HYDROIDS OF THE HAWAIIAN ISLANDS COLLECTED BY THE STEAMER ALBATROSS IN 1902.

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Previous to the Hawaiian cruise of the *Albatross* almost nothing was known regarding the hydroid fauna of that region. So far as the writer has been able to ascertain, but three species had been reported from those waters—two having been collected by the *Challenger* and one having been mentioned by Hartlaub as collected by Professor Schauinsland from near the island of Laysan.

The collection forming the basis of this report is thus from practically virgin territory, and when it is remembered that the Hawaiian Islands are farther removed from any continental mass than any other group of similar size, it will be seen that forms of unusual interest would probably be found which would throw light on the morphological and geographical relationships of the Hydroida as a whole. With these considerations in view it will be readily understood that the study of this collection was undertaken with keen interest. The result, however, has been far beyond any reasonable anticipation. It is doubtful whether any other collection, approximately of the same size, made during the last quarter of a century has yielded so great a number of unusually interesting forms.

Of the 49 species collected 29 are new, and as a whole these latter are more certainly distinct from previously known forms than is usually the case. As might have been expected, the majority of the novelties were found among the Calyptoblastea, but the most surprising occurred among the Gymnoblastea, a suborder that has comparatively few representatives in tropical waters. Of the 7 species of these latter, 2 were well-known Holarctic forms, 2 were new species of a genus hitherto known only from the Mediterranean, and 2 were so different from anything heretofore known that the writer has been unable to place them in any previously defined family, and has been forced to establish new families of Hydroida for their reception.

Another interesting and unexpected feature of this collection is the unusual proportion of forms provided with fascicled stems, more than half of the entire number of species being thus characterized, and all but one of the gymnoblastic forms. As has elsewhere been shown[a], the accessory tubes of the fascicled stem are in reality modified hydrocladia, and their utility lies in giving additional strength to the stems. Why this particular feature is so often developed in the Hawaiian region it is hard to imagine, especially as by far the greater number of species were taken in depths presumably beyond the influence of pronounced wave action.

[a] Nutting, American Hydroids, Part II, p. 5, 1904.

A study of the geographical distribution of the forms included in the collection reveals unmistakable relationship with the Australian region. One indication pointing strongly to this conclusion is the great number of Plumularidæ, which constitute about one-third of the species. The west coast of North America, and particularly Alaska, is characterized by a relatively poor representation of that interesting family, while Australia is one of the great centers of distribution of these typically tropical hydroids, the only region that rivals it being our own West Indian waters. In proportion to the total number of species collected, the Hawaiian region seems to be nearly as rich in these very graceful and interesting Hydroida as is the Australian.

In the following table the author has included, for the sake of completeness, the two Hawaiian forms, *Campanularia retroflexa* Allman and *Plumularia buskii* Bale, that were not collected by the *Albatross* during her recent cruise.

Geographical and bathymetric distribution of Hawaiian Hydroids.

(The asterisks denote the new species in the Albatross collection.)

	Australia.	California.	West Indies.	Alaska.	Arctic.	European.	New England coast.	Bathymetric distribution, in fathoms.
*Hydrodendrium gorgonides								272–296
Ceratella fusca	+							
Eudendrium rameum	+	+			+	+		99
Eudendrium capillare					+	+	+	134
*Balea mirabilis								127
*Corydendrium corrugatum								99–314
*Corydendrium minor								99–138
*Halecium scandens								59
*Campanularia eloisa								59–138
Campanularia spinulosa	+							52
Campanularia retroflexa[a]								20–40
*Stegopoma gilberti								122–143
*Stegopoma gracilis								95–218
*Stegopoma plumicola								59–163
*Opercularella longicauda								138
Calycella syringa		+		+	+	+	+	95
Lafoëa dumosa	+	+		+	+	+	+	10–143
Lafoëa fruticosa		+		+	+	+	+	99–176
*Lafoëa contorta								59–122
Lictorella halecioides	+				+	+	+	95–163
*Lictorella cervicornis								138
Filellum serpens		+			+	+	+	?
Cryptolaria pulchella								14–506
*Cryptolaria symmetrica								13–225
*Cryptolaria operculata								138
*Sertularia snyderi								59–163
Sertularella lata	+							44–134
Sertularella dentifera		+						129–293
*Sertularella torreyi								40–406
*Sertularella crenulata								95
Pasythea quadridentata	+		+					Surface.
Thuiaria fenestrata	+							14–20
*Diphasia palmata								134
Synthecium tubithecum			+					70–75
Synthecium orthogonia	+							14
Plumularia corrugata		+						122
*Plumularia jordani								73–130
Plumularia buskii	+							?
*Plumularia delicata								56–495
*Plumularia milleri								95
Monostæchas quadridens			+					122–138
*Monostæchas fisheri								56–59
*Antennella complexa								30–134
? Aglaophenia rigida			+					52
*Thecocarpus niger								16–163
Lytocarpus phœniceus	+							52–387
*Lytocarpus hawaiensis								44–115
*Lytocarpus balei								47–155
*Lytocarpus similis								213
*Halicornaria flava								59–163
*Halicorniaria bryani								213

[a] This species and also *Plumularia buskii* were not in the collections secured by the Albatross. They are included here in order to make the record of distribution as complete as possible, being the only known Hawaiian species that were not secured by the Albatross.

An analysis of the foregoing table shows that of the 51 species included 31 are peculiar to the Hawaiian region, leaving 20 that are found elsewhere. Of these latter 7 may be regarded as Holarctic, all being found in the arctic region and on the coasts of northern Europe, as well as in the North Pacific; these are *Eudendrium rameum*, *Eudendrium capillare*, *Calycella syringa*, *Filellum serpens*, *Lafoëa dumosa*, *Lafoëa fruticosa* and *Lictorella halecioides*. All but one of these (*Eudendrium rameum*) have been found on our New England coast and 4 of them have been reported from Alaska.

Excluding these Holarctic forms and *Pasythea quadridentata*, found in temperate and tropical seas throughout the world, there are 12 species still to be discussed. Seven of these—namely, *Ceratella fusca*, *Campanularia spinulosa*, *Sertularella lata*, *Thuioria fenestrata*, *Synthecium orthogonia*, *Plumularia buskii*, and *Lytocarpus phœniceus*—are, with a single exception[a], known to occur only in the Australian region. Of the remaining 5 species 2, *Sertularia dentifera* and *Plumularia corrugata*, have hitherto been reported from the California coast only; and 3, *Synthecium tubithecum*, *Monostæchas quadridens*, and *Aglaophenia rigida*, are West Indian, although the last of these is identified with much doubt.

Recapitulating, the distribution of the known Hawaiian species of hydroids may be summed up as follows:

Species peculiar to the Hawaiian region	31
Holarctic species	7
Pelagic and widely distributed	1
Australian species	7
Californian species	2
West Indian species	3

As would be expected from the isolated position of the Hawaiian Islands, the preponderance of peculiar species is very exceptionally large. At first sight it would appear that the Holarctic and Australian relationships were equal. A little consideration, however, will show us that the relationship with Australia is decidedly more intimate than that with the more northern great faunal area. This is strikingly shown, as has already been intimated, by the large number of plumularians included in the collection, embracing about one-third of the entire series. The occurrence of *Ceratella fusca*, a representative of an essentially Australian family, is also significant.

In connection with the appearance of three West Indian forms in the Hawaiian Islands it is interesting to remember that Dr. Alexander Agassiz, in discussing the echinid fauna of the West Indies, says:

> The resemblance of the fauna of the Gulf of Mexico and the Caribbean to that of the Pacific was noticed by writers, even at a time when the materials available for comparison included but little beyond the littoral fauna. * * * In fact, the deep-sea fauna of the Caribbean and of the Gulf of Mexico is far more closely related to that of the Pacific than to that of the Atlantic. Before the Cretaceous period the Gulf of Mexico and the Caribbean were undoubtedly in freer communication with the Pacific than with the Atlantic Ocean.[b]

It is somewhat strange that the large and cosmopolitan genus *Sertularia* has but one representative in the collection. This seems all the more remarkable when we

[a] *Sertularella lata* was secured by the *Challenger* on the Brazilian coast.

[b] Three Cruises of the *Blake*, vol. 1, p. 157, 1888.

remember that there are 32 species of that genus in Australian waters, as shown by Bale in his Catalogue of Australian Hydroids.

Hydroids were secured at 37 stations during the Hawaiian cruise, and at depths ranging from 10 to 500 fathoms. At 20 of these stations the depth was over 100 fathoms. The bottom was exceedingly rough almost everywhere, making successful dredging unusually difficult. The region is undoubtedly one favorable to hydroid life, and the depth at which the dredging was done was within a range which furnishes suitable conditions for both shallow and deep water forms. Notable hauls were made at the following stations:

Station 3854, off south coast of Molokai Island, 134 fathoms; 8 species.

Station 3859, between Molokai and Maui islands, 138 fathoms; 9 species.

Station 3939, off Laysan Island, 163 fathoms; 6 species.

Station 4098, off north coast of Maui Island, 95 fathoms; 6 species.

Station 4802, between Maui and Molokai islands, 122 fathoms; 6 species.

It is worthy of note that all of these hauls are in depths of from 95 to 163 fathoms.

SYSTEMATIC DISCUSSION.

HYDRODENDRIDÆ, new family.

Trophosome.—Colony branching, the hydrocaulus being composed of a spongy mass of chitinous tissue, which is covered with an external coating of naked cœnosarc. Hydranths with a single whorl of filiform tentacles and a flat hypostomé, resembling the oral disc of an actinarian.

Gonosome.—Sexual products borne in large hernia-like protuberances from the hydranth bodies. No sign of medusoid structure or of a blastostyle. Colonies bisexual.

HYDRODENDRIUM Nutting, new genus.

There being but a single known representative of the family, the generic definition can not at present be constructed, but will have to be essentially that of the family.

Hydrodendrium gorgonoides Nutting, new species.

(Pl. I, figs. 1–6; pl. VII, figs. 1, 2.)

Trophosome.—Colony flabellate in form and attaining a height of a foot or more, judging from the much-broken pieces secured. Hydrocaulus very woody and thick, the main stem in some places being as much as ¾ of an inch in thickness. The superficial fibers of which the hydrocaulus is composed are in general parallel, and ascend in a twisted or spiral manner. Branches very irregular and dendritic, the ultimate branchlets sometimes anastomosing to a limited extent. Hydranths irregularly scattered over the stem and branches, but showing a tendency to aggregate in the angles between adjacent branches and in the protected portions of the meshwork formed by the anastomoses of the terminal branchlets. Hydranths with a cylindrical body, which is rather short and stout in preserved specimens, an oral surface resembling the oral disc of simple actinians, and a single whorl of filiform tentacles around the margin of the disc, the tentacles having a somewhat nodulated appearance, owing to the presence of nematocyst batteries. The individual hydranths arise, not from a single cœnosarcal tube, but from several distinct filaments from the free cœnosarc with which the hydrocaulus is covered. (See figure 1.)

Gonosome.—The gonophores, if it is proper to call them such, are in the form of immense hernia-like protuberances from the middle or lower portion of the body of the hydranths, there being but one to a hydranth. Although the hydranths bearing these bodies are usually apparently unmodified, they sometimes appear to be somewhat shrunken, as if impoverished by the growth of the gonophores. These latter show no trace of medusoid structure, either externally or in sections, and, what is more remarkable, there is no sign of anything like a blastostyle or spadix. Gonophores bearing ova, and others bearing spermatozoa, are found on the same colony.

Distribution.—Station 3991, between Honolulu and Kauai Island, 296 fathoms.

This species being a representative of a new family, it seemed advisable to investigate it somewhat in detail, especially regarding certain histological features, some of which are worthy of further mention.

The stem.—Although presenting every appearance of being polysiphonic, this structure is not homologous with the ordinary polysiphonic stem. A cross section reveals the fact that we have here to deal not with a series of parallel tubes, but with a series of irregular lacunæ greatly lengthened along the axis of the stem and inclosed in a common matrix, as it were, of chitin. In cross section these lacunæ are of various sizes and shapes, and on the surface they reveal themselves as cross sections of deep irregular grooves, rather than tubes. (See fig. 4.)

Toward the interior of the section the cœnosarc appears often to be wanting in these spaces, but toward the surface the lacunæ are filled with it. The superficial grooves are filled, and here the cœnosarc overflows, as it were, and forms a complete investment of the stem. It will thus be seen that the cœnosarc is much deeper over the superficial grooves than between them, where the superficial layer is very scant. Being thus molded into the grooves the cœnosarc here forms thickened strands, several of which unite to form the hydranth body.

From an examination of such a section as is shown in figure 4 it seems that the mode of growth of the stem is somewhat as follows: Reasoning from homology, it is altogether probable that the chitinous parts of the hydrocaulus are formed by the ectoderm, although I have been unable to work out the beginning of this process. The deposition of chitin, then, takes place at the periphery of the lacunæ, the latter thus becoming smaller as the chitin invades them, in some cases, doubtless, being almost obliterated. Near the surface the ridges appear to be built up more rapidly than the bottoms of the grooves, and the outer or superficial sides of the grooves thus tend to meet or be bridged over with the rapidly forming chitin. Thus the spaces which were originally cross sections of deep grooves finally become round in section and appear to be sections of tubes, and we have, as a result, a stem, which, although morphologically polysiphonic or fascicled, is not so in strict homology, on account of the great difference in the manner of its formation.

Unless one has studied the formation of the skeletons in other cœlenterates, such as corals and Hydrocorallinæ, it is difficult to understand the mutual relations of endoderm, ectoderm, and chitin in this new form. Without entering into further discussion, however, it will suffice to say that the relations here and in the Hydrocorallinæ are, in my opinion, strictly homologous.

The Hydranths.—Cross sections and longitudinal sections of the nutritive "persons" of the colony show that they are typical hydroids, although they bear a distinct superficial resemblance to actinoid polyps. They are made up of the ordinary histological layers, the body cavity being simple and showing no trace of œsophageal tube or mesenterial filaments. There is practically no proboscis, the mouth being in the center of a flat oral disc, as in the actinians. At its base the hydranth body, or rather its foot, becomes continuous with the strands of cœnosarc which fill several of the adjacent superficial grooves of the hydrocaulus, and it is altogether probable that the lumen of the body is directly continuous with the central cavities of these tubes, although the condition of the material did not allow of definitely proving this point. The tentacles are solid, noncapitate, and arranged in a single circlet around the edge of the oral disc.

Gonosome.—This is the most remarkable feature of the form under consideration, being, in my opinion, the most primitive known among the Hydroida. Upon the body of an unmodified hydranth, below its middle, is borne a huge, hernia-like protuberance that is sometimes almost as large as the hydranth from which it springs. But a single one of these is borne on a single hydranth. Upon sectioning this strange gonophore it is found to be a simple sack, opening widely into the body cavity of the hydranth and consisting simply of the ordinary layers of the hydranth body, endoderm, ectoderm, and supporting layer, or "Stutzlamelle."

The male and female gonophores are borne on the same colony and are externally quite similar in appearance. Internally, they differ only in the sexual elements inclosed. If the gonophore is female, the developing ova are seen to be embedded in the endoderm, the older ones being distal and the younger being proximal in position. There is not a trace of any medusoid structure to be seen, carefully prepared sections, both transverse and longitudinal, showing no sign of radial canals or of blastostyle or manubrium. In the section figured in figure 5, plate 1, the line of ova can be traced around the bend where the gonophore joins the hydranth body until the smaller ones are seen embedded in the endoderm of the body wall itself. It seems likely, therefore, that they are originally differentiated in the endoderm of the body wall and afterwards are carried along with the portion of the wall that is pushed outward to form the hernia-like gonophore. Or they may migrate outward

after the gonophore is partially formed, as Weismann and others have found to be the case in many hydroids. The male gonophore, as said before, differs from the female only in bearing spermatozoa instead of ova. (See fig. 6, pl. 1.)

In *Hydra* the ova are formed directly in the body wall of functional hydranths, and there is nothing that can be called a true blastostyle as distinct from the hydranth itself. Here, however, each ovum is inclosed in a separate closed sack, develops a hard encasing wall around itself, and later develops a statoblast.

It thus appears that the reproductive parts in the *Hydra* are in some respects more highly specialized than those found in *Hydrodendrium*.

Relationships of the family Hydrodendridæ.—Up to comparatively recent times there was but one known family of Hydroids that exhibited the peculiar character of having the skeleton composed of a chitinous network which was covered with a layer of cœnosarc, and that was the family Hydractinidæ. Prof. Louis Agassiz, with his usual clear insight, recognized the relationship between this family and the Milliporidæ, the details of which have been worked out by several writers, including Professor Moseley. Since that time two other families having this characteristic have been described. One of these, the Ceratellidæ[a], was instituted in 1868 by Doctor Gray, who regarded it as a family of sponges. In 1888 Bale recognized its family rank and also that it was composed of true hydroids. In 1891 Prof. W. Baldwin Spencer, of Melbourne, discovered another remarkable form, *Clathrozoon wilsoni*, for which he instituted a new family, the Hydroceratinidæ, in which the colony is branching, as in the Ceratellidæ, but the superficial cœnosarc is enveloped externally by a very thin chitinous layer that incloses the entire hydrocaulus.

It thus appears that up to the present time no less than four families of Hydroida have been described having the common character mentioned above. The collection secured during the Hawaiian cruise of the *Albatross* contains two other species which, in my opinion, should form the types of two additional families of this group, making six in all, which may be characterized briefly as follows:

Table showing the main points of resemblance and difference between the families of Hydroida having the common character of stems composed of a chitinous (in one case calcareous) framework overlaid with naked cœnosarc.

	General character of colony.	Origin of hydranths.	Form of hydranths.	Defensive "persons."	Gonosome.
HYDRACTINIDÆ ...	An encrusting mass. Spines present. No hydrophores.	From several cœnosarcal tubes.	One circlet of filiform tentacles. Proboscis present.	Spiral zooids.	Borne on modified hydranths. Manubrium present.
CERATELLIDÆ	Branching. No spines. Hydrophores composed of basket-like open-work.	From several cœnosarcal tubes.	Scattered capitate tentacles. Proboscis present.	None.	Medusoid gonophores springing directly from the hydrocaulus.
HYDRODENDRIDÆ.	Branching. Neither spines nor hydrophores.	From several cœnosarcal tubes.	One circlet of filiform tentacles. No proboscis.	None.	Gonophores in form of hernia-like open sacks on body of unmodified hydranth.
TUBIDENDRIDÆ.... (A new family to be described later.)	Branching. Pseudohydrophores hardly evident.	From a single cœnosarcal tube.	Two circlets of filiform tentacles. Proboscis present.	Finger-like naked processes. Apparently no nematocysts.	Unknown.
HYDROCERATINIDÆ.	Branching. Tubular hydrophores present. Entire hydrocaulus covered with thin chitinous membrane.	From several cœnosarcal tubes.	One circlet of filiform tentacles. Proboscis present.	Nematophores with evident sarcostyles.	Unknown.
MILLEPORIDÆ	Massive or branching. Skeleton calcareous.	From several cœnosarcal tubes.	One circlet of capitate tentacles. A low proboscis.	Dactylozooids with scattered capitate tentacles.	Medusoid gonophores in ampullæ.

[a] The original spelling Ceratelladæ is here changed to conform to the A. O. U. code and to the practice of nearly all zoologists.

Family CERATELLIDÆ.

Trophosome.—Colony branched. Skeleton in the form of a chitinous network with slight bracket-like or tubular hydrophores serving as a support for the bases of the hydranths. Hydrocaulus in the form of network of anastomosing tubes, the whole inclosed in a common ectoderm layer.

Gonosome.—Gonophores medusoid; fixed and arising directly from the hydrocaulus. This definition is practically the same as that given by Prof. W. Baldwin Spencer in his "On the structure of Ceratella fusca (Gray)." (Transactions of the Royal Society of Victoria, 1891. Reprint, pp. 1–24.)

Genus CERATELLA.

Trophosome.—"Colony irregularly branching; more or less expanded in one plane; growing from a creeping base. Main stem flattened, branches rounded and beset with bracket-like hydrophores."[a]

Ceratella fusca Gray.

But a single specimen of this species was found.

Locality.—Station 4072, north coast of the island of Maui, 56 fathoms.

Ceratella fusca Gray, Proc. Zool. Soc., Vol. VIII, Nov., 1868, 577.

Family EUDENDRIDÆ.

Trophosome.—Colony branched, stem fascicled. Hydranth with a single circlet of filiform tentacles and a trumpet-shaped proboscis.

Gonosome.—The male gonophores form a verticil just beneath the tentacles of the hydranth, each gonophore having 2 to 4 chambers in linear series. Female gonophores not in regular verticils and usually clustered just beneath the tentacles on the bodies of the hydranths. The hydranths in both sexes are often more or less degenerated when bearing gonophores.

Genus EUDENDRIUM.

There being but one genus recognized in the family its characters are as given above.

Eudendrium rameum (Pallas).

Several specimens of *Eudendrium* were secured that I am unable to separate from this well-known form. They show the characteristic dendritic habit of growth of this species, but do not attain the size of British specimens. The gonosome, female, is present and shows no point of differentiation from *E. rameum*.

Localities.—Station 4077, off the coast of the island of Maui, 99 fathoms; station 4135, off the coast of the island of Kauai, 225 fathoms.

This species is of Holarctic distribution, being found off the coasts of Europe, the Arctic region, and in the Pacific as far south as Australia.

Tubularia ramea Pallas, Elenchus Zoophytorum, 83, 1116, 1766.

?Eudendrium capillare Alder.

A small specimen without gonosome is very doubtfully referred to this species. The colony is somewhat larger than British specimens.

Locality.—Station 3854, off the south coast of the island of Molokai, 134 fathoms.

?*Eudendrium capillare* Alder, Catalogue of the Zoophytes of Northumberland and Durham, p. 15, 1857.

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[a] Op. cit., p. 20.

TUBIDENDRIDÆ, new family.

Trophosome.—Colony branching, polysiphonic, the hydrocaulus being, at least in part, covered with naked cœnosarc. Ill-defined pseudo-hydrophores are often formed. Hydranths with two well-defined whorls of filiform tentacles, a pyriform body and entirely naked pedicels. Stem beset with irregularly distributed finger-like processes arising from the cœnosarc.

Gonosome.—Not known.

BALEA Nutting, new genus.

The generic characters of the type of this new family can not be defined so long as other members of the family are unknown. The author takes pleasure in naming this remarkable genus after Prof. W. M. Bale, the Australian naturalist, who has done such important work in the Hydroida of the Pacific.

Balea mirabilis Nutting, new species.

(Pl. II, fig. 3; pl. VII, figs. 3, 4.)

Trophosome.—Colony attaining a height of about 5 inches, flabellate in general outline; hydrocaulus polysiphonic, even to the tips of the ultimate branches, and at least partly covered with naked cœnosarc, which occupies parallel open grooves on the surface. Branches irregular, but laterally disposed on the sides of the main stem, sometimes subdividing, and bearing irregularly disposed and often hardly discernible hydrophores that are a mere thin rim around the naked bases of the hydranth pedicels. Hydranths exceedingly irregular in their disposition, apparently most abundant on the distal parts of the colony, where they are sometimes aggregated in clusters; body pyriform, elongated, with a proximal whorl of 12 to 16 filiform tentacles, and a distal whorl of larger filiform tentacles, which are 8 to 12 in number and are inserted on the widest part of the body. The hydranths are borne on rather slender pedicels which are without a covering of chitin. Scattered irregularly over the stem and branches are a number of tentaculiform organs that are unlike anything else known to the writer, although they are likely to prove homologous with sarcostyles. They are apparently almost exactly like the smaller tentacles of the hydranth in general form and structure, as viewed under a fairly high magnification. They are composed of ectoderm and endoderm, but I have thus far failed to find any nematocysts that are clearly defined. In form they have just about the proportion of length to breadth that is seen in the human finger. In life they are probably highly extensible, while in the preserved material they are contracted, in all likelihood, to their least dimensions.

Gonosome.—Unknown.

Locality.—Station 3856, between Molokai and Maui islands, 127 fathoms.

Cross sections of the stem or branches of this remarkable hydroid reveal a relation of tubes different from that found in any other that I have seen. The stem seems to be truly polysiphonic, the section showing a series of tubes much the same as one finds in some of the plumularians. The tubes, however, open quite freely into each other through irregular apertures in their chitinous walls. The walls of the peripheral tubes are much thinner than those of the central ones, and sometimes their outer portions are entirely lacking, thus exposing the naked cœnosarc. While I have not ascertained the manner of growth of this stem with certainty, it seems altogether likely that the cœnosarc pushes through the openings in the walls of tubes already formed and creeps along the grooves between adjacent tubes. At this stage we would have the condition of the cœnosarc on the surface of *Hydractinia*, for instance. Later the cœnosarc begins to form a thin layer of chitin on its outer surface, which arches over the groove and grows thicker and thicker, until finally we have a new tube of chitin with its usual cœnosarcal contents.

Another point of difference between this form and the others described on page 938 lies in the fact that the hydranth arises from a single cœnosarcal tube and not from several. In some cases it arises from one of the central tubes and in others from one of the superficial tubes, which indicates that the latter tubes have been formed after the appearance of the hydranth.

The irregular disposition of the hydranths is another feature that is exceptional, although it is shared with the Hydrodendridæ.

Relationships of the Tubidendridæ.—The form of the hydranth is essentially that of the Tubularidæ, especially as regards the disposition of the tentacles. It differs, however, in the relative size of the

proximal and distal set and in the fact that the pedicel is entirely naked. The character of the stem is unique in that it combines a true fasciculation with the presence of external cœnosarc. The dactylozooids, if such they are, are also unique in the apparent absence of well-defined nematocysts. It is unfortunate that the gonosome is absent, as that would in all probability furnish clews to the true affinities of this strange hydroid.

Family CLAVIDÆ.

Trophosome.—Stem branched or unbranched. Hydranths with scattered filiform tentacles.

Gonosome.—Gonophores either in the form of free medusæ or producing the sexual products in fixed sporosacs.

Allman, in his Monograph of the Gymnoblastic Hydroids, published in 1871, places the genus *Corydendrium* in the family Turridæ, under a mistaken idea that the only species known, *C. parasiticum*, bore medusæ with simple radial canals and simple tentacles. In 1883 Weismann published his Entstehung der Sexualzellen bei den Hydromedusen, in which he points out Allman's mistake and shows that *Corydendrium* produces no medusæ at all (p. 40). Weismann, however, does not attempt any general classification of the hydroids and does not correct the systematic error of Allman.

In 1897 Dr. Karl Camillo Schneider published his "Hydropolypen von Rovigno nebst Uebersicht über das System der Hydropolypen im Allgemeinen," in which he proposes a general revision of the classification of the Hydroida, the result being the throwing of numerous well-established families together and rendering the task of the workers in the Hydroida more perplexing than ever. He places the 20 families of Gymnoblastea recognized by Allman in 4 families. He does not regard *Corydendrium parasiticum* as representing a distinct genus, placing it in the old genus *Clava*.

The present writer thinks that Doctor Schneider is correct in placing this species in the Clavidæ, but that he is in error in failing to recognize the validity of the genus *Corydendrium*.

Genus CORYDENDRIUM.

Trophosome.—Colony branched and fascicled. Hydranths with scattered filiform tentacles.

Gonosome.—Gonophores borne on the stem and branches, in the form of either medusæ or fixed sporosacs.

Corydendrium corrugatum Nutting, new species.

(Pl. II, fig. 2; pl. VII, figs. 5, 6, 7.)

Trophosome.—Colony attaining a height of about 5 inches. Stem and branches fascicled, the former being nearly straight or irregularly but not abruptly bent, and bearing branches that are opposite, subopposite, or alternate, the whole forming a roughly pinnate structure. Branches often showing a well-marked annular constriction near their origins and bearing on their anterior aspect the hydrophore-like structures within which the hydranths retract. These hydrophores are inclined alternately to the right and left, are not very distant, and are cylindrical with a round terminal orifice, an even margin, and are usually distinctly corrugated with deep irregular annulations. Hydranths large, with elongate pyriform body and very numerous filiform tentacles emplanted over the surface so thickly that they almost entirely conceal the hydranth body. Proboscis very dilatable, as shown in figure 7.

Gonosome.—Unknown.

Distribution.—Station 3828, south of the island of Oahu, 319 fathoms; station 4077, northeast coast of the island of Maui, 99 fathoms.

The hydrocaulus of this species is much more thick and rigid than in *C. parasiticum*, and the hydrophores are more distinct and are decidedly corrugated.

Corydendrium minor Nutting, new species.

(Pl. II, fig. 1; pl. VII, figs. 8, 9.)

Trophosome.—Colony growing on a creeping root-stock, parasitic on a species of *Lafoëa*, and attaining a height of about one-half inch. Stem and main branches fascicled, the latter being irregularly disposed and giving forth alternate branches. The ultimate branchlets are not fascicled, but the perisarc is strong and tubular, ending abruptly at base of hydranths. Hydranths with an elongated

pyriform body with about 12 to 16 scattered filiform tentacles, which sometimes show a tendency to form a distal whorl of 4 and a proximal more numerous whorl, the middle part of the body being less thickly beset with tentacles.

Gonosome.—Gonophores taking the form of single medusæ on separate pedicels growing from the branches. The medusæ have 4 radial canals, unbranched, an apparently short, 4-lobed proboscis, and numerous strong marginal tentacles the disposition of which could not be made out in the immature medusæ examined.

Distribution.—Station 3859, between the islands of Molokai and Maui, 138 fathoms; station 4077, northeast coast of Maui, 99 fathoms; station 4098, north coast of Maui, 95 fathoms.

This appears to be a true *Corydendrium*, but it differs from either of the other species of the genus in bearing medusæ. It is much smaller in all its proportions than *C. parasiticum*, with which I have directly compared it.

Family HALECIDÆ.

Trophosome.—Stem fascicled. Saucer-shaped hydrophores borne alternately on branches and often having their margins reduplicated and a circular row of shining spots of dots some distance below the rim. Hydranths with conical proboscis and a single whorl of filiform tentacles.

Gonosome.—Gonophores in the form of either sporosacs or medusæ.

Genus HALECIUM.

Trophosome.—Colony without defensive persons, otherwise as described in the family definition.

Gonosome.—Gonophores in the form of fixed sporosacs. No medusæ.[a]

Halecium scandens Nutting, new species.

(Pl. II, fig. 5; pl. VIII, figs. 1–3.)

Trophosome.—Colony growing like dodder over a specimen of *Lytocarpus phœniceus*, the long stolon-like root-stock running along the main stem of the host for a surprising distance without branching or ramification of any sort. Near the distal end of the host a few branches of *H. scandens* are given off. Stem long, slender, nearly straight, unbranched, divided into very long, slender internodes just above the hydrophores. Hydrophores on short pedicels with broadly flaring margins and without reduplications. Hydranths very large, but the details not distinguishable.

Gonosome.—Gonangia springing from lumen of hydrophores, lenticular, broader than long, with a curious mushroom-like body differing in shape from any others that I have seen, and suggesting the possibility of a medusoid form.

Locality.—Station 3949, north of the island of Laysan, 59 fathoms.

The very great length of the internodes, combined with the shortness of the pedicels and peculiar gonophores springing from the hydrophores, although this latter may be purely sporadic, make this species quite distinct from others of the genus.

Of course if the gonophores produce medusæ the species would go into the genus *Campalecium* Torrey.

Family CAMPANULARIDÆ.

Trophosome.—Hydrothecæ well developed, nonoperculate, either with distinct pedicels or nearly sessile, but not adnate to or partly immersed in the stem or branches. Hydrothecal septum distinct. Hydranth with a trumpet-shaped or subglobular proboscis.

Gonosome.—Gonophores producing either the generative products direct or medusæ which do not bear ova on the proboscis.

The classification of the pediculate Calypteroblastea is at present in an exceedingly unsatisfactory condition, and no two authors are in substantial agreement as to the systematic arrangement of this perplexing group. The present author is by no means prepared to offer a revision at this time, but

[a] Dr. Harry Beal Torrey, in his Hydroida of the Pacific Coast of North America, page 48, describes a new genus of Halecidæ based on his discovery of a form which bears medusæ instead of sporosacs. To this interesting form he has given the name *Campalecium medusiferum*.

has decided to use a classification that will be conservative, not disturbing the more generally accepted arrangements of Hincks and Allman, except where they are manifestly contrary to facts discovered since they were proposed.

Genus CAMPANULARIA.

Trophosome.—Colony usually branched, sometimes fascicled.

Gonosome.—Gonangia producing sexual products which produce planulæ and not medusæ.

Campanularia eloisa Nutting, new species.

(Pl. II, figs. 4, 6; pl. VIII, figs. 4–7.)

Trophosome.—Colony attaining a height of about 5 inches. Stem and main branches fascicled, the pedicels sometimes opposite and sometimes springing from all sides of the main stem and branches, often being directed at right angles to the latter. Hydrothecæ quite large, tubular, with 14 to 16 strong rounded teeth, borne on long slender pedicels which are annulated just below the hydrothecæ, but usually not at the proximal end.

Gonosome.—Gonangia borne on stem and main branches, elongate-ovate in shape, truncate at distal end, proximal portion showing a number of very weak annulations. Pedicels very short. Gonangia considerably shorter than the hydrothecæ.

Distribution.—Station 3853, south coast of Molokai Island, 68.5 fathoms; station 3859, between the islands of Molokai and Maui, 139 fathoms; station 3949, northwest of the island of Laysan, 59 fathoms; station 4077, northeast coast of Hawaii Island, 99 fathoms.

This species evidently belongs to the Verticillata group, having a strongly fascicled stem and scattered pedicels. It differs from *C. verticillata* in the shape of the hydrothecæ and gonangia, and also in the arrangement of the pedicels.

Campanularia spinulosa Bale.

A fragmentary specimen which appears to belong to this species was secured at station 4071, off the north coast of the island of Maui, at a depth of 52 fathoms.

Campanularia spinulosa Bale, Proc. Linn. Soc. New South Wales, III, series 2, 1888, 756.

Family CAMPANULINIDÆ.

Trophosome.—Hydrothecæ pediculate, tubular, with an operculum composed of several converging segments forming a tent-like structure. Hydranth with a conical proboscis.

Gonosome.—Gonangia producing either the sexual elements direct or free medusæ.

Genus STEGOPOMA.

Trophosome.—Hydrothecæ with the distal ends beveled on opposite sides and the aperture closed with an operculum composed of numerous segments, the whole resembling an A tent.

This genus, proposed originally by Prof. G. M. R. Levinsen[a], seems to me to be practically convenient, whether a natural one or not, and it is therefore adopted in this paper. There is no character used in connection with the gonosome.

Stegopoma gilberti Nutting, new species.

(Pl. III, fig. 1; pl. IX, fig. 1.)

Trophosome.—Colony attaining a height of 6 inches or more. Stem and branches fascicled, branches irregularly alternate and themselves often giving off irregularly disposed branchlets. Pedicels arising irregularly from the peripheral tubes of the fascicled stem and branches. Hydrothecæ very large and slender, their bases passing insensibly into the pedicels, which are not more than one and a half times as long as the hydrothecæ; margin cut away on opposite sides so as to be strongly beveled, the beveled sides being fitted with opercula, which are split up into many narrow, ribbon-like

[a] Meduser, Ctenophorer og Hydroider fra Grönlands Vestkyst, Copenhagen, Særtryk af Vidensk. Meddel. fra den naturk. Foren, 1892, 35.

strips and meet in a ridge-like line above. The reduplication of the margin often complicates the structure of the operculum, which is then itself duplicated. Bottom of the hydrotheca with a distinct septum. Hydranths long and slender, with about 16 tentacles and a conical proboscis.

Gonosome.—Gonangia rather shorter than the hydrothecæ and nearly sessile, slender, narrowing very gradually below and ending in an operculate margin much like that of the hydrothecæ. Blastostyle bearing several male gonophores.

Distribution.—Station 4102, between the islands of Maui and Molokai, 122 fathoms.

Stegopoma gracilis Nutting, new species.

(Pl. III, fig. 2; pl. VIII, figs. 8, 9.)

Trophosome.—Colony parasitic. Pedicels springing from a nonfascicled creeping stolon. Hydrothecæ much smaller than the preceding, but otherwise almost a miniature of *S. gilberti*.

Gonosome.—Gonangia springing from rootstock, stout, decidedly longer than the hydrothecæ, the margin and operculum as in the hydrothecæ.

Distribution.—Station 4000, south of Kauai Island, 213 fathoms, station 4098, north coast of Maui Island, 95 fathoms, station 4101, between Maui and Molokai islands, 143 fathoms.

The entirely different habit of this species and its constant difference in size seem to sufficiently distinguish it from the preceding.

Stegopoma plumicola Nutting, new species.

(Pl. III, fig. 3; pl. IX, figs. 2, 3.)

Trophosome.—Colony parasitic on *Lytocarpus phœniceus* and consisting of sessile hydrothecæ borne on a creeping stolon. Hydrothecæ smaller and more robust than in *S. gilberti*, four or five times as long as wide, the ends beveled on opposite sides so as to form 2 long, broad, pointed teeth, between which the operculum, consisting of many narrow strips, is placed.

Gonosome.—Gonangia sessile on the rootstock, decidedly longer than the hydrothecæ margin, circular, but with a two-flapped operculum in the shape of an A tent.

Locality.—Station 3939, northwest of the island of Laysan 163 fathoms.

Genus OPERCULARELLA.

Trophosome.—Stem not fascicled. Hydrothecæ ovate in outline, the margin not distinct, its distal portion being produced into a number of narrow pointed strips which converge to form a conical operculum.

Gonosome.—The mature gonangia bear acrocysts.

? **Operculariella longicauda** Nutting, new species.

(Pl. III, fig. 5; pl. IX, figs. 4–7.)

Trophosome.—Colony parasitic on another hydroid, growing in tufts of pedicels from a creeping rootstock. Pedicels very long and slender, not annulated even at ends, sometimes five times as long as the hydrothecæ. Hydrothecæ small terete, very thin and collapsible, distal ends broken up into a many-parted operculum which sometimes introverts as in *Calycella syringa*.

Gonosome.—Gonangia borne on the rootstock, very large in comparison with the size of the hydrothecæ, deep urn-shaped with flaring campanulate margin and a flat operculum composed of several well-marked segments. The single gonangium found almost certainly belongs to this species, being found buried among the pedicels of the hydrothecæ. In dissecting the rubbish in which it was imbedded, the short pedicel broke before the connection with the rootstock from which the hydrothecæ sprung was proved.

Locality.—Station 3859, between Molokai and Maui islands, 138 fathoms.

Genus CALYCELLA.

Trophosome.—Stem a creeping parasitic rootstock. Hydrothecæ with a distinct margin, above which is a distinct, many-parted operculum which is often introverted.

Gonosome.—Gonangia borne on the rootstock, oval, and bearing globular acrocysts when mature.

Calycella syringa (Linnæus).

Locality.—Station 4098, north coast of Maui Island, 95 fathoms.

This is the only specimen of this well-known species that I have found in the collection.

Sertularia syringa Linnæus, Syst. Nat., 1311, 1767.

Family LAFOËIDÆ.

Trophosome.—Stem fascicled, consisting of an axial and several peripheral tubes, or else simple and consisting of a creeping rootstock. Hydrothecæ tubular, without operculum. Hydranths with a conical proboscis.

Gonosome.—Gonangia aggregated in groups or masses called "coppinia" masses. This family was described by Hincks in 1868. In 1888 Allman, in his Challenger Report, instituted the family Perisiphonidæ, in which the first or type genus was *Lafoëa*, the type of Hincks's family Lafoëidæ. This latter fact justifies us in retaining the family Lafoëidæ, modified, however, by the introduction of the character of the stem, which was first fully appreciated by Allman.

Genus LAFOËA.

Trophosome.—Stem polysiphonic. Hydrothecæ tubular, without diaphragm, and never adnate to the axial tube.

Gonosome.—A true "coppinia" mass, gonangia flask-shaped, with a single terminal aperture.

Lafoëa dumosa (Fleming).

This widely distributed species was found at three stations, namely: Station 3824, south coast of Molokai Island, 228–498 fathoms; station 3859, between the islands of Molokai and Maui, 138 fathoms; station 4101, between the islands of Maui and Molokai, 143 fathoms.

Sertularia dumosa Fleming, Edinburgh Phil. Jour., 1820, II, 83.

Lafoëa fruticosa (Sars).

Fine specimens of this species, with the gonosome well developed, were secured at station 4079, near Maui Island, 143 fathoms. Others were secured at station 4066, northeast coast of Hawaii Island, 176 fathoms, and at station 4077, between Hawaii and Maui islands, 99 fathoms.

"*Campanularia fruticosa*" Sars, Reise i Lofoten og Finmarken, 18, 1850.

Lafoëa contorta Nutting, new species.

(Pl. III, fig. 6; pl. IX, figs. 8, 9.)

Trophosome.—Colony parasitic, growing from a twisted rootstock. Hydrothecæ sessile, tubular, very long, and often bent and twisted in various ways; aperture round; margin slightly everted and often many times reduplicated. No operculum nor hydrothecal septum.

Gonosome.—Not known.

Distribution.—Station 3949, north of Laysan Island, 59 fathoms; station 4102, between the islands of Maui and Molokai, 122 fathoms.

The hydrothecæ are longer in proportion to their width in this species than in any other that I have seen, and the extent of reduplication of the margins imparts a highly ornamental effect.

Genus LICTORELLA.

Trophosome.—Stem fascicled. Hydrothecæ pedunculate, never adnate to the axial tube, diaphragm usually present. Nematophores often found on branches just below the hydrothecæ.

Gonosome.—Gonangia aggregated, with curiously protuberant "shoulders" on one or two sides of the distal end. These are horn-like processes which may curve upward, or downward, or be directed straight outward, according to the species.

Lictorella halecioides (Allman).

(Pl. x, figs. 1–4.)

Gonosome.—(Not heretofore described.) Gonangia forming a true "coppinia" mass, obovate in general form, with one shoulder produced into a conspicuous hook that bends over the gonangium. The gonangia are firmly adherent, the connection not being dissolved by boiling in potash. Fig. 1, pl. x, shows a cross section of the mass and stem, and also the connection between some of the gonangia and the component tubes of the stem. The hook is much broader in front view than in its lateral aspect, as shown in figs. 2–4.

This is one of the most abundant species in the collection, being found at station 3854, south coast of Molokai Island, 134 fathoms; station 3856, between the islands of Molokai and Maui, 127 fathoms; station 3859, between the islands of Molokai and Maui, 138 fathoms; station 3863, between the islands of Molokai and Maui, 127 fathoms; station 3936, north of the island of Laysan, 130 fathoms; station 3939, north of the island of Laysan, 163 fathoms; station 4098, north coast of Maui Island, 95 fathoms.

Lafœa halecioides Allman, Hydroida of the *Porcupine* Expedition, Trans. Zool Soc., Vol. VIII, 1873, 472.

Lictorella cervicornis, new species.

(Pl. IV, fig. 1; pl. x, figs. 5–9.)

Trophosome.—Colony flabellate, small, very delicate and graceful, attaining a height of about an inch and a quarter. Main stem and larger branches fascicled. Branches subalternate, most of them monosiphonic, sinuous, divided into regular internodes, each of which bears a strong process near its middle from which a pedicel springs. Hydrothecæ deep, tubular, cyathiform, projecting forward and outward, ending in a round aperture with even margin, the proximal end passing insensibly into the pedicel from which it is separated by an internal diaphragm. At the base of each pedicel there is a true nematophore containing a sarcostyle and a nematocyst battery.

Gonosome.—Gonangia forming a "coppinia" mass on the main stem, roughly triangular in outline, the distal ends being the broader on account of the opposite shoulders, which are quite conspicuous and end in round apertures. Midway between these shoulders there is a short neck ending in a third aperture. The individual gonangia are borne on short branchlets, which continue beyond them, arching over each gonangium so as to form a protecting network of such branches over the aggregated gonangia. This structure seems to resemble quite closely the phylactogonia found in certain genera of plumularian hydroids.

Locality.—Station 3859, between the islands of Molokai and Maui, 138 fathoms.

This is one of the most beautiful and graceful hydroids that I have seen. The gonosome is unique in certain features, but the species doubtless belongs in the genus *Lictorella*. The nematophores are indistinguishable from some of those found in the Plumularidæ.

Genus FILELLUM.

Trophosome.—Colony parasitic, growing from a creeping rootstock. Hydrothecæ tubular, greatly curved, the distal portion being adnate to the stem or to the host.

Gonosome.—Gonangia forming a true "coppinia" mass, much as in the genus *Lafoëa*.

Filellum serpens (Hassell).

Specimens of this well-known form were noticed while other species were being examined, but the species and station numbers were not noted at the time, and I have been unable to find them on going over the collection again. I am confident that I saw them, and it can be readily understood that they could well be overlooked in going over such a quantity of material a second time.

Campanularia serpens Hassell, Zoologist, Vol. VI, 1848, No. 69, 2223.

Genus CRYPTOLARIA.

Trophosome.—Stem fascicled, with an axial and peripheral tubes. Hydrothecæ without peduncles, and adnate to some extent, at least in the distal parts of the branches.

Gonosome.—A compact "coppinia" mass, much as in *Lafoëa*.

This genus was originally defined by Busk. Allman revised it in his Challenger Report, page 37, as having scattered, sac-like gonangia. In 1900 Bedot, in his "Hydraires provenant des campagnes de l'Hirondelle," page 21, describes an allied form, *Perisiphonia pectinata* Allman, which has a true "coppinia" mass and also a few scattered gonangia. He suggests that these latter may be gonangia of a different sex from those in the "coppinia" mass, and cites my own description of the gonosome of *Lafoëa dumosa*, in which the two sexes are present in the same colony.[a]

This author also describes the gonosome of *Cryptolaria conferta* Allman, which is a true "coppinia" mass, and which Allman himself described, but afterwards considered as a parasitic organism not belonging to the species on which it was found.[b]

Cryptolaria pulchella Allman.

This is one of the most abundant species in the collection. It was originally found in the *Challenger* collection, dredged near Honolulu.

Distribution.—Station 3809, south coast of Oahu Island, 125 fathoms; station 3814, off Diamond Head, near Honolulu, 284 fathoms; station 3848, south coast of Molokai Island, 73 fathoms; station 3849, south coast of Molokai Island, 73–43 fathoms; station 3858, between Molokai and Maui islands, 128 fathoms; station 3859, between Molokai and Maui islands, 138 fathoms; station 3863, between Molokai and Maui islands, 127 fathoms; station 4068, northeast coast of Maui Island, 18 fathoms; station 4098, north coast of Maui Island, 95 fathoms; station 4101, between the islands of Maui and Molokai, 143 fathoms.

Cryptolaria pulchella Allman, *Challenger* Report, The Hydroida, Part II, 40, 1888.

Cryptolaria symmetrica Nutting, new species.

(Pl. IV, fig. 2; pl. x, figs. 10, 11.)

Trophosome.—Colony attaining a height of about 7 inches. Stem and branches fascicled throughout, main branches irregularly disposed, but on opposite sides of the stem, ultimate branches subopposite, the whole structure being flabellate in form. Accessory tubes reaching to the tips of the ultimate branches. Hydrothecæ springing from the axial tube and projecting between the accessory tubes, their distal ends curving gracefully outward, regularly alternating. The hydrothecæ on the distal parts of the branches are without reduplication of margins; those on other parts of the colony have the margins extensively reduplicated, giving an appearance of extensive annulations. The hydrothecæ are much smaller than in other species of the genus that I have seen, are slender and graceful, and symmetrically disposed.

Gonosome.—Unknown.

Distribution.—Station 3854, south coast of the island of Molokai, 134 fathoms; station 3863, between the islands of Molokai and Maui, 127 fathoms; station 3871, between the islands of Molokai and Lanai, 13 fathoms; station 3987, north of the island of Kauai, 55 fathoms; station 4079, north of the island of Maui, 143 fathoms; station 4100, between the islands of Maui and Molokai, 130 fathoms; station 4135, north of the island of Kauai, 225 fathoms.

This species is of a golden yellow color and is one of the prettiest in the collection. By clearing with potash the connection between the hydrothecæ and the axial tube can be demonstrated, as well as the fact that the hydrothecæ are partly adnate.

? Cryptolaria operculata Nutting, new species.

(Pl. III, fig. 4; pl. x, figs. 12–14.)

Trophosome.—Colony (incomplete) about 2 inches high, flabellate in form. Stem and all but ends of ultimate branches fascicled, the tubes being continuous with the cavities of the hydrothecæ, there being no diaphragms nor pedicels. Branches irregularly disposed, the ultimate ones being subalternate. Hydrothecæ tubular, curved, varying greatly in the extent of immersion and equal in caliber throughout; margins very thin and collapsible, ending in two opposite broad points, and

[a] Proc. U. S. Nat. Mus., Vol. XXI, 1899, 751.

[b] See Allman, Hydroids of the Gulf Stream, p. 17, 1877; and Challenger Report, The Hydroida, Part II, 38, 1888.

supporting a bivalve operculum, the structure of which is so delicate as to be hard to decipher, the appearance being that of the operculum of the genus *Stegopoma*.

Gonosome.—Not known.

Distribution.—Station 3859, between the islands of Molokai and Maui, 138 fathoms.

It is likely that a separate genus should be instituted for this species and *Cryptolaria geniculata* Allman [a], both of which differ from all other known members of the genus in having a well-marked operculum.

Family SERTULARIDÆ.[b]

Trophosome.—Hydranths with a conical proboscis. Hydrothecæ sessile, adnate, or partly embedded in the hydrocaulus, arranged definitely in more than a single row. An operculum of less than five parts almost always present. Nematophores wanting.

Gonosome.—Gonophores always inclosed in gonangia and never producing medusoid forms.

Genus SERTULARIA.

Trophosome.—Hydrothecæ in opposite or subopposite pairs, each pair being normally borne on a separate internode of the hydrocaulus. Operculum normally of two flaps.

Gonosome.—Gonangia oval or ovate, with a short collar and broad aperture, and no internal marsupium.

Sertularia snyderi Nutting, new species.

(Pl. IV, fig. 5; pl. X, fig. 15.)

Trophosome.—Colony unbranched, attaining a height of about one-third of an inch. Stem simple, straight, slender, with nodes obscure or absent, but when evident about midway between the pairs of hydrothecæ. Hydrothecæ exceedingly slender, strictly opposite, but borne on front of stem, somewhat pistol-shaped, the butt of the pistol representing the proximal portion of the hydrotheca, the inner side of which is contiguous with its fellow, the distal three-fourths being free and bent outward nearly at a right angle with the stem. Aperture with two large opposite teeth and a minute superior tooth. Operculum very delicate, but apparently of two valves.

Gonosome.—Not known.

Locality.—Station 3939, northwest of the island of Laysan, 163 fathoms.

This species has the most slender hydrothecæ that I have seen in the genus. It was found growing as a parasite on a plumularian hydroid.

Genus SERTULARELLA.

Trophosome.—Hydrothecæ biserial, strictly alternate, with an operculum almost always composed of 3 or 4 strong triangular segments.

Gonosome.—Gonangia usually ornamented with annular ridges or corrugations. Aperture at the end of a trumpet-shaped tube, or else surrounded by blunt spines or nodules.

Sertularella lata (Bale).

Distribution.—Station 3848, south coast of the island of Molokai, 44 fathoms; station 3854, south coast of the island of Molokai, 134 fathoms.

Thuiaria lata Bale, Catalogue of the Australian Hydroid Zoophytes, 129, 1884.

Sertularella dentifera Torrey.

(Pl. XI, fig. 1.)

Gonosome.—(Hitherto undescribed.) Gonangia ovate, strongly annulated throughout, and with a very small tubular neck around which a collar arises.

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[a] *Challenger* Report, The Hydroida, Part II, p. 41, 1888.

[b] The classification of genera in this family and in the Plumularidæ is the same as that adopted in the author's monograph, "American Hydroids," Parts I and II, published by the U. S. National Museum as Special Bulletin No. 4. The definitions used in the present work are somewhat abridged, but practically the same.

Distribution.—Station 3818, off Diamond Head, near Honolulu, 293 fathoms; station 3854, south coast of Molokai, 134 fathoms; station 3863, between the islands of Molokai and Maui, 127 fathoms; station 3968, near French Frigate Shoal, 14½ fathoms; station 4101, between the islands of Molokai and Maui, 143 fathoms; station 4102, between the islands of Molokai and Maui, 122 fathoms.

Sertularella dentifera Torrey, Hydroids of the Pacific coast of North America, 61, 1902.

Sertularella torreyi Nutting, new species.

(Pl. IV, fig. 4; pl. XI, figs. 2, 3.)

Trophosome.—Colony (incomplete) attaining a height of about 2 inches. Stem not fascicled, divided into regular internodes each of which bears a branch and 2 hydrothecæ on one side and a single hydrotheca on the other. Branches regularly alternate, not divided into internodes. Hydrothecæ immersed nearly to their apertures, moderately distant; margins with 2 opposite lateral teeth and hardly a sign of the other 2; valves of the operculum not constant in number.

Gonosome.—Gonangia borne on main stem, very deeply urceolate, with slightly flaring, campanulate margin marked by a series of broad sinuations which correspond to broad, shallow longitudinal corrugations reaching from the margin about halfway down the sides of the gonangia. Aperture exceedingly broad, sometimes furnished with a membranous operculum which is irregularly ruptured for the escape of the sexual elements.

Distribution.—Station 3949, south coast of the island of Molokai, 70 fathoms; station 4003, off the island of Kauai, 751–406 fathoms.

The gonangia of this species are of very exceptional form for the Sertularidæ. I know of no other species of *Sertularella* with this type of gonangia, a type not infrequently found among the Campanularidæ.

Sertularella crenulata Nutting, new species.

(Pl. IV, fig. 3; pl. XI, figs. 4–7.)

Trophosome.—Colony about 3 inches high. Stem and proximal part of main branches fascicled, distal parts of branches monosiphonic. Branches alternate, moderately geniculated. Hydrothecæ rather long, curving gently outward and ending in a square margin and a 4-flapped operculum. The whole body of the hydrotheca is closely and evenly annulated with fine rugosities which are clear-cut and evenly distributed, making a very striking and beautiful ornamentation.

Gonosome.—Gonangia oval, strongly annulated throughout, and with an aperture surrounded by 4 unequal points or teeth. The gonangia are aggregated on the distal parts of the colony.

Distribution.—Station 3848, south coast of the island of Molokai, 44 fathoms; station 3854, south coast of Molokai, 134 fathoms.

This is a very striking and beautiful species, and is more closely annulated than any other of the genus that I have seen.

Genus PASYTHEA.

Trophosome.—Hydrothecæ strictly opposite, arranged in groups of pairs, a group to an internode, the upper pair being smaller and differing in shape from the lower; margin bilabiate, with a 2-flapped operculum.

Gonosome.—Gonangia oval, aperture large, collar round and narrow.

Sertularia quadridentata, Ellis & Solander, Nat. Hist. Zooph., 1786, 57.

Pasythea quadridentata Ellis and Solander.

Specimens of this widely distributed species were taken at station 3968, where the depth was 14½ fathoms, but as they were attached to pelagic algæ they probably came from the surface. The station was near French Frigate Shoal.

Genus THUIARIA.

Trophosome.—Hydrothecæ subopposite to alternate, more than two to an internode, margin smooth or with 1 or 2 teeth, operculum with 1 abcauline flap (very exceptionally with 2 flaps). Hydrothecæ usually more or less immersed.

Gonosome.—Gonangia oval, with large terminal aperture, and with 1 or 2 spines or horns at the shoulders.

Thuiaria fenestrata Bale.

Distribution.—Station 3955, north of Laysan Island, 20 fathoms; station 4068, northeast of Maui Island, 14 fathoms.

Thuiaria fenestrata Bale, Catalogue of the Australian Hydroid Zoophytes, 116, 1884.

Genus DIPHASIA.

Trophosome.—Hydrothecæ biserial, opposite or alternate, aperture broad, operculum evident and consisting of a single adcauline flap.

Gonosome.—Gonangia usually with an internal marsupium and often marked with spines or lobes on its distal portion.

Diphasia palmata Nutting, new species.

(Pl. IV, fig. 6; pl. XI, figs. 8–10.)

Trophosome.—Colony attaining a height of about 1 inch. Stem not fascicled, smooth without nodes or hydrothecæ for some distance, breaking suddenly into a number of widely divergent branches, which again divide into branchlets, all being in the same plane. Branches with very faint nodes just above the hydrothecæ. Hydrothecæ much as in *D. rosacea*, opposite, tubular, their proximal three-fourths vertical and parallel, their distal portions being bent abruptly outward. Margin even. Operculum of a single strong adcauline flap.

Gonosome.—Gonangia (female) borne in rows on front of branches, each composed of four very unequal gonangial leaves, one of which is much longer and broader than the others, imparting a very unsymmetrical appearance to the whole gonangium. Leaves notched near their ends in some cases. There is an evident internal marsupium of the type characteristic of the genus.

Locality.—Station 3854, south coast of the island of Molokai, 134 fathoms.

This is a well-marked species of a genus that has no other typical representative this far to the south, so far as I know. The manner of branching is very unusual in *Diphasia*.

Genus SYNTHECIUM.

Trophosome.—Branches opposite, with regular nodes. Hydrothecal margins smooth, round, often rimmed or reduplicated. Operculum apparently wanting.

Gonosome.—Gonangia springing from the interior of hydrothecæ, where they replace hydranths.

Synthecium tubithecum (Allman).

Distribution.—Station 3819, south coast of the island of Molokai, 70 fathoms; station 4053, northeast coast of the island of Hawaii, 29 fathoms.

This species has not before been reported from the Pacific.

Sertularia tubitheca Allman, Mem. Mus. Comp. Zool., Vol. V, 1877, No. 2, 24.

Synthecium orthogonia (Busk).

Locality.—Station 4068, northeast coast of Maui Island, 14 fathoms.

But a single fragmentary specimen was found. It agrees well with the figure and description given by Bale (proceedings of the Linnæan Society of New South Wales, 1888, page 767).

Sertularia orthogonia Busk, Voyage of *Rattlesnake* (Narrative, Appendix IV, 1852).

Family PLUMULARIDÆ.

Trophosome.—Hydrothecæ adnate to hydrocaulus and on one side only of hydrocladia. Hydranths with a conical proboscis and a single whorl of filiform tentacles.

Gonosome.—Gonangia often inclosed in corbulæ, or protected by special nematophorous branches. Medusæ never produced.

Genus PLUMULARIA.

Trophosome.—Cœnosarc of stem not canaliculated, hydrocladia unbranched, hydrothecæ with smooth margins, nematophores always movable, not adnate.

Gonosome.—Gonangia simple sac-shaped or bottle-shaped.

Plumularia corrugata Nutting.

Locality.—Station 4102, north coast of the island of Maui, 122 fathoms.

This specimen agrees closely with those collected by Richard Rathbun off the coast of Brazil.

Plumularia corrugata Nutting, American Hydroids, 1900, Part I, 64.

Plumularia jordani Nutting, new species.

(Pl. VI, fig. 5; pl. XII, figs. 1–2.)

Trophosome.—Colony dark in color, rigid in habit, flabellate in form; main stem fascicled, strongly geniculate; branches arising from peripheral tubes, nearly straight, fascicled proximally, simple distally, bearing pinnate branchlets which, like the distal parts of main branches, are divided into regular internodes, each of which bears a hydrocladium on a strong process near its distal end, the process showing a conical protuberance on its upper side. Hydrocladia subalternate, those on each side being alternately raised and depressed, as viewed under the lens, so that the hydrocladia on each side occupy two distinct planes, a very exceptional character. Hydrocladia divided into regularly alternating hydrothecate and intermediate internodes, the former being about twice as long as the latter and bearing hydrothecæ just below their middle. Hydrothecæ small, cylindrical, margin even, scarcely flaring. Nematophores large in proportion to the hydrothecæ, the supracalycine pair arising from a point above the hydrothecal margin; a mesial nematophore on the proximal end of each hydrothecate internode, another near the proximal end of each intermediate internode, and a pair on the upper side of each of the processes from the stem or branch supporting hydrocladia, these being the only cauline nematophores. Hydranths very large, not capable of retracting within the hydrothecæ.

Gonosome.—Not known.

Locality.—Station 3936, near the island of Laysan, 79 to 130 fathoms.

This species is unique among the Plumularidae in the disposition of the hydrocladia in two planes on each side, and is of a peculiarly stiff and rigid habit, and the main stem is more plainly geniculate than in any other species of the genus with which I am acquainted.

Plumularia delicata Nutting, new species.

(Pl. V, fig. 2; pl. XII, figs. 3–5.)

Trophosome.—Colony attaining a height of about 6 inches. Stem simple, divided into regular internodes each of which bears a hydrocladium from a process near its distal end. Hydrocladia divided into alternating hydrothecate and intermediate internodes, each of which has an internal chitinous thickening near each end and all of which are longer than in allied species, the hydrothecate internodes being about twice as long as the others and bearing the hydrothecæ a little above their middle. Hydrothecæ cup-shaped, about as high as broad, anterior profile straight. Nematophores large, a supracalycine pair and 2 mesial ones to each hydrothecate internode, and 2 mesial ones to each intermediate internode.

Gonosome.—Gonangia bottle-shaped, but stouter than those of *P. setacea*, borne on front of stem.

Distribution.—Station 3842, south coast of Molokai, 495 fathoms; station 4072, north coast of the island of Maui, 56 fathoms.

This species is nearest to *P. palmeri* Nutting, but differs in bearing 2 mesial nematophores, instead of 1, on each internode of the hydrocladia; and in having much longer intermediate internodes.

Plumularia milleri Nutting, new species.

(Pl. V, fig. 1; pl. XII, figs. 6, 7.)

Trophosome.—Colony attaining a height of about 1 inch. Stem not fascicled, divided into regular internodes each bearing a hydrocladium from a strong process near its distal end. Hydrocladia divided into alternating hydrothecate and intermediate internodes, the former being considerably the longer and bearing hydrothecæ a little above their middle; all internodes showing internal thickenings near each end, the thickenings appearing at first sight much like corrugations. Hydrothecæ as in *P. setacea*, but more distant. Nematophores very loosely attached and often wanting, the supracaly-

cine pair originating near the top of hydrothecæ, a mesial one at base of each hydrotheca, and another in the middle of each intermediate internode; a pair of cauline nematophores in the axil of each hydrocladium, and others irregularly placed on the stem.

Gonosome.—Gonangia very long, slender, delicate, curving gently at distal end and tapering gradually to the round terminal aperture. The gonangia are not in an upright position, as in allied species, but project so as to be parallel with the hydrocladia.

Locality.—Station 4098, north coast of the island of Maui, 95 fathoms.

This species is unique, I believe, in the regularly horizontal position of the gonangia.

Genus MONOSTÆCHAS.

Trophosome.—Colony branched, the hydrocladia being borne on the upper sides of the branches. No cauline nematophores.

Gonosome.—Gonangia ovate, without protective branches of any kind.

Monostæchas quadridens (McCrady).

Distribution.—Station 3854, south coast of the island of Molokai, 134 fathoms; station 3859, between the islands of Molokai and Maui, 138 fathoms.

I am unable to separate these specimens from others from our Atlantic coast, the only perceptible difference being somewhat shorter nematophores in the specimens from the Hawaiian region.

Plumularia quadridens McCrady, Gymnophthalmata of Charleston Harbor, 1857, 97.

Monostæchas fisheri Nutting, new species.

(Pl. v, fig. 3; pl. xii, fig. 8.)

Trophosome.—Colony growing from a straggling root-stock and attaining a height of three-quarters of an inch. Stem monosiphonic, smooth, with distinct but irregular nodes. Branches sometimes alternate and sometimes opposite, but always on opposite sides of the stem. Hydrocladia arising from upper sides of branches, divided into regularly alternating hydrothecate and intermediate internodes of nearly equal length; nodes alternately straight and oblique, the former being above and the latter below the hydrothecæ. Hydrothecæ very large for this group, cup-shaped, thin-walled, with a slightly flaring margin and the adcauline wall almost entirely free from the hydrocladium. There are no cauline hydrothecæ. Supracalycine nematophores borne on very slender horn-like processes from the hydrocladium; 2 mesial nematophores to each intermediate internode, and 2 (1 immediately above and 1 below the hydrotheca) on each hydrothecate internode.

Gonosome.—Gonangia borne on the hydrocladia at bases of hydrothecæ, obovate in form, as in *M. quadridens.*

Distribution.—Station 3936, off Laysan Island, 79 to 130 fathoms; station 3949, off Laysan Island, 59 to 152 fathoms; station 4072, northeast coast of the island of Maui, 56 fathoms.

The hydranths of this species are colored almost black by a dark pigment resembling that found in many species of *Lytocarpus.*

Genus ANTENNELLA.

Trophosome.—Colony consisting of hydrocladia springing direct from a creeping root-stock, without a true stem. Hydrocladia and hydrothecæ as in the preceding genus.

Gonosome.—Gonangia pyriform, aperture distal, round.

Antennella complexa Nutting, new species.

(Pl. v, fig. 4; pl. xii, fig. 9.)

Trophosome.—Colony sometimes attaining a height of about 4 inches. Creeping root-stocks intertwined so as to resemble closely a fascicled stem from which the hydrocladia arise in great profusion, but with no regularity of arrangement whatever. All of these parallel root-stocks bear hydrocladia and are closely appressed to each other, but are easily separated with the needles.

Hydrocladia disposed on all sides of this pseudo-stem, divided into alternating hydrothecate and intermediate internodes of approximately equal length, although there is much variation in this

particular, the hydrothecate internodes ending in a straight upper and an oblique lower node and bearing a hydrotheca near the middle or a little below. Hydrothecæ rather deep cup-shaped, margin even, about half of adcauline side free from the hydrocladium.

Supracalycine nematophores scarcely reaching the hydrothecal margin; 4 to 6 mesial nematophores between adjacent hydrothecæ.

Gonosome.—Gonangia pyriform, with a round margin, large terminal aperture and 2 nematophores on the short pedicel. They are borne at the bases of the hydrothecæ.

Localities.—Station 3854, south coast of the island of Molokai, 30 fathoms; station 3859, between the islands of Molokai and Maui, 138 fathoms.

This species is of peculiar interest, as it shows the manner of forming a stem by the aggregation of root-stocks. I have elsewhere shown that the peripheral tubes of the fascicled stem in many species are formed by modified hydrocladia.[a]

The student of the Hydroida is continually having the extreme plasticity of these organisms forced upon his attention, and this plasticity, with its complementary lack of fixity, is the cause of untold confusion in the systematic discussion of the group.

Genus AGLAOPHENIA.

Trophosome.—Hydrothecal margin dentate; a posterior intrathecal ridge present; 3 nematophores attached to each hydrotheca.

Gonosome.—Gonangia inclosed in true corbulæ, the leaves of which do not bear hydrothecæ at their bases.

? **Aglaophenia rigida** Allman.

A single fragmentary specimen, without gonosome, found at station 4072, north coast of the island of Maui at a depth of 52 fathoms, is referred, with considerable doubt, to this species. Another fragment was secured at station 3847, south coast of Molokai Island, 23 fathoms.

Aglaophenia rigida Allman, Mem. Mus. Comp. Zool., V, 1877, No. 2, 43.

Genus THECOCARPUS.

Trophosome.—Stem fascicled, hydrothecæ toothed, nematophores attached to the hydrothecæ.

Gonosome.—Corbula composed of separated leaves, each of which bears a hydrotheca near its base on its outer side. More than one hydrotheca between the corbula and the stem.

Thecocarpus niger Nutting, new species.

(Pl. v, fig. 5; pl. xiii, figs. 1–6.)

Trophosome.—Colony black in color, attaining a height of about 6 inches. Stem fascicled, proximal portion unbranched, distal part giving off a number of irregularly disposed large branches which themselves often branch in an irregular manner; smaller branches not fascicled, and the internodes not apparent unless the specimen is boiled in potash, when a regular division into short nodes divided by oblique internodes is apparent. Hydrocladia alternate, borne on front of stem and branches, divided into regular internodes, each of which bears a hydrotheca and shows an internal chitinous ridge at about its middle. Hydrothecæ ovoid in shape, margin with about 10 irregular jagged teeth, the points of which turn inward, the anterior one forming a horn-like projection rising somewhat above the others; intrathecal ridge low and straight, nearly horizontal. Supracalycine nematophores horn-like, not very large, rising about to the top of the hydrotheca; mesial nematophore arising above the middle of the hydrotheca, projecting outward and upward, not attaining the level of the top of the hydrotheca, and with two apertures; cauline nematophores large, 2 at the base of each hydrocladium.

Gonosome.—Gonangia contained in a corbula bearing a close resemblance to that characteristic of *Aglaophenia*, but really of the *Thecocarpus* type. It is very large, gracefully arched, with the concave side upward, composed of 18 to 20 pairs of corbula leaves, each of which bears a hydrotheca near its base on the outside and 2 rows of large tubular nematophores with conspicuous nematocysts. The last 2 or 3 pairs of leaves are represented by hydrothecæ alone, and 1 or 2 hydrothecæ are found on the stem between the first true corbula leaf and the stem from which the corbula springs.

[a] American Hydroids, Part II, p. 5, 1904.

Distribution.—Station 3939, north of the island of Laysan, 163 fathoms; station 3955, northeast of the island of Laysan, 20 fathoms; station 3961, south of the island of Laysan, 19 fathoms; station 3962, south of the island of Laysan, 16 fathoms.

This remarkable species is represented by a number of fine specimens from the waters about Laysan. The corbula is so much like that of *Aglaophenia* in external appearance that it would deceive anyone who did not carefully investigate it. The trophosome also is almost that of a typical *Aglaophenia*. The black color is constant in all the specimens and is produced by a dense black pigment throughout the colony.

Genus LYTOCARPUS.

Trophosome.—Stem fascicled; hydrothecal margin strongly toothed or sinuous; mesial nematophores with 2 openings, cauline nematophores broad and triangular in outline.

Gonosome.—Gonangia borne on hydrocladia, which are modified so as to form protective branchlets, often aggregated into a pseudo-corbula, with leaves formed by modified hydrocladia instead of appendages to hydrocladia, as in the genus *Aglaophenia*. There is a hydrotheca at the base of each protective branch.

Lytocarpus phœniceus (Busk).

This is one of the most common species in the collection, being found at the following stations: Station 3809, south coast of the island of Oahu, 125 fathoms; station 3814, off Diamond Head, Oahu, 284 fathoms; station 3845, south coast of the island of Molokai, 60 fathoms; station 3848, south coast of the island of Molokai, 73 fathoms; station 3849, south coast of the island of Molokai, 73 fathoms; station 3939, north of the island of Laysan, 163 fathoms; station 3978, south of Bird Island, 32 fathoms; station 3979, south of Bird Island, 222 to 387 fathoms; station 3987, north of the island of Kauai, 55 fathoms; station 4071, north of the island of Maui, 52 fathoms; station 4072, north of the island of Maui, 56 fathoms.

Plumularia phœnicea Busk, Voyage of the *Rattlesnake*, Narrative, Appendix IV, 1852.

Lytocarpus hawaiensis Nutting, new species

(Pl. v, fig. 6; pl. xii, figs. 10–13.)

Trophosome.—Colony attaining a height of about 4 inches. Stem fascicled; branching pinnate, the branches distant and not fascicled, not plainly divided into internodes, bearing the alternate hydrocladia. Hydrothecæ ovate in general outline, margin with a rather prominent anterior tooth and 2 small uneven lateral teeth on each side; intrathecal ridge obsolete. Supracalycine nematophores strong, regularly curved, reaching considerably above the hydrothecal margin; mesial nematophores moderate in size, regularly curved outward, and not nearly reaching the top of the hydrotheca; cauline nematophores very long and slender, 2 on the branch at the base of each hydrocladium.

Gonosome.—Gonangia borne on branches which are modified into protective contrivances taking the form of sickle-shaped phylactogonia, 1 to each of the much-flattened gonangia. Gonangia borne on rows on the upper side of the branch, orbicular, but considerably broader than long when viewed from the flat side. The phylactogonia are armed with 2 rows of long conspicuous tubular nematophores.

Distribution.—Station 3853, south coast of Molokai Island, 115 fathoms; station 3875, between Maui and Lanai islands, 65 fathoms; station 3848, south of the island of Molokai, 44–73 fathoms.

Lytocarpus balei Nutting, new species.

(Pl. vi, fig. 1; pl. xiii, figs. 7, 8.)

Trophosome.—Colony attaining a height of about 2 inches. Stem fascicled; branches irregularly alternate and fascicled, except on the distal parts; hydrocladia alternate, each with 2 strong septal ridges and 1 weak one opposite each hydrotheca. Hydrothecæ oval in general outline, aperture nearly vertical, margin almost smooth, and a very strong intrathecal ridge usually reaching more than halfway across the hydrotheca and ending in a round knob. Supracalycine nematophores small, slender, reaching nearly to the hydrothecal margin; mesial nematophores very strong, and reaching considerably above the hydrothecal margin.

Gonosome.—Gonangia borne on specialized hydrocladia with one or more hydrothecæ at their bases, bean-shaped, arranged in 2 rows. The distal part of each of these specialized hydrocladia is curved and armed with strong nematophores, but without hydrothecæ. They alternate irregularly with ordinary hydrocladia, the tendency being to an arrangement in which there are 2 ordinary hydrocladia between adjacent phylactogonia.

Locality.—Station 3852, off the south coast of Molokai, 47 to 115 fathoms.

This is the smallest species of *Lytocarpus* found in the collection. It seems to be a very well-marked species, especially in its gonosome.

Lytocarpus similis Nutting, new species.

(Pl. VI, fig 3; pl. XIII, figs. 9, 10.)

Trophosome.—Colony about 7 inches high, irregularly branched. Stem and branches fascicled. Hydrocladia alternate, often without distinct internodes, but with small internal thickenings just below the supracalycine nematophores and opposite the lower part of the hydrothecæ. Hydrothecæ deep, anterior outline concave, margin with 3 lateral teeth on each side and a rather longer anterior tooth. Supracalycine nematophore slender, terete, distinctly overtopping the hydrotheca; mesial nematophore short, not reaching the middle of the hydrotheca, regularly convex in outline.

Gonosome.—Gonangia borne on modified hydrocladia which do not form pseudo-corbulæ, but which are irregularly interspersed among normal hydrocladia. Each of these modified hydrocladia has a normal hydrotheca at its base, then one or more aborted hydrothecæ, then globular gonangia arising regularly from aborted hydrothecæ, each with a mesial and 2 supracalycine nematophores. Gonangia flattened, containing blastostyles supporting gonophores which are partly encircled by a sickle-shaped rim of cœnosarc.

Locality.—Station 4000, southwest of the island of Molokai, 213 fathoms.

This species is particularly interesting for two reasons. First, its gonosome furnishes a beautiful example of the homology between the gonophore and the hydranth, the former arising from aborted hydrothecæ. Second, we have in this species a further proof, if any more is needed, of the fact that a classification of the genera of the Plumularidæ can not be based on the trophosome alone, for the trophosome of this form is almost a typical *Aglaophenia*, while its gonosome is that of a true *Cladocarpus*.

Genus HALICORNARIA.

Trophosome.—Stem not fascicled. Hydrothecæ with no posterior intrathecal ridge. Hydrocladia not branched and without septal ridges.

Gonosome.—Gonangia borne on the stem or on the bases of the hydrocladia, not taking the place of hydrothecæ, and not protected by corbulæ or protective branches of any kind.

Halicornaria flava Nutting, new species.

(Pl. VI, fig. 2; pl. XIII, figs. 11, 12.)

Trophosome.—Colony attaining a height of about 5 inches. Brownish yellow in color. Stem monosiphonic, not regularly branched, divided into regular internodes, each of which bears a hydrocladium. Hydrocladia alternate; nodes not seen in profile, but marked by translucent lines when viewed by reflected light. Hydrothecæ orbicular, large, margin with a single broad lateral lobe on each side, and one in front and another behind; a very strong anterior intrathecal ridge arising from above the middle of the hydrotheca and ending in a round knob at its center. Mesial nematophore attached throughout to the front of the hydrotheca and ending in a point projecting above the margin of the latter; the nematophore having a strong chitinous point at about its middle, projecting inward toward the hydrotheca, a unique feature in this genus so far as I know. Supracalycine nematophores short, triangular, not reaching nearly to the top of the hydrotheca. There are 2 strong, broad cauline nematophores at the front of the base of each hydrocladium.

Gonosome.—Gonangia in the form of simple pyriform bodies arranged in a row along the front of the stem, one at the base of each hydrocladium. Their tops do not seem to have regular apertures of any kind, but simply to be ruptured by the escape of the sexual elements. There are no protective branchlets.

Locality.—Station 3939, north of the island of Laysan, 163 fathoms.

The bright brownish-yellow color of this species is quite conspicuous when the specimens are fresh.

Halicornaria bryani Nutting, new species.

(Pl. VI, fig. 4; pl. XIII, figs. 13, 14.)

Trophosome.—Colony parasitic on *Lytocarpus similis*, attaining a height of about 3 inches. Stem simple, divided into regular internodes, each of which bears a hydrocladium. Hydrocladia stout, not evidently divided into internodes. Hydrothecæ very large, ovate in outline, margin with 1 or 2 ill-defined lateral sinuations; intrathecal ridge anterior, very strong, ending in a round knob. Supra-calycine nematophore small, not reaching to margin of the hydrotheca; mesial nematophore very short and strong, variable in shape, with a regularly arched outline and ending considerably below the hydrothecal margin.

Gonosome.—Gonangia obconoid, with truncate summits, borne in a row on the front of the stem, each being at the base of a hydrocladium. No phylactogonia. The hydrothecæ of this species are the largest that I have seen in the genus.

Locality.—Station 4000, southwest of the island of Kauai, 213 fathoms.

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EXPLANATION OF PLATES.[a]

PLATE I.

Hydrodendrium gorgonoides Nutting.

Fig. 1. Part of colony (× 5).
2. Cross section of stem, showing naked cœnosarc above (× 125).
3. Hydranth and gonophore (× 25).
4. Cross section of stem, showing irregular lacunæ (× 25).
5. Longitudinal section of hydranth (to the right), and gonophore (to the left), showing ova in the endoderm (× 125).
6. Longitudinal section of male gonophore, showing spermary (× 125).

PLATE II.

(All figures × 5.)

Fig. 1. Corydendrium minor Nutting.
2. Corydendrium corrugatum Nutting.
3. Balea mirabilis Nutting.
4. Campanularia eloisa Nutting.
5. Halecium scandens Nutting.
6. Campanularia eloisa Nutting.

PLATE III.

(All figures × 5.)

Fig. 1. Stegopoma gilberti Nutting.
2. Stegopoma gracilis Nutting, growing as a parasite on Halicornaria.
3. Stegopoma plumicola Nutting, parasitic on Lytocarpus phoeniceus.
4. ?Cryptolaria operculata Nutting.
5. ?Opercularella longicauda Nutting.
6. Lafoea contorta Nutting. Basal part of colony to the left, distal part to the right.

[a] The photomicrographs were made by the author. The pen drawings were made by Mrs. Elizabeth B. Darrow, after camera lucida drawings in pencil by the author.

PLATE IV.

(All figures × 5.)

Fig. 1. Lictorella cervicornis Nutting, showing gonosome.
2. Cryptolaria symmetrica Nutting.
3. Sertularella crenulata Nutting.
4. Sertularella torreyi Nutting.
5. Sertularia snyderi Nutting.
6. Diphasia palmata Nutting.

PLATE V.

(Figures 3-6 × 5. Figs. 1 and 2 are much more highly magnified than the others.)

Fig. 1. Plumularia milleri Nutting, showing peculiar disposition of the gonangia.
2. Plumularia delicata Nutting.
3. Monostæchas fisheri Nutting.
4. Antennella complexa Nutting.
5. Thecocarpus niger Nutting, showing gonosome.
6. Lytocarpus hawaiensis Nutting, showing gonosome.

PLATE VI.

(All figures × 5.)

Fig. 1. Lytocarpus balei Nutting.
2. Halicornaria flava Nutting.
3. Lytocarpus similis Nutting.
4. Halicornaria bryani Nutting.
5. Plumularia jordani Nutting.

PLATE VII.

Fig. 1. Hydrodendrium gorgonoides Nutting, single hydranth with hernia-like gonophore.
2. Expanded hydranth.
3. Balea mirabilis Nutting, part of branch.
4. Balea mirabilis, single hydranth, showing the two whorls of tentacles.
5. Corydendrium corrugatum Nutting, part of branch.
6. Corydendrium corrugatum, single hydranth and hydrophore.
7. Oral view of hydranth.
8. Corydendrium minor Nutting, part of branch.
9. Corydendrium minor, sessile medusa.

PLATE VIII.

Fig. 1. Halecium scandens Nutting, part of branch.
2. Halecium scandens, hydranth and hydrophore.
3. Halecium scandens, gonangium and gonophore.
4. Campanularia eloisa Nutting, part of colony with gonangium.
5. Campanularia eloisa, hydrotheca.
6. Campanularia eloisa, hydrotheca.
7. Campanularia eloisa, part of branch showing scattered pedicels.
8. Stegapoma gracilis Nutting, group of hydrothecæ.
9. Stegopoma gracilis, hydrotheca and gonangium.

PLATE IX.

Fig. 1. Stegopoma gilberti Nutting, part of colony.
2. Stegopoma plumicola Nutting, group of hydrothecæ.
3. Stegopoma plumicola, hydrotheca and gonangium.
4. Opercularella longicauda Nutting, group of hydrothecæ.
5, 6. Opercularella longicauda, hydrothecæ showing different positions of the opercula.
7. Opercularella longicauda, gonangium.
8. Lafœa contorta Nutting, group of hydrothecæ on main stem.
9. Lafœa contorta, hydrothecæ on end of branch.

PLATE X.

Fig. 1. Lictorella halecioides (Allman), cross section of part of "coppinia" mass.
2–4. Lictorella halecioides, gonangia.
5. Lictorella cervicornis Nutting, part of branch.
6. Lictorella cervicornis, hydrotheca (much enlarged).
7. Lictorella cervicornis, nematophore (greatly enlarged).
8. Lictorella cervicornis, group of gonangia with phylactogonia.
Fig. 9. Litorella cervicornis, single gonangium with phylactogonium.
10. Cryptolaria symmetrica Nutting, proximal part of branch.
11. Cryptolaria symmetrica, distal part of branch.
12. Cryptolaria operculata Nutting, part of a branch.
13, 14. Cryptolaria operculata, single hydrothecæ.
15. Sertularia snyderi Nutting, part of colony.

PLATE XI.

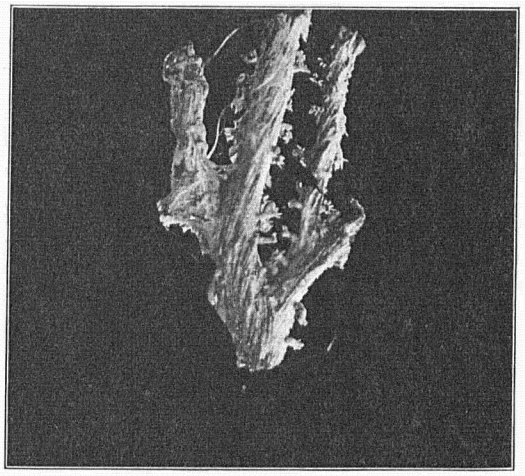
Fig. 1. Sertularella dentifera Torrey, gonangium.
2. Sertularella torreyi Nutting, part of stem with gonangium.
3. Sertularella torreyi, end of branch.
4. Sertularella crenulata Nutting, part of branch.
5. Sertularella crenulata, hydrotheca (much enlarged).
Fig. 6. Sertularella crenulata, gonangium.
7. Sertularella crenulata, end of gonangium showing aperture.
8. Diphasia palmata Nutting, part of stem.
9 and 10. Diphasia palmata, front and lateral views of gonangia.

PLATE XII.

Fig. 1. Plumularia jordani Nutting, part of a colony.
2. Plumularia jordani, hydrotheca and nematophores (greatly enlarged).
3. Plumularia delicata Nutting, part of branch.
4. Plumularia delicata, hydrothecate internode (much enlarged).
5. Plumularia delicata, gonangium.
6. Plumularia milleri Nutting, part of colony with gonangia.
7. Plumularia milleri, hydranth.
Fig. 8. Monostæchas fisheri Nutting, part of branch.
9. Antennella complexa Nutting, part of branch.
10. Lytocarpus hawaiensis Nutting, part of stem showing branch origin and nematophores.
11. Lytocarpus hawaiensis, hydrothecæ.
12. Lytocarpus hawaiensis, gonangium with phylactogonium.
13. Lytocarpus hawaiensis, side view of gonangium.

PLATE XIII.

Fig. 1. Thecocarpus niger Nutting, three hydrothecæ.
2. Thecocarpus niger, one hydrotheca (greatly enlarged).
3. Thecocarpus niger, part of stem, showing nematophores and hydrocladial origin.
4. Thecocarpus niger, corbula.
5. Thecocarpus niger, section of corbula, showing gonangium.
6. Thecocarpus niger, corbula leaf with basal hydrotheca.
7. Lytocarpus balei Nutting, three hydrothecæ.
Fig. 8. Lytocarpus balei, branchlet with gonangia.
9. Lytocarpus similis Nutting, three hydrothecæ.
10. Lytocarpus similis, gonangia on branchlet.
11. Halicornaria flava Nutting, three hydrothecæ.
12. Halicornaria flava, gonangium.
13. Halicornaria bryani Nutting, three hydrothecæ.
14. Halicornaria bryani, gonangium.



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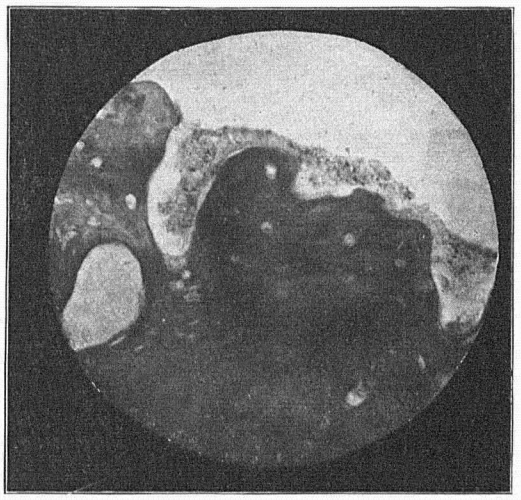

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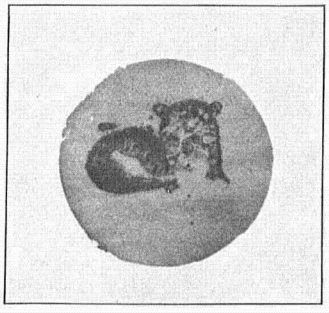

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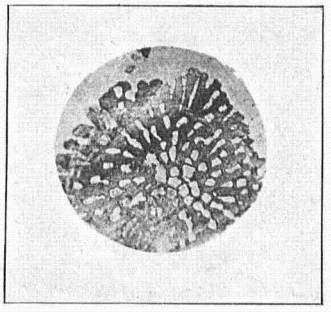

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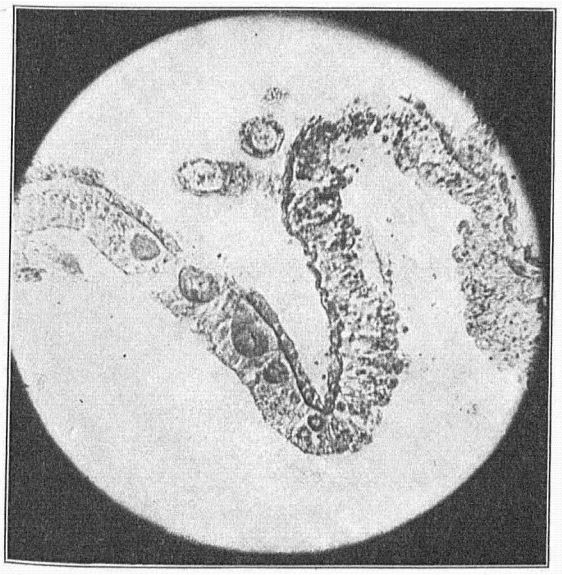

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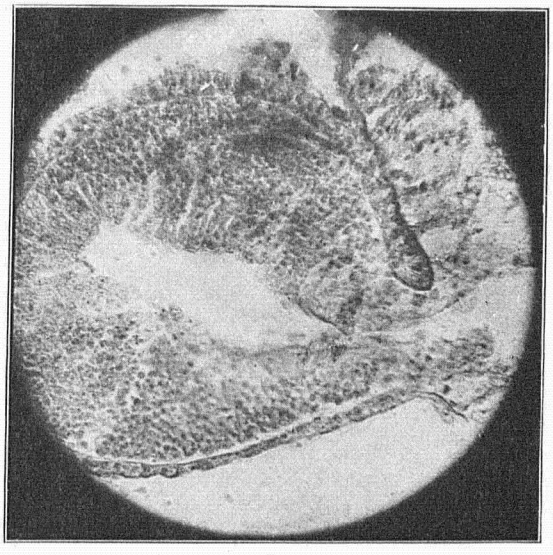

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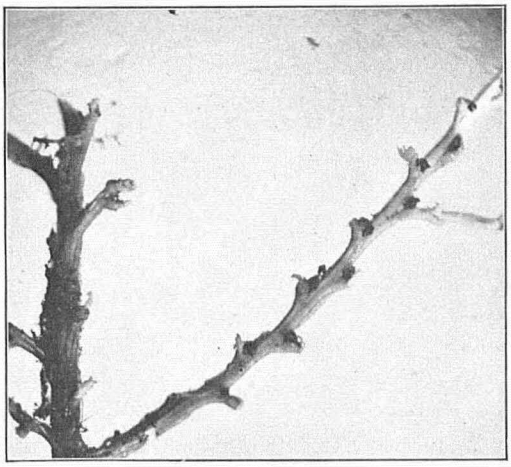

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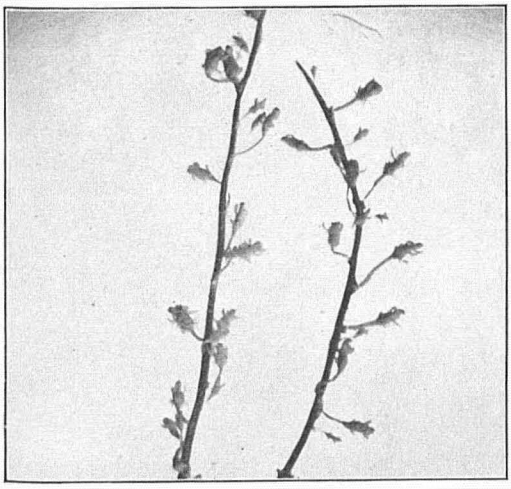

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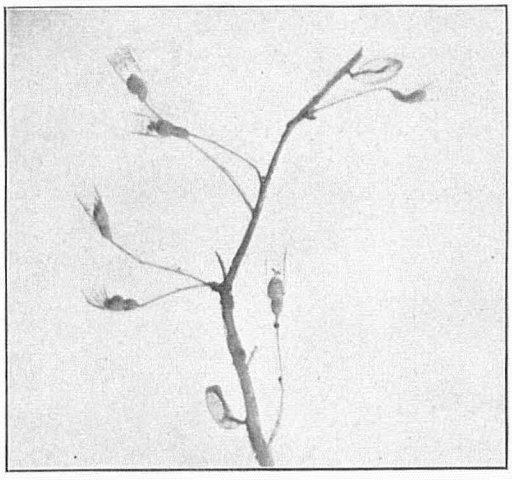

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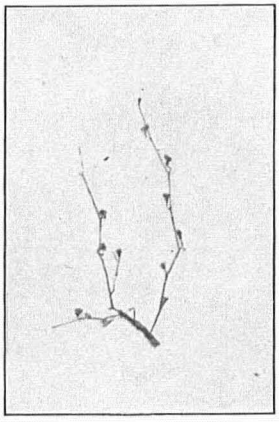

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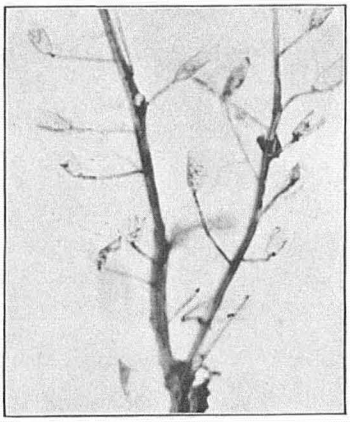

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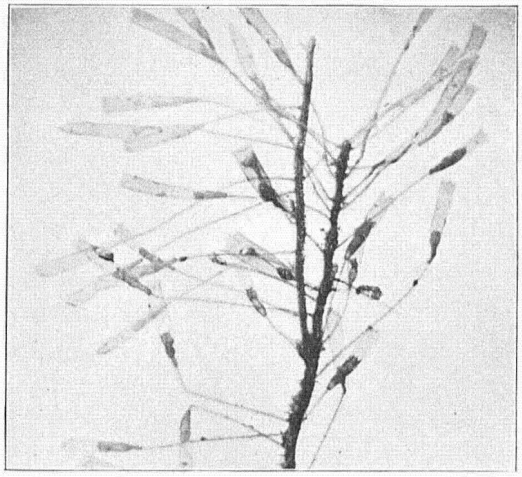

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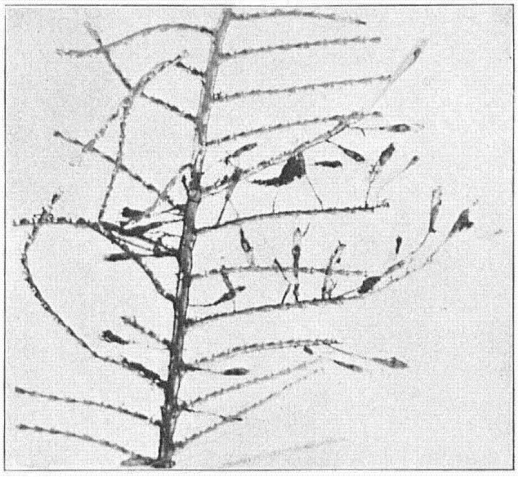

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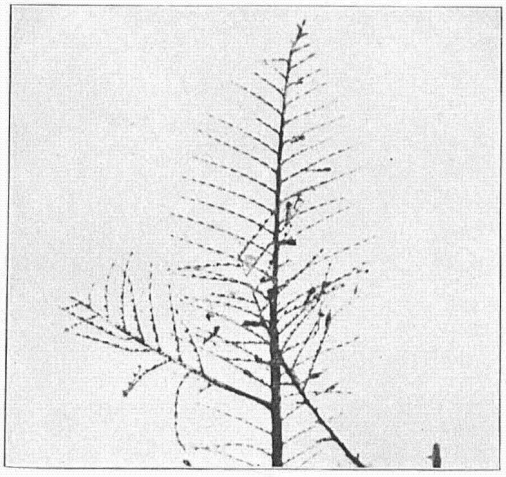

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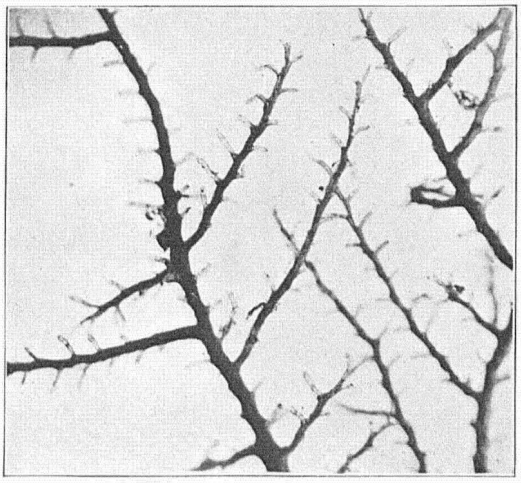

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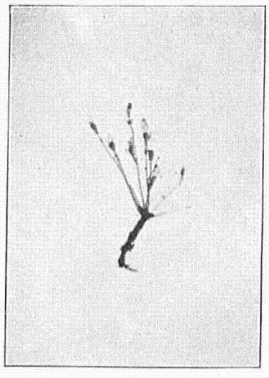

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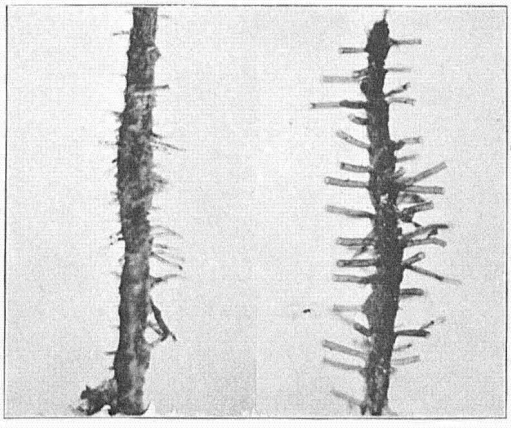

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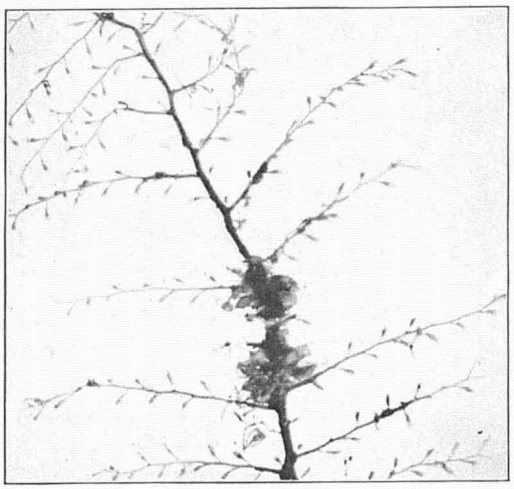

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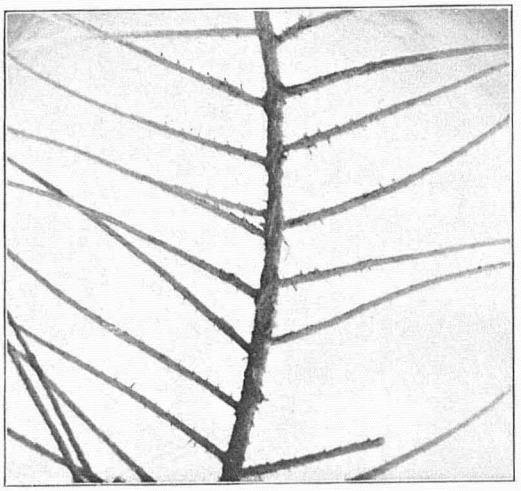

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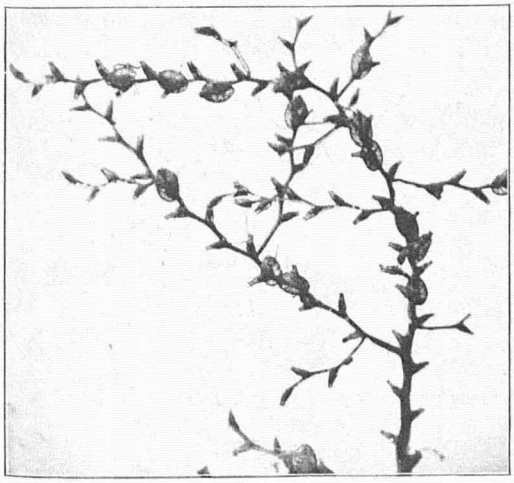

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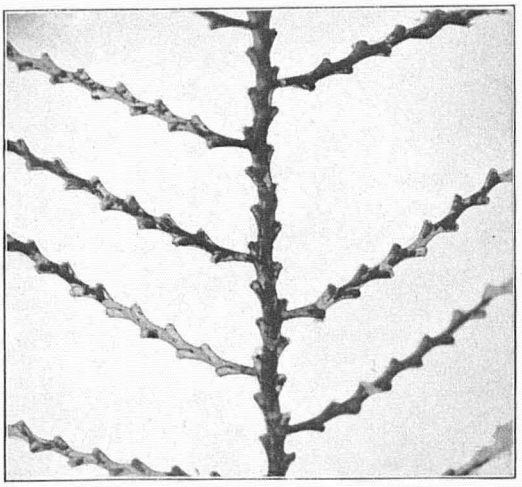

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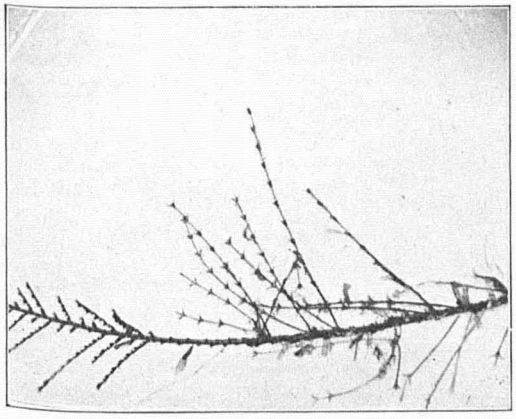

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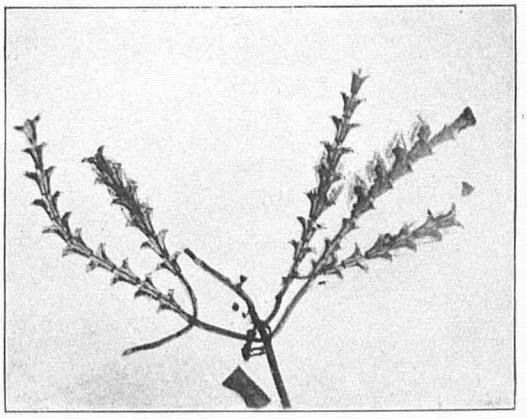

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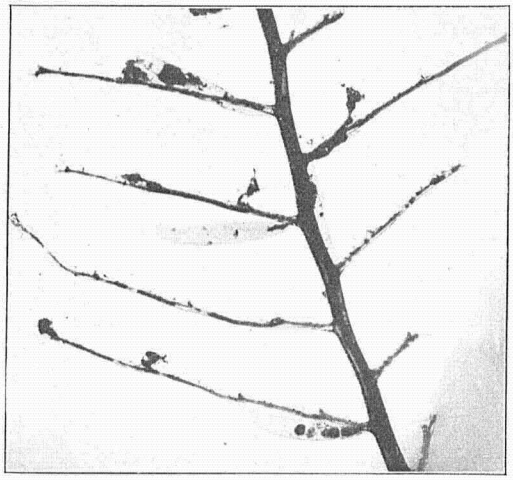

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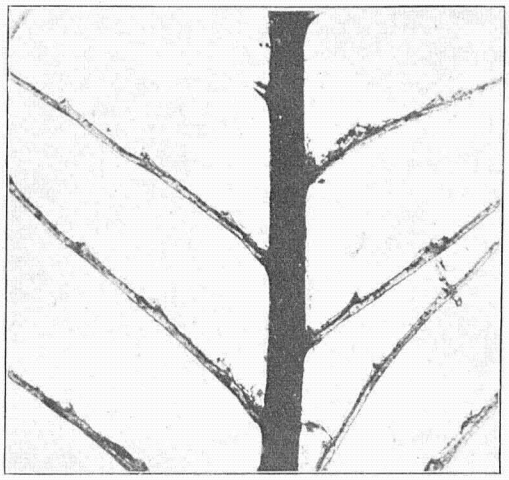

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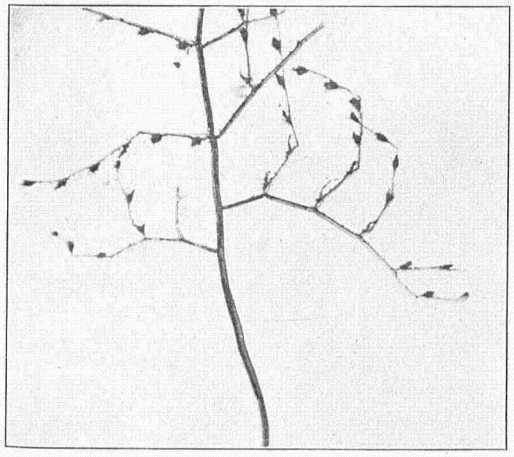

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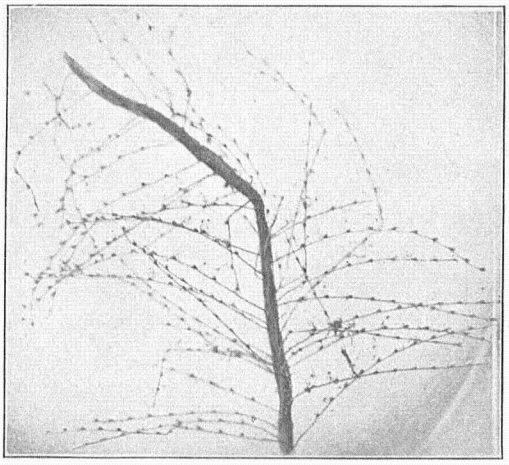

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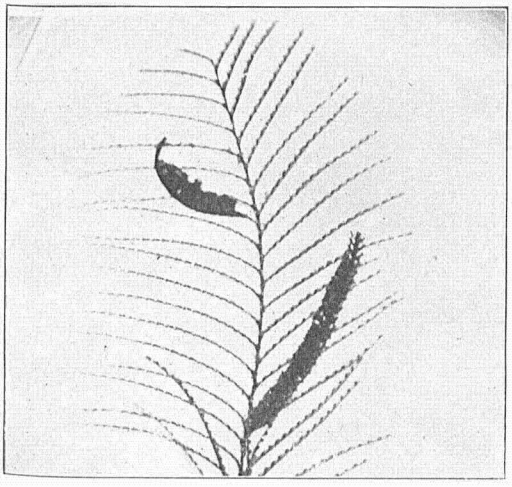

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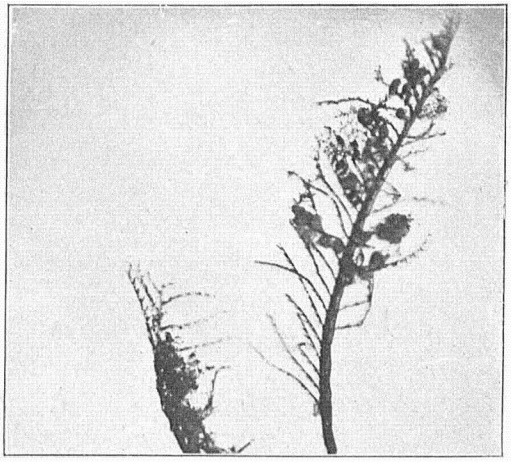

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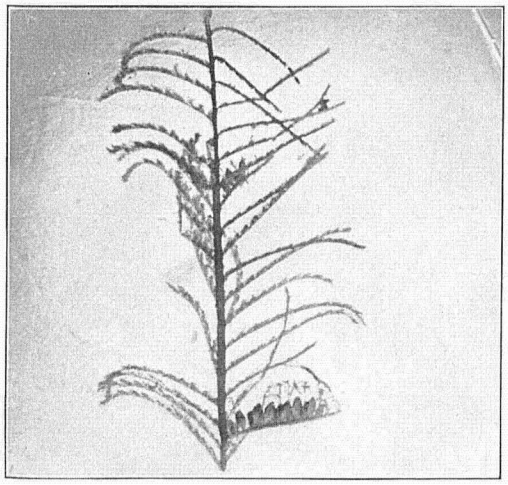

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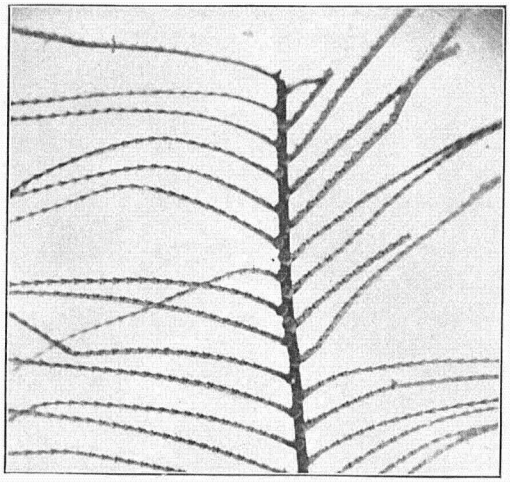

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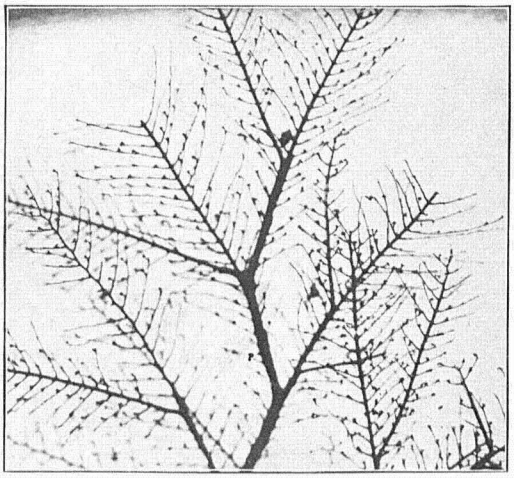

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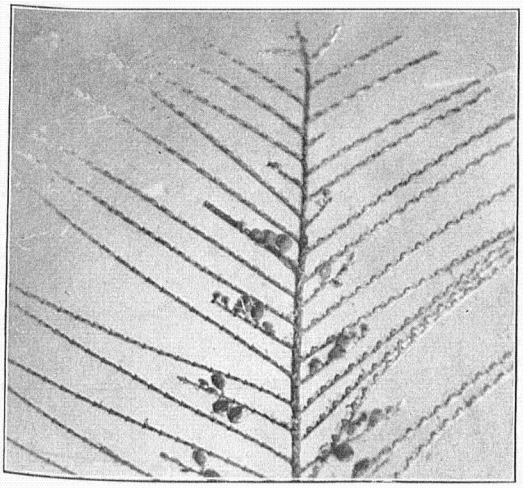

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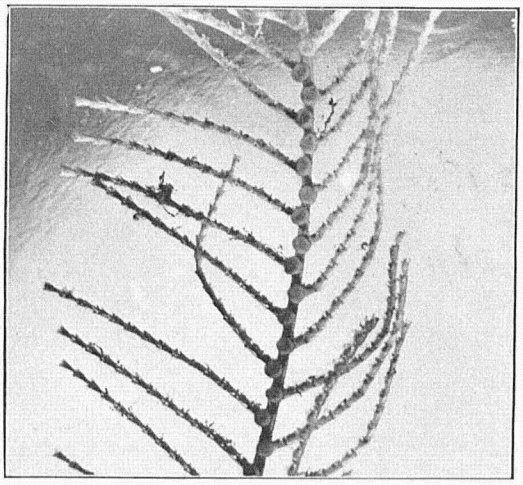

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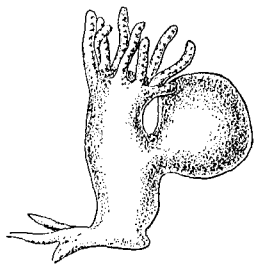

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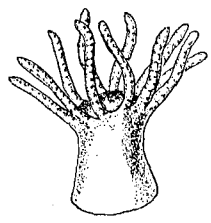

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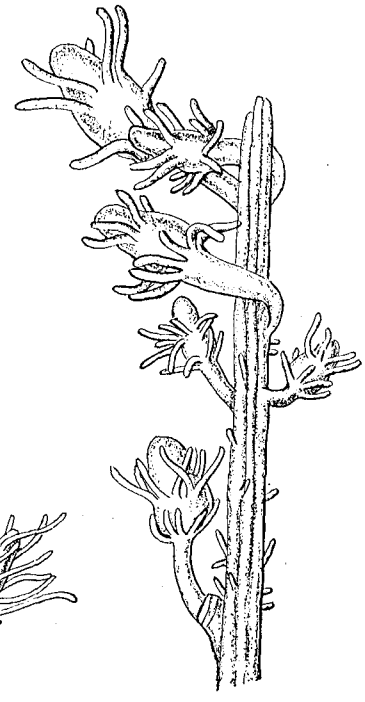

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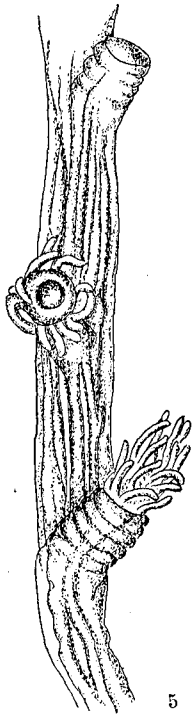

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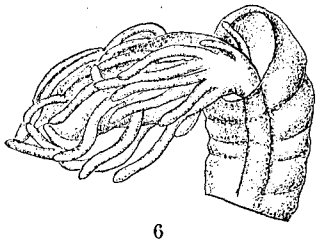

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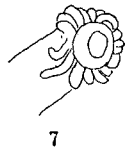

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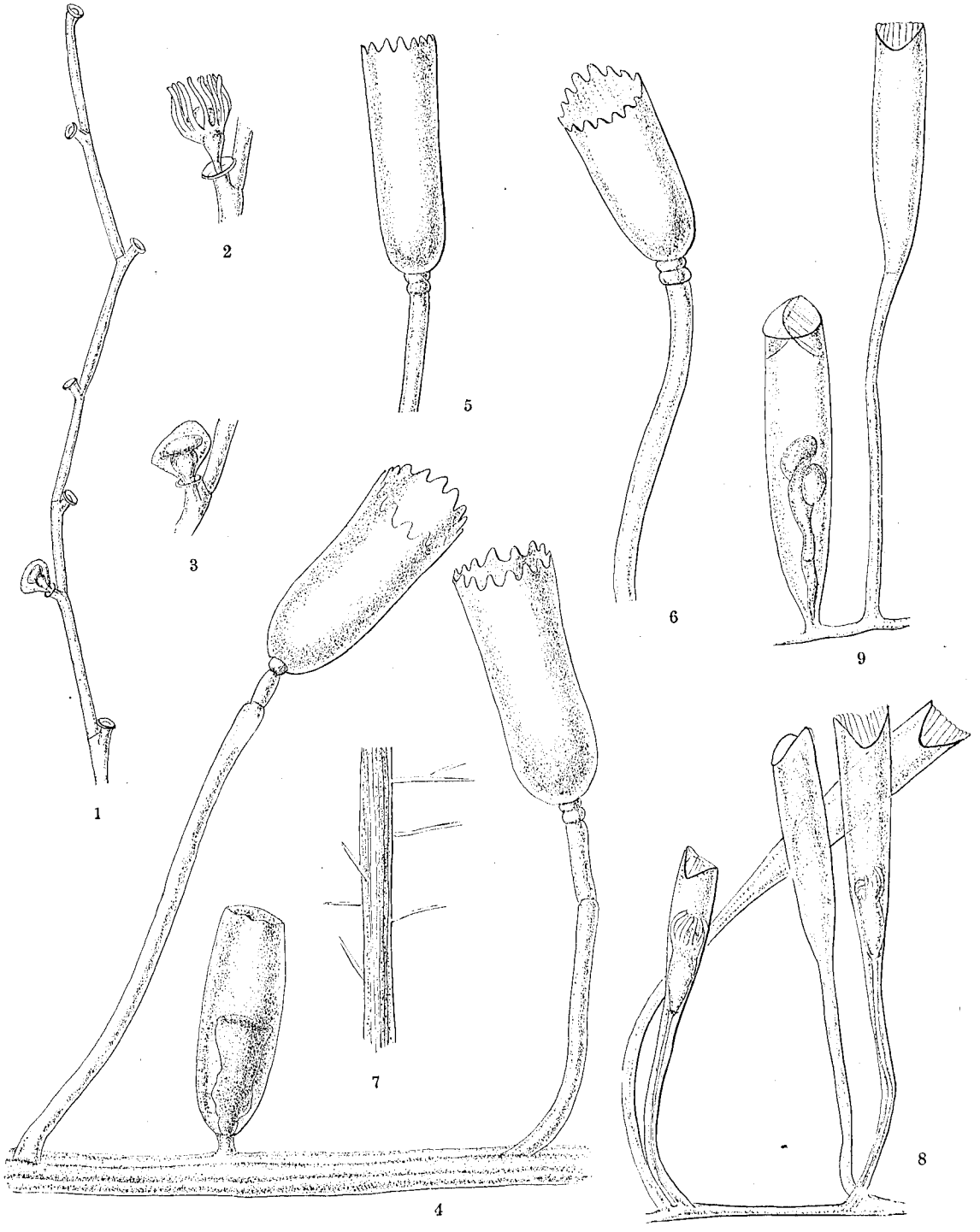
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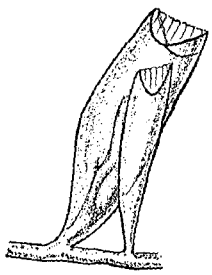
PLATE IX.



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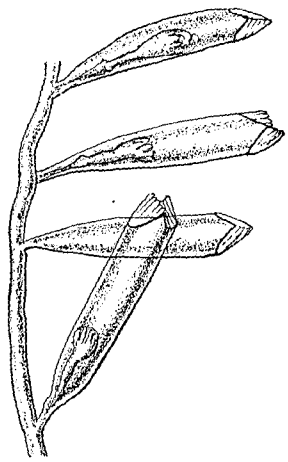

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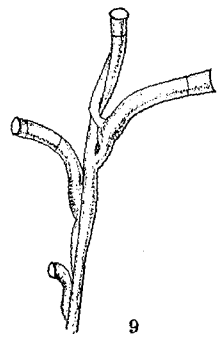

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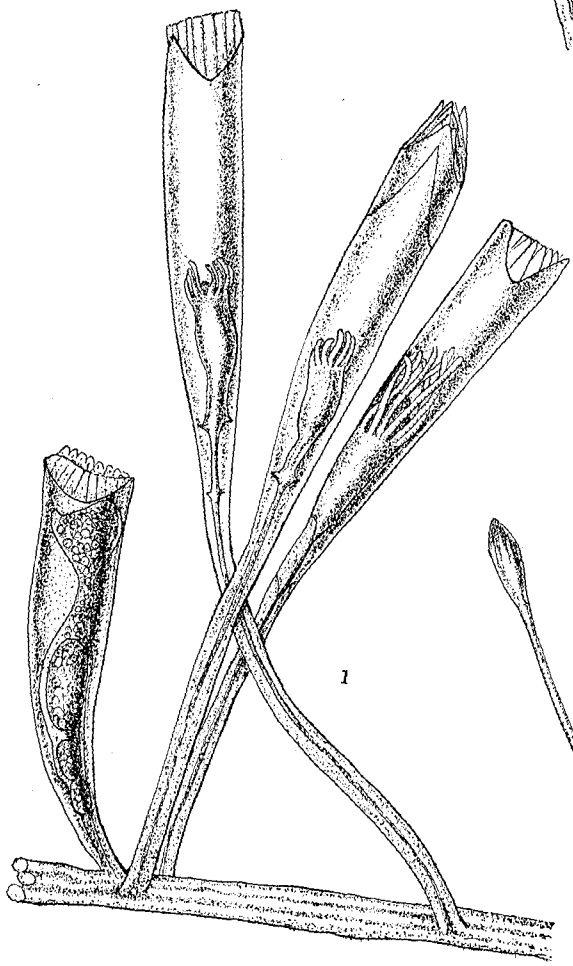

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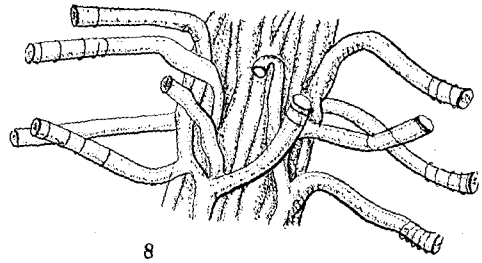

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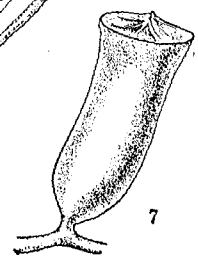

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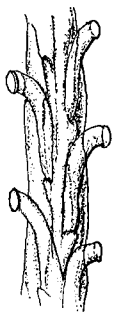

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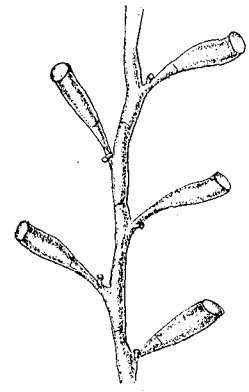

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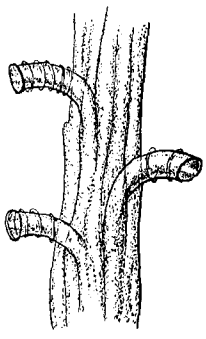

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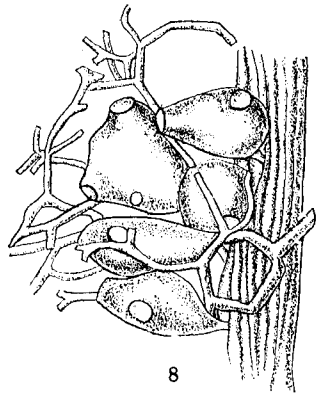

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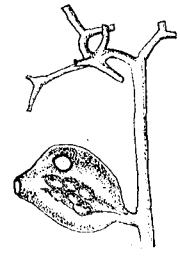

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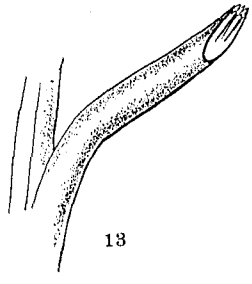

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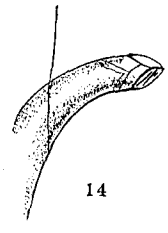

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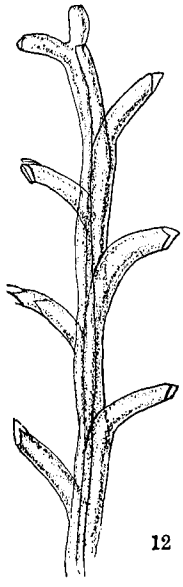

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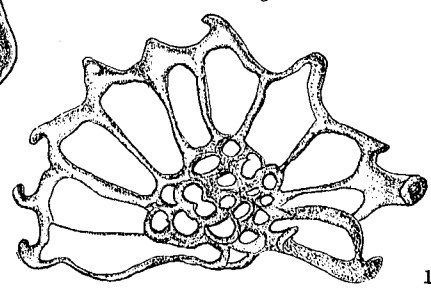

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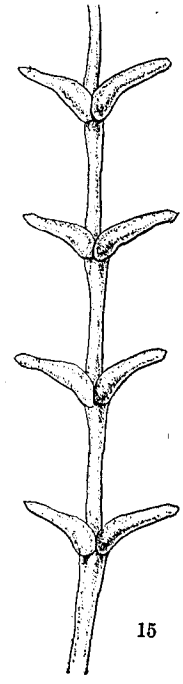

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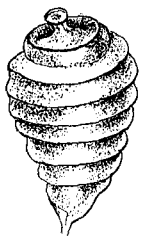

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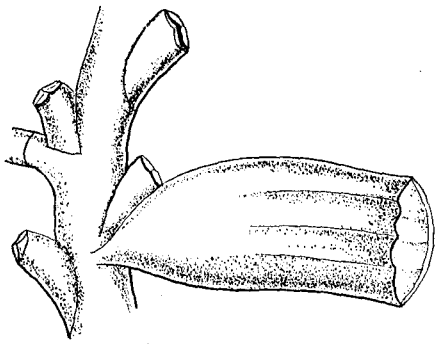

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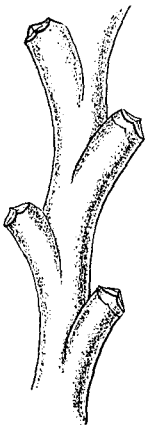

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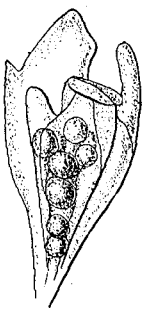

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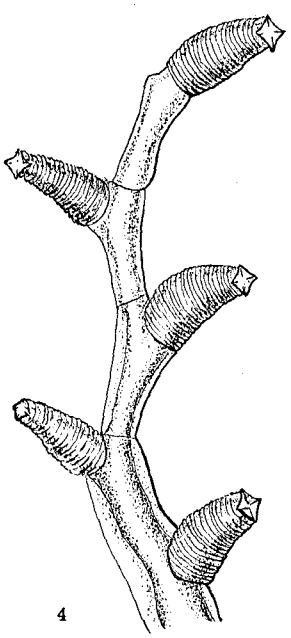

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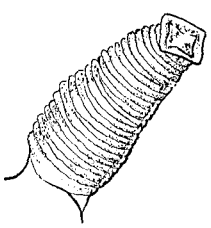

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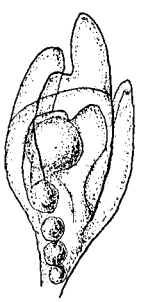

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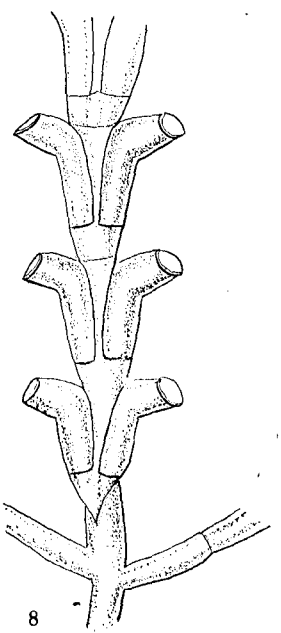

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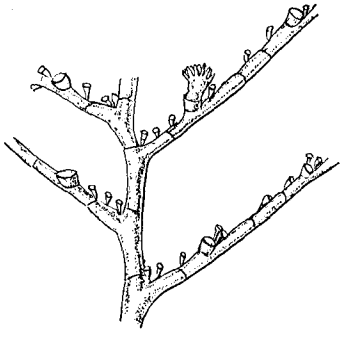

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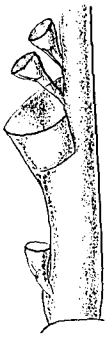

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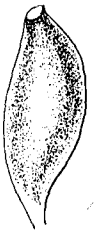

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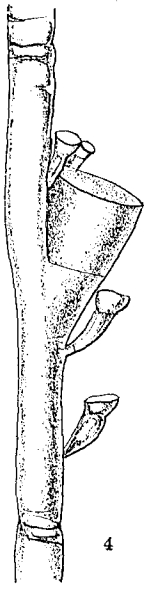

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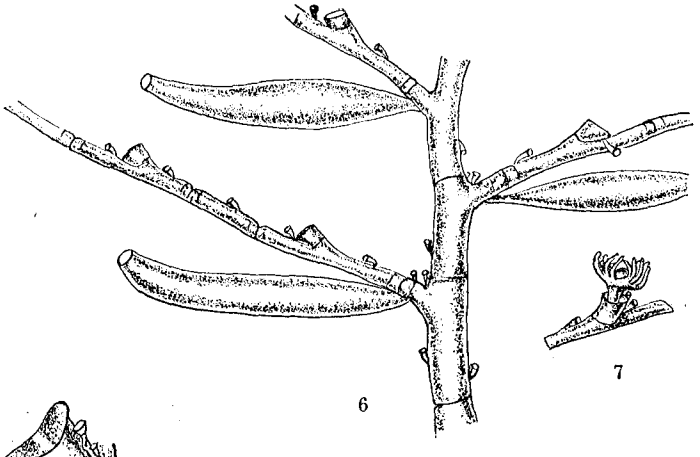

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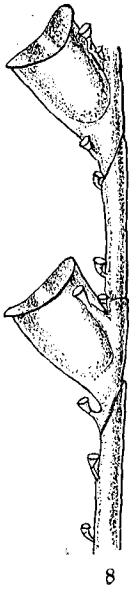

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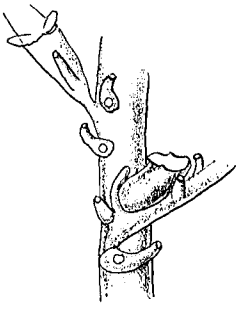

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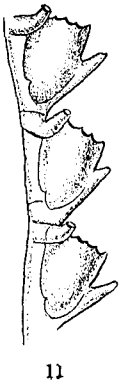

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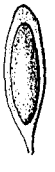

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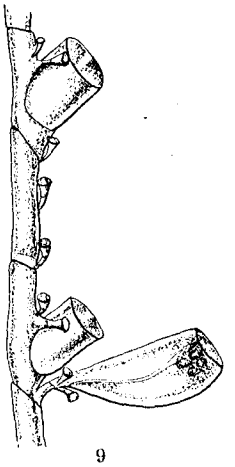

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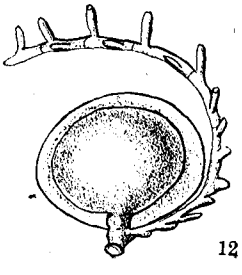

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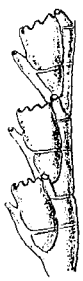

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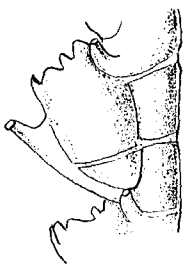

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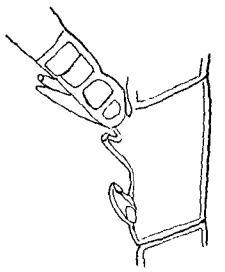

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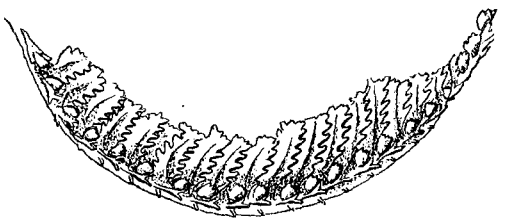

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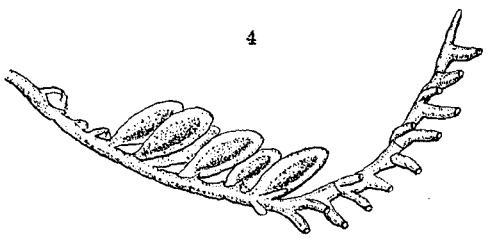

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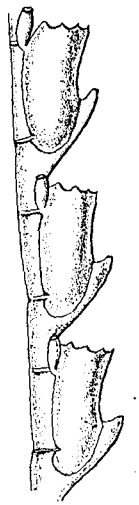

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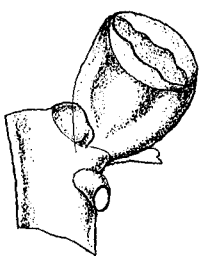

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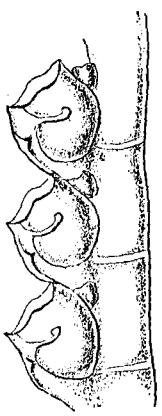

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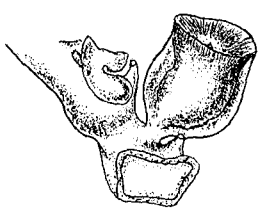

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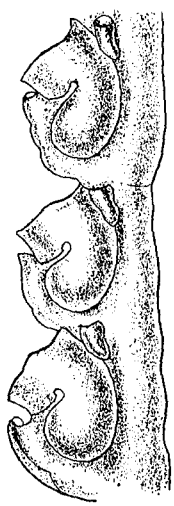

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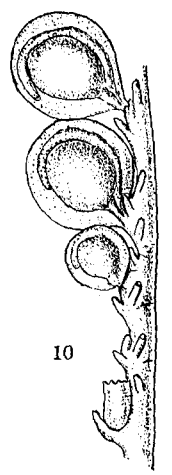

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