together with *Tubularia larynx* Ell. & Sol. Gonothecae with mature gonophores are plentifully present.

The mediterranean specimens agree in all characteristics with the many colonies from boreal localities in the collection of the Rijksmuseum. The margin of the theca is provided with distinct crenel-shaped teeth, truncated at the top and separated by rounded incisions. The hydrothecae are slightly more slender than those from boreal localities; the diameter of the opening is slightly smaller than that of boreal specimens. The gonothecae contain 5-6 gonophores; they are slightly smaller than usually met with in northern specimens.

Laomedea loveni is a boreal species, commonly distributed in the northern parts of the Atlantic Ocean. It is particularly common in the North Sea area, where it penetrates into brackish waters. It has also been found in the Mediterranean, from where it was recorded by Stechow (1919) (Marseilles, Cette, Triest, as *Gonothyraea hyalina* and *G. loveni*).

Laomedea spec.

Localities:

Beira, South Africa, M. Weber (Collection Zoological Museum Amsterdam). Several hydrocauli with some mutilated hydrothecae on *Tubularia* spec.

Off Ampenan, West coast of Lombok, 13 fms., G. F. Tydeman, May, 1909 (Collection Zoological Museum Amsterdam). Some colonies with damaged hydrothecae on *Idiella pristis* (Lamx.).

Badly preserved specimens of *Laomedea*, which could not be identified with certainty, are present from the above mentioned localities.

LITERATURE 1)

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