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28 May, 1885.

CATALOGUE

OF THE

AUSTRALIAN HYDROID ZOOPHYTES,

By W. M. BALE.

PRINTED BY ORDER OF THE TRUSTEES,
E. P. Ramsay, F.L.S., Curator.

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PREFACE.

LIKE the "Catalogue of the Crustacea," the "Catalogue of the Hydroid Zoophytes" is issued by the Trustees with a view not only to affording a guide to the collections of the Museum, but also to providing students of natural history in Australia with a compact account of all that has been done hitherto in the description and illustration of the Australian representatives of this group. Prefixed to the systematic portion of the Catalogue is a general Introduction on the morphology of the Hydroida. The Catalogue itself contains also a large amount of new matter, which, with the numerous plates, illustrating a large proportion of the species, will, it is believed, render it a work of permanent value.

The letters A.M., after the description of a species, indicate that it is represented in the collection of the Australian Museum.

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INTRODUCTION.

THOUGH it would be impracticable, within the limits of the present work, to give a complete account of the organization of the Hydroid Zoophytes, a brief sketch of the more important features of their structure and life-history can scarcely fail to be of interest, at least to those students who have but limited opportunities of access to the fuller literature of the subject, and is indeed essential to a proper comprehension of the terminology.*

For the substance of the *résumé* here presented I am mainly indebted to Mr. Hincks' History of the British Hydroid Zoophytes, with some aid from other European authors; for of the anatomy and development of the Australian Hydroida next to nothing has been recorded, the species in almost every case being known solely from their chitinous exo-skeletons. As regards the Calyptoblastea—the sub-order in which these structures attain their highest development, and to which nearly all the known Australian species belong—this is not of great relative importance, as the animals are formed on the same general plan throughout the group; but in the other principal section—the Gymnoblastea—there exists very great diversity of form and armature; it is therefore the more to be regretted that so little is known of the Australian representatives of this sub-order.†

* The terminology used in describing the Hydroida is rather complicated, the more so that our two principal English authorities—Professor Allman and the Rev. Thos. Hincks—have adopted different designations for many portions of the Hydroid structure. I have not thought it necessary to give a table of the terms in use, as they are explained in the text and can readily be found by reference to the index.

† I can find no account hitherto of any Australian Gymnoblastea, except three or four polyparies, the animals of which are unknown.

The type of the order Hydroida is the *Hydra*, a little animal common enough in pools which contain water for the whole or the greater part of the year. If some of the weeds be collected from such pools and placed with water in a glass vessel, the *Hydra*, when present, may be found after the lapse of an hour or two clinging to the glass or the weeds. The body is light brownish, cylindrical and very slender when fully extended, but often changing to a globular or any intermediate form. Its greatest length may be about half an inch, but is usually rather less. The upper or distal extremity, in which is situated the mouth, is surrounded by a circlet of slender thread-like arms or tentacles; and the basal or proximal portion forms an adhesive disc, by which the *Hydra* attaches itself to weeds or other substances, and by the aid of which it can move slowly from place to place, exactly as a sea-anemone glides along the glass wall of an aquarium.* Indeed, except in the relatively longer body and fewness of the tentacles, the *Hydra* is externally a miniature sea-anemone, and comports itself in the same fashion, seizing with its tentacles and devouring any small animal that may come in contact with it. The body of the *Hydra*, which, like the tentacles, is exceedingly extensile and contractile, is occupied by a cavity which extends from the base to the apex, and is without internal organs of any kind; being, in fact, a simple digestive tube, or food-sac, with a single aperture—the mouth—by which the food is received and the undigested residue expelled.† The body-wall is composed of two layers, which also extend throughout the tentacles; of these the outer is known as the *ectoderm*, and the inner as the *endoderm*. "Each consists of numerous nuclear bodies, or 'endoplasts,' embedded in a granular 'intercellular substance' or 'periplast'; and each may be rendered

* In its locomotive habit the *Hydra* stands alone among the animals of which it is in most respects the type.

† The absence of a distinct alimentary canal, divided off from the general cavity of the body, distinguishes the sub-kingdom Cœlenterata, to which the Hydrozoa belong, from all the higher groups; while in the one lower sub-kingdom—the Protozoa—there is no permanent body-cavity at all, and the food mixes freely with the soft protoplasmic material which occupies the interior.

more or less complex by vacuolation or fibrillation." Between these two layers the reproductive elements are developed, the male organs consisting of small conical receptacles, situated somewhat below the tentacles, while the globular ova are produced lower down on the body in a simple sac, and are ultimately set free by the rupture of the ectoderm.

The body of the *Hydra* possesses a wonderful reparative power, which enables it to recover without difficulty from the effects of injuries. Thus if it be cut open for its entire length, it will under favourable conditions speedily unite again, while the division of the body into several distinct portions merely results in the development of a complete *Hydra* from each fragment. These and many other experiments of a similar nature, which were first made by Abraham Trembley, and described in his celebrated work on the *Hydra*,* have often been repeated with the same results; not so, however, another and still more remarkable experiment, in which, he says, he succeeded, namely, turning the animal inside out, and keeping it alive in this condition, the external and internal surfaces of the body changing their functions as well as their position. Trembley's statement has been unhesitatingly accepted by later authors, but does not appear to have ever been confirmed; and Professor Engelmann, who has repeated the experiment in a great number of cases and under various conditions, has invariably found either that the *Hydra* died, or that the body, when it did not regain its proper position, separated below the tentacles and became disintegrated, a new body being sometimes budded off from the remaining distal portion.†

The most common mode of increase in *Hydra*, as in all the members of the order, is by gemmation. The young *Hydra* first appears as a slight protuberance on the body of the parent; it increases rapidly in size, often showing the rudiments of the tentacles on the second day, and on the third or fourth day it is

* Mémoires pour servir à l'histoire d'un genre de Polypes d'eau douce, à bras en forme de cornes. Leyden, 1744.

† Zoologischer Anzeiger, Vol. I. Rösel had also failed in this experiment.

sufficiently developed to seize and devour its prey, though it usually remains attached to the parent for a few days longer. Sometimes the vegetative activity is so great that a third, and even a fourth generation may be developed before the separation of the first bud from the parent stock, forming, for the time being, a composite plant-like structure. Occasionally the *Hydra* multiplies by fission, which may be either transverse or longitudinal.

The Hydroid Community.

We have seen that in *Hydra* the process of gemmation sometimes gives rise to a compound structure, consisting of several *Hydræ*, or *polypites*, which ultimately become detached, and enter upon a separate existence, the normal habit of the zoophyte being solitary. This habit is shared by only one or two other genera; throughout the rest of the order the polypites which are produced by gemmation remain organically connected, forming a permanent colony. The whole organism, whether simple, as in *Hydra*, or complex, as in the Hydroida generally, is called the *hydrosoma*, the plant-like structure of the composite forms being also known as the *hydrophyton*. In some instances it consists merely of a few polypites springing from a thread-like fleshy stolon, which is attached to some foreign substance; in other cases it forms an erect, plant-like, ramified structure, varying in height from a fraction of an inch to several feet; and in the larger species bearing many thousands of polypites, all the result of growth and gemmation from a single ovum. The forms assumed by these organisms are varied and beautiful; some resemble miniature trees with their stems, branches, and twigs; others produce graceful pinnate shoots like delicate fern-fronds; and in the large family of the Plumulariidæ the prevailing form is elegantly plumous or feather-like. In the latter family the polypites are borne in a single series along each of the ultimate ramules,* in the Sertulariidæ each ramule usually bears two series. The hydrosoma consists essentially of the

* Called by Kirchenpauer "hydrocladia."

cœnosarc and the *zooids*. The former is the fleshy substance composing the root, stem, and branches, the latter comprise the *polypites** or *hydranths*, which are the ordinary hydra-like alimentary zooids, by whose exertions the community is supplied with nutriment, and the *gonozooids*, or reproductive buds, which are charged with the generative functions, and are generally subject to singular modifications which mask their homological identity with the polypites. There is an outer protective investment or exo-skeleton, sometimes membranous, usually chitinous, and in rare instances calcareous. This is called the *perisarc* or *periderm*, also, when spoken of as a whole, the *polypary* or *polypidom*; in the sub-order Gymnoblastea it invests only the cœnosarc, or a portion of it; in the Calyptoblastea it forms in addition special receptacles for the zooids. It is absent in *Hydra*. Other elements enter into the composition of the hydrosoma in particular families or genera; such are the *spiral* and *tentacular appendages* of *Hydractinia* and *Podocoryne*, the *snake-like organs* in *Ophiodes* and *Ophionema*, and the *nematophores* of the Plumulariidæ. The whole assemblage of the reproductive elements of the community, with the structures developed in connection with them, is spoken of collectively as the *gonosome;* the cœnosarc, with the polypites and all appendages other than those connected with generation, constitutes the *trophosome*. As in other classes the term "individual" is used to signify the complete product, by growth or gemmation, of a single ovum, whether such product is combined in a "hydrosoma," or consists, wholly or partially, of a number of detached zooids; the want of another suitable word however has led most writers on the Hydroida to speak of the zooids as "individuals."

The *cœnosarc* or common flesh, which gives origin to the zooids and other appendages, and binds them into an organic whole, consists of delicate fleshy tubes, composed of ectoderm and endoderm, like the zooids, with the body-walls of which they are

* The term "polypide" is restricted to the zooids of the Bryozoa, and "polype" to those of the Actinozoa; the older writers however include all these animals, with many others, under the general name of Polypes.

in fact continuous. At the base of each zooid there is a small aperture, by which the nutrient matter finds access to the interior of the cœnosarcal tube, and thence circulates throughout the entire organism, conveying pabulum to those parts of the hydrosoma which are unable to seek it for themselves. The circulation, which is alternately from the polypites to the cœnosarc and back again, is regulated by the motion of vibratile cilia which line the endoderm of the cœnosarc.

Mr. Hincks aptly compares the hydrosoma to a tree, of which the cœnosarc constitutes the roots, trunk, and branches, while the polypites represent the leaves, and the reproductive buds the flowers, the similarity consisting not merely in appearance, but to a great extent in function also; and this is further exemplified by the fact that all the polypites and other appendages may fall off, leaving only the cœnosarc, from which a new growth of zooids is produced. This occurs in *Tubularia*, and from one to two days is often sufficient for the formation of a new polypite in place of that which has fallen off, though it appears that sometimes the zooids may be absent for several months of the year. The polypites, instead of falling off, are sometimes absorbed by the cœnosarc.

The essential part of the cœnosarc is the *hydrorhiza*, which serves as an organ of attachment in all the fixed members of the order, and which either bears the zooids immediately or gives rise to the *hydrocaulus*, or erect, often branching stem, which, in its turn, supports the zooids. The hydrorhiza most commonly takes the form of a filiform creeping stolon, invested by the perisarc, usually anastomosing and forming a network, and firmly attached to some foreign substance; but in a few instances its thread-like tubes are merely anchored in the soft mud or sand. In other cases, especially among the smaller species, it overruns the fronds of marine plants with a network of delicate flat stolons, which scarcely seem to rise above the surface of the plant to which they are attached, and from which it is impossible to separate them, except by the use of some agent capable of

disintegrating the vegetable matter. There is often a series of small loop-like inversions of the perisarc situated at nearly equal distances along each margin. In *Plumularia compressa* and *P. australis* the hydrorhiza is of this type and is very wide, forming a broad ribbon-like expansion. When erect stems are given off, the creeping fibres usually radiate from the base, so as to afford the maximum of security against detachment. The investing tubes of the hydrorhiza are sometimes so matted together as to form a continuous crust, and in *Hydractinia* these tubes are incomplete, their upper wall being composed of a chitinous network, which permits the soft cœnosarcal matter contained within them to communicate freely with a naked external layer of the same substance which covers the surface of the polypary.*

The *hydrocaulus*, or erect portion of the cœnosarc, may be absent or represented only by the slender pedicles which spring from the hydrorhiza and support the polypites; more often, however, it consists of a principal stem, usually more or less branched.† In a great many cases the ultimate ramules are arranged pinnately on the stem and branches; in a few instances they are in whorls or irregularly disposed, and in some species, such as *Sertularia operculata*, the ramification is regularly dichotomous, and there is no distinction between stem and branches. When the stem consists of a simple tube it is said to be *monosiphonic;* frequently however several cœnosarcal tubes, each with its perisarc, combine to form a *polysiphonic* or *fascicled* stem. This condition is of common occurrence among the Plumulariidæ. If a polypidom of *Aglaophenia divaricata* be examined it will be found that two or three additional tubes have grown up in contact with the original simple stem, thickening and strengthening it, and by following up these tubes for some distance they may be seen to terminate one by one at various points, the termination being abrupt and open, where no

* See *Hydractiniidæ*.

† Some writers have used the term "hydrocaulus" to signify the *main stem* only, but it refers properly to the whole of the cœnosarc except the hydrorhiza.

doubt the upward growth has been arrested by the death of the organism. In many species the structure is more complex, the tubes being more numerous and completely surrounding the original simple stem, except in front; but even in such species the terminal portions of the branches are often simple, while the ultimate ramules which bear the polypites never partake of the polysiphonic character. In *Aglaophenia Huxleyi* the hydrocaulus is composed of many closely compacted tubes, each of which has in its thickened perisarc a series of small oval or flask-shaped cavities, opening laterally by a minute circular foramen at the summit. I am not aware what purpose these cells serve, or whether during life they contain any special organs.

Sometimes, as in *Thuiaria lata*, the stem is so thickly fascicled by the growth of a number of stolonic tubes that the lower part is completely enveloped by them, and thus forms a thick, woody, fibrous trunk.*

The hydrocaulus is often produced upwards beyond the polypiferous portion into long tendrils, which sometimes have the peculiar structure of the hydrorhiza; in some cases which I have met with these prolongations give rise to new stems, but this is probably abnormal.

The portion of the perisarc or polypidom which invests the cœnosarc is sometimes continuous throughout, but more frequently that of the stem and branches is jointed at intervals more or less regular (at least among the Calyptoblastea), the Plumulariidæ in particular having seldom more than one polypite on an internode. The joints are often elongated and oblique, with the perisarc thinner and more flexible than in other parts of the polypary, thus imparting to the whole hydrosoma an amount of elasticity which must be most useful in enabling it to bear the shock of the waves without injury. A very conspicuous joint of this kind occurs at the base of each of the primary pinnæ of *Aglaophenia longicornis*, and in some of the smaller species of the same genus one or two

* In the Bryozoa exactly similar tubular filaments originate from the polypides and grow downwards, surrounding the lower cells and forming a fascicled stem.

such joints are found near the base of the stem. The internodes which bear the polypites in *Aglaophenia* and its allies are often furnished with one or more internal transverse thickenings of the perisarc, forming partial septa. The supplementary tubes which assist in forming the polysiphonic stem are commonly unjointed.

The *polypites* or *hydranths*, the nutritive zooids, are formed on the same general plan as the *Hydra*, but vary in outward form and in the character and arrangement of the tentacles, which are often much more numerous than those of *Hydra*. The mouth, which is simple or lobed, "is commonly borne on the summit of a more or less prominent proboscis, which is capable of great elongation or contraction, and is remarkable for its mobility. In some genera the proboscis is conical, in others it is trumpet- or funnel-shaped."* There is sometimes an intermediate layer between the ectoderm and endoderm, which is said by Professor Allman to be muscular. It is among the tentacles that the greatest diversity exists, but this remark applies only to the Gymnoblastea, those of the Calyptoblastea being always filiform and arranged in a single circle round the mouth of the hydranth. Among the Gymnoblastea they may be either filiform or capitate, and sometimes both forms co-exist. In some genera they are scattered over the general surface of the polypite; in others they form two or more circlets, sometimes closely approximate, sometimes widely separated, as for example in *Tubularia*, where there is a circle of long filiform tentacles springing from the base of the polypite, and a second series of very short ones surrounding the oral aperture. In the singular *Lar sabellarum* of Gosse there are two tentacles only, situated at the sides of a bilabiate head-like proboscis, which is separated from the body of the polypite by a constriction resembling a neck.†

* Hincks.

† Gosse, Trans. Lin. Soc., vol. xxii; Hincks, An. & Mag. Nat. Hist., Nov., 1872. This hydroid is described by Gosse and Hincks as bearing "a most ludicrously close resemblance to the human figure," which is heightened by their "incessantly bowing and tossing about their arms in the most energetic manner."

The tentacles are thickly beset with *nematocysts* or *thread-cells*,* and those which are capitate have the terminal bulb made up of an aggregation of them. "The thread-cells, which bear so important a part in the Hydroid economy, exhibit many modifications. They occur in the ectodermal layer, and are present in astonishing profusion, not only on the tentacles but in other portions of the structure. They consist of minute sacs imbedded in the flesh and filled with fluid, which contain a long and delicate thread, capable of being projected with considerable force and inconceivable rapidity. These threads bury themselves in any soft substance against which they may be directed, and, it is supposed, convey into the wound which they make some poisonous fluid.

"The thread-cell is a most interesting piece of structure. The long dart which it encloses is borne on a continuation of the inner wall of the sac (the 'sheath' of some writers, the 'axial body' of others), which is often covered with barbs. When retracted, the thread is spirally coiled within the cell and sometimes wound round the sheath. Two kinds of thread-cell are often met with in the same species. Besides the formidable instruments with which the tentacles are armed, large bean-shaped cells are sometimes crowded together in immense quantities, as, for example, in the ectoderm of the cœnosarc in *Hydranthea,* and in the outer covering of its gonophore. It is difficult to imagine what relation these can bear to the economy of the animal.

"Besides the thread-cells, the arm of the Hydroid bears another organ, which has been named by Dr. Wright the *palpocil*, and which is connected, no doubt, with the sense of touch. It consists of a long and delicate spine, springing from a small bulb, which is buried in the ectoderm. These palpocils or sensitive hairs are scattered over the tentacles in many species, and over other portions of the body, and must aid the capture of prey by giving instant notice of the presence of any animalcule

* Called also *cnidæ*. These organs are found also in some Annelides, and in some of the nudibranchiate Molluscs.

or other small creature that may brush against them. It may be their function to rouse the thread-cells into action.

"Besides the ordinary tentacles, peculiar appendages occur in two genera, *Cladonema* and *Stauridium*, which I have named *false tentacles*, and which seem to discharge the function of tactile organs. They are filiform processes, standing out in a single series, near the base of the body, at some distance below the arms, and at first sight might be taken for tentacles deprived of their capitate extremities. They are, however, perfectly rigid, and the tips at least are thickly covered with the sensitive palpocils. It seems to be their office to warn the polypite of the presence of prey, for if one of them is touched by an animalcule in its course the body is immediately bent towards it and the tentacles are brought into play."*

In some rare cases the tentacles are united towards the base by a delicate web or calyx, which represents, in a rudimentary form, the "umbrella" or swimming-bell of the medusiform gonozooid.

The size of the polypites varies greatly. They are usually very small in the Calyptoblastea, but in the Gymnoblastic suborder several reach a length of from one-fourth to half an inch, and *Clava squamata* sometimes attains an inch in height. These, however, are but pigmies compared with a Hydroid which was brought up in the deep-sea dredgings of the "Challenger," a single polypite of which measured 7 inches in diameter!

Among the Calyptoblastea the polypites are provided with special chitinous cells, called *hydrothecæ* or *calycles*, into which they can usually retire completely for protection; and authors generally have divided the group into two sub-sections—the Campanulariadæ and Sertulariadæ—according to the form and arrangement of these receptacles. In the Campanulariadæ they are usually more or less campanulate or bell-shaped, with a plain or crenulate margin, and are *pedunculate;* while in the Sertulariadæ they are very varied in form, and *sessile*, with the

* Hincks, Brit. Hyd. Zooph.

basal part inserted in the stem or branch. The passage between the hydrotheca and the cavity of the hydrocaulus varies from a mere thread-like tube, as in some Campanularians, to an opening the full width of the hydrotheca. In some species of *Halicornaria* the margin of this aperture is cut into small pointed denticles. The oral aperture may be plain, or, as more commonly happens, toothed, lobed, or crenate; and in a great number of species is furnished with an *operculum*. This appendage is most conspicuous in some of the Campanularians, where it consists of a prominent conical crown, the converging segments of which open out to allow of the egress of the polypite, closing together again on its withdrawal. The common species of *Sertularella* have an operculum of three pieces, one of which originates from each of the three sides of the orifice; and in some other genera there is a sort of valve, which may be attached either at the margin of the aperture or some distance within it. Sometimes, especially in *Sertularella*, there are one or more internal teeth or small tubercles, situated just within the margin.

The *intrathecal ridge* is a partial septum, projecting into the cavity of the hydrotheca, and when most fully developed (as in *Aglaophenia phœnicea*) almost dividing it into two loculi. It occurs where the hydrotheca is reflexed or doubled upon itself, so that the chitinous wall is bent inward on the upper or lower side; if the flexure be very abrupt the contiguous portions of the wall come into contact and become completely united, forming the intrathecal ridge. In many cases it is quite rudimentary, consisting merely of a slight constriction of the calycle, and in such species as *Aglaophenia plumosa* such a constriction occurs on the side next the pinna near the base of the calycle, while there is a more fully-developed ridge on the upper side, nearer to the aperture.

The intrathecal ridge is a characteristic feature of the Aglaophenian section of the Plumulariidæ, though some species are without it; it is also present in some *Plumulariæ*, and a good instance of its occurrence in *Sertularia* is presented by *S. crenata*.

In *Hydractinia* and *Podocoryne* occur the *spiral* and *tentacular appendages*, the first of which are "long filamentary organs, spirally coiled while at rest, with clusters of thread cells round the free extremity;" and the latter, according to Mr. Hincks, "slender, very extensile tentacula distributed singly on the outskirts of the colony." The spiral appendages (which are probably defensive organs) are situated near the margin of the hydrorhizal expansion, and when anything irritates the cœnosarc they instantly and simultaneously uncoil and twist about in a most energetic manner.

Somewhat analagous to the spiral appendages are the *snake-like organs* which are found in *Ophiodes* and *Ophionema*. "One of them is always stationed close to the polypite, and great numbers are distributed upon the creeping stolon. They are vigorous in their movements, capable of enormous elongation, and surmounted by a large capitulum, thickly covered with thread-cells. They may act not only as organs of defence but also as auxiliaries in the capture of food."

Professor Allman regards the tentacular appendages of *Hydractinia* as abnormal zooids, and M. Mereschkowsky holds the opinion that not only are all appendages of this kind to be similarly regarded, but that the polypites themselves are colonies formed by the union of a single alimentary zooid (the body) with several other zooids (the tentacles), whose sole duty is to provide food for the community.* This view is supported by analogy with the allied order of the Siphonophora, and, it may be added, of the Hydroid corals.

Among the most interesting and remarkable members of the Hydroid colony are the *nematophores* or *sarcothecæ*, which are characteristic of the family Plumulariidæ, and occur in all the members of it. They consist of small chitinous receptacles springing from the periderm of the cœnosarc, and containing an extensile process derived from the ectoderm, and in communication with it by a small aperture at the base. The sarcode of

* An. & Mag. Nat. Hist., March and April, 1878.

these organs is usually well supplied with thread-cells, hence the name *nematophores*, bestowed on them by Mr. Busk; Mr. Hincks, however, considering that the presence of the thread-cells is not the primary characteristic, and is perhaps not universal, has substituted the term *sarcotheca* for the chitinous cell, and *sarcostyle* for the contained sarcode-mass.* The sarcothecæ of *Plumularia* and *Antennularia*, and of their immediate allies, are very commonly more or less wine-glass-shaped, and in most cases are *bithalamic*, or divided into two loculi by an incomplete transverse septum; some, however, are without any division (*monothalamic*). In all the species which I have observed they are *canaliculate*, or with the margin of the cup more or less sinuated on one side; sometimes the sinuation is very slight, in other cases it consists of a deep notch, and in the second pair of laterals of *P. aglaophenoides* the terminal cup is represented only by a small remnant of one side. There is a median sarcotheca just below each calycle, and in most species a number of others distributed around the calycle, and along the stem, branches, and pinnules, in regular and definite order, varying with the species. The lateral or *supracalycine* sarcothecæ, those which in many species are placed at the sides of the calycle, are often *pedunculate*, or mounted on processes of the cœnosarc which embrace the calycle on each side for part of its height. The median sarcothecæ are often curved forward, thicker at the base than the others, so that they are rigidly fixed, and quite open on the inner side.

In *Aglaophenia* and the other genera which possess a similar trophosome the form and arrangement of the sarcothecæ are very distinctive. They are not only arranged in definite order round the calycles, but are attached to them, though having their origin in the hydrocaulus. They are usually monothalamic,† very variable

* In Kirchenpauer's papers the nematophores of *Plumularia* and *Antennularia*, and the median ones in *Aglaophenia*, are called *nematothecæ*; those which are attached to the sides of the calycle in the latter genus are termed *nematocalyces*.

† According to Mr. Busk, the terminal part of the mesial sarcotheca in *A. Macgillivrayii* forms a cup distinct from the lower part, and it appears to be the same with the other two or three members of the same section, judging from Kirchenpauer's figures.

in form, but generally more or less tubular, and often very long, the anterior one being sometimes two or three times the length of the calycle. There is usually one in front and one at each side of the calycle, and two or more on each intermode of the stem, but none on the ultimate ramules (except those connected with the hydrothecæ). In *Halicornopsis* there is only one sarcotheca to each calycle, the laterals being absent. Kirchenpauer has noted the presence of two apertures in the median sarcothecæ of *Aglaophenia*, but supposed them to be confined to a single section of the genus. It will be found, however, that in the great majority of species there are either two distinct external apertures or a single one, which is canaliculate, and the form of which clearly shows that it is the result of the union of a terminal with an external lateral aperture. So far as my observation of the genus extends I find that when the median sarcotheca is of considerable length the terminal aperture is distinct from the lateral one, which is immediately above the point at which the sarcotheca stands off from the calycle.* When the sarcotheca is much shortened the two apertures are of course brought together, and unite to form the canaliculate sarcotheca, as in *A. parvula*, *A. pluma*, &c.; and in those cases where the sarcotheca is truncated close down to the calycle (as in *A. myriophyllum*) there is necessarily only a simple orifice. It will also be found that the lateral sarcothecæ are similar in this respect to the median one, though owing to their lateral apertures being on the inner side they are often inconspicuous, and have escaped observation in consequence. In one section of *Halicornaria* the lateral sarcothecæ have two orifices, besides the lateral one, all of which may be either distinct or united, both conditions often occurring in the same species.†

The contents of the sarcothecæ consist generally, if not universally, of two distinct lobes, one (the superior) bearing a cluster of thread cells, the other consisting of a soft extensile process, rounded when at rest, but capable of great elongation and

* In *A. Huxleyi*, however, the mesial sarcotheca, though of considerable length, is canaliculate in front.

† *Vide Aglaophenia.*

division, resembling to a great extent the pseudopodia of a Rhizopod. "The protoplasmic processes, which are emitted by the inferior lobe, have been well described by Allman. They are very mutable, and exhibit frequent changes of form, often attaining a great length. Sometimes they are cylindrical and slender, stretching along the stems and branches, to which they are closely appressed, and along which they glide slowly, almost imperceptibly, in *Amœba*-like fashion. Sometimes they appear clavate at the extremity, sometimes they swell out at intervals into bulbous dilatations. Occasionally they may be seen to reach across to a neighbouring branch, and fix the extremity upon that, and rarely they give off two branches at the top, which move in opposite directions. I have observed them in a state of great activity, as I have mentioned elsewhere, on a young specimen of *Plumularia frutescens*, which they completely invested 'with a multitude of gossamer-like threads.' These extraordinary prolongations of the granular mass in the nematophore can be entirely withdrawn.

"The action of the thread cells on the superior lobe is much more rarely witnessed. Meneghini seems to have noticed it, but without comprehending its true nature. On a specimen of *Aglaophenia pluma* I have seen the contents of the nematocysts discharged, and the long delicate threads streaming upwards from the extremity of the lateral nematophores. These fine extensile lines were cast out to enormous distances, intertwining and waving about in the water. Three or four were usually emitted from each cluster of thread cells, and, in some cases, I noticed that the cyst itself was raised to some height above the nematophore, and borne on a slender pedicle. At times a tuft of the threads might be seen slowly contracting, and I have observed one dragging down with it a mass of stuff which it had collected."*

In the bilobed condition of the sarcostyle we have the key to the double-apertured or canaliculate structure of the sarcotheca, the terminal aperture giving egress to the superior lobe, while

* Hincks, An. & Mag. Nat. Hist., November, 1872.

the extensile process emerges from the lateral orifice or the sinuated margin, as the case may be. Mr. Hincks says that in *A. pluma*, where the cavity of the mesial sarcotheca communicates with that of the calycle by an internal aperture, the extensile process only rises as high as this aperture and finds its way out through the calycle, while in species which have two external apertures it emerges directly into the surrounding water from the lateral one. The equivalent of the external lateral orifice is, however, in such species as *A. pluma*, not the opening into the calycle, but the canal-like aperture in the front of the sarcotheca; the internal opening is distinctly superadded, and is found in all the Australian species which I have seen, except one, most of these species having in addition two distinct external apertures. The one species in which I have failed to find any passage between the sarcotheca and the calycle is *A. delicatula*, Busk, which is closely allied to *A. pluma* in most respects, including the canaliculate form of the median sarcotheca. In *A. phœnicea* the internal passage is very minute. Where the three apertures exist the terminal one is, as usual, devoted to the superior lobe, but I am not aware of the respective functions of the other two, though it is most probable that they both serve for the emission of the extensile filaments.

The function of the nematophores is still uncertain. It has been generally assumed that they act as defensive organs, and perhaps as scavengers, cleansing the surface of the polypary from extraneous matter; while Mr. Hincks suggests that they may serve the purpose of alimentation, the extensile filaments surrounding and appropriating minute organic particles, in the same fashion as the very similar pseudopodia of the Rhizopods.

Professor Allman considers that the Graptolites were probably Hydroida in which the calycles were totally suppressed, while the nematophores were developed in great numbers, so that the function of nutrition was entirely supplied by the Rhizopod-like prolongations of the sarcostyle. In Allman's classification the Graptolites form the sub-order RHABDOPHORA.

In the singular genus *Ophionema* the sarcotheca does not contain the ordinary bilobed sarcostyle, but a long capitate filament, similar to the snake-like organs of *Ophiodes*.

Two genera of Campanularians—*Lafoëina* and *Oplorhiza*—possess urticating organs which appear to be closely allied to the nematophores of the Plumulariidæ. Professor Allman says:—"These appendages in Lafoëina are long, filiform, and flexuous, while in Oplorhiza they are short and cup-shaped. In both genera they remind us strongly of the nematophores of the Plumulariidæ. Like these, they consist of chitinous receptacles with fleshy contents which are probably of a simply sarcodic nature, and in which thread-cells are immersed. In the species on which the genus Oplorhiza is founded, these contents extend through the proximal part of the appendage in the form of a cylindrical column, which towards the summit becomes enlarged into a bulb in which numerous very long curved thread-cells are imbedded. A very similar condition exists in *Lafoëina tenuis*.

"Lafoëina and Oplorhiza afford the only known instances in which organs resembling true nematophores occur outside of the family of the Plumulariidæ."*

On the hydrorhiza of *Lineolaria spinulosa* I find a number of minute simple tubular processes, which may possibly be of a nature analogous to the organs just described. A few precisely similar bodies are found on the gonothecæ of the simple variety of *Plumularia filicaulis*, which are decumbent and adnate to the plant to which the zoophyte is attached. In neither case, however, have living specimens been observed, and it is consequently impossible to decide what the functions of these minute organs may be.

Reproduction.

The most remarkable and interesting part of the life-history of the Hydroida is that which relates to reproduction. In many families the *gonozooids*, or generative buds, become detached

* Report on the Hydroida of the Gulf Stream, Mem. Mus. C.Z., Cambridge.

from the parent organism and lead an independent life, generally assuming a form singularly unlike that of the ordinary polypite; they are, in fact, small *medusæ*, or *jelly-fish*, and as such many of them were known and described long before their origin was suspected. These free-swimming gonozooids, or *planoblasts*, consist of two principal parts—the *gonocalyx* and the *manubrium*. The first of these, called also the *umbrella* or *swimming-bell*, is a more or less convex hyaline dome, or inverted cup, often hemispherical, by the pulsations of which the creature moves through the water; the second is a modified polypite, which depends from the apex of the umbrella like the tongue of a bell. Several *radial canals* (generally four) start from the central point of the swimming-bell and proceed directly to its margin, where they are united by a *circular canal*, and beyond which they are continued as free tentacles to a greater or less length. The whole of the canals are spoken of, collectively, as the *gonocalycine* canal system. Between them the substance of the umbrella is a delicate, filmy, transparent web, and it usually forms a horizontal expansion, extending some distance inward from the margin, like a circular shelf. This expansion is the *velum*, or *veil*. Besides the tentacles which are continuous with the radial canals, there are often others—the *interradial tentacles*—which have their origin in the circular canal.

The margin of the umbrella often gives rise to two kinds of bodies, which are in all probability rudimentary sense-organs. These are known as the *lithocysts* and *ocelli;* the first are situated between the tentacles, and consist of minute sacs containing one or more refractive spherules of lime; and the ocelli are coloured pigment spots, sometimes containing lens-like bodies, and seated on the bases of the tentacles. The latter bodies probably act as rudimentary organs of sight.

The manubrium is furnished at the distal extremity with a mouth, and sometimes with a circlet of short oral tentacles like those of *Tubularia*. The generative elements are in many cases developed between its ectoderm and entoderm; in other instances

they occupy special sacs, which are borne on the radial canals. It is probable that the planoblast perishes soon after the sexual products are matured and set free, but during its existence it may give rise, by gemmation, to a number of zooids similar to itself, vegetative growth being no less active in it than in the stationary polypite.

Though so dissimilar in its general aspect to the hydranth, a close study of the medusan planoblast reveals the fact that the latter is merely a modification of it, and that, with the exception of the marginal canal, each portion has its homologue in the structure of the nutritive zooid. The manubrium is merely the proboscis or distal portion of the polypite (the proximal part being probably represented by the peduncle, by which the gonozooid is originally attached); the radial canals correspond with the tentacles; and the umbrella is simply an extension of the intertentacular web or calyx, which in a few species unites the tentacles of the polypite for some distance from their base. Nor are intermediate forms wanting: the free gonozooids of *Clavatella* and *Eleutheria*, which walk about by means of the tentacles, or of suctorial discs developed from them, and which are not provided with a swimming-bell, exhibiting very distinctly their close relationship both to the perfect medusan zooid and the ordinary polypite.

The free-swimming medusa represents the highest development of the Hydroid reproductive zooid, and by obtaining a distinct idea of its organization we are better enabled to comprehend the true nature of the various less-specialized forms. As before stated, the generative zooid, whether fixed or free, is called the *gonozooid;* it is usually, however, enclosed in a protective covering or *ectotheca*, and the entire reproductive bud, consisting of the gonozooid and the ectotheca, is known as the *gonophore*. It may originate from the cœnosarc, from an ordinary polypite, or from a polypite specially modified; the modification in some cases is slight, consisting simply of a reduction in the number of the tentacles; or the tentacles may be represented

only by clusters of thread-cells; or, again, the polypite may be completely atrophied, forming a simple styliform process on which the gonophores are borne. In the Calyptoblastea the latter arrangement is general—the supporting process, which is termed the *blastostyle* or *gonoblastidion*, bearing the gonophores on its sides, those nearest the summit first attaining maturity. In this sub-order the blastostyle, with the gonophores which spring from it, is contained in a chitinous urn or capsule, called the *gonotheca* or *gonangium*. When partially developed the ova are, in some cases, transferred to a second receptacle—the *acrocyst* or *marsupium*,—which is situated on the summit of the gonotheca, and where they undergo further development before their final liberation.

The simplest form of reproduction (if we except that of *Hydra*, in which the ova and spermatozoa are developed between the body-layers of the nutritive zooid) is by fixed *sporosacs*, or closed processes, with a central column containing a prolongation of the cœnosarcal canal, called the *spadix*, around which the generative elements are developed. The sporosacs remain attached, except in *Dicoryne*, in which genus they become free, and swim about by means of cilia. The entire sporosac corresponds to the manubrium of the medusa, the body-cavity of which is represented by the interior of the spadix.

The *disguised medusoid* differs from the sporosac in the possession of an external sac, which represents the umbrella, but is completely closed, and in the wall of which are rudimentary radial canals.

In the *attached medusiform gonophore* a considerable advance in structure is exhibited. The gonocalyx is open at the distal extremity, and has in its walls a complete system of gonocalycine canals. The manubrium, however, is still closed at the distal extremity, and derives its nutriment from the cœnosarcal cavity; the tentacles are represented by four tubercles around the aperture of the gonocalyx (as in *Tubularia*), and the gonophore remains attached to the parent organism.

In the *free medusiform gonophore* the marginal tentacles are developed, and in general the velum; the zooid becomes detached, and swims freely by means of the contractions of the umbrella, and nutrition is provided for by the presence of a mouth at the distal extremity of the manubrium. The medusoid often changes its form considerably after its liberation, and in some cases different stages of the same organism have been described as distinct species or genera, in the absence of a complete knowledge of its life-history.

In some cases medusæ, which appear absolutely identical, may belong to totally different genera, while on the other hand species which seem most closely allied in the structure of the trophosome may differ greatly in the form of the gonozooids.

In some families of the Hydroida, medusiform zooids, similar to those just described, are produced directly from the ovum, the fixed or *Hydra* stage being entirely absent, so that all the zooids of a species have the same medusoid structure. They form the sub-order MONOPSEA, of Allman.

The gonozooid may contain either male or female elements; in some cases both sexes are found on the same hydrosoma, but the reverse is more commonly the case.

The ovum passes in general through a gastrula stage, and develops into a ciliated elongated embryo, called the *planula*, which, after pursuing an active existence for a certain time, alters its form, and attaches itself by the larger end to some foreign body, and gradually develops into a polypite, from which, by regular gemmation, the complete Hydroid colony is produced. The planula form is, however, not invariable; in *Tubularia* for example, the embryos are retained within the rudimentary gonocalyx till they have assumed the polypite form; and in another genus the embryo is amœboid, and without cilia.

The male and female elements may be derived either from the ectoderm or endoderm, according to the species or genus; and in some cases the male elements may arise from the ectoderm, and

the ova from the endoderm. It has also been found that in many Hydroids the sexual cells are formed in the cœnosarc, and subsequently migrate into the gonophores; these are called *Cœnogenous* Hydroids, while those in which the generative zooids are formed before the sexual cells which they contain are termed *Blastogenous*.*

In *Aglaophenia* and its allies a remarkable class of structures is developed in connection with the reproductive part of the hydrosoma, serving the purpose of a kind of protection to the gonothecæ, which are often somewhat delicate in texture. Among these the form called the *corbula* occurs most frequently; it is subject to two principal modifications, according to which it is known as the *closed* or *open* corbula. The latter consists of a pinna, which gives off two series of arched secondary pinnules meeting at the tips, and forming a kind of basket-like receptacle, in which the gonothecæ are produced. These pinnules do not as a rule bear hydrothecæ, but are armed along each side with a series of nematophores; in a few cases, however, each of them bears a hydrotheca at the base. The pinna which supports the corbula usually has a single hydrotheca on its basal part, and sometimes more than one. The closed corbula differs considerably from the open in general appearance, but it is similar in essential structure; the number of pinnules, however, is reduced to four or five pairs, which take the form of broad leaflets, and are united to one another by their adjacent margins, so that they form a closed pod. The fringe of nematophores along one side of each leaflet is suppressed, the other series remaining and marking the line of junction between every two leaflets. In *A. parvula* the corbula is of this type; but in some specimens the leaflets are all separate, and have nematophores along both margins. The closed corbula has often been spoken of as if it were composed of *ribs* or pinnules like those of the open corbula, but united by a chitinous expansion; in reality, however, the expansion is formed by the broadened pinnules themselves, and the so-called

* Weissman, Zoologischer Anzeiger, Vol. III (1880).

ribs or *costæ* are merely the rows of nematophores which indicate the lines of union. The nematophoros of the closed corbula are usually much smaller than those of the open one.

Many modifications of detail occur in both kinds of corbula, and the gonosome is often provided with protective structures which do not unite to form a corbula. In some cases pinnules similar to those which compose the open corbula are scattered at more or less regular intervals along the stem, each bearing a gonotheca, and taking the place of an ordinary pinna.* In other genera the gonothecæ are protected by simple or branched filaments, which in some instances spring from the ordinary pinnæ, and in others from the stem; but in all cases are richly provided with nematophores. The branched filaments, springing from the bases of the pinnæ, are the *phylactogonia* of Allman.

Distribution of the Australian Hydroida.

Our knowledge of the hydroid fauna of Australia is confined almost entirely to the species inhabiting the eastern part of the Continent, from the Gulf of Carpentaria on the north to the shores of South Australia on the south, and inclusive of Tasmania. Within these limits two distinct areas of distribution are included, namely, the north-east and the south-east, which differ almost entirely in the species proper to them; though, as might be expected, the two faunas mingle to some extent on the northern part of the coast of New South Wales. Out of ten species obtained from or near Port Stephens six are found also in Bass' Straits, while two are found further north, and the other two have not, so far, occurred in any other locality. I know of only two species which have been found in both the northern and southern regions, one of these, *Idia pristis*, which is common along the north-eastern coast, having been found, in a single instance, by

* These pinnules, whether scattered along the stem or combined to form an open corbula, are the *nematocladia* of Kirchenpauer, and the branches supporting them are the *gonocladia* of the same author.

Mr. Haswell at Griffiths' Point, while the other—*Plumularia campanula*, a southern species—has been met with at Holborn Island. So far as is known no other hydroid indigenous to the north-eastern region has been met with beyond its limits, except *Pasythea quadridentata* (which has been found near Ascension), and two or three species which occur further north, namely, *Plumularia effusa* and *P. badia* at Singapore, *P. effusa* and *Aglaophenia Macgillivrayi* in the Phillipines, and *A. urens* at Batang and in Java. Probably, however, it will be found that with regard to Hydroid distribution the islands and seas for some distance north of the Continent must be included in the same province. There appear to be no genera yet known as peculiar to this region. *Idia* has hitherto been considered so; but *I. pristis* has, as already stated, been found on the southern coast, while an Indian Hydroid, described by Dr. Armstrong as *Thimaria compressa** is undoubtedly a second species of the same genus.

The South-eastern province, while possessing many species peculiar to itself, has also a number which are common to other localities. The following list includes such as are known :—

Obelia geniculata, Lin. Great Britain, Labrador, Massachusetts, North Cape, New Zealand.

Lafoëa fruticosa, Sars. Great Britain, North Cape, Iceland, &c.

Sertularia operculata, Lin. Europe, Africa, America, New Zealand.

Sertularia elongata, Lamx. New Zealand.

Sertularia minima, D'A. W. Thompson. New Zealand.

Sertularia bispinosa, Gray. New Zealand.

Sertularia trispinosa, Coughtrey. New Zealand.

Sertularia unguiculata, Busk. New Zealand.

Diphasia pinnata, Pallas. N. Zealand, Europe, S. Africa.

Diphasia attenuata, Hincks. England.

* Journal of the Asiatic Society of Bengal, 1879.

Sertularella divaricata, Busk. Magellan's Sts., Patagonia.
Sertularella polyzonias, Lin. New Zealand, Europe, America.
Sertularella Johnstoni, Gray. New Zealand.
Idia pristis, Lamx. North-eastern Coast of Australia.
Plumularia obliqua, Saunders. England.
Plumularia campanula, Busk. Holborn Island.
Plumularia filicaulis, Poeppig. Chili.

It is obvious, from the foregoing list, that the Hydroida of the South-eastern province have more affinity with those of New Zealand than with those of any other part of the globe. Several species, which are stated to have been found in Australia as well as in other parts of the world, have not been mentioned, as the part of Australia from which they were obtained has not been recorded. Such are *Aglaophenia formosa*, Busk, from Australia, New Zealand, and South Africa; *Antennularia cymodocea*, Busk, from South Africa and Australia; *Aglaophenia pluma*, Lamx., from Australia, Europe, and South Africa; *Aglaophenia glutinosa*, Lamx., from India and Australia; and *A. flexuosa*, Lx., from Australia, South Africa, and the Indian Ocean. The last two are doubtful species, and I think it is also doubtful whether the true *A. pluma* is found in Australia.

Four distinct genera are peculiar to the south-east of Australia, namely, *Lineolaria*, with two species, and *Halicornopsis*, *Eucopella*, and *Ceratella* with one each. The section of the genus *Plumularia*, in which only one hydrotheca is borne on each pinna, is also characteristic of the same region. Six species are known, all of which have been found in Victoria, and of these one only has been found elsewhere than in southern Australia, namely, *P. obliqua*, which occurs in England and Tasmania.

Many of the Australian species of *Aglaophenia* and *Halicornaria* are remarkable for the possession of median nematophores of great length, such as appear to be rare in other parts of the world.

The following table will show approximately the distribution of the species among the various genera, a number of doubtful species being omitted.

Genus.	N.E. only.	S.E. only.	Common to both.	Locality unknown.	Total.
Eudendrium	.....	1	.....	.....	1
Pennaria	.....	1	.....	.....	1
Tubularia	.....	1	.....	1	2
Tibiana	.....	.....	.....	1	1
Ceratella	.....	1	.....	.....	1
Dehitella	.....	.....	.....	1	1
Campanularia	3	3	.....	4	11*
Obelia	.....	1	.....	.....	1
Eucopella	.....	1	.....	.....	1
Lafoëa	.....	1	.....	.....	1
Lineolaria	.....	2	.....	.....	2
Sertularia	3	26	.....	2	31
Diphasia	2	3	.....	.....	5
Pasythea	2	.....	.....	.....	2
Sertularella	.....	9	.....	.....	9
Thuiaria	2	1	.....	.....	3
Idia	.....	.....	1	.....	1
Aglaophenia	11	6	.....	3	20
Halicornaria	2	8	.....	.....	10
Halicornopsis	.....	1	.....	.....	1
Plumularia	4	13	1	.....	18
Antennularia	1	.....	.....	.....	1
Hydra	.....	1	.....	.....	1

*1 from Lewin's Land.

Literature.

The literature of the Australian Hydroida may be said to commence with Lamouroux and Lamarck, though a few of our species are identical with European ones which had been described by still earlier writers. The two authors just mentioned described a number of Hydroids from Australia, but unfortunately, owing to the general meagreness of their descriptions, and the absence in most cases of figures, their species are in many instances unrecognizable. In a few cases however some peculiarity of structure enables us to determine them readily, for example in *Sertularia elongata* and *Idia pristis*, of Lamouroux.

Some more recent writers however (especially Kirchenpauer), have identified various species with those of the two authors named above, though the descriptions are often totally insufficient, and might apply equally well to other species; in such cases I have accepted the earliest identification, except where there appeared to be sufficient reason to the contrary. Busk and Kirchenpauer have identified two different species with *Dynamena divergens*, Lamouroux: I have adopted Busk's as the earlier of the two, and also as approaching nearer to the original description than the other, though I doubt whether either of them is really the same as Lamouroux' species.

A very important collection of Australian Hydroids was obtained during the voyage of H.M.S. "Rattlesnake," and described by Mr. Busk in an appendix to the first volume of the account of the voyage, published in 1852. Thirty-one species were obtained, of which all but six were described as new; Mr. Busk had little doubt however that some had been previously described by Lamouroux or Lamarck, but not sufficiently for identification. This collection included species both from the north and south of the Continent. Unfortunately, no figures were published; the descriptions however as a rule are sufficiently detailed to enable the species to be recognised without much uncertainty. By the kindness of Mr. Busk I am enabled to copy his drawings of several of the species which have not come under my own observation.

In 1861 Mr. Hincks published in the Annals and Magazine of Natural History a short paper describing and figuring two remarkable Hydroids from Port Philip (*Lineolaria spinulosa* and *Campanularia tincta*).

In 1864 Dr. Kirchenpauer published a paper on the genus *Dynamena* of Lamouroux, with descriptions and figures of a number of new species, including several from various parts of Australia.

The proceedings of the Zoological Society for 1868, contained a paper by Dr. Gray in which were described and figured two

supposed sponges, one from New South Wales, the other probably from some other part of Australia, but Mr. H. R. Carter has pointed out in the Annals and Magazine of Natural History for January, 1873, that these organisms really belong to the Hydroid-family Hydractiniidæ.

In 1872 and 1876 appeared the two parts of Kirchenpauer's memoir on the Plumularidæ, with descriptions and figures of many new species, including a number from the north, east, and south of Australia.

Mr. D'Arcy W. Thompson published in the Annals and Magazine of Natural History for February, 1879, a paper on New and Rare Hydroids from Australia and New Zealand, in which several new species are described and figured.

The Journal of the Microscopical Society of Victoria for 1882, contained a paper by me on the Hydroida of South-eastern Australia, with descriptions and figures of about twenty-six new species, and a list of those already known.

The above are the principal works in which Australian species are described; several species, however, which were first met with in other parts of the world, are described in Dieffenbach's New Zealand, Hutton and Coughtrey's papers in the transactions of the New Zealand Institute, the British Hydroid literature, &c. A list is appended of the principal works which have been quoted or alluded to in the text of the present work:—

ELLIS.—Essay towards a Natural History of the Corallines found on the coast of Great Britain and Ireland. London, 1755.

ELLIS AND SOLANDER.—The Natural History of many curious and uncommon Zoophytes. London, 1786.

TREMBLEY.—Mémoires pour servir à l'histoire d'un genre de Polypes d'eau douce, à bras en forme de cornes. Leyden, 1744.

BAKER.—An attempt towards a Natural History of the Polype. London, 1743.

ESPER.—Die Pflanzenthiere, &c. Nuremburg, 1791.

PALLAS.—Elenchus Zoophytorum. Haag, 1766.

PERON ET LESUEUR.—Voyage de découvertes aux Terres Australes pendant les années 1800–1804. Paris, 1807.

QUOY ET GAIMARD.—L. de Freycinet; Voyage autour du Monde, executé sur l'Uranie et la Physique pendant les années 1817–1820. Zoologie par Quoy et Gaimard. Paris, 1824.

SAVIGNY.—Description de l'Egypte. Histoire naturelle; Polypes par Savigny. Explication des planches par Andouin. Paris, 1821–1829.

LAMOUROUX.—Bulletin Philomatique. Paris, 1812.

——— Histoire des Polypiers Coralligènes flexibles. Caen, 1816.

——— Exposition Méthodique des genres de l'ordre des Polypiers. Paris, 1821. (Including the plates of Ellis and Solander's "Zoophytes," with others.)

———, BORY DE ST. VINCENT, ET E. DESLONGCHAMPS.—Dictionnaire des Zoophytes, forming part of the Encyclopédie Méthodique. Paris, 1824.

LAMARCK.—Histoire Naturelle des Animaux sans Vertèbres. 3rd Edit. Brussels, 1837.

BLAINVILLE.—Manuel d'Actinologie. Paris, 1834–1837.

EHRENBERG.—Die Corallenthiere des rothen Meeres. Berlin, 1834.

LISTER.—Philosophical Transactions for 1834.

SCHWEIGGER.—Beobachtungen auf Naturhischen Reisen.

FLEMING.—Natural History of British Animals.

FORBES.—Monograph of the British Naked-eyed Medusæ. Ray Society, 1848.

D'ORBIGNY.—Voyage dans l'Amérique meridionale. Zoophytes. Paris and Strasbourg, 1835–47.

GRAY.—Dieffenbach; Travels in New Zealand, Vol. II. Materials towards a Fauna of New Zealand; additional radiate animals, by J. E. Gray. London, 1843.

BUSK.—On Sertularian Zoophytes of South Africa, in British Association Report. London, 1851.

——— J. Macgillivray; Narrative of the Voyage of H.M.S. "Rattlesnake." London, 1852. Vol. I, Appendix IV. An account of the Polyzoa and Sertularian Zoophytes collected; by G. Busk.

JOHNSTON.—A History of the British Zoophytes. 2nd Edit. London, 1847.

HUXLEY.—The Oceanic Hydrozoa, with a general introduction. Ray Society, 1859.

KRAUSS.—Beiträge zur Kenntniss der Corallineen und Zoophyten der Südsee. Stuttgart, 1837.

CARUS U. GERSTÆCKER.—Handbuch der Zoologie, 1863.

MCCRADY.—Gymnophthalmata of Charleston Harbour. Proc. Elliott Soc. Charleston, 1859.

GREENE.—Manual of the Sub-kingdom Cœlenterata. 1861.

AGASSIZ, L.—Contributions to the Natural History of the United States Acalephæ, Vols. iii & iv. 1860–62.

AGASSIZ, A.—Illustrated Catalogue of North American Acalephæ. Cambridge, U.S., 1865.

KIRCHENPAUER.—Ueber neue Sertulariden, &c. Verhandlung der Kaiserlichen Leopoldino-Carolinischen deutschen Akademie der Naturforscher. 1864.

HINCKS.—On New Australian Hydrozoa. Annals and Magazine of Natural History. April, 1861.

——— A History of the British Hydroid Zoophytes. London, 1868.

ALLMAN.—Monograph of the Gymnoblastic Hydroids. Ray Society 1871-2.

——— New Genera and Species of Hydroida. Journal of the Linnean Society, Zoology. Feb. 1876 (vol. xii).

——— Report on the Hydroida of the Gulf Stream. Memoirs of the Museum of Comparative Zoology, Harvard. Cambridge, U.S., 1877.

HELLER.—Zoophyten und Echinodermen des Adriatischen Meeres. Wien, 1868.

SARS.—Bidrag til Kundskaben om Norges Hydroider. 1873.

HUTTON.—New Zealand Sertularians. Transactions of the New Zealand Institute, vol. v.

GRAY.—Proceedings of the Zoological Society. Nov., 1868 (vol. viii).

CARTER.—New Hydractiniidæ. An. and Mag. Nat. Hist., Jan. 1873; Jan., 1877; Apr., 1878.

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CLASSIFICATION.

The Hydroida are divided by Professor Allman into five sub-orders, of which only the first three come within the scope of the present work.

Sub-order I.—GYMNOBLASTEA.—In this group the hydrosoma is fixed, usually compound, and provided with a polypary which only invests the cœnosarc, or a portion of it, never forming true hydrothecæ or gonothecæ. The gonophores are variable in character, and spring from the cœnosarc, from the polypites, or from gonoblastidia. No Australian species have hitherto been described (except three or four empty polyparies).

Sub-order II.—CALYPTOBLASTEA.—The hydrosoma in the second sub-order is compound and fixed, and the polypary, besides investing the cœnosarc, forms hydrothecæ for the protection of the polypites. The gonophores are borne on gonoblastidia and enclosed in gonothecæ. Nearly all the known Australian recent Hydroida belong to this sub-order.

Sub-order III.—ELEUTHEROBLASTEA.—The hydrosoma is simple and locomotive, with a discoid hydrorhiza, and is destitute of a polypary; the sexual elements are not contained in gonophores, but are developed between the body-walls of the hydranth. *Hydra oligactis* is the only Australian species yet known.

Sub-order IV.—MONOPSEA.—In this group the hydrosoma is free and solitary, consisting of a single polypite furnished with a

swimming-bell with radial and circular canals, and corresponding in all particulars with the medusiform gonophores of some of the attached forms, except that it is developed directly from the ovum instead of being budded off from a fixed stock.* The generative products are developed in processes of the body-wall, or of the radiating canals. Owing to the structural identity of these zooids with the gonozooids of some of the Gymnoblastea and Campanularians it is impossible to determine the position of a new form except by tracing its development. As the zooids of this group are not special reproductive buds the term "gonocalyx" would be inapplicable to the swimming-bell, which is known as the *nectocalyx*, its canals being termed the *nectocalycine canals*. Nothing is known of the Australian species.

Sub-order V.—RHABDOPHORA.—This sub-order consists of the extinct Graptolites, which are characteristic of the Silurian strata, and, with a single doubtful exception, are not found in more recent formations, though some occur in the upper Cambrian rocks. The hydrosoma is compound, and, at least in the great majority of cases, free. There is a chitinous polypary which is generally strengthened by an axial rod. In some cases there is a single series, in others two series, of small cellules, which are usually described as hydrothecæ; but Professor Allman considers that they partake rather of the character of nematophores, and that true hydrothecæ and polypites were absent. In some cases the proximal extremity of the polypary bears a chitinous disc, which is supposed to be homologous with the "pneumatophore" of the Physophoridæ. Many of the Australian graptolites are described and figured in Professor M'Coy's Prodromus of the Palæontology of Victoria.

In Mr. Hincks' classification the Gymnoblastea are divided into twelve, and the Calyptoblastea into nine, families, while in Pro-

* This group is sometimes ranked as an order or sub-class, under the name of MEDUSIDÆ. The species belonging to it, in conjunction with the gonozooids which resemble them, formed the old order of the GYMNOPHTHALMATA, or Naked-eyed Medusæ.

fessor Allman's system there are several additional. Among the Australian species, so far as known, only four families of Gymnoblastea, and six of Calyptoblastea are represented, one of the latter being peculiar to Southern Australia.

New Species.

With but one or two exceptions, all the specimens from the north and east of Australia, which I have had under observation, were included in a large and important collection sent me by Mr. Haswell for identification. They were mostly obtained by Mr. Haswell himself, or by collectors connected with the Australian Museum. Among them were eleven new species, and ten of those already described by Mr. Busk, with six or seven which had been described by other authors. Of the whole number, eight had previously been found in Victoria. All of these, except two, however, came from localities not further north than Port Stephens. The new species described in the present work, other than those from Mr. Haswell's collection, are nine in number, and have all been collected at various parts of Port Philip (chiefly at Queenscliffe), except *Plumularia Buskii*, which came from Griffiths' Point.

My best thanks are due to Mr. Haswell, not only for the interesting collection above-mentioned, but for valuable advice and assistance in the preparation of the present catalogue. I have also to thank Mr. J. R. Y. Goldstein, of Melbourne, Mr. C. M. Maplestone, of Portland, Mr. T. D. Smeaton, of Adelaide, and Mr. J. F. Bailey, of Melbourne, each of whom has furnished me with examples of species which I have not obtained elsewhere.

The generic and specific descriptions to which the name of the author is appended in capitals are quoted *verbatim*. The characters of the various families have in nearly every case been taken from Mr. Hincks' British Hydroid Zoophytes, as also, for the most part, has the synonymy of such species as are found in Britain.

AUSTRALIAN HYDROID ZOOPHYTES.

Sub-Order I.—GYMNOBLASTEA.

TUBULARINA, Ehrenberg, Cor. roth. Meeres; Johnston, Brit. Zooph.

CORYNIDÆ (order), Huxley, Oceanic Hydrozoa.

TUBULARIÆ, Agassiz, N.H.U.S.

GYMNOTOKA (except Hydra), Carus, Handbuch der Zoologie.

ATHECATA, Hincks, Brit. Hyd. Zooph.

GYMNOBLASTEA, Allman, Mon. of the Gymnoblastic Hydroids.

TUBULARIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

POLYPITES *flask-shaped, with two sets of filiform tentacula, one oral, the other placed near the base of the body.*

TUBULARIA, *Linné* (in part).

PARYPHA, Agas., N.H.U.S. (some of the species).
THAMNOCNIDIA, Agas., N.H.U.S. (ditto).

Stems simple or branched, rooted by a filiform stolon, the whole invested by a polypary; polypites flask-shaped, with filiform tentacles disposed in two verticils—the oral short and surrounding a conical proboscis, the aboral long and forming a circle near the

base of the body; gonophores borne on peduncles springing from the body of the polypite between the two circles of tentacles, containing fixed sporosacs.—(HINCKS.)

TUBULARIA RALPHII, *Halley*, MS.

Stems clustered, three or four inches in height, slender, light brown, smooth or obscurely wrinkled transversely, simple or rarely branched; polypites about one-third of an inch across the tentacles, pinkish grey in color.

Gonophores in clusters on branched peduncles; ovate, with four small tubercles at the summit, and a small aperture.

Hab.—Hobson's Bay, common on piles, ships, &c.

This species was described by the Rev. J. J. Halley in a paper which was read before the Microscopical Society of Victoria in June, 1879, but which has not been published. It is very similar to *Tubularia coronata*, Abildgaard, in size and general appearance, but differs in color.

TUBULARIA PYGMÆA, *Lamx.*

Lamx., Hist. Polyp. Flex.; Deslongch., Encycl. Méth.; Lamk., An. s. Vert.; Blainv., Man. d'Act.

Tubes solitary, annulated, slightly flexuous, but little branched; branches very short; height about a centimetre.

On the *Amphiroa dilatata* of Australasia—(LAMOUROUX).

Polypite unknown.

TIBIANA, *Lamarck.*

An. s. Vert.

Polypidom tubular, membranous or horny, more or less flexuous or zigzag; the polyp-apertures lateral, alternate or rarely scattered, prominent.

Polypites unknown.

"The stem in *Tibiana* is formed of numerous tubes, agglutinated together without anastomosing; at a height which varies according to the species or individual, the tubes separate and take the form of branches more or less subdivided, generally flexuous or zigzag; the apertures of the polypes are situated in a prolongation of the tube at the extremity of each flexure; sometimes these apertures are directed towards the base of the polypary, usually they are vertical; the tubes of the stems and branches are fistulous, without articulations or internal septa. The substance of the polypary appears horny, but slightly flexible, brittle, sometimes slightly calcareous."—(Lamouroux, Hist. Polyp. Flex.)

In the absence of any knowledge of the polypites the reference of this genus to the Tubulariidæ is of course only conjectural.

TIBIANA RAMOSA, *Lamk.*

Lamk., An. s. Vert.; Lamx., Hist. Polyp. Flex.; Deslongch., Encycl. Méth.; Schweigger, Beobachtungen auf naturhistorischen Reisen (fig.), Handbuch.

Stem about the thickness of a goose-feather, branched at the extremity, flexuous, with large, scattered, polyp-tubercles*; aperture superior or horizontal; height two or three décimetres, color whitish. (LAMOUROUX.) Australasia.

The type of this genus is the *T. fasciculata*, Lamk., in which the stem and branches are acutely zig-zagged, with a polyp-aperture at the exterior of each angle; the present species differs in the scattered position of the apertures, and in their being situated in large tubercles (called cellules by Lamarck), as well as in other particulars, and according to Lamouroux its position is very doubtful. I have unfortunately not met with Schweigger's work, in which it is figured.

* "Cellulis prominulis sacciformibus." Lamarck.

EUDENDRIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

POLYPITES *borne on a well-developed stem, with a single verticil of filiform tentacula surrounding the base of a large trumpet-shaped proboscis.*

EUDENDRIUM, *Ehrenberg* (in part).

Stem branched, rooted by a creeping filiform stolon, the whole invested by a chitinous polypary; polypites borne at the extremity of the branches, vase-shaped or roundish, with a prominent trumpet-shaped proboscis and a single verticil of filiform tentacula round the base of it. Gonophores developed from the body of the polypite below the tentacles, or from the stem, containing fixed sporosacs—the female simple, the male consisting of several chambers arranged in moniliform series. (HINCKS.)

Mr. Maplestone has found at Portland a small species of *Eudendrium*, of which, in the absence of further specimens, I am unable to give a sufficiently full description to distinguish it from some of the known species. The specimens found are small, slender, freely branched, with a few spiral turns at intervals, especially about the joints. The polypites were of an orange-brown color.

PENNARIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

POLYPITES *with two sets of tentacles—one oral and capitate, the other aboral and filiform.*

PENNARIA, *Goldfuss.*

Handb. der Zool.

TROPHOSOME.—*Hydrophyton composed of a symmetrically-ramified hydrocaulus, rooted by a creeping filiform hydrorhiza, the whole*

invested with a chitinous perisarc. Hydranths flask-shaped, with the filiform tentacles constituting a proximal set, and arranged in a single verticil round the base of the hydranth, and the capitate tentacles a distal set scattered on the body of the hydranth.

GONOSOME.—*Gonophores developed in a more or less perfect verticil between the proximal and distal sets of tentacles. Umbrella deeply ovate; manubrium large, destitute of oral appendages; marginal tentacles four, rudimental, no ocelli.* (ALLMAN.)

PENNARIA AUSTRALIS, n. sp. (A.M.)

Hydrocaulus 7 or 8 inches in height; stem slightly flexuous, with regular, alternate, ascending pinnæ, both series directed somewhat to the front, ultimate ramules borne in a single series along the distal side of each pinna; stem slightly ringed above the origin of the pinnæ; pinnæ with a few spiral turns at the base, and generally one or two rings above the origin of each ramule; ramules with a few spiral turns at the base, and occasionally one or two at the extremity, smooth throughout the rest of their length. Polypites large, flask-shaped, borne at the extremity of the stem, pinnæ, and ramules; filiform tentacles 7–12, springing from a little above the base of the polypite, about as long as the polypite, and slightly enlarged at the tips; capitate tentacles 9–14, four of them generally surrounding the proboscis, the rest scattered, principally on the distal part of the polypite; capitulum containing five or six nematocysts much larger than the rest.

Gonophores large, ovate-oblong, with four tubercles at the summit.

Stems very dark brown, pinnæ lighter.

Hab.—Clark Island, Port Jackson (Mr. Haswell).

In its ramification and all other essential particulars this species agrees closely with *P. Cavolinii* and *P. gibbosa*, but differs from both in the ultimate ramules not being ringed throughout. The proboscis is generally surrounded by four

short tentacles forming a tolerably regular verticil; the rest are more scattered, and a single one may be often found almost close to the filiform series. The largest gonophores contained about nine closely-packed irregularly-shaped ova.

The polypites were white, but had been preserved in alcohol.

HYDRACTINIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

POLYPITES *claviform, sessile, with a single verticil of filiform tentacles round the base of a conical proboscis, borne on an expanded and continuous crust; the cœnosarc naked above.*

In this remarkable family the hydrorhiza usually forms a continuous expansion, investing the surface of shells. The following description of the structure in the genus *Hydractinia* is from Mr. Hincks' "British Hydroid Zoophytes":—

"There is some difficulty in examining the chitinous expansion, closely adnate, as it usually is, to the body on which the colony is planted. Frequently, however, in the case of old shells tenanted by the *Pagurus*, it is found to extend for some distance beyond the edge of the shell, and to form a considerable addition to the lip. This portion can be readily removed and submitted to the microscope. A careful examination of this free extension of the crust has yielded the following results:—The upper surface is invested by a white fleshy substance, from which the polypites and spiral organs are developed in large numbers, the latter almost exclusively on the extreme margin. On examination, this soft layer is found to be mainly composed of a multitude of delicate, anastomosing, tubular stolons closely packed together. The surface of the layer is more or less roughened by minute points of chitine which protrude through it, and running in lines, mark out the course of the stolonic tubes. At intervals, large grooved and muricated spines occur, which are also partially covered by the fleshy crust.

"If a portion of the base be divided transversely, so that the intimate structure may be examined in section, the following appearances are observable:—

"A large proportion of the slice is seen to be occupied by a chitinous framework, the upper side of which is overspread by the fleshy carpet that bears the polypites, while the inferior surface is more or less covered by a thin layer of a mucus-like substance. The appearance of the framework itself, as seen in section, is that of a series of tubes laid side by side on a plate of chitine, and closely appressed one to the other.

"The tubular orifices are completely filled in with cœnosarc. Above they rise into many spinous projections so as to exhibit a jagged outline; below they rest uniformly on the chitinous base. Here and there smaller spinous processes are given off from the *under* surface of the latter, and penetrate the mucous layer that invests it.

"The structure of the framework seems to be of this kind. From a thin basal lamina of chitine rise numerous chitinous lamellæ, terminating above in serrulated edges, which sometimes run parallel to one another, and sometimes anastomose. The spaces between them form the channels in which the soft cœnosarcal stolons are contained, and from these rise the polypites and the spiral and tentacular appendages. The passages or tubes thus formed are covered in above, not by a solid wall, but by a chitinous network, which stretches across them a little *below* the free serrated edges of the lamellæ.

"Through the meshes of this fenestrated covering the fleshy matter passes and forms a superficial layer, filling in the grooves between the ridges, and overlying the framework, with the exception of the points of the spinules.

"The larger spines owe their origin to the elevation of the tubes at certain points."

Mr. H. J. Carter, whose researches into the structure and affinities of the Hydractiniidæ* have added greatly to our knowledge of the family, has shown that in some cases the

* Annals and Magazine of Natural History, January, 1873, January, 1877, and April, 1878.

substance of the shell on which the zoophyte has established itself is destroyed and entirely replaced by the chitinous polypary; also, that in certain species the polypidom is not encrusting, but forms an erect branching structure, which is the case with the two Australian species, provisionally described as sponges by Dr. Gray, under the names of *Ceratella fusca* and *Dehitella atrorubens*. Transition forms occur, in which the polypidom is usually encrusting, but also forms here and there erect branches. Some of the species described by Mr. Carter are furnished with a calcareous instead of a chitinous polypidom.

CERATELLA, *Gray*.

Proc. Zool. Soc., Nov., 1868.

Sponge or coral [hydrophyton] irregularly dichotomously branched, more or less expanded on a plane from a single base; of a dark brown colour, of a uniform hard horny substance, stem hard, dark brown, solid, base dilated, rather compressed, of a uniform rigid somewhat spongy texture, with a velvety surface which is formed of an abundance of very minute cylindrical tortuous grooves. The branches and branchlets tapering, formed of a large quantity of nearly parallel, paler brown, projecting horny points, divergent at the ends, and producing a spinulose surface. The branchlets tapering to a point with a series of acute divergent tufts of spicules on each side (oscules or cells) with a small circular mouth below the produced acute end of the branchlet, and the tufts seem to be produced at the base of the previously formed tufts.—(Gray.)

Ceratella fusca, *Gray*.

Gray, Proc. Zool. Soc., Nov., 1868 (fig.)
Carter, An. & Mag. Nat. Hist., Jany., 1873.

Coral expanded, fan-shaped, forming an oblong frond, branches divergent from the base with numerous lateral subalternate dichotomous branches; similar but smaller lateral branchlets.—(Gray.)

Hab.—Bondi Bay, near Sydney.

(See *Dehitella atrorubens*.)

DEHITELLA, *Gray*.

Proc. Zool. Soc., Nov., 1868.

Sponge or coral [hydrophyton] dichotomously branched, expanded, growing in a large tuft from a broad tortuous creeping base, of a dark brown colour, and uniform hard rigid substance. Stem hard, cylindrical, opaque, smooth; branches and branchlets covered with tufts of projecting horny spines on every side; those on the branches often placed in sharp-edged narrow transverse ridges; those of the upper branches and branchlets close but isolated and divergent from the surface at nearly right angles.

This genus is distinguished from *Ceratella* by the greater thickness and cylindrical form of the stem, by the more tufted and irregular manner of growth, and by the tufts of spicules (oscules or cells) being more abundant and equally dispersed on all sides of the branches and branchlets.—(Gray.)

Dehitella atrorubens, *Gray*.

Gray, Proc. Zool. Soc., Nov., 1868 (fig.)
Carter, An. & Mag. Nat. Hist., Jan., 1873.

The description of this species is the same as that of the genus. The locality is unknown, but it is said to be probably Australian.

Both *Ceratella fusca* and *Dehitella atrorubens* were identified as members of the Hydractiniidæ by Mr. H. J. Carter, who has also shown that the erect mode of growth normal to them occurs as an occasional variation in certain typical encrusting species of *Hydractinia*. Regarding these two species he writes as follows:—"In Dr. Gray's two Australian species there are no actual spines independently of the projecting portion of clathrate structure on the proximal sides of the hydrothecæ, and the 'spinulose' little knobs on the surface of *Ceratella fusca*.

"The hydrotheca in *D. atrorubens* is formed of a simple scoop-like projection on the sub-rectangular clathrate structure of the stem, stopped at the bottom by a septum of the same; there is no decided hole there larger than the diameter of the common

mesh, for the cœnosarc of the interior to communicate with the sarcode of the polype as in the Cape species; while in *Ceratella fusca*, which is almost as delicate in its branches as a *Sertularia*, and not unlike it in the alternate but here spiral not opposite position of its hydrothecæ, the latter are formed by a projection of the clathrate tissue in the shape of a clam-shell, whose ribs, extended beyond the margin, end respectively in an inflated tubercle of the same kind as that which characterizes the surface of the stem, rising up like little knobs on the knots of the clathrate network to which Dr. Gray has appropriately applied the term 'spinulose'; the bottom of the hydrotheca is filled up with a clathrate septum, in which there is no decided hole present."

Sub-Order II.—CALYPTOBLASTEA.

SERTULARINA, Ehrenberg, Coral. des roth. Meeres; Johnst., Brit. Zooph.

SERTULARIADÆ, Huxley, Oceanic Hydrozoa.

SERTULARIÆ, Agassiz, N.H.U.S.

SKENOTOKA, Carus, Handbuch der Zoologie.

THECAPHORA, Hincks, Brit. Hyd. Zooph.

CALYPTOBLASTEA, Allman, Mon. of the Gymnoblastic Hydroids.

CAMPANULARIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

HYDROTHECÆ *terminal, pedicellate, campanulate;* POLYPITES *with a large trumpet-shaped proboscis.*

CAMPANULARIA, *Lamarck* (in part).

An. s. Vert.

CLYTIA, LAOMEDEA, } Lamouroux (in part), Bull. Phil., 1812.

SERTULARIA, Lamk. (in part), An. s. Vert.

? SILICULARIA, Meyen, Nova Acta, 1834.

ORTHOPYXIS, Agassiz (for some of the species), N.H.U.S.

LAOMEDEA, Agassiz, N.H.U.S.; Allman, An. Nat. Hist., May, 1864.

Stems simple or branched, rooted by a filiform stolon; hydrothecæ bell-shaped and hyaline, without operculum; polypites with a large cup-shaped proboscis; gonothecæ borne on the stems or on the creeping stolon; gonophores containing fixed sporosacs, which mature their products within the capsule.—(HINCKS).

While it is probable that most of the species here assigned to *Campanularia* would come under that genus as limited by Mr. Hincks, our want of knowledge in most cases of the gonosome renders their exact position doubtful. Several of them are destitute of the ringed stalks so common in the family, the calycles being sub-sessile, and springing from a projection of the hydrocaulus. Some of these species (such as *Laomedea reptans*, Lamx., and *L. antipathes*, Lamx.), form a section of the genus *Sertularia* in Lamarck's classification.

CAMPANULARIA ANTIPATHES, *Lamx.* Plate ii, fig. 5.

Laomedea antipathes, Lamx., Hist. Polyp. Flex. (fig.); Encycl. Méth.; Blainv., Man. d'Act.

Sertularia antipathes, Lamk., An. s. Vert.

Stem rough, branching, somewhat woody; branches pinnate; cellules campanulate, scattered on the branches and pinnæ; pedicle springing from a flattened process color, reddish-brown, sometimes greyish; height about a décimetre.

Australasia.—(LAMOUROUX).

(Stem thick; hydrothecæ alternate; margin entire).

CAMPANULARIA TORRESII, *Busk.* Plate ii, fig. 3. (A.M.)

Laomedea Torresii, Busk, Voy. of Rattlesn.

Hydrocaulus attaining a height of two or three inches, pinnate; three hydrothecæ, one of them axillary, between every two pinnæ on the same side, pinnæ alternate. Hydrothecæ, one on each internode of the stem and pinnæ; large, campanulate, nearly sessile, springing from a process of the hydrocaulus; aperture with four shallow emarginations, not thickened.

Gonothecæ? Color, light brown.

Hab.—Prince of Wales Channel, Torres St. (Mr. Busk); Fitzroy Id., 12 fathoms (Mr. Haswell).

Mr. Busk says that this species differs from *L. antipathes*, Lx., in its smaller size and in the four shallow emarginations of the mouth; also in not having the margin thickened. The joints between the internodes are somewhat obscure.

CAMPANULARIA REPTANS, *Lamx.* Plate ii, fig. 8.

Laomedea reptans, Lamx., Exp. Méth. (fig.); Deslongch., Encyc. Méth.

Sertularia reptans, Lamk., An. s. Vert.

Campanularia reptans, Blainv., Man. d'Act.

Stem creeping, scarcely visible, cylindrical and branching; cellules scattered, campanulate, with entire margins; pedicel conical, very short, fixed on a sort of flattened area.

Color yellowish.

Hab.—On the leaves of *Ruppia antarctica*, Lewin's Land.—(LAMOUROUX.)

The stem is creeping, very slender, and divided by an articulation above the origin of each lateral prolongation, giving rise to the polypiferous peduncles; these prolongations resemble very short sections of a cylinder, the peduncles which spring from them are very small, conical, and composed of a single joint; the capsules [hydrothecæ] are semi-elliptical, with entire borders. —(LAMARCK).

CAMPANULARIA LAIRII, *Lamx.* Plate ii, fig. 7.

Laomedea Lairii, Lamx., Hist. Polyp. Flex.; Ex. Méth. (fig.); Deslongch., Encycl. Méth.

Campanularia Lairii, Lamk., An. s. Vert.

Root-mass shrubby, stem simple or slightly branched; cellules scattered, divergent, borne on long peduncles; color reddish-brown; height about a centimetre.

Seas of Australasia.—(LAMOUROUX.)

(Peduncles smooth, hydrothecæ with entire margins.)

CAMPANULARIA MARGINATA, *n. sp.* Plate i, fig. 2.

Hydrocaulus simple, smooth or slightly ringed, about half an inch in height, divided into three or four long internodes, each bearing on its slightly curved summit a hydrotheca with a very short peduncle, and giving rise on the convex side, just below the summit, to the next internode. Hydrothecæ large, campanulate, four-toothed, with a thickened margin, and a thickened ring parallel with it at a little distance below.

Gonothecæ? Color, yellowish-brown.

Hab.—Queenscliff; Portland (Mr. Maplestone.)

I have only seen two or three small specimens of this species. The calycles are from $\frac{1}{25}$ to $\frac{1}{20}$ of an inch in length, the younger ones more narrowed towards the base than those which are older. They have a number of minute papillæ, forming an irregular ring inside near the base, and on some of them the remains of an operculum were perceptible. In the Portland specimens each calycle was borne on a distinct pedicel springing from the hydrorhiza.

CAMPANULARIA RUFA, *n. sp.* Plate i, fig. 1. (A.M.)

Hydrocaulus polysiphonic, pinnate, stem and pinnæ unjointed, or with very few joints at irregular intervals; pinnæ alternate or sub-alternate, rather distant, a hydrotheca on the stem midway between every two, and one in each axil. Hydrothecæ alternate, sub-cylindrical, tapering below, slightly narrowed below the aperture, the slender peduncle springing from a broader process of the hydrocaulus; aperture entire, everted.

Gonothecæ? Color, reddish-brown, calycles lighter.

Hab.—Holborn Id., 20 fath. (Mr. Haswell.)

I received only one specimen, which is an inch in height, with pinnæ about half an inch long. The texture is denser and firmer than in most campanularians. The calycles often have several

rings below the aperture, which probably indicate successive renewals of the contained polypite.

Campanularia undulata, *Lamx.* Plate ii, fig. 4.

Clytia undulata, Lamx., Encycl. Méth.; Quoy and Gaim., Voyage de l'Uranie (fig.)

Campanularia undulata, Lamk., An. s. Vert.

Zoophyte much branched, stoloniferous; cellules on long peduncles; peduncles undulated; ovarian capsules ovato-lanceolate.

This *Clytia*, a near ally of *C. urnigera*, Lamx., presents, like it, a creeping and stoloniferous stem [hydrorhiza], much branched, the branches flexuous. The cellules, which are numerous, small, campanulate, with entire margins, are borne on long and slender peduncles, undulated throughout their length. The ovicells are of an oval form, very long, without any apparent aperture.

The undulated *Clytia* was found on the marine plants of Port Jackson, by Quoy and Gaimard—(Lamouroux).

Campanularia urnigera, *Lamx.* Plate ii, fig. 9.

Clytia urnigera, Lamx., Hist. Polyp. Flex. (fig.), Encycl. Méth.

Campanularia urnigera, Lamk., An. s. Vert.

Stem [hydrorhiza] flexuous, stoloniferous, and creeping; cellules on long peduncles, globular, truncate; capsules ovoid, with a small truncate aperture.

On a Fucus from Australasia—(Lamouroux).

(Peduncles smooth; hydrothecæ with entire apertures.) It is doubtful whether the description and figure are sufficient for identification, especially as the two calycles figured are by no means alike.

CAMPANULARIA MACROCYTTARA, *Lamx.* Plate ii, fig. 6.

Clytia macrocyttara, Lamx., Encycl. Méth.; Quoy et Gaim., Voyage de l'Uranie (fig.)

Campanularia macrocyttara, Lamk., An. s. Vert.

Zoophyte creeping; stem [hydrorhiza] simple; cellules large, campanulate, solitary, scattered; aperture marginate, quadridendate; peduncles twisted.

This *Clytia* is so remarkable by the large size of the cellules and by their twisted peduncles, that it has been thought desirable to figure it in spite of the smallness of the polypary; it presents a simple stem, adherent throughout its whole extent. From this stem rise, at some distance apart, large cellules, rigid, campanulate, with a quadridentate aperture, and thickened margin; the peduncle which supports it is twisted throughout, and of the length of the cellule—(LAMOUROUX).

Hab.—On *Zostera antarctica*, coasts of Australasia.

CAMPANULARIA COSTATA, *n. sp.* Plate i, fig. 3.

Hydrocaulus absent. Hydrothecæ springing directly from the hydrorhiza without any regular order, large, almost cylindrical or slightly expanded upwards, narrowed below, transversely annulated throughout a great part of their length, generally smooth near the peduncle; aperture not contracted, plain, everted, peristome often double or triple.

Gonothecæ? Color, pale brownish.

Hab.—Port Darwin, parasitic on *Idia pristis* (Mr. Smeaton).

The hydrorhiza is inconspicuous, being closely adnate to the hydrocaulus of *Idia;* the calycles appear therefore to spring directly from the latter, and have been described as its gonothecæ. They are about $\frac{1}{20}$ of an inch in length, and resemble the gonothecæ of some *Plumulariæ*, except in being open at the top. They often appear to have been added to once or twice by fresh

growths, the former everted lips remaining below the aperture. This species will probably form the type of a distinct genus, but as our knowledge of it is at present incomplete it is here ranked provisionally under *Campanularia*.

CAMPANULARIA TINCTA, *Hincks*. Plate i, fig. 4-6.

Campanularia tincta, Hincks, An. Nat. Hist., April, 1861, (fig.)
Hincksia tincta, Agassiz, Cont. Nat. Hist. U.S.

Hydrorhiza reticulate, stems simple, very variable in length, bearing each a single hydrotheca; a small spherule immediately below the base of the hydrotheca, the rest of the stem stouter and more or less undulated. Hydrothecæ large, tubular or slightly expanded upwards, contracted just above the base, where there is an internal annular thickening; aperture furnished with from six to ten small crenations.

Gonothecæ large, decumbent, sub-cordate, attached by a short stalk which springs from a sinus at the base; flat beneath, convex above; aperture terminal, looking upwards.

Color of gonothecæ dark brown; hydrothecæ pale.

Hab.—Australia (Pt. Philip), Laminarian zone (Mr. Hincks); Portland (Mr. Maplestone).

Specimens received from Mr. Maplestone differ somewhat from those described by Mr. Hincks, the hydrothecæ being often tubular and not expanding upwards, and the gonothecæ having the upper surface smooth, which in Mr. Hincks' specimens was transversely ribbed. The latter difference however may possibly be developmental or abnormal, which appears the more probable from the fact that most of the gonothecæ in my specimens were distorted and irregular in shape, only one or two having the outline in accordance with Mr. Hincks' figures and description. The stems are usually about half or one-third as long as the calycles, but may be twice their length. The walls of the hydrothecæ are usually thick and solid, and their proportionate length and breadth vary greatly.

Mr. Hincks mentions that he possesses a second Australian species of *Campanularia* agreeing with *C. tincta* in the recumbent gonothecæ.

Doubtful Species.

The following species is not figured, and the description seems too slight to be of much use:—

Campanularia simplex, *Lamx.*

Laomodea simplex, Lx., Hist. Pol. Flex.; Deslonch., Encycl. Méth.

Stem simple; cellules elongated, campanulate, scattered; color deep brown; height about 2 centimetres.

On Fucus from Australasia.—(Lamouroux.)

OBELIA, *Péron et Lesueur.*

"Hist. Gen. des. Medus.," Ann. du Museum, xiv, 1809.

Laomedea, Lamx., Bull. Philom., 1812.

Campanularia (in part), Lamk., An. s. Vert.

Monopyxis, Ehrenberg, Coral. roth. Meer.

Thaumantias (in part), Forbes, Brit. Naked-eyed Medusæ.

Eucope (in part), Gegenbaur, "Syst. d. Medus.", Zeits. f. wissenschaft, Zool. viii (the free zooid); Agas., N.H.U.S.

Obelia, M'Crady, Gymnoph. Charlest. Harbour; Agas., N.H.U.S.; Allman., An. Nat. Hist., May, 1864; Hincks, Brit. Hyd. Zooph.

Stem branching, plant-like, rooted by a creeping stolon; hydrothecæ campanulate, without operculum; gonothecæ borne on the stem and branches; reproduction by free medusiform zooids.

Gonozooid: Umbrella (at the time of liberation), depressed and disk-like; manubrium short and quadrate; radiating canals, 4; marginal tentacles numerous (increasing in number with age), prolonged at the base and projecting inwards; lithocysts, 8, 2 in each interradial space, borne on the inner side of 8 of the tentacles near the base.—(Hincks.)

OBELIA GENICULATA, *Lin.* Plate ii, fig. 2.

"*Knotted-thread Coralline*," Ellis, Corall. (fig.)

Sertularia geniculata, Lin., Sys. Nat.; Pallas, Elench.; Lamk., An. s. Vert.

Laomedea geniculata, Lamx., Hist. Pol. Flex., Encyc. Méth.; Johnst., Brit. Zooph. (fig.); Gosse, Devon Coast (fig.)

Campanularia geniculata, Flem., Brit. An.

Monopyxis geniculata, Ehr., Cor. roth. Meer.

Eucope diaphana, Agas., N.H.U.S. (fig.)

Obelia geniculata, Allman, An. Nat. Hist., May, 1864; Hincks, Brit. Hyd. Zooph. (fig.); Coughtrey, An. Nat. Hist., Jan., 1876.

Eucope alternata, A. Agas., N. Am. Acaleph.

STEM *zig-zag*, sometimes sparingly branched, *jointed at each of the flexures, and thickened immediately below them, so as to form a series of projections or rests, from which the pedicels rise;* HYDROTHECÆ *somewhat obconical*, rather short, the length slightly exceeding the width, *with a plain margin, borne on short annulated stalks* (rings 4–6), *which are sub-erect and taper slightly upwards;* GONOTHECÆ axillary, urn-shaped, attached by a short ringed stalk (3–4 rings.)

GONOZOOID.—UMBRELLA (at the time of liberation), very shallow, discoid, colorless, presenting a reticulated appearance; MARGINAL TENTACLES 24; SPOROSACS oval. (HINCKS.)

Hab.—New Zealand; Port Phillip; Glenelg; King George's Sound; (Mr. Coughtrey); North Cape (Sars.); Labrador (Hincks); Massachusetts, U.S. (Agassiz); European seas.

Mr. Hincks says that "there are two marked forms of this species, one delicate, of a pure whiteness and rather humble growth; the other much larger and coarser in habit, and less strongly zig-zagged." He also mentions having seen specimens in which the scale of all the parts was much smaller than in the

common form, and which bore a profusion of capsules, many of them springing from the creeping stolon, and borne in some cases on rather long peduncles. The gonothecæ of the ordinary form generally project at right angles to the plane in which the calycles lie, but are sometimes appressed to the stem. I have quoted Mr. Hincks' description of *O. geniculata*, not having observed it, but a medusiform gonozooid which I have frequently met with appears to belong to this species. The umbrella is often reverted, so that the lower side from which the manubrium depends is convex instead of concave. This change of form is accomplished by a sudden jerk, after which the umbrella slowly resumes its normal position. I failed to discover any trace of the "veil" which is generally considered as characteristic of the whole group of gymnophthalmate medusæ; indeed it is difficult to reconcile the existence of such an organ with the power possessed by these zooids of turning the swimming-bell inside out.

EUCOPELLA, *Von Lendenfeld.*

Zool. Anzeig. VI (1883).

Trophosome similar to that of Campanularia; gonophores consisting of free medusoids, which are destitute of a manubrium.

EUCOPELLA CAMPANULARIA, *Von Lendenfeld.*

Zool. Anzeig. VI (1883).

I have not seen Dr. Von Lendenfeld's description of this species, and cannot therefore give the specific characters. The following note is from the last (August) number of the Journal of the Royal Microscopical Society:—"Dr. Lendenfeld describes a new sub-family of hydroids, *Eucopellinæ*, in which the medusa has no digestive organs, and lives only a short time after its escape from the gonophore. Only one species, *Eucopella campanularia*, is known, and this is found in Australia. The larva is a campanularian whose hydranths are carried upon short, unbranched stems, which spring from a creeping root. The

medusa has a veil, well-developed marginal sense-organs, radial and circular chymiferous tubes, and large reproductive organs, but it has no mouth, stomach, or tentacles. It discharges its reproductive elements within twenty-four hours after its liberation, and it lives only about thirty-six hours."

LINEOLARIDÆ, *Allman.*

HYDROTHECÆ *and* GONOTHECÆ *springing from the hydrorhiza, with short or rudimentary peduncles; the whole polypary closely adnate to a foreign body.*

This family was formed to include the single species *Lineolaria spinulosa*, described by Mr. Hincks as a Campanularian, and placed by Agassiz among the Sertularians. It partakes of the characters of both groups, but differs essentially from the Sertulariidæ in not having the calycles inserted in the stem or hydrorhiza, though owing to the rudimentary condition of the peduncles they appear sessile upon it. *L. flexuosa*, however, has distinct though short peduncles. The mouth of the hydrotheca, with its two lateral teeth, approximates in form to that of many of the *Sertulariæ*. In the adnate condition of the calycles *Lineolaria* stands alone among the Hydroida.

LINEOLARIA, *Hincks.*

An. Nat. Hist., April, 1861.

The generic characters are the same as those of the family. The original description included certain characteristics which are of specific value only, and are therefore omitted.

LINEOLARIA SPINULOSA, *Hincks.* Plate i, fig. 10–11. Plate xix, fig. 38. (A.M.)

An. Nat. Hist., April, 1861 (fig.).

Hydrorhiza straight, convex above, slightly wrinkled transversely, furnished with minute scattered tubular processes; branches given off at right angles, often anastomosing. Hydro-

thecæ alternate, not close, sub-sessile, projecting at right angles to the hydrorhiza, oblong, broader at the base; aperture terminal, oval, looking upwards, with two long erect lateral teeth and a membranous operculum; a long erect spine at the base of each hydrotheca.

Gonothecæ about three times the length of the hydrothecæ, ovate or somewhat oblong, tapering towards the base; with a row of strong spines running down each side and meeting below, and a few scattered spines in the central area; orifice subterminal, circular, looking upwards, with a thickened and slightly elevated margin surrounded by a few minute irregular denticles.

Color, very pale; hydrothecæ and gonothecæ covered with wavy transverse striæ, and furnished with a delicate striated lateral wing or expansion, surrounding the whole margin and adherent to the supporting substance.

Hab.—Australia (Pt. Philip), Laminarian zone (Mr. Hincks); Portland (Mr. Maplestone); only known to occur on *Cymodocea antarctica*, Hooker.

Though the whole of the base of the hydrotheca is in contact with the hydrorhiza, it is attached only by a narrow central portion, which represents the peduncle. The structure can only be properly displayed when the organism is removed from the *Cymodocea*, which is easily accomplished with a needle after it has been immersed for a few seconds in boiling liquor potassæ. The marginal wing (which is not perceptible until the polypidom is detached) is marked with oblique lines which give it very much the appearance of the continuous median fin of the flatfishes.

LINEOLARIA FLEXUOSA, *n. sp.* Plate i, fig. 7–9. (A.M.)

Hydrorhiza usually flexuous, branched, giving off in each flexure a single hydrotheca, which is directed forwards almost parallel with the hydrorhiza. Hydrothecæ alternate, the proximal part oblong, closely adnate to the weed to which the

hydrosoma is attached; the smaller distal part free, erect; peduncle very short; aperture oval, with two lateral teeth.

Gonothecæ? Hydrosoma colorless and transparent.

Hab.—On algæ, Williamstown.

This species is very small and inconspicuous, and even boiling in liquor potassæ failed to separate it completely from the cuticle of the weed on which it grew. Though agreeing with *L. spinulosa* in having the calycles springing from the creeping stolon and adnate to the supporting substance, it differs from it widely in minor characteristics. The free part is variable in length, sometimes equalling the adnate portion.

LAFOËIDÆ, *Hincks.*

Brit. Hyd. Zooph.

HYDROTHECÆ *tubular*; POLYPITES *cylindrical, with a conical proboscis.*

LAFOËA, *Lamouroux.*

Expos. Méth.

CALICELLA, Hincks (in part), An. Nat. Hist., 3rd ser., viii.

Stem a simple, creeping, tubular fibre, or erect and composed of many tubes aggregated together, rooted by a filiform stolon; hydrothecæ tubular, sessile or with a short pedicel, without an operculum, more or less regularly disposed on the stem and branches; polypites cylindrical, with a conical proboscis. Reproduction unknown.—(HINCKS.)

The genus *Lafoëa* is not very well defined. Professor Allman regards as "an essential character of the genus the absence of any definite floor to the hydrotheca, a character which it possesses in common with the operculate genus Cuspidella. The cavity of the hydrotheca thus passes uninterruptedly into that of the supporting peduncle, or if the hydrotheca be sessile, into the cavity of the stem or branch which carries it."*

* Hydroida of the Gulf Stream.

LAFOËA FRUTICOSA, *Sars*. Plate ii, fig. 1.

Campanularia fruticosa, Sars, Reise i Lofoten og Finmarken, Nyt Magaz. f. Naturvid. 1850 (fig.)

Campanularia gracillima, Alder, North. and Durh. Cat. in Trans. Tynes. F. C., III (fig.)

Calicella fruticosa, Hincks, Devon and Cornw. Cat., An. Nat. Hist., ser. 3, VIII.

Lafoëa gracillima, G. O. Sars, Bidr. til Kunds. om Norg. Hydr. (fig.)

Lafoëa fruticosa, Sars, Bemærkn. over fire Norske Hydroid., Videnskab. Forhandl. 1862; Hincks, Brit. Hyd. Zooph. (fig.); An. Nat. Hist., Feb. 1874 (fig.)

STEM erect, compound, irregularly and often sub-unilaterally branched; HYDROTHECÆ *very slender, long*, with an entire aperture, *of a thin and fragile material, borne on short pedicels, with* 3 *or* 4 *rings, or loosely twisted and with two whorls;* GONOTHECÆ unknown.

Height (when finely grown) about 3 inches.—(HINCKS.)

Hab.—Bass' Sts. (Busk); Great Britain, Bergen, North Cape, Iceland, &c.

Mr. Hincks says of this species that "it grows in shrubby tufts, and, when living is of a light yellow or citron-colour. The calycles are distinctly stalked; they are much narrowed below, and a little above the base curve outwards on one side, and are slightly concave at the opposite point: this gives them a somewhat crooked appearance." The polypidom shrivels when dry.

The *L. gracillima* (Alder) differs from the ordinary form in having the pedicel shorter and loosely twisted, with two whorls, instead of being distinctly ringed. The calycle also is longer and thinner, and the polypites are citron-coloured. Mr. Hincks unites the two forms with some hesitation.

A specimen from Bass' Straits, in Mr. Busk's collection, has been examined by Mr. Hincks, who has "little doubt that it is identical with the present species."

HALECIIDÆ, *Hincks.*

HYDROTHECÆ *biserial, subsessile, jointed to a lateral process from the stem; polypites partially retractile.*

HALECIUM, *Oken.*

Lehrb. Naturg. 91 (1815.)

THOA, Lamx., Hist. Polyp. Flex.

Zoophyte plant-like, more or less branched, rooted by a creeping stolon; hydrothecæ biserial, tubular or deeply campanulate, subsessile, jointed to a short lateral process from the stem; polypites partially retractile, large and fusiform; gonothecæ scattered, dissimilar in the two sexes; reproduction by means of fixed sporosacs. (HINCKS.)

In this genus, which is intermediate between the Sertulariidæ and the Campanulariidæ, the calycles* are tubular or campanulate, broad at the base and sessile on processes of the hydrocaulus (not pedunculate); they are usually borne in series of three or four, each springing out of the one immediately below it, and indicating successive generations of polypites. The genus does not appear to be common in Australia; I have only a single specimen of one small species, which is similar to *H. tenellum*, and may be identical with it.

SERTULARIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

HYDROTHECÆ *perfectly sessile, more or less inserted in the stem and branches;* POLYPITES *wholly retractile, with a single wreath of filiform tentacles round a conical proboscis;* GONOZOOIDS *always fixed.*

* Professor Allman says that the calycles in this genus (into which the polypites are not wholly retractile), are not true hydrothecæ, and he has given them the name of *hydrophores.*

SERTULARIA, *Linné* (in part).

DYNAMENA, Lamx. (in part).

AMPHISBETIA, Agassiz (*for S. operculata*).

Zoophyte plant-like; stems simple or branching, jointed, rooted by a creeping stolon; hydrothecæ biserial, opposite to alternate, without external operculum, mostly arranged in pairs; gonothecæ scattered, with a simple orifice, and without an internal marsupium.

The above definition is slightly altered from that of Mr. Hincks, which does not allude to the paired arrangement of the calycles, an important point of distinction between this genus and its allies *Sertularella* and *Thuiaria*. The hydrothecæ may be either opposite or more or less alternate, and in many species both arrangements co-exist in the same polypidom, but in either case they are in distinct pairs; the only exceptions to this rule which I have met with are that in most of the pinnate species there is a single unpaired calycle in the axil of each pinna, and that in a few species (*S. acanthostoma*, *S. crenata*, *S. insignis*), the first internode of each pinna bears a single hydrotheca on its lower side only. The genus *Dynamena* of Lamouroux, which has been adopted by several later authors, was formed to include those species in which the hydrothecæ are distinctly opposite, as distinguished from those in which they are alternate or subalternate, but this artificial characteristic offers no valid generic distinction; for not only is it the case, as pointed out by Mr. Hincks, that different portions of the same polypidom—as the stem and pinnæ—may be dissimilar in this respect, but the same variation often occurs in a single pinna.

The genus *Desmoscyphus* was proposed by Professor Allman for certain species in which the calycles are adnate to the hydrocaulus for their whole length, and those of each pair are also adnate to each other in front. The first of these characters is said by Professor Allman himself (in speaking of the genus *Thuiaria*) to be of but minor importance, and the second is found in many true *Sertulariæ*. Indeed, the majority of our species

have the calycles of each pair adnate to each other in front, and where not actually in contact they are usually more or less approximate, though in two or three species they project directly outwards, and are equidistant at the back and front of the polypary.

In all the species of *Sertularia* of which the gonothecæ have come under my notice, they have a distinct orifice with an operculum, and with a more or less prominent border provided with minute irregular denticles within the margin.

SERTULARIA OPERCULATA, *Lin.* Plate vi, fig 1; plate xix, fig. 3. (A.M.)

"*Sea-hair*," Ellis, Corall. (fig.)

Sertularia operculata, Lin., Syst.; Esper, Pflanz. Sert. (fig.); Lamk., An. s. Vert.; Johnston, Brit. Zooph. (fig.); Hincks, Brit. Hyd. Zooph. (fig.)

Sertularia usneoides, Pall., Elench.

Dynamena operculata, Lamx., Hist. Pol. Flex., Encyc. Méth.

Dynamena pulchella, D'Orb., Voy. dans l'Amér. Merid.

Amphisbetia operculata, Agassiz, N.H.U.S.

Dynamena fasciculata, Kirch., Verhand. Akad. der Naturf., 1864 (fig.)

Hydrocaulus attaining a height of seven or eight inches, much branched dichotomously, a hydrotheca at each side of every axil. Hydrothecæ opposite, a pair on each internode, not in contact with each other, tubular, slightly divergent, adnate up to the margin, or nearly so; aperture with a spine-like tooth in front, and the back and outer side produced upwards into a similar tooth, usually slightly incurved.

Gonothecæ long, obovate; aperture operculate, with a slightly elevated border.

Color, light brown.

Hab.—Queenscliffe; Griffiths' Point (Mr. Goldstein); Port Elliott, S. A. (Mr. Smeaton); Pt. Stephens (Mr. Haswell); Portland (Mr. Maplestone); Williamstown; Europe; S. Africa; Patagonia; Falkland Ids.; Auckland Islands; New Zealand; Kerguelen's Land, &c.

Mr. Hincks describes *S. operculata* as having "the aperture sloping inwards towards the stem, its outer angle produced into a very fine and sharp point, which is slightly incurved, and with a minute denticulation on each side"; adding that one of the denticles is often absent, while the other is equal in length to the principal mucro. I have never met with the former variety, and such English specimens as I have seen agree with our own in having two teeth only, of which the one at the front is the shorter. The gonothecæ of Australian specimens are usually considerably narrower than the European in proportion to the length, but I have seen one in which this was not the case. In those from Griffiths' Point the wall of the gonotheca is exceedingly thick, equalling one-sixth of its whole diameter.

SERTULARIA BISPINOSA, *Gray*, plate vi, fig. 2; plate xix, fig. 4-5. (A.M.)

Dynamene bispinosa, Gray, Dief. N.Z.

Sertularia bispinosa, Coughtrey, Tr. N.Z. Inst., VII (fig.)

Sertularia operculata? D'A. W. Thompson, An. Nat. Hist., February, 1879.

Hydrocaulus attaining a height of eight or nine inches, much branched dichotomously, a hydrotheca at each side of every axil. Hydrothecæ opposite, a pair on each internode, not in contact with each other, tubular, slightly divergent, adnate for about half their height; free part contracted on the inner side; aperture with the outer margin produced upwards into two spine-like teeth, the back one more elevated and larger than the other, which is almost in front of it.

Gonothecæ obovate, widened laterally, with angles at the sides of the aperture, which are often produced upwards into erect tubular processes, aperture operculate, with a slightly elevated border.

Color, light yellowish brown.

Hab.—Brighton, S.A. (Mr. Smeaton): Bass' Sts.? New Zealand.

In its habit this species closely resembles *S. operculata*, but is rather coarser, and differs in having the calycles adnate only half their height, with the free portion contracted; also in the form of the gonothecæ. It appears to be plentiful in New Zealand, but on our own coast it is much less common than *S. operculata*. I have seen only two Australian specimens, between which and those from New Zealand there is no perceptible difference.

SERTULARIA TRISPINOSA, *Coughtrey*, plate vi, fig. 3; plate xix, fig. 6. (A.M.)

Trans. N.Z. Inst., VII (fig.)

Hydrocaulus one or two inches in height, dividing dichotomously and forming short bushy tufts, a hydrotheca at each side of every axil. Hydrothecæ opposite, a pair to each internode, not in contact with each other, tubular, divergent, adnate for the greater part of their length; aperture with two nearly equal long erect spines or teeth on the outer margin, and a shorter one on the everted inner margin, the latter recurved towards the hydrocaulus.

Gonothecæ pyriform, much widened laterally at the summit, with erect tubular processes at the angles; aperture operculate, with a slightly elevated border.

Color, dull brown.

Hab.—New Zealand; Victoria?

This species is easily distinguished from its nearest allies, *S. operculata* and *S. bispinosa*, by its short tufted habit, the

toothing of the calycles, and the distinctive form of the gonothecæ. I have seen only one Australian specimen, and could not ascertain its exact locality.

SERTULARIA MAPLESTONEI, *n. sp.*, plate vi, fig. 4; plate xix, fig. 2. (A.M.)

Hydrocaulus slender, pinnate, two or three inches in height; stem flexuous, each internode bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, with internodes bearing from one to four or five pairs of hydrothecæ, the proximal ones longest. Hydrothecæ in pairs, not in contact with each other, sub-alternate, tubular, divergent, free part short, contracted on the inner side; a minute process usually within the outer wall of the cell, a little below the middle; aperture with two spine-like teeth, one in front, the other at the back outer angle.

Gonothecæ borne on the stem, long, sub-tubular, produced upwards into two wide angular processes at the sides of the aperture; aperture operculate, margin slightly elevated.

Color, brown.

Hab.—Portland (Mr. Maplestone).

The calycles in this species much resemble those of *S. operculata*, but are sub-alternate. The pinnate shoots are very slender and graceful.

SERTULARIA BIDENS, *n. sp.*; plate vi, fig. 6; plate xix, fig. 1. (A.M.)

Hydrocaulus pinnate, four or five inches in height, stem flexuous, each internode bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, divergent, with internodes bearing from one to three or four pairs of hydrothecæ, the proximal ones longest. Hydrothecæ in pairs, not in con-

tact with each other, sub-alternate, flask-shaped, upper side horizontal; a small process usually within the outer wall of the cell, a little above the base; aperture small, looking upwards, with two teeth on the outer margin.

Gonothecæ borne on the stem, long, ovate, with two sharp angles at the sides of the aperture; aperture operculate, margin elevated and slightly everted.

Color, dark brown.

Hab.—Queenscliff; Williamstown.

A near ally of the last species, from which however it differs considerably in appearance, owing to the much greater relative width of the calycles. The marginal teeth vary a good deal in length.

SERTULARIA PULCHELLA, *D'A. W. Thompson.* Plate vi, fig. 5; plate xix, fig. 10.

An. and Mag. Nat. Hist., Feby., 1879 (fig.)

Sertularia bicuspidata, Lamk., An. s. Vert.?

Hydrocaulus pinnate, about half an inch in height, stem flexuous, slender, each internode bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, with internodes bearing from one to three pairs of hydrothecæ, the proximal ones longest. Hydrothecæ in pairs, opposite or nearly so, in contact with each other in front or closely approximate, flask-shaped, upper side horizontal, a small process usually within the outer wall of the cell, a little above the base; aperture small, looking upwards, with two long teeth on the outer margin.

Gonothecæ very large, one on a stem, borne near the base; pyriform, with the sides produced upwards into two large, erect, conical processes, extending far above the aperture, which has a short tubular neck and an operculum.

Color, light brown.

Hab.—George Town (D'A. W. Thompson); South Australia (Mr. T. D. Smeaton).

I have met with this species only in Mr. Smeaton's collection. It is almost a miniature of *S. bidens* in the form of the calycles, but besides its minute size throughout, and the slenderness of the stem, it differs in the pinnæ being more ascending, and the calycles almost exactly opposite and directed more to the front than in *S. bidens*, also in the calycles of each pair being usually in contact. The specimen which I have seen diverges in some points from Mr. Thompson's description; thus, although the pinnæ are very slender between every two pairs of calycles, the joints are wanting between some of the proximal pairs, so that there are more than one pair on an internode, as in *S. bidens*, &c. The gonotheca is about equal in length to five *complete internodes* of the pinnæ, and, in the specimen to which I allude, has the denticles round the aperture, as in *S. elongata* and most other *Sertulariæ;* it is indeed like that of *S. elongata*, in size as well as form, notwithstanding the great difference in size of the two polyparies.

Mr. Thompson thinks this species may be the *S. bicuspidata*, of Lamarck; it is different, however, from the species described under that name by Heller.*

SERTULARIA AUSTRALIS, *Kirchenpauer*. Plate VIII, fig. 7–8.

Dynamena australis, Kirch., Verhand. Akad. der Naturforscher, 1864 (fig.)

Sertularia australis, D'A. W. Thompson, An. Nat. Hist., February, 1879 (fig.)

Shoots pinnate, short, springing from a long, simple, creeping stolon; pinnæ alternate; hydrothecæ sub-tubular; aperture bicuspidate; gonothecæ large, urceolate, operculate.

* Zoophyten und Echinodermen des Adriatischen Meeres.

Delicate brownish-colored pinnate stems rise singly from simple root-tubes, creeping on Sargassum. The stems are laterally beset with cells, and on each side a pinnule grows out from each third cell, always in such a way that these pinnules are alternate. A pinnule is given off, for instance, from the left of the first pair of cells, from the right of the second pair, and none from the third; the fourth have at their origin a pinnule directed to the left; the fifth pair one directed to the right; the sixth none, and so on. The cells are almost tubular, somewhat puckered and arched outward, swollen out towards the front, so that where they touch one another (in pairs) no interspace is observable. The mouth of the cell runs out towards the side, turned away from the stem, into two blunt points, between which there is a deep rounded incision. The gonothecæ are comparatively large and oval, but approaching towards the conical form, and provided at the opening with a neck-like rim. On several capsules of the specimens examined was still present the half-opened operculum, which was formerly regarded as characteristic of *D. operculata*, but which is probably present in most *Dynamenæ* (except *D. rosacea* and *D. pinnata*). The habit immediately distinguishes this and the following species from the rest of the *Dynamenæ*, among which, so far as I am aware, there are no plumose species besides these two and *D. marginata*.

Our specimens were found on *Sargassum*, from Port Philip, in the Binder collection of Algæ.—(KIRCHENPAUER.)

Hab.—Pt. Phillip (Kirchenpauer, D'A. W. Thompson); Sealer's Cove; Cape Lefebvre; George Town; (D'A. W. T.)

The description of the arrangement of the pinnæ, given above, is involved in strange confusion, owing to the author's assumption that all the calycles of the stem are in pairs, while in reality the one in each axil is unpaired. The true arrangement seems to be the same as in a great number of other species, namely, that each internode of the stem bears on one side, close to the base, a pinna with a hydrotheca in the axil, and above it a pair of hydrothecæ. Mr. D'Arcy W. Thompson says that the hydro-

caulus is much twisted at the base, and that "the dried specimens are harsh and brittle to the touch, and the colour is a distinctive and characteristic reddish brown." According to the same author there are one or two pairs of hydrothecæ on each internode of the pinnæ.

SERTULARIA PENNA, *Kirchenpauer*. Plate viii, figs. 5–6.

Dynamena penna, Kirch., Verhand. Akad. der Naturforscher, 1864 (fig.)

Shoots elongated, pinnate, springing from a creeping stolon, pinnæ alternate; hydrothecæ obconical, aperture bicuspidate; gonothecæ small, tubuliform.

Hab.—Bass' Straits (Van Diemen's Land).

Pinnate stems about three inches long, of straw-yellow color, rise from creeping root-tubes. They are beset with cells, between which grow out the alternate pinnules in the same regular way as in the preceding species. The cells are more obconical than globular, and the end of the cell-wall turned away from the rachis runs out at the aperture into two blunt points, which, however, are smaller and more closely approximated than in the preceding species. The present species is further distinguished from *D. australis*, which is likewise pinnate, by the color and size, also by the form of the cells, and more especially by the form of the sexual capsules. These are unusually small, scarcely longer than the cell, and almost cylindrico-tubular, only a little contracted above, but provided with a broad neck or rim.

Our specimens were found among Algæ from Bass' Straits, in the Binder collection, with the root-tubes fastened on the dead stem of a larger (no longer recognizable) Hydroid Zoophyte, and seem, without closer scrutiny, like branches of the latter.—(KIRCHENPAUER).

SERTULARIA ELONGATA, *Lamx.* Plate vi, figs. 7–8; plate xix, fig. 7. (A.M.)

Sertularia elongata, Lamx., Hist. Polyp. Flex. (fig.); Deslongch., Encycl. Méth.; D'A. W. Thompson, An. Nat. Hist., Feb., 1879 (fig.); Blainv., Man. d'Act.

Sertularia lycopodium? Lamk., An. s. Vert.

Dynamene abietinoides, Gray, Dief. N.Z.

Sertularia abietinoides, Coughtrey, Trans. N.Z. Inst. VII. (fig.)

Hydrocaulus pinnate or rarely bipinnate, attaining a height of about three inches; stem flexuous; each internode bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, with internodes bearing from one to four or five pairs of hydrothecæ, the proximal ones longest. Hydrothecæ in pairs, not in contact with each other, sub-alternate, tubular, widely divergent and free for half their length or more; aperture usually directed more to the front in those along one side of the pinna than in the opposite series, large, furnished with six long teeth, the two nearest the stem or pinna with a considerable interval between them, sometimes exceeding one-third of the margin, which at this part is usually somewhat everted.

Gonothecæ on the stem, or in large specimens on the pinnæ, large, pyriform, with the sides produced upwards into two large erect conical processes, extending far above the aperture, which has a short tubular neck, and an operculum.

Color variable, bright brown to dull greyish.

Hab.—Bass' Sts., Port Philip, South Australia, New Zealand, &c.; very common.

This is by far the commonest species on the Southern coast, and is found trailing along the stems of seaweeds, which it clothes with a forest of pinnate shoots, sometimes three inches or more in height, but very often not exceeding an inch. In the larger form some of the pinnæ near the summit may assume the character of the stem and give off secondary pinnæ, but this is

not of general occurrence. The calycles vary remarkably in size, being in proportion to the general dimensions of the polypary. Large specimens have usually four or five pairs of hydrothecæ on the proximal internodes of the pinnæ, while the small form has only one or two; but in either case the internodes towards the ends of the pinnæ bear only one pair each. As a rule, the calycles along one side of the pinnæ are directed straight outwards, while the opposite series are somewhat recurved, so that the apertures face the front, but this is not universal. I have occasionally seen the peristome, with its circle of teeth, doubled or tripled.

SERTULARIA UNGUICULATA, *Busk.* Plate vi, fig. 9–12; plate xix, fig. 8. (A.M.)

Sertularia unguiculata, Busk, Voy. of Rattlesn.

Sertularia sp.? Coughtrey, An. Nat. Hist., Jan., 1876 (fig.)

Thuiaria ambigua, D'A. W. Thompson, An. Nat. Hist., Feb., 1879 (fig.)

Hydrocaulus pinnate, often branched, attaining a height of four or five inches, stem-internodes either long—bearing on one side a pinna with three hydrothecæ above it, and on the other a pinna with two hydrothecæ above and one below—or short, bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, each attached by a slender oblique joint; internodes at and near the distal ends each with one pair of hydrothecæ, proximal ones often with several pairs. Hydrothecæ sub-alternate on the stem, mostly opposite on the pinnæ, urceolate; upper part free, divergent, projecting in front; lower part adnate, often immersed, those on the pinnæ in pairs, in contact or approximate in front, widely separated behind; aperture small, oval, horizontal, with two long lateral teeth, the outer larger and usually incurved.

Gonothecæ on the stem, large, obovate; aperture wide, operculate, with a slightly elevated thickened border.

Color, bright brown.

Hab.—Swan Id., Banks' St. (Busk); Sealer's Cove (D'A. W. Thompson); Portland (Mr. Maplestone); Griffiths' Point (Mr. Goldstein); Queenscliff; New Zealand; Robe, S.A. (Mr. Smeaton); Sydney (Mr. Maplestone).

This is a common species, and remarkable for its variability. The small variety overruns seaweeds, and consists of pinnate shoots often less than an inch in height, with the stem-internodes mostly of the short type, the lower pinnæ with one or two of the proximal internodes bearing about two pairs of hydrothecæ each, and the remaining portion of these pinnæ, as well as the whole of the upper ones, jointed below every pair. In the large form the stems are thick, usually grow in clusters, are often branched, especially near the summit, and are divided for the most part into long internodes (which are formed by the complete coalescence of two of the shorter ones); the internodes of the pinnæ decrease in length from the proximal towards the distal ends, those at the former part usually bearing four or five pairs of calycles on each. In this case the hydrothecæ on the stem and the longer joints of the pinnæ are much more closely adnate than those at the distal ends, those on the stem especially being often immersed for a great part of their length. The polypidom thus acquires a Thuiarian aspect, except towards the ends of the pinnæ, and this is still more noticeable in a variety of which I have seen but a single specimen, in which all the internodes of the pinnæ, or all but one, bear more than one pair of calycles, and these are closely adnate for the greater part of their length. In another fine variety, of which I have received a specimen from Mr. Maplestone, some of the pinnæ bear as many as twenty-four pairs of calycles on the longest internode, which are as closely adnate as in the last-mentioned variety, and which, moreover, are nearly alternate and separated from those opposite them in front as well as behind. Those towards the ends of the pinnæ are of the ordinary Sertularian type. The most remarkable feature in this variety, however, is the presence on some of

the pinnæ of a third series of hydrothecæ, running for some distance along the front of the first internode. This species seems to partake in some degree of the characteristics of *Sertularia*, *Thuiaria*, and *Desmoscyphus*, and in the last variety to show the transition towards *Selaginopsis*.

SERTULARIA GEMINATA, *n. sp.* Plate v, fig. 6, 7; plate xix, fig. 15. (A.M.)

Hydrocaulus slender, pinnate, much branched, four or five inches in height, stem-internodes each bearing a pinna with a pair of hydrothecæ above it and one in the axil; pinnæ alternate, each attached by a slender oblique joint, with internodes bearing from one to three or four pairs of hydrothecæ, the proximal ones usually longest. Hydrothecæ sub-alternate on the stem, opposite on the pinnæ, tubular, upper half divergent, ascending, those on the pinnæ in pairs, adnate to each other for about two-thirds of their length, adnate by not more than half their length to the front of the pinna, from which they project forward; aperture small, transversely oval, looking upwards, with two prominent lateral incurved teeth.

Gonothecæ on the stem and branches, ovate; aperture operculate, with a slightly elevated border.

Color, greyish brown.

Hab.—Queenscliff; Portland (Mr. Maplestone).

Easily distinguished by the tubular hydrothecæ, each pair forming a geminate body attached to the front of the pinna, and projecting forward at a rather wide angle. There is sometimes a considerable interval between every two pairs.

SERTULARIA FLEXILIS, *D'A. W. Thompson.* Plate viii, fig. 1. An. & Mag. Nat. Hist., February, 1879 (fig.)

Hydrocaulus slender, attaining a height of about 8 inches. Pinnæ alternate, given off at rather distant intervals. Hydrothecæ opposite, in pairs, sub-alternate on the main stem, one in the axil of each pinna, generally two pairs to each internode, tubular, distant, strongly divergent, those on the main stem less

so than those on the pinnæ; aperture small, looking upwards, with one broad tooth on each side. Gonothecæ attached just beneath the base of a hydrotheca on the main stem only, and confined to the upper part; globular, smooth, margin slightly everted; orifice with a round operculum.

Sealer's Cove (Dr. F. Mueller).

Approaching *Dynamena distans* of Lamouroux in the wide space between the pairs of hydrothecæ, but in no other particular.—(THOMPSON.)

SERTULARIA TRIDENTATA, *Busk*. Plate ix, fig. 10.

Voy. of the Rattlesn.

Cells urceolate, ventricose below, contracted towards the mouth, mouth looking forwards and outwards, circular, with three acute teeth, two lateral, longer than the third, which is above.

Bass' Sts., 45 fathoms.

Yellowish white, simply pinnate, height about $2\frac{1}{2}$ inches, pinnæ in the middle $\frac{3}{4}$ inch. Cells ventricose below, almost flask-shaped, the two lateral teeth long, acute, slightly everted, the upper tooth sharp, not nearly so long as the others, the border of the mouth excavated below, so that the mouth is as nearly as possible vertical, lateral teeth sloped or bevelled off from below upwards, not from above downwards. (BUSK.)

This species would come under the genus *Dynamena* of Lamouroux, and is therefore distinct from the *S. tridentata* of that author. Mr. Busk's figure shows the central pinnæ considerably longer than those above and below, and divergent at right angles. The calycles on the pinnæ are in pairs, opposite and in contact with each other in front.

SERTULARIA RECTA, *Bale*. Plate v, fig. 1.

Journ. Mic. Soc. Vict., ii (fig).

Hydrocaulus pinnate, stem flexuous, each internode bearing a pinna with a pair of hydrothecæ above it, and one in the axil;

pinnæ alternate, divergent, with one pair of hydrothecæ on each internode. Hydrothecæ in pairs, not in contact with each other, sub-alternate, flask-shaped, upper side horizontal; aperture small, looking upwards, with two broad rounded lateral teeth, one of which almost or quite conceals the other in a front or back view of the polypidom.

Gonothecæ?

Color, brownish, hydrothecæ pale, except towards the mouth, where they are red.

Hab.—Brighton, S. Australia—(Mr. Smeaton).

I have not met with this species except in Mr. Smeaton's collection. The calycles project directly outwards, and consequently present no noticeable difference, whether the polypary be viewed from the back or front of the slide.

SERTULARIA MACROCARPA, *n. sp.* Plate v, fig. 2; plate xix, fig. 11. (A.M.)

Hydrocaulus pinnate, five or six inches in height, stem flexuous, each internode bearing a pinna with a pair of hydrothecæ above it and one in the axil; pinnæ alternate, with one or two pairs of hydrothecæ on each internode. Hydrothecæ in pairs, opposite or sub-alternate, flask-shaped, or sub-tubular, upper side almost horizontal (except in those towards the ends of the pinnæ, which, with the supporting internodes, are often very much elongated and produced upwards); those of each pair on the pinnæ in contact or approximate in front, widely separated behind; aperture small, looking upwards, with two broad rounded lateral teeth, a strong internal tooth projecting into the neck from the inner side.

Gonothecæ borne in rows on the stem, large, obovate; aperture operculate, with an elevated margin.

Color, dark brown, sometimes blackish.

Hab.—Queenscliff; Williamstown; Portland (Mr. Maplestone).

This species somewhat resembles *S. recta*, but is larger, with the pinnæ much less divergent; the calycles do not project directly outward, but are directed somewhat towards the anterior aspect of the polypary, and the upper border is not usually horizontal, except perhaps in one or two pairs at the proximal ends of the pinnæ. As they approach the extremity of the pinna they become (in most specimens) more and more slender and less divergent, the terminal ones being quite tubular and directed upwards at a small angle with the attenuated and much elongated internodes. In some specimens, however, all the calycles are more or less tubular and ascending. The calycles are not equally distant in front and behind from those opposite to them, as in *S. recta*, but are approximate in front, with the inner side more curved than in that species; they are further distinguished by the internal tooth on the inner side, which is absent in *S. recta*. The Portland specimens have much longer pinnæ than the others, and also differ in having two calycles on each internode throughout.

SERTULARIA DIVERGENS, *Lamx.* Plate v, fig. 3; Plate xix, fig. 16.

Dynamena divergens, Lx., Hist. Polyp. Flex. (fig)., Encyc. Méth.; Blainv., Man. d'Act.

Sertularia divergens, Lamk., An. s. Vert.; Busk, Voy. of Rattlesn.

Sertularia flosculus, D'A. W. Thompson, An. Nat. Hist., Feby., 1879 (fig.)

Hydrocaulus pinnate, about three-fourths of an inch in height, stem slightly flexuous, each internode usually bearing a pinna with a pair of hydrothecæ above it, and one in the axil; pinnæ alternate, short, usually wanting on the two or three topmost internodes, divergent almost at right angles, the processes supporting them furnished with an oblique fold, internodes each bearing one pair of hydrothecæ, triangular below the base of the hydrothecæ, slender above; joints narrow, distinct, oblique. Hydrothecæ sub-alternate on the pinnate part of the stem, opposite on the upper part and the pinnæ, tubular, upper half

free, divergent, those on the pinnæ and upper part of the stem in pairs, in contact in front, separated behind, those towards the ends scarcely divergent; orifice small, with two lateral teeth.

Gonothecæ borne near the base of the hydrocaulus, one or two on a shoot, obovate, aperture operculate, margin slightly elevated.

Color, yellowish brown.

Hab.—Swan Id., Bank's St. (Mr. Busk): Adelaide? (Mr. Thompson): Williamstown; Portland (Mr. Maplestone).

Mr. Busk's identification of Lamouroux' *Dynamena divergens* with the present species is very doubtful, and Kirchenpauer has identified it with a different but closely allied form, namely that figured in Savigny's "Egypt," and wrongly supposed by Audouin to be identical with *D. distans*, Lamx. The specific name of *D. divergens* has reference to the strongly divergent pinnæ, which are almost perpendicular to the stem, but Savigny's species is without pinnæ, or if it is, as I think probable, the same as the stemless form of the next species, the pinnæ when present are by no means so widely divergent as in the present form. Lamouroux' figure differs from *S. tenuis* in the form of the hydrothecæ, and from Busk's species in the length and slenderness of the internodes, while the latter are represented with three or four spiral turns at the base of each, a peculiarity which is probably imaginary. Though the arrangement of the pinnæ in the present species is normally alternate, it is not unusual to find one or two internodes at the base of the stem bearing two pinnæ each, which are then opposite.

SERTULARIA TENUIS, *n. sp.* Plate v, fig. 4, 5; plate xix, fig. 16. (A.M.)

Dynamena distans, Audouin (nec Lamx.), L'Egypte (fig.)?

Hydrocaulus slender, simple or pinnate, about three-fourths of an inch in height, stem-internodes bearing either a pair of hydrothecæ only, or a pinna with a pair of hydrothecæ above it and one in the axil; pinnæ irregular, alternate, ascending, usually absent near the summit of the stem, the process supporting them

furnished with an oblique fold; internodes each bearing one pair of hydrothecæ, triangular below the base of the hydrothecæ, slender above; joints narrow, distinct, oblique. Hydrothecæ sub-alternate on the pinnate part of the stem, opposite on the upper part and on the pinnæ, long, tubular, upper half (or more) free, widely divergent; those on the pinnæ and upper part of the stem in pairs, in contact in front, separated behind; those towards the ends less divergent than the rest, orifice small, with two lateral teeth.

Gonothecæ borne near the base of the hydrocaulus, one or two on a shoot, obovate, aperture operculate, margin slightly elevated.

Color, pale brownish.

Hab.—Williamstown.

This species is found profusely investing frondose algæ, but only here and there assuming the pinnate form. It may be distinguished from *S. divergens* by the greater length and slenderness both of the calycles and the internodes of the hydrocaulus, also by the fewness and irregularity of the pinnæ, and by their ascending at an angle of about 45°. A full-sized specimen of *S. divergens* usually has five or six pinnæ on each side of the stem, while in *S. tenuis* I have only found from one to three on each side, the stems being about the same height. The species figured in Savigny's "Egypt," and incorrectly assigned by Audouin to the *Dynamena distans* of Lamouroux, is very similar to the undivided form of the present species, and is perhaps not specifically distinct, though its hydrothecæ are more widely divergent, and the peculiar form of the lateral teeth (sloped off from below upwards) is more pronounced than in *S. tenuis* and *S. divergens*.

SERTULARIA BICORNIS, *Bale*. Plate v, fig. 9.

Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus pinnate, about half an inch in height, stem flexuous, each internode bearing a pinna with a pair of hydro-

thecæ above it and one in the axil; pinnæ alternate, divergent almost at right angles, the processes supporting them furnished with an oblique joint or fold, internodes each bearing one pair of hydrothecæ, broadly triangular below the base of the hydrothecæ, slender above; joints narrow, distinct, oblique. Hydrothecæ in pairs, opposite throughout, or sub-alternate on the stem, in contact in front, separated behind (sometimes only approximate on the stem), short and broad, squarish, divergent, adnate by the base only to the hydrocaulus, from which they project forward nearly or quite horizontally; aperture tubular, transversely oval, with two small lateral teeth; an erect tubular process at each side of the aperture; two or three minute denticles sometimes projecting into the cell, about the middle.

Gonothecæ ?

Color, yellowish brown.

Hab.—Queenscliff.

In its habit similar to *S. divergens*, but totally different in the form of the hydrothecæ, which are peculiar in the possession of the two erect tubular processes at the sides of the aperture.

SERTULARIA TRIGONOSTOMA, *Busk.* Plate v, fig. 8. (A.M.)
Voy. of the Rattlesn.

Hydrocaulus pinnate, about two inches in height, stem thick, each internode usually bearing a pinna, with a pair of hydrothecæ above it and one in the axil; pinnæ alternate, irregular in length, with one pair of hydrothecæ to each internode. Hydrothecæ alternate on the stem, sub-alternate on the pinnæ, ovate, contracted towards the aperture, a small portion free, projecting forwards and outwards; those on the pinnæ in pairs, in contact in front, widely separated behind; aperture triangular, longest side below, with two inconspicuous lateral teeth.

Gonothecæ ?

Color, light yellowish.

Hab.—Prince of Wales Channel, Torres Sts., 9 fathoms (Busk); Albany Passage, 9 fathoms (Mr. Haswell).

In its general appearance this species has a good deal the aspect of an *Aglaophenia*. In one of the specimens which I have examined, the internodes at the base of the stem each bear two opposite pinnæ, with two or three calycles above them on each side; the remainder of the hydrocaulus is regularly divided as described above.

SERTULARIA ACANTHOSTOMA, *Bale*. Plate iv, fig. 7, 8. (A.M.)
Journ. Mic. Soc. Vict., vol. II (fig.)

Shoots pinnate, attaining a height of about an inch; pinnæ opposite, slender at their origin, each pair springing from the stem immediately below a pair of hydrothecæ; three pairs of hydrothecæ on the stem between every two pairs of pinnæ. Hydrothecæ opposite on the stem, subalternate on the pinnæ; one pair on every internode except the proximal internode of each pinna, which bears a single one on the lower side; tubular, expanding upwards, the inner side sinuous; aperture oval, not contracted, with eight pointed teeth on each side, three of which are longer than the other five; every alternate tooth somewhat incurved; a small process projecting horizontally into the hydrotheca from about the middle of the inner side, with a fold continued from it across the cell; a second process projecting into the cell from the outer side, near the base; and a small fold extending from about the bases of the outer pair of teeth to a point a little distance down the front of the hydrotheca.

Gonothecæ?

Color, light yellowish.

Hab.—Robe, S. A. (Mr. Smeaton); Belfast (Mr. Maplestone.)

Having been furnished by Mr. Maplestone with several specimens of this remarkable species, I am enabled to amend and add to the original description, taken from a small mounted

specimen. The two sides of the calycle are symmetrical in the arrangement of the teeth; the three pairs of large ones and one pair of the smaller ones project slightly outwards, while the four alternating pairs are directed somewhat inwards, and two pairs appear to spring from within the margin. The fold in the cell-wall at the outer angle appears in lateral view like a partition dividing off a small chamber from the general cavity of the calycle.

SERTULARIA INSIGNIS, *D'A. W. Thompson.* Plate viii, fig. 2–3.

An. & Mag. Nat. Hist., February, 1879.

Hydrorhiza consisting of a few short fibres neither branching nor anastomosing. Hydrocaulus attaining a height of 6 or 7 inches, pinnæ opposite. Hydrothecæ tubular, unconstricted, rather long, the orifice with about six small rounded teeth, those on the main stem divergent at right angles, opposite, those on the pinnæ diverging slightly upwards, alternate or sub-alternate. Yellow. Gonothecæ springing from the base of the pinnæ close to the main stem, oblong, much elongated, about eight times the length of the hydrothecæ, with two long divergent spines at the top, orifice small, inconspicuous.

George Town (Harvey.)

Pinnæ short, almost perpendicular to the main stem.—(THOMPSON.)

Like *S. acanthostoma* this species is remarkable for having the calycles opposite on the stem, and sub-alternate on the pinnæ, with an unpaired calycle on the first internode of each pinna; it also possesses the additional peculiarity of having the calycles on the stem divergent at right angles.

SERTULARIA CRENATA, *n. sp.* Plate iv, fig. 2.

Hydrocaulus pinnate or bipinnate, about 2 inches in height, stem flexuous, divided into alternate long and short internodes, the

latter bearing each a pinna with a hydrotheca in the axil, and the former a pair of alternate hydrothecæ only; pinnæ alternate, rather distant, divided by oblique joints into internodes, each of which bears a pair of hydrothecæ (except the proximal one on each pinna, which bears a single hydrotheca on its lower side only). Hydrothecæ in pairs, not in contact, alternate throughout, large, tubular, expanding upwards, adnate about half their height, abruptly divergent, ascending; a partial septum extending from the angle of flexure on the outer side nearly half across the cell; aperture wide, looking upwards and outwards, margin with ten small upright nearly equal teeth.

Gonothecæ?

Color, brown.

Hab.—Schnapper Point, Pt. Phillip (Mr. J. F. Bailey).

In the only specimen found the pinnæ are long, and a few of those near the summit bear one or two short pinnules each.

SERTULARIA TUBA, *n. sp.* Plate iv, fig. 11. Plate xix, fig. 17. (A.M.)

Hydrocaulus pinnate or bipinnate, between one and 2 inches in height, forming a tangled mass by the anastomosing of the pinnæ; divided into internodes each of which usually bears two pairs of hydrothecæ, those on the stem bearing a pinna also, which springs from just below one of the hydrothecæ of the upper pair; pinnæ distant, alternate, divergent almost at right angles, and often giving off one or two pinnules, joints oblique. Hydrothecæ in pairs, opposite, in contact with each other in front, separated behind, long, tubular, free for nearly one-third of their length, upper half curved outwards, aperture vertical, margin membranous, with two very indistinct lateral teeth.

Gonothecæ ovate, aperture operculate, with elevated border, and a circle of long internal teeth, projecting into the neck.

Color, yellowish brown.

Hab.—Queenscliff; Portland (Mr. Maplestone).

In this species the arrangement of the internodes and hydrothecæ is usually precisely the same on the stem, pinnæ, and pinnules, but occasionally internodes are met with on the pinnæ bearing only one pair of hydrothecæ each. The pinnæ and pinnules anastomose freely, and instances may sometimes be seen where almost every pinna along one side of a stem is united to a neighbouring stem.

SERTULARIA PATULA, *Busk*. Plate v, fig. 10.
Voy. of Rattlesn.

Hydrocaulus pinnate, usually less than an inch in height; internodes of the stem long, each bearing a pair of pinnæ at the summit, and a pair of hydrothecæ about the middle; pinnæ distant, opposite, widely divergent, indistinctly divided into internodes, each with one pair of hydrothecæ. Hydrothecæ opposite in pairs, not in contact, tubular, adnate three-fourths of their height, upper portion curved outwards, ascending; aperture circular, looking upwards and outwards, margin slightly sinuated at the sides, not toothed, somewhat everted.

Gonothecæ?

Color whitish, transparent.

Hab.—Bass' St. 45 fathoms (Busk): Williamstown; Queenscliff.

A small specimen found at Williamstown contained the polypites, which were of a purple-red color.

SERTULARIA ORTHOGONIA, *Busk*. Plate ix, fig. 11.
Voy. of Rattlesn.

Cells tubular, nearly half free, divergent laterally at a right angle, mouth looking directly outwards, border entire, slightly everted.

Ovicell—?

Hab.—Prince of Wales Channel, Torres St., parasitic on *S. pristis.*

Very like *S. patula* in habit and size, perhaps a variety. The cells however throughout the whole of the polypidom are of the same character in each form, and exhibit no intermediate steps. In the present species the cells are much longer, rather narrower, and the upper half is turned out abruptly at a right angle, whilst in the former they ascend at an angle of 45°, and the free part is much shorter. Branches in both opposite.—(BUSK.)

This is very probably a variety of *S. patula*, as Mr. Busk suggests. In one of my specimens of the latter species there is a single calycle produced horizontally and with the mouth vertical, as in *S. orthogonia*, but the outward curve is less abrupt than in Mr. Busk's figure of that species.

SERTULARIA MINIMA, *D'A. W. Thompson.* Plate iv, fig. 9–10; Plate xix, fig. 12–13. (A.M.)

Synthecium gracilis, Coughtrey, Trans. N.Z. Inst., vii, (fig.)

Sertularia pumila, Coughtrey, Tr. N.Z. Inst., viii.

Sertularia minima, D'A. W. Thompson, An. Nat. Hist., February, 1879.

Sertularia pumiloides, Bale, Journ. Mic. Soc. Vict., ii, (fig.)

Hydrocaulus simple, attaining a height of about one-fourth of an inch, with a pair of hydrothecæ on each internode, joints slender, oblique. Hydrothecæ tubular, in pairs, opposite, mostly in contact with each other in front, separated behind, adnate most of their length, upper half divergent, ascending; aperture looking upwards, with two prominent lateral teeth, the outer larger.

Gonothecæ sub-globular, aperture operculate, with scarcely elevated margin; one only on a shoot, springing from behind the basal part of the proximal internode.

Color, brownish yellow.

Hab.—New Zealand (Coughtrey); Gulf of St. Vincent (D'A. W. Thompson); Portland (Mr. Maplestone); Williamstown; Queenscliff (robust var.).

The common form of this species, which I have found growing profusely on seaweeds thrown on the beach at Williamstown, agrees precisely with Mr. Coughtrey's description of the New Zealand specimens. It is about ⅛ of an inch in height, and there are not more than eleven internodes on a shoot; the hydrorhiza is flat and ribbon-like, with regular transverse markings along the margins, as in many species of *Plumularia*. The form which I have described as *S. pumiloides* differs in the larger size of the hydrosoma generally, in having 14-16 internodes on a shoot, and in the structure of the hydrorhiza, which is zig-zag, irregular in width, and without the transverse markings. A specimen from New Zealand seems intermediate, though longer than either of the other varieties, and in view of this fact, and of the very slight difference between them, I think it will be advisable to treat *S. pumiloides* as a variety of *S. minima*, rather than as a distinct species.

SERTULARIA MINUTA, *Bale*. Plate iv, fig. 3-4; plate xix, fig. 14.

Journ. Mic. Soc. Vict., ii (fig.)

Hydrocaulus simple, minute, with a pair of hydrothecæ on each internode, joints slender. Hydrothecæ tubular, in pairs, opposite, in contact with each other in front, separated behind; base expanded outwards, forming a somewhat angular projection; upper part abruptly divergent horizontally, with a fold or crease in the angle; divergent part short, free; aperture directed outward and slightly forward, somewhat expanded, with three teeth, one superior and two lateral; emarginate below.

Gonothecæ large, thick, oblong, aperture operculate, with slightly elevated margin; one only on a shoot, springing from behind the basal part of the proximal internode.

Color, brown.

Hab.—Sorrento, Pt. Philip (Mr. J. B. Wilson.)

None of the specimens exceeded $\frac{1}{12}$ of an inch in height, or consisted of more than four internodes, which altogether barely equalled the height of the gonotheca. The calycles are proportionately small, and the whole hydrosoma is much smaller than that of any other known species of *Sertularia*.

SERTULARIA LOCULOSA, *Busk*. Plate iv, fig. 5-6; Plate ix, fig. 12; Plate xix, fig. 9. (A.M.)

Voy. of "Rattlesn."

Hydrocaulus attaining a height of about half an inch, simple, or rarely with a few short alternate pinnæ, each springing from an internode which bears in addition a pair of alternate hydrothecæ and one in the axil; joints either single and horizontal, or double, with the second one very slender and oblique. Hydrothecæ short and broad, in pairs, all except those on pinna-bearing internodes opposite, in contact with each other in front, separated behind, upper half abruptly divergent, with the angle of flexure appearing as a horizontal fold crossing the cell, aperture contracted, directed outwards, with two lateral teeth, generally broad and rounded.

Gonothecæ, one or two on a shoot, broad, ovate, truncated at the summit, with four or five very strong transverse annulations; aperture wide, operculate.

Color, brown.

Hab.—Bass' St., 45 fathoms (Busk.); Portland (Mr. Maplestone); Queenscliff.

The horizontal folds crossing the calycles appear in front view like transverse septa dividing them into two parts, so that each pair, with the basal part of the supporting internode, forms a triangular body apparently divided into five loculi, and usually about as broad as long. In Mr. Busk's specimens, however, the length is greater in proportion, sometimes equalling double the breadth, owing mainly to the elongation of the lower part of the internode. I have met with another variety which differs considerably from the ordinary form in general appearance, in consequence of the calycles being more elongated, the aperture looking more upwards than outwards, and the lateral teeth being produced upwards into sharp points. This form strongly resembles Kirchenpauer's figure of his *D. australis*. In both these varieties the hydrothecæ at the base of the hydrocaulus approximate to the ordinary type. The only specimens in which pinnæ were present were two or three sent me by Mr. Maplestone, and in these the central part of the stem, which bore the pinnæ, had an aspect totally different from that usual in the species, owing to the separation and alternate arrangement of the hydrothecæ, and the presence of an unpaired one in each axil. The calycles in this form resemble those of the last-mentioned variety. The jointing of the hydrocaulus in this species is somewhat peculiar. Immediately above each pair of calycles there is a simple, not very conspicuous, joint, and above this in many cases a very slender oblique joint, the superior internode being produced downwards into a sharp point in front of the lower one which is similarly produced upwards behind it. In some shoots these joints occur between every two internodes; in others they are much less frequent, and may be absent throughout. Similar joints are found in *S. minima*, *S. bicornis*, *S. divergens*, &c., and at the base of the pinnæ in *S. unguiculata* and *S. geminata*, but in the present species they are noticeable for their irregularity, and on account of their being superadded to the ordinary joints. The gonothecæ (which have not previously been described) resemble those which are usual in the genus *Sertularella*, but have a broad operculum.

SERTULARIA CONFERTA, *Kirchenpauer*, plate viii, fig. 9.

Dynamena conferta, Kirch., Verhand. Akad. der Naturforscher, 1864 (fig.)

Shoots simple, short, springing from a long branched creeping stolon; hydrothecæ close, sub-tubular, aperture vertical, marginate, margin entire; gonothecæ large, rugose-annulate.

Hab.—Carpentaria.

From long, fine, somewhat branched tubes, which twine around algæ, rise here and there single, simple, small stems, one to two lines in height; these are jointed, and each joint consists of a pair of polype-cells (hydrothecæ). The cells occupy the whole length of the joint, so that each appears to be placed almost directly on the one below, and as the cells themselves, narrow in proportion to their length, recede from one another below and approach each other above, the single joint takes on a form (namely, broader below than above) which distinguishes this species surprisingly from all the rest. Moreover the lateral almost perpendicular portion of the mouth, which is surrounded by a smooth swollen rim, is here quite peculiar, as well as the unusual thickness of the chitinous cell-wall, and the dark brown color. The part of the stem enclosed between the two cells of a joint appears to be separated lengthwise into two chambers, which, as they are separated also by partitions from the parts lying above and below, might be set down as peculiar accessory cells. The form of the sexual capsules further is very remarkable; they are large compared with the cells, are ringed as in some sertularians (*S. rugosa*, *S. polyzonias*, *S. tenella*), and are not situated as in the other *Dynamenæ* on the stems, between the cells, but directly on the creeping root-tubes. This species appears so perfectly different from all other species of *Dynamena* that it should perhaps be looked upon as a distinct genus, but unfortunately in our specimens, from the Binder collection of Algæ, nothing of the form of the animal was to be recognized.

Lamouroux' short description of his *D. obliqua* suits this species very well in some points, but it is much too inexact for identification to be possible in the absence of a figure.—(KIRCHENPAUER.)

SERTULARIA GROSSE-DENTATA, *Kirchenpauer*, plate viii, fig. 10.

Dynamena grosse-dentata, Kirch., Verhand. Akad. der Naturforscher, 1864 (fig.)

Shoots minute, simple, springing from a creeping stolon; hydrothecæ tubular, interrupted, margin of the aperture tridentate; gonothecæ?

Hab.—Australia.

The stems are small, scarcely half an inch high, quite simple, with creeping root-tubes attached to Algæ and beset with about a dozen pairs of cells. The form of these cells is very remarkable; they are almost cylindrical tubes, which however are sharply bent inwards about the middle, and are arched outwards almost at a right angle. A characteristic feature is the horizontally-placed mouth of the cells, whose somewhat thickened rim runs out into two short thick denticles, as in other species; opposite these denticles stands however a third similar tubercle or tooth on the side turned to the stem; between the three tubercles the border is evenly concave. An undoubted *Dynamena* with three-toothed cell-openings is not known to me; yet a name derived from that peculiarity cannot well be selected for it, as it is necessary to avoid confusion with *Sertularia tridentata*, Lamx., and with *S. tricuspidata*, Alder, and especially with *S. tricuspidata*, Murray, which last, to judge from Murray's drawing, is probably a *Dynamena*, but is distinguished from the present species partly by the habit (similar to that of *D. operculata*), and partly by the fact that the denticles or points of the opening all three stand on the outer angle of the cell. (Murray has given his species

the name mentioned above without knowing that Alder had already taken it for a totally different species.)

Generative capsules were not present in our specimens, which were found on Australian Polysiphoniæ in the Binder collection. —(KIRCHENPAUER.)

SERTULARIA ARBUSCULA, *Lamx.*, plate viii, fig. 11.

Lamx., Hist. Polyp. Flex. (fig.); Deslongch., Encycl. Méth.; Lamk. An. s. Vert.; Blainv., Man. d'Act.

Root forming a thick mass; stem thick, short, branching from the base; branches and branchlets numerous, short, and scattered; cellules small, campanulate, ventricose, with entire margin; capsules ovoid, elongated, with a small aperture at the summit; color, deep brown; height, four to six centimetres.

Seas of Australasia.—(LAMOUROUX.)

From the alternate disposition of the calycles this species appears to be a *Sertularella*. The calycles are by no means what we should describe as campanulate, being rounded and swollen at the base, and narrowed upwards towards the small aperture.

SERTULARIA TUBIFORMIS, *Lamx.*, plate viii, fig. 12.

Dynamena tubiformis, LX., Expos. Méth. (fig.), Encycl. Méth.; Blainv., Man. d'Act.

Sertularia tubiformis, Lamk., An. s. Vert.

Stem pinnate, pinnæ simple and alternate, covered with cellules in the form of a tube, almost cylindrical, a little arched, with entire aperture. The articulations which support each pair of cellules are conoidal and elongated. Color, deep brown; height, about two centimetres.

Hab.—On the Hydrophytes of Australasia.—(LAMOUROUX.)

Doubtful Species.

The species of *Sertularia* which follow have not been figured, and it is very improbable that the descriptions will be found sufficient to admit of their identification.

Sertularia turbinata, *Lamx.*

Dynamena turbinata, Lx., Hist. Polyp. Flex., Encyc. Méth.
Sertularia turbinata, Lamk., An. s. Vert.

Root creeping; stem straight, simple; cellules somewhat elongated, aperture widened, margin entire; color, yellowish-fawn; height about a centimetre.

On the Fuci of Australasia.—(Lamouroux.)

Sertularia obliqua, *Lamx.*

Dynamena obliqua, Lx., Hist. Polyp. Flex., Encyc. Méth.; Blainv., Man. d'Act.

Sertularia obliqua, Lamk., An. s. Vert.

Stem simple, straight; cellules oval, a little arched; aperture so oblique as to appear almost vertical; color, deep-fawn; height, one to one and a half centimetres.

On the Fuci of Australasia.—(Lamouroux.)

Sertularia barbata, *Lamx.*

Dynamena barbata, Lx., Hist. Polyp. Flex., Encyc. Méth.; Blainv., Man. d'Act.

Sertularia ciliata, Lamk., An. s. Vert.

Stem dichotomous; cellules with oval apertures, the margin furnished with very long cilia; color whitish; height about two centimetres.

On the Fuci of Australasia.—(Lamouroux.)

Sertularia sertularioïdes, *Lamx.*

Dynamena sertularioïdes, Lx., Hist. Polyp. Flex., Encyc. Méth.

Stem thick, short, and branching; branches alternate; cellules often almost alternate, margin entire; height, two to three centimetres; color, brown.

On the Thalassiophytes and Zoophytes of Australasia.—(Lamouroux.)

SERTULARIA RIGIDA, *Lamx.*

Sertularia rigida, Lx., Hist. Polyp. Flex.; Deslongch., Encyc. Méth.; Blainv., Man. d'Act.

Sertularia divaricata, Lk., An. s. Vert.?

Dichotomous; divergent branches fragile; cellules distant, rather large, conical; aperture oval with a point at the external margin; color, greenish-gray; height, three to four centimetres.

Australasia.—(LAMOUROUX.)

Lamarck says that the calycles are alternate, and that the polypary "forms a little loose shrub, of a blackish-brown, with rigid and divergent ramification."

SERTULARIA DISTANS, *Lamx.*

Lamx., Hist. Polyp. Flex.; Deslongch., Encyc. Méth.; Lamk., An. s. Vert.

Stem slightly branched; cellules campanulate, very distant from each other, gibbous; aperture narrowed and dentate; height, one to two centimetres.

Australasia.—(LAMOUROUX.)

SERTULARIA TRIDENTATA, *Lamx.*

Lamx., Hist. Polyp. Flex.; Deslongch., Encyc. Méth.; Lamk., An. s. Vert.

Root-mass shrubby; stem straight, simple, pinnate; pinnules divergent; cellules with three teeth on the margin, and the aperture oblique; color yellowish; height, four to six centimetres.

Australasia.—(LAMOUROUX.)

SERTULARIA SCANDENS, *Lamx.*

Sertularia scandens, Lx., Hist. Polyp. Flex.; Deslongch., Encyc. Méth.; Blainv., Man. d'Act.

Sertularia millefolium, Lamk., An. s. Vert.?

Principal stem filiform, without hydrothecæ, climbing on Gorgonia and other marine productions; secondary stems numerous, simple, scattered, pinnate; cellules with dentate margin; gonothecæ oval, truncate, with two horns; color pale yellowish; height, two to four centimetres.

Australasia.

This Sertularia is much smaller than the preceding (*S. elongata*) in all its parts; it differs also in its more rigid and flexuous habit.—(LAMOUROUX.)

(Possibly the small variety of *S. elongata*.)

DIPHASIA, *Agassiz.*
Nat. Hist. U.S.

SERTULARIA (auct.) in part.
DYNAMENA, *Lamx.* in part.

Zoophyte plant-like; stem more or less branching, jointed, rooted by a creeping stolon; hydrothecæ opposite, a pair on each internode, occasionally sub-alternate, with an internal, valve-like operculum; gonothecæ scattered, differently shaped in the two sexes—the female ample, more or less cleft or divided into segments above, containing a marsupial chamber; the male smaller, with a central tubulous aperture.—(HINCKS.)

The *Sertularia digitalis*, *S. mutulata*, and *S. sub-carinata* of Mr. Busk are placed conjecturally under this genus, but in each case only one kind of gonotheca is at present known, nothing corresponding to the typical female gonotheca, as above described, having yet been discovered.

DIPHASIA PINNATA, *Pallas.* Plate ix, fig. 1.

Sertularia pinnata, Pallas, Elench.; Johnst., B.Z. (fig.)

Sertularia fuscescens, Turt. Gmel.; Lamx., Hist. Pol. Flex., Encyc. Méth.

Nigellastrum pinnatum, Oken, Lehrb. Nat.

Diphasia pinnata, Agas., N.H.U.S.; Hincks, Brit. Hyd. Zooph. (fig.)

Sertularia nigra (the female), Pall., Elench.; Johnst., Brit. Zooph. (fig.)

SHOOTS pinnate, *somewhat lanceolate, deep red or pink when living, drying black or reddish brown;* STEMS *straight, tapering towards the tip, compressed,* delicately serrated; *pinnæ* simple, alternate or sometimes opposite, *not constricted below the calycles,* much attenuated towards the base, often greatly elongated. HYDROTHECÆ *sub-alternate or sometimes opposite, small, crowded, tubulous, adherent, slightly everted at the top,* with a wide even aperture. GONOTHECÆ

(male) ovate, tapering to a blunt point below, with a number of short denticles at the top, round the central papillary aperture; (female) *ample, sub-sessile, smooth and varnished, obovate, divided by longitudinal lines, which meet at the apex, into four lobes.*—(HINCKS.)

Hab.—Sydney; South Africa; South-west coast of England.

"The shoots, which attain a height of 6 inches or upwards, spring from the midst of a twisted and tangled mass of fibres, which sometimes involves the lower part of the stem for a considerable distance. A sheaf of many plumes is often bound together at the base in this way. The species varies in habit. In some cases the shoots are plumous in form, elongate and slender; in others the pinnæ are enormously produced, giving a breadth of as much as 3 inches. The pinnæ taper off very finely towards the point of origin, becoming suddenly thicker above it and continuing of equal width to the extremity. There is no constriction below the calycles, as in all the preceding species. *D. pinnata* deviates in this respect from the typical character of the genus. Its hydrothecæ are not arranged in pairs, separated from each other by a distinct joint, but are closely arrayed along each side of the branches in slightly alternate order.

"Specimens, when dried, lose their brilliant colouring (which is due to the presence of the animal pulp), and become black, sometimes with a tinge of red, and varnished.

"The capsules are produced in immense profusion, often forming rows along the upper side of almost every pinna, and giving the zoophyte much the appearance of a minature tree heavily laden with fruit. The female gonotheca, which is three times as large as the male, presents a structure analogous to that which has been described in several of the preceding species. It is lobate, and the segments, which are closely adherent at first, separate as the embryos reach maturity.

"In Mr. Busk's collection, there is a specimen with the male capsules from Sydney, and one with the female from South Africa."—(HINCKS.)

I have never met with this species, and fancy that it must be extremely rare in Australia, as from its large size and conspicuous appearance it could scarcely have so far escaped observation otherwise. In the wide unjointed pinnæ, with the hydrothecæ not arranged in pairs, it approximates to the genus *Thuiaria*, in which, indeed, it was placed by Oken. There would seem to be as good reason for separating this species from the *Diphasiæ* as for separating *Thuiaria* from *Sertularia*. Obviously the generic description of *Diphasia*, given by Mr. Hincks, does not apply to it.

DIPHASIA ATTENUATA, *Hincks*, plate ix, fig 2.

Sertularia rosacea, Ellis, Cor. (fig.)

Sertularia pinaster, var., Johnst., Brit. Zooph. (fig.)

Sertularia attenuata, Hincks, An. Nat. Hist., Oct., 1866.

Diphasia attenuata, Hincks, Brit. Hyd. Zooph. (fig.)

STEMS *straight, somewhat rigid*, pinnately branched, *often running out above into long tendril-like filaments*, which are thickened and bifid at the extremity; branches simple, or bearing one or two ramules, alternate, inclined upwards, sometimes furnished with tendrils. HYDROTHECÆ *tubular, slender and gracefully curved, about half their length free and divergent, but not abruptly bent, with a plain sub-erect aperture.* GONOTHECÆ (female), *elongate-pyriform*, tapering off below, and gradually expanding upwards, *bristling with strong spines above, which are arranged on six longitudinal ridges, and extend down the upper third of the capsule*; (male) ovate, with six longitudinal ridges, terminating above in angular points, the aperture sub-conical, rising in the midst of them.—(HINCKS.)

Hab.—Port Adelaide (Mr. Busk); southern shores of England.

This species has been regarded by most authors as a variety of *D. rosacea*, till its claim to specific rank was pointed out by Mr. Hincks, who says of it:—"*D. attenuata* is more robust and rigid

and of larger growth than its ally, and wants its delicate membranous texture. The calycles do not shrivel in drying, as those of *D. rosacea* do. The stems are much firmer and of a decided horn colour. They are commonly furnished with long tendril-like extremities. These are occasionally met with on *D. rosacea*, as on other species, but they are very characteristic of *D. attenuata*."

DIPHASIA DIGITALIS, *Busk*. Plate ix, figs. 3–5.

Sertularia digitalis, Busk, Voy. of Rattlesn.

Cells digitiform, slightly curved to the front, mouth circular, looking directly upwards, margin entire, expanded.

Ovicells long-ovoid, muricate, spines numerous, crowded, mouth prolonged, tubular.

Hab.—Prince of Wales Channel, Torres Sts., 9 fathoms.

Dark grey, almost black. Stem 2 to 3 inches in height, rising either from a strong main trunk (?) or from a mass of intertwined radical tubes. Stems or branches pinnate, pinnæ or branches alternate, straight, divaricate. The cells of a pair are, on the branches, adnate to each other all their length. Cells on stem distichous and wide apart. Ovicells long, flask-shaped, with a tubular mouth, all on one side of the rachis, sometimes in pairs, generally single file.—(BUSK.)

This species bears a close resemblance to the *Desmoscyphus longitheca* of Allman. (Hydroida of the Gulf Stream.)

DIPHASIA MUTULATA, *Busk*. Plate ix, figs. 6–9.

Sertularia mutulata, Busk, Voy. of Rattlesn.

Cells compressed or flattened from side to side; sometimes angular, lower half adnate, upper half divergent, projecting like a bracket. Mouth looking directly upwards, narrow, oblong, quadrangular.

Ovicells aculeate, with strong, widely-set spines, pyriform, depressed.

Hab.—Prince of Wales Channel, Torres Sts., 9 fathoms.

Light olive grey, about 3 inches in height, irregularly (?) branched, branches not opposite. The cells are distichous, and of a very peculiar form, varying in some degree according to situation. The younger (?) cells on the secondary branches are flat on the inferior or outer aspect, with two angles on each side, or are quadrangular; whilst the cells on the stems or older or fertile branches are usually rounded below, or on the outer side, and thus have only one angle on each side. The mouth varies in shape according to the cell; in the former case being a regular long rectangle; in the latter it is rounded on the outer side. Ovicells placed in a single series on one side of the rachis.—(Busk).

I have only met with one small fragment of this species (besides a mounted specimen received from Mr. Busk), which was parasitic on one of Mr. Haswell's specimens of *Aglaophenia Huxleyi*, dredged from a depth of 15 fathoms at Port Molle. It bore a number of gonothecæ, all of the same kind as those described by Mr. Busk.

Diphasia sub-carinata, *Busk*. Plate iv, fig. 1; plate xix, fig. 18. (A.M.)

Sertularia sub-carinata, Busk, Voy. of Rattlesn.

Hydrocaulus attaining a height of 1 or 2 inches, simple, or with irregular pinnately-disposed ramuli. Hydrothecæ opposite, one pair to each internode, not in contact with each other; long, tubular, somewhat expanded upwards; upper half abruptly divergent, slightly ascending; aperture wide, looking upwards, with an internal valvular operculum, and with three large rounded teeth, two lateral and one inferior and external; an angular ridge or keel running down the front of the hydrotheca.

Gonothecæ in one or two rows at the lower part of the hydrocaulus, ovate, with a narrow tubular orifice; the surface furnished with numerous slightly curved spines, which are wanting near the peduncle and over a great part of one side which is appressed to the hydrocaulus.

Color, varying from dirty-whitish to very dark brown.

Hab.—Bass' Sts., 45 fathoms (Busk); Pt. Stephens (Mr. Haswell); Griffiths' Point (Mr. Goldstein); Portland (Mr. Maplestone); Queenscliff; Williamstown.

The ridge in front of the hydrotheca is very slight, and when the polypidom is mounted in balsam it usually becomes indistinguishable. Some of the older calycles often show two or three distinct peristomes, doubtless indicating successive growths of polypites. I have only once met with the gonothecæ, which, in the specimens then found, were all of the same kind, and have the general character of the male gonothecæ in this genus. They have not previously been described.

SERTULARELLA, *Gray*.

Brit. Mus. Radiata.

SERTULARIA (auct.) in part.

COTULINA, Agassiz, N.H.U.S (for *S. polyzonias* only).

AMPHITROCHA, Agassiz, *ibid.* (for *S. rugosa*).

Zoophyte plant-like; stem simple or branching, jointed, rooted by a creeping stolon; hydrothecæ biserial, decidedly alternate, one usually borne on each internode, with an operculum composed of several pieces, the orifice generally toothed; gonothecæ usually ringed transversely.

Mr. Hincks says that in this genus the calycles have always a toothed orifice, and that the gonangia are always transversely ringed, and differ slightly in the two sexes; one or two exceptional species, however, are now known in which the margin of the calycles is entire, and the gonothecæ are not ringed; and I

have not been able to discover any sexual differences in the gonothecæ of such species as I have met with, except *S. neglecta* (Thompson). The genus is readily distinguishable from *Sertularia* by the arrangement of the calycles, each of which occupies a separate internode (at least throughout the greater part of the polypidom), while in *Sertularia* the calycles are in pairs, of which each internode bears one or more. In the European species (with the exception of *S. tricuspidata*) the calycles are all four-toothed; but, so far as is known, only one Australian species partakes of this character, all the rest being furnished with three teeth, more or less prominent. The transversely-ringed gonothecæ, though not universal in the genus, and not entirely confined to it, are very characteristic. In most cases they have a toothed summit with an inconspicuous aperture, but sometimes (as in *S. Johnstoni* and its allies) the aperture is prominent and tubular, or funnel-shaped. One or two species of *Sertularia* have the gonothecæ ringed, as in the present genus; the only one which I have observed is *S. loculosa*, Busk, in which, as in other *Sertulariæ*, there is a distinct operculum, a feature which I have not met with in *Sertularella*.

SERTULARELLA POLYZONIAS, *Lin.* Plate iii, fig. 1. Plate xix, fig. 25. (A.M.)

"*Great Tooth Coralline*," Ellis, Coral. (fig.)

Sertularia polyzonias, Linn. Syst.; Esper, Pflanz. (fig.); Lamk., An. s. Vert.; Lamx., Polyp. Cor. Flex.; Johnst., Brit. Zooph. (fig.); Dalyell, Rem. An. (fig.)

Sertularia flexuosa, Linn., Syst.

Sertularia ericoides, Pall., Elench.

Sertularia pinnata, Templeton, Mag. N. H. ix.

Sertularia Hibernica, Johnst., B.Z. (1st. Ed.)

Sertularia Ellisii, M. Edwards, Lam. An. s. Vert. (2nd Ed.); Johnst. B. Z. (1st Edit.)

Sertularella polyzonias, Gray, B. M. Radiata; Hincks., Brit. Hyd. Zooph. (fig.)

Cotulina polyzonias, Agassiz, N.H.U.S.

Sertularia simplex, Hutton, Trans. N.Z. Inst. V.; Coughtrey, Tr. N.Z. Inst., vii (fig.)

Hydrocaulus simple or irregularly branched, divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate about half their height, large, divergent, ventricose below, contracted above; aperture expanding, with four teeth.

Gonothecæ ovate, with a few transverse rugæ, and a tubular neck, summit with three or four teeth.

Color, whitish.

Hab.—Williamstown; New Zealand; northern seas of Europe and America; Mediterranean; South Africa; Falkland Islands, &c.

This species is figured by Mr. Hincks as 2 or 3 inches in height, and luxuriantly branched. The Australian specimens which I have met with are, however, much more humble in growth, being only about ¾ inch in height, and rarely branching, as in one of Ellis' figures.

SERTULARELLA INDIVISA, *Bale.* Plate iii, fig. 5; Plate xix, fig. 27. (A.M.)

Journ. Mic. Soc. Vict., Vol. II. (fig.)

Hydrocaulus usually simple, twisted at the base, about one-third of an inch in height, divided by narrow twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate about half their height, divergent, with two or three slight transverse rugæ, or sometimes nearly smooth; narrowed upwards and contracted near the aperture, which is furnished with three marginal teeth, one superior and two

lateral; also with three internal, compressed, vertical teeth, alternate with the marginal ones.

Gonothecæ, three to four times the length of the hydrothecæ, borne on the hydrorhiza or near the base of the hydrocaulus, usually not more than one on a shoot; ovate, with distinct, not close, transverse rugæ, and a tubular neck; summit with from three to six teeth (generally four).

Color, yellowish brown.

Hab.—Williamstown; St. Kilda; Queenscliff; Portland (Mr. Maplestone); Robe, South Australia (Mr. Smeaton).

This species is sometimes found completely overgrowing fronds of algæ, and bearing a profusion of gonothecæ. It rarely exceeds half an inch in height, and occasionally gives off one or two pinnately-disposed branches.

SERTULARELLA SOLIDULA, *Bale.* Plate iii, fig. 6. Plate xix, fig. 28. (A.M.)

Journ. Mic. Soc. Vict., Vol. II. (fig.)

Hydrorhiza matted, sometimes forming a continuous expansion in parts; hydrocaulus simple, about half an inch in height, twisted at the base, and divided by slightly-twisted joints into swollen internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate from one-third to half their height, divergent, smooth, contracted near the aperture, swollen below; aperture with three marginal teeth, one superior and two lateral; also with three internal, compressed, vertical teeth, alternate with those on the margin.

Gonothecæ twice or three times the length of the hydrothecæ, borne on the stems, frequently three or four in a row; ovate, with transverse rugæ and a tubular neck, summit with three indistinct teeth.

Color, light brown; the polypidom thick.

Hab.—Williamstown; Queenscliff.

The gonothecæ vary much in the number and distinctness of the transverse rugæ, sometimes bearing a strong resemblance to those of the last species.

SERTULARELLA MACROTHECA, *Bale*. Plate iii, fig. 4. Plate xix, fig. 24. (A.M.)

Journ. Mic. Soc. Vict., Vol. II. (fig.)

Hydrocaulus simple, twisted at the base, about half an inch in height; divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ very large, adnate about half their height, smooth, close, slightly divergent, both series directed towards the front; aperture contracted, with three inconspicuous marginal teeth, one superior and two lateral; three internal compressed vertical teeth within the front margin, the central one largest, extending about one-third across the cell; a similar tooth, but narrower, within each of the other two sides of the aperture.

Gonothecæ sub-globular, between two and three times as long as the hydrothecæ, with a few slight distant transverse rugæ; summit truncate.

Color brown, very dark and opaque before preparation.

Hab.—Griffiths' Point (Mr. Goldstein).

Each gonotheca was surmounted by a globular body about equal to it in size, which is probably an external marsupium, but which could not be seen distinctly owing to its being coated with sand and other foreign matter.

SERTULARELLA LÆVIS, *Bale*. Plate iii, fig. 2. Plate xix, fig. 26.

Journ. Mic. Soc. Vict., Vol. II. (fig.)

Hydrocaulus simple, twisted at the base, about one-third of an inch in height, divided by narrow twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ

adnate rather less than half their height, divergent, long, smooth, slightly narrowed towards the aperture; each forming, with its internode, a sub-fusiform body; aperture with three marginal teeth, one superior and two lateral.

Gonothecæ about twice as long as the hydrothecæ, borne on the stem or on the hydrorhiza, ovate, with a few large transverse rugæ and a short tubular neck, with three teeth on the summit.

Almost colorless and transparent.

Hab.—Williamstown.

Readily distinguished from *S. indivisa* by its long smooth calycles, not contracted below the aperture, and by the absence of the internal teeth.

SERTULARELLA PYGMÆA, *Bale.* Plate iii, fig. 8. Plate xix, fig. 19.

Journ. Mic. Soc. Vict., Vol. II (fig.)

Hydrocaulus simple, twisted at the base, about one-fourth of an inch in height; divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate about half their length, divergent, tubular or sub-conical, smooth; aperture not contracted, margin with three teeth, one superior and two lateral.

Gonothecæ about three times the length of the hydrothecæ, two or three on a shoot; with close, strong, transverse annulations their whole length, and a short tubular neck, with entire margin, rising from within the uppermost of the transverse rugæ; the narrow spaces between the costæ closely striated.

Color, yellowish brown.

Hab.—Griffiths' Point (Mr. Goldstein); Portland (Mr. Maplestone); Queenscliffe; New Zealand; Robe, South Australia (Mr. Smeaton).

This species closely resembles *S. Johnstoni*, Gray, in the form of the calycles, but differs in its minute size and simple habit.

SERTULARELLA JOHNSTONI, *Gray*. Plate iii, fig. 7. Plate xix, fig. 21. (A.M.)

Sertularia Johnstoni, Gray, Dief. N.Z.; Hutton, Trans. N.Z. Inst., v; Coughtrey, Tr. N.Z. Inst., vii (fig.)

Sertularella Johnstoni, Allman, Jour. Lin. Soc., Zool., xii (fig.)

Hydrocaulus about 3 inches in height, branched, pinnate or bipinnate, forming a dense tuft; internodes of the stem sometimes bearing more than one hydrotheca; pinnæ ascending, alternate, with three hydrothecæ (one axillary) between every two on the same side. Hydrothecæ borne each on the upper part of a short internode, adnate rather more than half their length, tubular or sub-conical, divergent and directed towards the front; aperture not contracted, with three teeth, one superior and two lateral, the former slightly recurved.

Gonothecæ borne on the stem and pinnæ, obovate, with strong transverse annulations which vary greatly in number and closeness; aperture tubular or infundibuliform, situated excentrically on the summit.

Color, brown.

Hab.—Queenscliffe; N. Zealand; Tasmania; Portland (Mr. Maplestone); Robe, S.A. (Mr. Smeaton).

In all the Australian specimens which I have met with the neck of the gonotheca is very narrow, with an expanding everted margin, while New Zealand specimens have the neck wider and simply tubular, as described by Professor Allman. The number of annulations is about eight in the Australian specimens, and thirteen or fourteen in those from New Zealand, though the latter are smaller. Mr. Coughtrey, however, says that both forms are found in New Zealand. According to Allman, the gonangial orifice is sometimes central and less decidedly exserted.

SERTULARELLA DIVARICATA, *Busk*. Plate iii, fig. 9. Plate xix, fig. 20.

Voy. of the Rattlesn.

Hydrocaulus 3 or 4 inches in height, straggling, pinnate or bipinnate; pinnæ alternate, distant, divergent, with three hydrothecæ (one axillary) between every two on the same side; internodes of the stem often bearing more than one hydrotheca, those of the pinnæ each with a single hydrotheca on its upper part. Hydrothecæ distant, tubular, adnate most of their height, free part bent outwards; aperture with three teeth, the superior slightly recurved.

Gonothecæ borne on the pinnæ, obovate, strongly annulated; orifice rather wide, tubular or infundibuliform, excentric.

Color, pale-brownish.

Hab.—Pt. Stephens (Mr. Haswell); Bass' Sts.; Patagonia; Straits of Magellan; (Mr. Busk).

This species is very close to *S. Johnstoni*, Gray, but differs in having the pinnæ and hydrothecæ more distant, and in the latter being less divergent, and not so much directed to the front. Its habit is coarser and more straggling than that of *S. Johnstoni*, and it does not appear to form thick tufts. The gonothecæ have not previously been described. The *Sertularia divaricata* of Lamarck (a probable synonym of *S. rigida*, Lamx.) appears to be a different species from the present.

SERTULARELLA NEGLECTA, *D'A. W. Thompson*. Plate iii, fig. 3; plate xix, fig. 22-23. (A.M.)

An. & Mag. Nat. Hist., Feb., 1879 (fig.)

Hydrocaulus about an inch in height, pinnate or bipinnate, much twisted or ringed throughout; pinnæ in pairs, subalternate, or rather irregular, divergent almost at right angles, usually with two hydrothecæ (one axillary) between every two

on the same side. Hydrothecæ springing from the latero-anterior aspect of the hydrocaulus, one on each internode, tubular, long, adnate only by a small portion; upper part recurved, aperture with three long, pointed teeth, the inner one shorter than the others; a small conical tooth or process inside the margin on the anterior side of the hydrotheca.

Gonothecæ (a), borne in clusters on the stem or proximal part of the pinnæ, large, ovate, with transverse rugæ, narrowed upwards to the summit, terminating in two (rarely more) large conical hollow teeth, one more elevated than the other: (b) borne near the ends of the pinnæ, obovate, slenderer, teeth smaller and about equally elevated.

Color, reddish or yellowish brown.

Hab.—Queenscliff; Portland (Mr. Maplestone); Robe, S.A. (Mr. Smeaton).

The two different forms of gonothecæ occur on distinct specimens, and are probably sexual, some of the larger ones containing what appear to be the remains of ova. The calycles generally shrivel more or less when dry, assuming a three-sided form, with transverse wrinkles.

SERTULARELLA RAMOSA, *D'A. W. Thompson.* Plate viii, fig. 4.

An. & Mag. Nat. Hist., February, 1879 (fig.).

Hydrorhiza consisting of short matted fibres. Hydrocaulus attaining a height of about 3 inches, strong and shrubby, main stem flexuous, giving off alternate pinnæ, often themselves pinnate; internodes short, joints oblique and conspicuous. Hydrothecæ large, urceolate, somewhat tumid, smooth, upper third divergent, one to each internode; orifice four-sided with short rounded teeth at the angles. Color, brown; gonangia long, ovate, smooth, with a distinct four-sided neck; orifice, quadrangular, with four teeth. New Zealand, Dr. Jolliffe; Bass' Straits.?—(D'A. W. THOMPSON.)

It is very doubtful whether this is an Australian species, Mr. Thompson having found only one fragment in material from Bass' Straits, which he thinks may have got into it accidentally.

PASYTHEA, *Lamouroux.*

Bull. Phil., 1812.

Polypidom simple or dichotomously branched: hydrothecæ opposite, in pairs, arranged in sets at some distance apart (each set occupying the central part of an elongated internode); gonothecæ smooth or transversely ringed.

PASYTHEA QUADRIDENTATA, *Ellis & Sol.* Plate vii, fig. 3. (A.M.)

Sertularia quadridentata, Ellis & Sol., Zooph. (fig.); Lamk., An. s. Vert.

Pasythea quadridentata, Lamx., Hist. Pol. Flex. (fig.); Expos. Méth. (fig.); Deslongch., Encyc. Méth.

Tuliparia quadridentata, Blainv., Man. d'Act.

Hydrocaulus about half an inch in height, simple. Hydrothecæ opposite, one, two, or three pairs in a set; each pair in contact with those above and below in the same set, also in contact with each other in front, separated behind; the upper half divergent laterally, but less so in the top pair of a set than in the others; aperture contracted, looking outwards, operculate, with two lateral teeth and one above.

Gonothecæ sub-globular, with close transverse annulations throughout; aperture terminal, with a slightly elevated margin.

Color, yellowish brown.

Hab.—Fitzroy Id. (12 fath.); Pt. Stephens; (Mr. Haswell): African coast, near Ascension, (El. & Sol.)

The lowest internode bears usually only one pair of hydrothecæ, the next one or two bear sets of two pairs each, and the

rest three pairs each. In Ellis' figures the back of the polypidom is shown. I have not met with the gonothecæ, and the above description of them is in accordance with Lamouroux' figure.

PASYTHEA HEXODON, *Busk.* Plate ix, fig. 13.

Voyage of the "Rattlesnake."

Cells in sets of six, three on each side, a single axillary cell in each dichotomous division of the polypidom.

Ovicell pedunculated, ovoid, adnate to the rachis, with a lateral opening.

Hab.—Cumberland Id., 27 fathoms.—(BUSK.)

IDIA, *Lamouroux.*

Hist. Polyp. Flex.

Zoophyte pinnate, hydrothecæ (on the pinnæ) forming two continuous series in contact with each other along the front of the hydrocaulus; gonothecæ borne on the front of the stem.

This genus, which is closely allied to *Thuiaria*, was instituted by Lamouroux for the reception of the single species *I. pristis*. Another hydroid, undoubtedly referable to the same genus, has been described by Dr. J. Armstrong (Journal of the Asiatic Society of Bengal, 1879) under the name of *Thimaria compressa*.

IDIA PRISTIS, *Lamx.* Plate vii, fig. 1–2; plate xix, fig. 33. (A.M.)

Idia pristis, Lamx., Hist. Pol. Flex. (fig.); Expos. Méth. (fig.); Encyc. Méth.

Sertularia pristis, Busk, Voy. of Rattlesn.

Hydrocaulus 4 or 5 inches in height, pinnate; stem thick, fistulous, divided into short internodes, each bearing a pinna with a pair of hydrothecæ above it and one in the axil; pinnæ alter-

nate, ascending, unjointed, or with only one or two joints in each. Hydrothecæ alternate, those on the pinnæ all in contact (each one adnate to those above and below, and to the two on the opposite side), all adnate to the front of the hydrocaulus; tubular, the upper portion divergent laterally, sometimes almost horizontally; free portion varying in length, aperture rounded, looking upwards; a slight angular ridge running up the hydrotheca in front, from the base to the aperture.

Gonothecæ borne on the front of the stem; large, nearly as broad as long, longitudinally ribbed, rounded at the base, truncated above, with an elevated tubular neck; aperture circular, margin everted.

Color, pale brownish; the stems and pinnæ very transparent.

Hab.—Prince of Wales Channel, Torres St., 9 fathoms; off Cumberland Islands, 27 fathoms; (Busk): Fitzroy Island, 12 fathoms; Albany Passage, 9 fathoms; Port Molle, 15 fathoms; Port Curtis; Griffiths' Point; (Mr. Haswell).

Var. *B. n. var.*—With narrower pinnæ and less projecting hydrothecæ, and without the hydrothecæ in the axils*. *Hab.?*

I have only one specimen of the narrower variety, from an unknown locality. It has one or two joints in each of the longer pinnæ, while in the commoner form joints are of less frequent occurrence. The divergent portion of the hydrothecæ of this species, projecting beyond the edges of the pinnæ, give them an acutely serrate appearance, resembling the beak or "saw" of the saw-fish (*Squalus pristis*, Lin.); hence the specific name. The axillary hydrothecæ, when present, are curved towards the back of the polypidom. In a front view the edges of the thick fistulous pinnæ are usually seen outside the adnate parts of the hydrothecæ, and about the summit of each of the latter there is a thickening of the polypidom extending a short distance inwards from the side of the pinna.

* If the characteristics of this form should prove to be constant and always associated it would be advisable to separate it as a distinct species.

THUIARIA, *Fleming.*

Brit. An.

SERTULARIA (auct.) in part.

CELLARIA, Lamk. in part, An. s. Vert.

NIGELLASTRUM, Oken, Lehrb.

BISERIARIA, Blainv., Man. d'Act.

Zoophyte plant-like, stem branching, jointed, rooted by a filiform stolon; hydrothecæ biserial, not in pairs, usually more or less immersed; gonothecæ similar to those of Sertularia.

The adnate or immersed condition of the hydrothecæ, which has been usually relied on as furnishing the essential character of the genus *Thuiaria*, is, as pointed out by Professor Allman, totally inadequate to serve as a generic distinction, and is in fact quite as pronounced in many true *Sertulariæ* as in the former genus. "The adnate condition of the hydrotheca affords, in fact, no distinctive character at all; and if *Thuiaria* is to stand as a legitimate genus, some other character must be sought for. Now this will be found in the mode of division of the hydrocaulus into internodes. In all the true Sertulariidans (*Sertularia, Sertularella, Diphasia*) there is a joint occurring at regular intervals between every two or every two pairs of hydrothecæ quite irrespectively of the degree of adhesion of the hydrotheca to the hydrocaulus; while in *Thuiaria* the joints occur at distant and, for the most part, irregular intervals, thus leaving numerous hydrothecæ to be carried on each internode."* In so far as the above remark refers to the genus *Sertularia* however it is by no means borne out by examination of the Australian species. In most of these there is undoubtedly a joint between every two pairs of hydrothecæ, but in some others this is only the case in the distal portions of the pinnæ. In *S. elongata, S. bidens,* and *S. Maplestonei* the proximal internode of each pinna (in large specimens)

* Journ. Lin. Soc., Zoology, Vol. xii, p. 267.

usually bears four or five pairs of calycles, the next internode two or three pairs only, and so on diminishing till the third or fourth internode, and all the rest, bear only one pair each. In very small shoots of *S. elongata*, and probably of the other species, the proximal internodes may support two pairs and all the rest one each, or in the upper pinnæ there may be one pair on every internode. In *S. tuba* there are usually two pairs on each internode throughout the polypidom. On the other hand *Thuiaria lata* is often divided into short internodes, mostly of three hydrothecæ each. It appears to me that the true distinction between *Sertularia* and *Thuiaria* consists in the fact that in the former genus the calycles are in pairs, while in the latter they form two series,* those on opposite sides of the hydrocaulus having no special relation to each other. In *Sertularia* the internodes accordingly contain an even number of calycles; in *Thuiaria* they are quite as likely to bear three or five as four or six. The distinction is often very clearly shown in the stem-internodes, which, in some species of *Thuiaria*, bear on one side a pinna with a calycle above and another below it, and a single unpaired calycle on the opposite side, while in those *Sertulariæ* which bear three calycles on each stem-internode one of them is axillary and the other wo always form a pair above it.

THUIARIA FENESTRATA, *n. sp.* Plate vii, fig. 7; plate ix, fig. 14. (A.M.)

Sertularia crisioides, Busk., Voy. of Rattlesn. (nec Lamx.?)

Salacia tetracyttara, Lamx., Hist. Polyp. Flex. (fig.); Expos. Méth. (fig.); Deslonch., Encycl. Méth.?

Hydrocaulus, 1–2 inches in height, pinnate or bipinnate, often forming a tangled mass by the anastomosing of the pinnules; stem indistinctly and irregularly jointed, fascicled below; pinnæ

* Hence the name *Biseriaria*, bestowed upon the genus by Blainville.

alternate, jointed at irregular intervals, three hydrothecæ between every two on the same side of the stem. Hydrothecæ opposite or sub-alternate on the pinnæ, alternate on the stem, a rather wide space between the two series; closely adnate to the hydrocaulus throughout their length, conical, slightly curved outwards, the square base of each (on the pinnæ) with its outer angle in contact with the upper and back part of the one below, so that a small triangular space is left below each hydrotheca; aperture rounded, vertical, with two indistinct lateral teeth.

Gonothecæ ovate or sub-globular, truncate a little above the broadest part; aperture with four shallow emarginations.

Color, light brownish.

Hab.—Off Cumberland Id. (Busk.): Albany Passage, 9 fathoms; Pt. Curtis, 5–7 fathoms; (Mr. Haswell).

This species, though undoubtedly very close to *D. crisioïdes*, Lamx., must, I think, be considered distinct from it, if the original description and figure of the latter species are accurate. Lamouroux says (Encycl. Méth.) that there are few species of *Dynamena* as small as *D. crisioïdes*, and that its height never exceeds two centimetres, while the ramuli are divided by strongly-marked joints into internodes, composed of 4–6 calycles. Quoy and Gaimard's figure (Voyage de l'Uranie) agrees with this description and shows the pinnæ springing by very slender bases from much broader processes of the stem. This latter character is wanting in the present species, and though some of the smaller pinnules near the summit are occasionally composed of short internodes this is exceptional, the internodes of the pinnæ usually bearing a much larger number of calycles, often twenty to thirty. There is a calycle on the stem immediately below each pinna and in contact with it, while the corresponding one in *T. crisioïdes* is not close to the pinna, but at a little distance below. The joints in the pinnæ of the present species are not so strongly marked as in *T. crisioïdes*, and the cell-apertures appear to be different in form. The square bases of the calycles with

the triangular spaces below them, which form such a characteristic feature of *T. fenestrata*, are not present, or are not represented, in Lamouroux' species. The polypidom is very thin and transparent over these spaces, so that when the hydrosoma is seen in fluid they appear almost like openings. The calycles on the stem differ from those on the pinnæ in being distinctly alternate, and not in contact with those above and below, but when the pinnæ commence to give off secondary pinnules they assume the character of the stem. The shortest internodes on the stem bear on one side a single hydrotheca, and on the other a pinna springing from between two hydrothecæ which are both in contact with it; the longer internodes are equivalent to two or more of the shorter ones.

Mr. Busk informs me that a specimen of this species in the Gay herbarium is identified with the *Salacia tetracyttara* of Lamouroux, an identification which is possibly correct, judging from the description given by Deslongchamps in the Encyclopédie Méthodique of the true structure of the so-called *S. tetracyttara*. After repeating Lamouroux' account of the genus, in which it is described as having the calycles in groups of four arranged all round the stem, he continues:—"I have cited word for word the observations on this genus, put forward by Lamouroux in his 'Histoire des Polypiers Coralligènes Flexibles.' I must remark however that after having, for the revision of this article, studied the genus *Salacia* in his beautiful and rich collection which belongs to the town of Caen, I have failed to perceive the cellules united in fours, and as it were verticillate, which are indicated by Lamouroux, and which are shown in his figure; I appeared to see elongated cellules, with slightly prominent apertures, situated one above another along the two opposite sides of the branches, and separated by a continuous hollow axis of about the same thickness as the cellules themselves. It seems to me that this genus, so distinct according to the description, is not so in nature, and that the species that Lamouroux assigns to it is a *Sertularia* with very long opposite cellules, or rather according to the distinction which he has established between the true Sertu-

lariæ with alternate cellules, and the Sertulariæ with opposite cellules, or *Dynamena*, a species of this latter genus*."

THUIARIA QUADRIDENS, *n. sp.* Plate vii, fig. 5–6. (A.M.)

Hydrocaulus 1–2 inches in height, stem flexuous, indistinctly jointed, each internode bearing a single hydrotheca on one side and a pinna between two hydrothecæ on the other; pinnæ alternate, not close, narrow at point of junction with the stem, jointed at irregular intervals. Hydrothecæ alternate or sub-alternate, the two series not in contact, large, swollen, curved outwards, adnate almost to the margin, or with a free contracted portion of variable length (in those on the stem sometimes more than one-third of their height); those on the pinnæ crowded or with short intervals between them; aperture looking outwards and a little upwards, with four equal teeth, one superior, one inferior, and two lateral; the inner and lower angle of the hydrotheca produced into a chitinous spur (sometimes branched) which projects into the cavity of the stem or pinna, often crossing it and becoming united to the opposite hydrotheca.

Gonothecæ? Color, deep brown.

Hab.—Pt. Curtis, 5 fathoms; Holborn Id., 20 fathoms; (Mr. Haswell.)

This species has a glossy appearance when dry. The specimen from Holborn Id. has the pinnæ divided into much shorter internodes than the other. The most remarkable feature is the presence of the processes from the bases of the hydrothecæ, which I have not seen in any other species.

*As the genus *Salacia* seems to have been founded on characters which had no existence in the type species, Lamouroux' name has of course no claim to acceptance; and the more recently discovered species which really possess the characters assigned in error to *S. tetracyttara* should retain the generic name of *Grammaria*, bestowed on one of them by Stimpson (Marine Invertebrata of Grand Manan).

THUIARIA LATA, *Bale.* Plate vii, fig. 4. (A.M.)
Journ. Mic. Soc. Vict., Vol. II, (fig.)

Hydrocaulus branched, pinnate, 6 or 8 inches in height; stem fascicled towards the base, thick, divided into internodes, each of which bears a single hydrotheca on one side, and a pinna between two hydrothecæ on the other; pinnæ alternate, not close, long, straight, narrow at junction with the stem, divided into internodes of various lengths. Hydrothecæ alternate, the two series more widely separated behind than in front; tubular, completely adnate; base not divided off from the cavity of the hydrocaulus; aperture oblique, with two lateral teeth, sometimes nearly obsolete.

Gonothecæ? Color, whitish.

Hab.—Griffiths' Point (Mr. Goldstein); Port Stephens (Mr. Haswell); Queenscliff.

This species is transparent and almost colorless when in fluid. In some specimens the majority of the internodes of the pinnæ bear only three hydrothecæ; in others the internodes are longer. The pinnæ are often an inch in length, and the lower part of the stem, in large specimens, is much thickened.

PLUMULARIIDÆ, *Hincks.*

Brit. Hyd. Zooph.

HYDROTHECÆ *sessile and unilateral.* ZOOPHYTE *furnished with nematophores (minute calycles, containing an extensile offshoot from the cœnosarc, and frequently bearing thread-cells).* POLYPITES *with a single wreath of filiform tentacles round a conical proboscis; gonozooids always fixed.*

This extensive and beautiful family is divided in Mr. Hincks' British Hydroid Zoophytes into three genera, two of which,

Aglaophenia and *Plumularia*, have the ultimate ramules pinnately arranged, while in the third genus, *Antennularia*, they are in regular whorls. Several new genera have however been discovered in which different modes of ramification prevail; thus in *Monostæchas*, Allman, the hydrothecal ramules are arranged in a single series along one side only of the branches, in *Antennopsis*, Allman, they are irregularly scattered on all sides, and in *Hippurella* (of the same author) the ramules are ordinarily pinnate, but become verticillate at the tips of the branches. This last genus has however been further examined by Mr. Fewkes, who says that the verticillate ramules do not bear hydrothecæ but nematophores only, and are really a portion of the gonosome. In *Antenella*, Allman, the shoots which bear the calycles are precisely similar to the pinnæ of *Plumularia*, but spring directly from the hydrorhiza, without any stem. Professor Allman considers this a distinct genus, but Mr. Hincks thinks otherwise, regarding the species as merely degraded forms of ordinary *Plumulariæ* or *Antennulariæ*. In favour of this view of the subject it may be mentioned that Mr. Busk found *P. campanula* in Bass' Straits with the stemless form* and the erect branching shoots growing *in the same colony*, and Kirchenpauer mentions a similar fact in regard to *P. filicaulis*, while Mr. Hincks describes a stemless form of *P. Catharina*. The tendency to produce hydrothecal ramules from the hydrorhiza is not entirely confined to *Plumularia*, for *Halicornaria humilis*, which grows parasitically on larger species of the same genus, has, in all the specimens which I have met with, erect pinnate stems as well as pinna-like shoots springing directly from the hydrorhiza. From these facts it seems probable that individual species of any of the genera belonging to the Plumulariidæ may in some cases assume a simple or *Antenella* form.

* This form of *P. campanula* was found by me growing separately, and named *P. indivisa*, *vide* Journ. Mic. Soc. Vict. ii. It is worthy of note that the calycles of *P. campanula* are (as in several other species) borne on the branches (and no doubt on the young stems) as well as on the pinnæ, so that the simple shoots might be regarded either as stems without pinnæ, or as ramuli without stems.

PLUMULARIA, *Lamarck* (in part).

An. s. Vert.

AGLAOPHENIA, Lamx. (in part), Bull. Phil. 1812.

PLUMULARIA, M'Crady.

ANISOCALYX, Donati. (Heller, Zooph. u. Echin. des Adriat. Meeres), (for some of the species.)

HETEROPYXIS (in part), Heller, Zooph. u. Echin. des Adriat. Meeres, (for *H. disticha.*)

POLYPLUMARIA, Sars, Bidrag til Kunds. om Norg. Hyd. (for *P. flabellata.*)

ANTENELLA, Allman, Hyd. Gulf Stream, (for some of the species).

Zoophyte consisting of pinnate (or rarely undivided) shoots, often branched, jointed, rooted by a creeping stolon; hydrothecæ generally more or less distant, margin not toothed; sarcothecæ distributed along the hydrocaulus, not attached to the calycles; gonothecæ never enclosed in corbulæ nor protected by gonangial ramules.

The genus *Plumularia* of Lamarck, (*Aglaophenia* of Lamouroux), consisted of two well-marked groups, distinguished from each other by several characteristic features. Forbes (as Mr. Hincks points out) suggested the dismemberment of the genus, in which he was followed by Johnston, and the course adopted by M'Crady of assigning Lamouroux' name to one division and Lamarck's to the other has been followed by Mr. Hincks and later writers. It should however in justice be mentioned that the modern arrangement was first proposed by Lamouroux himself in the article "*Aglaophenia*" in the Encyclopédie Méthodique.

The species of the genus *Plumularia* as now accepted possess for the most part a polypidom somewhat delicate in texture, with the calycles, and also the pinnæ, set at some distance apart, so that the hydrosoma has a light and graceful aspect; * the

* *P. aglaophenoides* forms a striking exception, the texture being as dense, and the calycles as closely set, as in *Aglaophenia.*

margins of the calycles are not toothed; and the sarcothecæ are not connected with the calycles, though some are arranged in a regular plan around them, the rest being distributed in definite order along the hydrocaulus. In *Aglaophenia* on the other hand, the polypary is usually of a more or less densely corneous texture, the calycles are close together, or nearly so, and the pinnæ also are generally nearly approximate; the margins of the calycles are usually toothed or lobed; each calycle has a median anterior sarcotheca and two lateral ones attached to it, and there are no others along the ordinary pinnæ; these organs moreover are of the most varied forms, from a rounded sac to a slender tube two or three times the length of the calycle, and they have usually two, and often three or four, apertures.

The genus *Plumularia* is divided by Kirchenpauer into three sub-genera, *Isocola*, *Anisocola*, and *Monopyxis*. The first of these includes those species in which every internode of the pinna bears a hydrotheca, and the second those in which every alternate internode is shorter and bears a sarcotheca only. This arrangement, though convenient, is founded on a difference which is by no means constant, as certain species are often found to exhibit in different parts of the polypidom the characteristics of both groups, the intermediate sarcotheca, which is normally on the same internode as the calycle below, being in some instances separated from it by a distinct joint. The third sub-genus, *Monopyxis*, is founded on a more valid distinction, the presence, namely, of a single hydrotheca only on each pinna. The species are all minute, and, so far as I am aware, only two were known up to 1881, when I described four new species. All the known members of this group are found in Victoria, and only one has been recorded from beyond south-eastern Australia, namely *P. obliqua*, which is common on some parts of the English coast, and which also occurs in Tasmania.

The sarcothecæ in *Plumularia* and *Antennularia* are usually somewhat like a wine-glass in shape, slender at the point of attachment, and movable; but in several of our species those

which occupy a median position are fixed by a stout base, more or less curved over forwards, and quite open on the inner side.

The genus *Anisocalyx* of Donati, consists of typical *Plumulariæ*, and *Heteropyxis disticha* (Heller), is also a true *Plumularia*. *Polyplumaria* (Sars) is simply a *Plumularia* which is exuberantly branched and re-branched in the same plane, and *Diplopteron* (Allman), is distinguished by the possession of two pairs of lateral sarcothecæ, and by its doubly pinnate ramification. The latter character, however, is common to several species of *Plumularia*. If this genus be retained I would suggest that it be modified so as to comprise all species with *more than one* pair of lateral nematophores, in which case *P. aglaophenoides*, which has three pairs, would be included in it. I have already referred to *Antenella*. All the species which have hitherto been described as belonging to it have the general characters of *Plumularia*, and should, I think, be retained in that genus.

PLUMULARIA CAMPANULA, *Busk*. Plate x, fig. 5. (A.M.)
Voy. of Rattlesn.

Hydrocaulus 4 or 5 inches in height, stem polysiphonic, erect, giving off numerous small, slender, pinnately-disposed branches, which bear hydrothecæ as well as pinnæ. Pinnæ alternate, distant, springing from each internode, or every second internode of the branches, joints oblique, internodes long, a hydrotheca on each, except the first on each pinna. Hydrothecæ borne at the lower ends of the internodes, set at an angle of about 40°, large, campanulate; margin entire, free at the back. Sarcothecæ bithalamic, canaliculate, the median ones fixed and stout at the base; one at each side of the hydrothecæ, pedunculate, one in front, one midway between every two hydrothecæ, usually on the same internode as the lower, and one on the proximal internode of each pinna.

Gonothecæ oblong or ovate, tapering below, or short and broad (flabelliform); a sarcotheca on each side near the peduncle.

Var. *B.* (*P. indivisa*, Bale, Journ. Mic. Soc. Vic. II, fig.). Consisting of short, slender stems, bearing hydrothecæ only without pinnæ.

Stem and hydrorhiza brown, pinnæ whitish, transparent.

Hab.—Bass' St., 45 fathoms, both varieties (Busk.): Holborn Id., 20 fathoms; Pt. Stephens; branched variety; (Mr. Haswell): Portland (Mr. Maplestone); Williamstown; simple variety.

In the specimen from Holborn Id. the internodes are very long, and each of those on the branches gives rise to a pinna. In that from Pt. Stephens they are shorter, and every alternate one bears a hydrotheca only, without pinnæ. The pinnæ in this species spring directly from the branch, and not from a process. Gonothecæ were found on the specimen from Port Stephens, and on the simple variety, but in each case they had been dried and were so much distorted that it was difficult to ascertain their true form. It appears, however, to be oblong in the larger ones. It is doubtful whether the smaller gonothecæ are the male form, or are merely undeveloped. In this and also in the next species it is not uncommon to find the hydrothecal internode divided into two, so that the intermediate sarcotheca occupies a separate short internode, as is normally the case in a great many species.

PLUMULARIA BUSKII, *n. sp.* Plate x, fig. 3, plate xix, fig. 34-35. (A.M.)

Hydrocaulus 2 or 3 inches in height, stem thick, monosiphonic, unbranched, bearing hydrothecæ as well as pinnæ, internodes short; pinnæ alternate, approximate, deciduous, one on each internode of the stem, both series springing from the front, joints oblique, internodes short, a hydrotheca on each, except the first on each pinna. Hydrothecæ set at an angle of about 45°, large, campanulate; margin entire, free at the back. Sarcothecæ bithalamic, canaliculate, the median ones fixed and stout at the base; one at each side of the hydrotheca, peduncule; one in front, fixed, curved over and almost appressed to

the hydrotheca, one in the sinus behind the back of the hydrotheca, one between every two hydrothecæ on the pinnæ, usually on the same internode as the lower, two abreast in the corresponding position on the stem-internodes, and one on the proximal internode of each pinna.

Gonothecæ, female—large, borne on the stem, three-sided, truncate, tapering below; a row of large sarcothecæ (about six), running up each of the narrower sides: male—small, borne on the pinnæ, ovate, with a sarcotheca at each side near the peduncle.

Color, light brown.

Hab.—Griffiths' Point (Mr. Goldstein.)

This species resembles the last in the form of the calycles, in the pedunculate lateral sarcothecæ, and in having each pinna borne at the side of a hydrotheca on the stem or branch; in most other respects it differs widely, the thick unbranched stem, with its short internodes, and both series of pinnæ borne on the front, giving it a very distinctive aspect. The sarcotheca behind the calycle (which is not present in *P. campanula*) is very delicate and can only be well seen when the polypidom is free from foreign matter. The pinnæ spring from processes of the stem, which are sharply constricted in the middle, where they readily separate, so that stems may be found from which all the pinnæ have disappeared. Some of the shoots when found were of a beautiful crimson color. Male and female gonothecæ are borne on the same shoot.

PLUMULARIA AGLAOPHENOIDES, *n. sp.* Plate x, fig. 6. (A.M.)

Hydrocaulus several inches in height, bipinnate, stem thick, polysiphonic, flexuous; pinnæ alternate, distant, given off from each flexure of the stem, with two distinct oblique joints near the base, and obscurely jointed for the rest of their length, bearing hydrothecæ as well as pinnules; pinnules alternate, approximate, one on each internode of the primary pinnæ, both series borne

towards the front and supporting a hydrotheca on each internode, the joints between the hydrothecal internodes often obsolete. Hydrothecæ large, close, campanulate, broad at the base, set at an angle of about 45°, margin deeply sinuated behind. Sarcothecæ bithalamic, canaliculate; one, stout at the base, fixed close in front of each hydrotheca; one at each side of the hydrotheca, pedunculate; two abreast behind the hydrotheca, bract-like, and two others above them; one on the proximal internode of each pinna and pinnule, similar to those in front of the hydrothecæ; the rest slender at the base.

Gonothecæ?

Color, dark brown.

Hab.—Broughton Ids., 25 fathoms (Mr. Haswell.)

The general aspect of this species is more like an *Aglaophenia* than a *Plumularia*, owing to its general habit, dark color, and closely-set calycles, which are quite as near each other as those of the former genus. The only specimen which I have seen is about two inches long, but is incomplete; it appears to have been slightly branched. The flexuous fascicled stem somewhat resembles that of *Aglaophenia Huxleyi*. Sometimes the hydrothecal internodes on the pinnules are separated by distinct oblique joints, but these are often absent, the pinnule being continuous. There is a hydrotheca on the pinna at the side of each pinnule, as in *P. campanula*, etc. The pair of sarcothecæ immediately behind each hydrotheca have the upper chamber reduced to a mere remnant of one side. Nearly all the calycles and sarcothecæ, with the front portion of the pinnules, were filled with dense blackish matter, which made it difficult to ascertain the minute structure.

PLUMULARIA OBCONICA, *Kirchenpauer*. Plate xviii, fig. 3–4. Abh. ver. Hamb. VI (fig.)

Shoots monosiphonic, simple, numerous, erect, springing from a creeping hydrorhiza; hydrocladia long, secund; hydrothecæ obconic, aperture sub-entire, plicate; gonothecæ elongate-ovate,

pedunculate, female (containing ova) pileate, provided with nematothecæ; nematothecæ on the hydrocladia simple, minute, on the gonothecæ large, biloculate.

Hab.—Gulf of St. Vincent.

From short, creeping root-tubes rise several simple stems 5–7 centimetres high, of a bright yellowish-brown color, segmented and beset with pretty long hydrocladia. The hydrocladia on each segment of the stem are arranged nearly uniserially one above another, alternately a little to the right and to the left; and while they are all turned to one side they are yet so arranged as to arch first towards one side and then towards the other, and as they stand close together they enclose a hollow space. The hydrothecæ, which are found sometimes on the stem as well as the pinnæ, have the form of an inverted cone, and are somewhat folded above in the neighbourhood of the opening, so that the border appears uneven. The hydrotheca occupies the middle of each segment; at the lower end, and sometimes also at the upper, is a small nematotheca. The female gonothecæ are large, of a longish oval, fixed below on a short stalk, and provided above with a large round opening. This is covered with an upwardly arched operculum, which after the escape of the contents appears as it were turned over. On the gonotheca itself and on the operculum there are a few, sometime five or six, large funnel-shaped nematothecæ. The male spermatic capsules are smaller, oval, and without nematothecæ. In the Godeffroy Museum. (KIRCHENPAUER.)

PLUMULARIA BADIA, *Kirchenpauer*. Plate xviii, fig. 1–2.

Abh. ver. Hamb. VI (fig.)

Shoots monosiphonic, erect, pinnately or bipinnately branched; stem, branches, and branchlets equal in thickness, irregularly jointed; hydrocladia alternate, very short, appressed to the pinnæ; hydrothecæ vascular, mouth subentire, more or less sinuated, anterior lip produced into a point; nematothecæ infundibulate,

biloculate, one above and one below each hydrotheca; gonothecæ unknown.

Hab.—Brisbane; Singapore.

The thin one-tubed stem, which rises from a small root-ball, is a few inches high, and is beset with two rows of pinnately-arranged branchlets, which are of the same thickness as the stem, and at the upper portion of the latter grow to an equal height with it (they are thus of unequal length), so that the whole polype-colony looks as if truncated. At times one of these branchlets divides into two, sometimes one grows like the stem itself. Stem and branches are colored a fine chestnut-brown. On the stem as well as the branchlets are placed the short, quite thin, pale, scarcely visible hydrocladia, which are distinctly segmented. The incisions between the segments are very deep, and as it were provided with a joint. In the middle of each segment is the hydrotheca, with uneven border produced to a point in front; under and above this and always a little separated from it is a funnel-shaped nematotheca, the lower placed on a special swelling-out of the hydrocladium.

The Museum Godeffroy received (in 1865) specimens from Brisbane; the Berlin Museum, through Professor von Martens, specimens from Singapore. The habit of the two is somewhat different; the Australian specimens are smaller and less regularly pinnate, so that they might easily be taken for distinct species; yet the segmentation of the branchlets and hydrocladia, and the structure of the hydrothecæ and of the nematothecæ are the same. Gonothecæ were absent in both. (KIRCHENPAUER.)

PLUMULARIA EFFUSA, *Busk.* Plate xviii, fig. 5.

Busk, Voy. of Rattlesn.; Kirchenpauer, Abh. ver Hamb. VI (fig.)

Shoots monosiphonic, erect; hydrorhiza massed; stem slightly flexuous, branching; lower branches regularly opposite, upper irregularly scattered, branching dichotomously; branches and

branchlets erect, open, hydrocladia alternate, four on each internode of the pinnæ; hydrothecæ vascular, aperture sub-entire, lobate; nematothecæ biloculate, infundibulate; gonothecæ?

Hab.—Philippines; Singapore; (Kirchenpauer): Prince of Wales Channel, Torres St. (Busk).

From a small, ball-like root, below which hangs a bundle of fine tubules, rise single-tubed stems about 12–16 centimetres in height, from which branchlets proceed on both sides; these are either undivided or specially branched on the upper part of the hydrosoma. The lower branches are as a rule opposite, the upper are arranged irregularly, sometimes several on the one, sometimes on the other side of the stem, which then usually makes a slight bend between every two branches. The distance between the branches is almost equal. The lower branches are usually broken off, so that the lower part of the stem appears bare. The upper branches sometimes divide dichotomously. Branchlets, branches, and sometimes also the stem itself are beset with thickly-placed, very delicate, scarcely noticeable pinnules (the hydrocladia) of which there are always four on each segment, arranged almost in one row on one side of the branchlet, but turned alternately first to one side and then to the other with great regularity. The vase-shaped cells proper have a smooth border, arched somewhat outwards, and deeply concave behind. The very transparent water-clear hydrothecæ contrast very strongly with the brown-colored remaining portion of the polypary. This description and the figure are from specimens brought by Professor von Martens, of the Prussian Expedition. The specimens described by Busk seem to have been larger and more strongly branched, but belong, so far as can be recognized without a figure, to the same species.—(KIRCHENPAUER.)

I have copied Kirchenpauer's description and figure as they are more detailed than the original ones of Mr. Busk, and as the drawings of the latter gentleman prove conclusively that Kirchenpauer's identification of the species is correct. The calycles are

ventricose below, and the lip is strongly everted in front. According to Kirchenpauer there is but a single supracalycine sarcotheca above each calycle. Both series of pinnules spring from the front of the stem and branches, contrasting strongly with the allied species *P. Ramsayi*, in which they are borne on thicker processes which are directed outward from the sides of the stem and branches (or pinnæ).

PLUMULARIA RAMSAYI, *n. sp.* Plate xi, fig. 3-4. (A.M.

Hydrocaulus 4 or 5 inches in height, monosiphonic, bipinnate, stem and pinnæ jointed at irregular intervals; pinnæ very irregular and variable in length and closeness, the processes supporting the pinnules very prominent; pinnules very fine and slender, borne on the stem and pinnæ, alternate, not close, transversely wrinkled, obliquely jointed, each internode bearing a hydrotheca. Hydrothecæ small, parallel with the pinnules, expanding upwards, margin expanding in front, sinuated at each side towards the back. Sarcothecæ bithalamic, canaliculate, with slender bases, one below each hydrotheca and one at each side above it, three in each axil.

Gonothecæ ?

Color, dark brown or black, except the pinnules, which are lighter.

Hab.—Pt. Denison, 5 fathoms; Pt. Molle, 15 fathoms; Albany Passage, 9 fathoms; (Mr. Haswell).

This species is extremely variable in habit, a specimen from Pt. Molle having the pinnæ at an average distance of about one-eighth of an inch, while one from Pt. Denison has them two or three times as distant and much larger, and another from the same place has only three in a height of four inches, one of them almost as long as the stem. There is no regularity in their arrangement, as they may be either opposite or alternate, and there are often two or three on one side to one on the other. The ascending processes of the stem and pinnæ on which the

pinnules are borne are stouter and very much darker than the pinnules themselves, which spring from them as from brackets. Except in this last feature the habit is similar to that of *P. effusa;* in that species, however, the calycle is ventricose below, and has the lip strongly everted in front. Another distinction is afforded by the anterior sarcotheca, which in *P. effusa* springs from a point close to the calycle, and extends half-way up the front of it, while in the present species it is borne on a distinct prominence of the pinnule some distance below the hydrotheca, and is not long enough to reach as far as its base. According to Kirchenpauer *P. effusa* has only a single sarcotheca above the calycle instead of one on each side. All the specimens differ in the size of the calycles, and the length of the internodes supporting them; one from Pt. Molle has the remains of the gonothecæ, which spring from the axils of the pinnules, but being delicate and membranous are so shrivelled that it is impossible to ascertain what their original form has been.

PLUMULARIA CORNUTA, *n. sp.* Plate xi, fig. 1-2. (A.M.)

Hydrocaulus attaining a height of 2 feet, monosiphonic, with numerous ascending branches, jointed at irregular intervals; pinnæ fine and slender, alternate, not close, transversely wrinkled, obliquely jointed, the first internode on each bearing a long tubular process with a hydrotheca adnate to the side of it, a hydrotheca on each of the rest. Hydrothecæ parallel with the pinnæ, expanding upwards, margin expanding in front, sinuated at each side towards the back. Sarcothecæ bithalamic, canaliculate, with slender bases, one below each hydrotheca and one at each side above it, two at the sides of each axil, one on each pinna close to the base, one below each of the tubular processes, and sometimes one midway between every two pinnæ.

Gonothecæ?

Color, brown.

Hab.—Pt. Molle, 15 fathoms; Pt. Denison; Holborn Id., 20 fathoms; (Mr. Haswell).

The calycles, with the internodes supporting them, are similar to those of *P. Ramsayi*, but are larger. The specimens from Holborn Id. and Port Denison are very glossy, the latter much darker than the other; that from Pt. Molle is duller and has thicker stems. The most remarkable feature in this species is the presence of the horns on the pinnæ, which vary in length in the different specimens, and are evidently aborted secondary pinnules, each supporting a single hydrotheca and terminating above in a point. In the Pt. Molle specimen the calycles and internodes are shorter than usual, and the anterior sarcotheca springs from a point almost close to the calycle, very much as in *P. effusa*, which species, however, differs in the more ventricose hydrothecæ, the strongly everted front margin, the single superior sarcotheca, the absence of the horns on the pinnæ, and the totally different habit.

PLUMULARIA PRODUCTA, *Bale.* Plate x, fig. 4. (A.M.)
Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, unbranched, about one-third of an inch in height; pinnæ alternate, one or two on each internode, a hydrotheca on each internode of the pinnæ. Hydrothecæ set at an angle of about 30°, cup-shaped, but with the back much produced upwards, front wall of the cell doubled inwards, just below the aperture, and continued into a transverse septum or intrathecal ridge, which extends more than half across the cavity of the cell; aperture entire, expanding in front. Sarcothecæ bithalamic, canaliculate, fixed, stout at the bases, one below each hydrotheca.

Gonothecæ?

Transparent, almost colorless.

Hab.—Queenscliff; Williamstown; Portland (Mr. Maplestone).

A small but distinct species, which is very delicate, and shrivels when dry. Judging from a number of specimens which I have

since received, the figure would appear to represent a somewhat exceptional form. The inflection in front of the calycle is usually deeper, and the lip strongly salient, while the whole cell is curved more away from the pinna. In another variety the calycles are larger, and the front is cut down close to the origin of the ridge.

PLUMULARIA FILICAULIS, *Poeppig*, M.S. Plate xi, fig. 6–7; plate xix, fig. 41–42. (A.M.)

Kirchenpauer, Abh. ver. Hamb., VI (fig.)

Hydrorhiza broad, ribbon-like, with strong transverse markings at intervals along the margins; hydrocaulus monosiphonic, unbranched, attaining a height of about one-fifth of an inch, joints of the stem oblique, internodes near the base fusiform or funnel-shaped; pinnæ alternate, transversely wrinkled, one on each internode, usually divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, attached only by a small part of the base, back constricted midway between the base and the aperture, with a rudimentary intrathecal ridge; margin produced or peaked behind and in front. Sarcothecæ, one at each side behind the hydrothecæ, bithalamic (?), canaliculate, slender at the base, very transparent, the rest bithalamic, canaliculate, fixed, curved forward, with stout stems and shallow expanded terminal cups; one in front of each hydrotheca, to which the terminal cup is almost appressed, one between every two hydrothecæ, on the intermediate internode, one in each axil, and two on the front of each stem-internode.

Color, pale yellowish brown.

Hab.—Bay of Talcahuano, Chili (Poeppig); Portland (Mr. Maplestone).

Var. *indivisa*, n. var. The polypiferous ramuli rising direct from the hydrorhiza, hydrothecæ more constricted and bent

over at the back, with the intrathecal ridge well-developed, extending often half across the hydrotheca, margin of the aperture more produced and pointed before and behind.

Gonothecæ irregularly ovate in outline, springing from the hydrorhiza, and closely adnate to the supporting substance on the flat under side; upper side convex, transversely undulated; the margin surrounded by a narrow thin adherent expansion; a few small circular perforations (?) scattered over the surface, from which spring very short, delicate, tubular processes; aperture small, subterminal, looking upwards.

Hab.—Portland, on *Cymodocea antarctica* (Mr. Maplestone).

According to Kirchenpauer, the pinnate and undivided shoots are found growing together in the same colony, but I have ranked the simple form from Portland as a distinct variety owing to the difference in the calycles. Kirchenpauer says that there are no supracalycine nematophores; but this is a mistake due to the fact that they are very delicate and easily lost or shrivelled when the polypary is dried. The median sarcothecæ have a tubular stem, curved forward, and terminating in a shallow cup; those immediately in front of the calycles are sometimes so close as to appear adnate, hence Kirchenpauer has failed to perceive their true nature, and has fallen into the singular error of describing them as peduncles of the calycles. Though somewhat peculiar in form, however, these median sarcothecæ do not differ in any essential particular from those of other species, being, as in the majority of cases, bithalamic and canaliculate. According to Kirchenpauer's figures and description, the joint dividing the hydrothecal internode from the short one below it, comes between the calycle and the anterior sarcotheca; this, however, is certainly not the case in the specimens which I have seen, and such a condition is, I believe, unknown in any species. In the simple shoots which I have examined the short internodes are quite distinct from those which bear the calycles, but in one of the pinnate specimens the portions of the hydrocaulus which represent the former are continuous with the hydrothecal internodes

below them, the intermediate joint being almost obliterated. The gonothecæ have not hitherto been described; I have met with them so far only on the simple form.

PLUMULARIA SETACEOIDES, *Bale.* Plate xi, fig. 8; plate xix, fig. 36. (A.M.)

Journ. Mic. Soc. Vict., II (fig.)

Hydrorhiza stout, with waved margins; hydrocaulus monosiphonic, occasionally branched, attaining a height of about 3 inches; pinnæ alternate, not close, recurved, transversely wrinkled, one borne near the summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ set at an angle of about 40°, cup-shaped, margin entire. Sarcothecæ bithalamic, canaliculate, slender at the base, terminal cup wide and shallow, especially in the laterals; one below each hydrotheca, and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one at the base of each pinna, and one on the lower part of each stem-internode.

Gonothecæ large (eight or nine times as long as the hydrothecæ), obliquely truncated a little above the broadest part, transversely rugose; borne at the bases of the pinnæ, often forming two rows, extending half-way up the stem.

Color, yellowish brown, sometimes colorless and transparent.

Hab.—Botany Bay (Mr. Haswell); Portland (Mr. Maplestone); Williamstown; Queenscliff.

There appear to be two varieties of this species, one colorless, very lax and delicate, 2 or 3 inches in height, the other not more than an inch in height, brownish, with setaceous pinnæ, equal all up the stem, and only about one-twenty-fourth of an inch in length. This small form was from Queenscliff, and so closely resembles the other in minute structure that I do not think they can be separated unless the gonothecæ should prove different from those of the larger form. The specimen from

Botany Bay is also small, and differs from the others in not having the pinnæ recurved, and in being of a deep reddish-brown color. The trophosome of this species closely resembles that of *P. setacea*, but in the latter the sarcothecæ are larger and more slender, and the laterals are placed higher above the calycle. The gonothecæ somewhat resemble those of *P. halecioides*.

PLUMULARIA DELICATULA, *Bale*. Plate XI, fig. 5.
Journ. Mic. Soc. Vict., II (fig.)

Hydrorhiza with waved margins; hydrocaulus monosiphonic, unbranched, about an inch in height; pinnæ alternate, not close, transversely wrinkled, one borne near the summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ parallel with the pinnæ, urceolate, contracted towards the oblique entire aperture. Sarcothecæ bithalamic, canaliculate, slender at the base, terminal cup wide and shallow, especially in the laterals; one below each hydrotheca and one at each side above it, one between every two hydrothecæ, on the intermediate internode, two in each axil, one on the lower part of each stem-internode, and a few tubular ones on the hydrorhiza.

Gonothecæ ?

Color, yellowish brown.

Hab.—Griffiths' Point (Mr. Goldstein); Portland (Mr. Maplestone).

A slender species, readily distinguished by the form and position of the hydrothecæ, with their oblique apertures.

PLUMULARIA GOLDSTEINI, *Bale*. Plate xi, fig. 9.
Journ. Mic. Soc. Vict., II (fig.)

Hydrorhiza flat, with transverse markings at short intervals along the margins; hydrocaulus monosiphonic, unbranched, about one-sixth of an inch in height; pinnæ alternate, recurved,

one borne near the summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ three or four on a pinna, the base raised on a vertical process of the pinna, and the body of the cell thence directed downwards to the pinna, where it is recurved and terminates in a vertical aperture; the base of the hydrotheca separated from the process of the pinna by an oblique septum, which is continued for a short distance into the cell, forming a rudimentary intrathecal ridge; three or four slight constrictions in the pinna, radiating from the hydrotheca. Sarcothecæ bithalamic, canaliculate; one below each hydrotheca, and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one in each axil, and one on the lower part of each stem-internode; the median ones fixed, stout at the base, the rest more slender.

Gonothecæ ?

Color, pale yellowish, transparent.

Hab.—Queenscliff; Portland (Mr. Maplestone).

A very beautiful little species, the back part of the calycle, with the process from the pinna, forming together an erect, nearly conical body, with a rounded summit.

PLUMULARIA OBLIQUA, *Saunders*. Plate xii, fig. 1–3.

Laomedea obliqua, Saunders, in litt.; Johnston, B.Z. (fig.)

Campanularia, Lister, Phil. Trans. 1834.

Plumularia obliqua, Hincks, An. Nat. Hist. 3rd Ser. VIII; Brit. Hyd. Zooph. (fig.)

Hydrorhiza with transverse markings along the margins; hydrocaulus monosiphonic, unbranched, about half an inch in height; stem slender, flexuous; pinnæ alternate, each borne near the summit of an internode, and supporting a single hydrotheca; distal part curving from under the hydrotheca, and swollen at the summit on the inner side, with one or two faint

constrictions behind the hydrotheca. Hydrothecæ rounded at the base, somewhat compressed laterally, aperture at right angles to the cell and pinna, margin sinuated behind down to the summit of the pinna, from which a rudimentary intrathecal ridge projects into the cell. Sarcothecæ bithalamic, canaliculate, with slender bases, one below each hydrotheca and one at each side above it, one in each axil, and one near the middle of each stem-internode; those above the hydrotheca with the upper chamber compressed, and the whole convex upper margin open.

Gonothecæ very large, ovate, truncate above.

Colorless and transparent.

Hab.—Williamstown; Tasmania; England.

Var. robusta, n. var. Considerably stouter throughout than the type, the stems less flexuous, usually with numerous internal annular thickenings of the polypary, and the constrictions behind the calycle strongly marked, so that the polypidom has a ringed appearance; stem-internodes usually proportionately shorter below the pinnæ; hydrothecæ larger, with the intrathecal ridge somewhat more fully developed.

Hab.—Portland (Mr. Maplestone).

This species is the only one of the section to which it belongs (*Monopyxis*) which has been found beyond the limits of Southern Australia. In specimens from Williamstown some of the stems are prolonged upwards into long tendrils, having a similar structure to that of the hydrorhiza.

PLUMULARIA SPINULOSA, *Bale*. Plate xii, fig. 11, 12. (A.M.)
Jour. Mic. Soc. Vict., II (fig.)

Hydrorhiza with transverse markings along the margins; hydrocaulus monosiphonic, unbranched, about one-fourth of an inch in height; stem slender, pinnæ alternate, each borne about the middle of an internode, and supporting a single hydrotheca; distal part curved, and abruptly contracted on the inner side

behind the hydrotheca to half the thickness of the lower part; contracted part with two or three slight constrictions behind the hydrotheca, produced upwards into an incurved spine above the margin. Hydrothecæ rounded at the base, much compressed laterally, aperture at right angles to the cell and pinna, margin somewhat everted in front, slightly sinuated towards the back; an intrathecal ridge springing from the pinna just below the aperture, curved forwards and downwards nearly to the base of the cell. Sarcothecæ bithalamic, canaliculate, with slender bases; one below each hydrotheca, and one at each side above it, one in each axil, and one on the lower part of each stem-internode; those above the hydrotheca and in the axils with the upper chamber compressed, and the whole convex upper margin open.

Gonothecæ?

Color, pale, yellowish, transparent.

Hab.—Queenscliff.

Considerably smaller than *P. obliqua*, and recognizable at once among its allies by the prolongation of the pinna upwards into a spine, and by the well-developed intrathecal ridge.

PLUMULARIA PULCHELLA, *Bale.* Plate xii, fig. 6; plate xix, fig. 37.

Journ. Mic. Soc. Vict., II (fig.)

Hydrorhiza matted; shoots crowded, hydrocaulus monosiphonic, unbranched, about one-fourth of an inch in height, transversely wrinkled; stem slender, pinnæ alternate, each borne about the middle of an internode, and supporting a single hydrotheca, distal part curving abruptly from under the hydrotheca, widening upwards, with from one to three constrictions behind the hydrotheca. Hydrothecæ campanulate, margin entire, slightly everted, rising a little above the summit of the pinna, at right angles to it and the cell. Sarcothecæ bithalamic, canaliculate, with slender bases; one below each hydrotheca, one on each side above it, and two in each axil.

Gonothecæ, six or seven times the length of the hydrothecæ, ovate, obliquely truncate; the orifice surrounded by large smooth internal teeth.

Color, pale yellowish, transparent.

Hab.—Queenscliff.

The campanulate form of the hydrothecæ, and the arrangement of the sarcothecæ, distinguish this species from the others of the same section. In size it about equals *P. spinulosa*, but the calycles are smaller.

PLUMULARIA HYALINA, *Bale*. Plate xii, fig. 4, 5.
Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, unbranched; from one-fourth to one-third of an inch in height; stem flexuous, with from one to four transverse wrinkles in each internode; pinnæ rather distant, alternate, one borne close to the summit of each internode, and supporting a single hydrotheca; distal part curving from under the hydrotheca, smooth, incurved at the summit. Hydrothecæ ventricose, the back bent inwards at the summit of the pinna, forming a cavity which is occupied by the sarcothecæ; aperture at right angles to the cell and pinna, broadly notched behind. Sarcothecæ bithalamic, canaliculate, with slender bases; one below each hydrotheca (often absent), and one at each side behind it.

Gonothecæ?

Almost colorless, transparent.

Hab.—Queenscliff.

The part of the internode below the hydrotheca is longer than in the allied species, and usually has a slight projection from which springs the anterior sarcotheca; in some cases, however, this is entirely absent, and there is no sign of the sarcotheca having been detached; it would seem probable, therefore, that in these cases the sarcotheca is obsolete. The stem-processes supporting the pinnæ are very short. The superior sarcothecæ are very small, and depressed close to the summit of the pinna.

PLUMULARIA COMPRESSA, *Bale.* Plate xii, fig. 9, 10; plate xix, fig. 39, 40.

Jour. Mic. Soc. Vict., II (fig.)

Hydrorhiza very broad, with transverse markings along the margins; hydrocaulus monosiphonic, unbranched, about half an inch in height; stem slender, pinnæ alternate, each borne near the summit of an internode, and supporting a single hydrotheca, distal part curved from under the base of the hydrotheca, smooth, swollen at the summit on the inner side. Hydrothecæ somewhat contracted towards the base, slightly compressed laterally, their longer axes (from back to front) set at right angles to the plane of the hydrocaulus; aperture at right angles to the cell and pinna, margin sinuated behind down to the summit of the pinna; from which a rudimentary intrathecal ridge projects into the cell. Sarcothecæ monothalamic, canaliculate, stout at the bases; one below each hydrotheca, fixed, its oblique aperture almost appressed to the front of the cell; one at each side above the hydrotheca, abruptly recurved and open on the convex upper side from the recurved extremity to nearly the base; one in each axil, simple, bract-like.

Gonothecæ, one or two on a stem, springing close to the base, about four times the length of the hydrothecæ, very convex behind, nearly straight in front; aperture vertical, projecting in advance of the front, margin everted.

Color, pale yellowish.

Hab.—Robe, S. A.? (Mr. Smeaton); Portland (Mr. Maplestone).

The original description of this species was taken from mounted specimens in bad condition, and was erroneous in several particulars. It differs from all the allied species except *P. australis*, in having monothalamic sarcothecæ; the superior ones appear at first sight to be bithalamic, and similar to those in the same position on *P. obliqua* and *P. spinulosa*; in reality, however, this appearance is caused by the upper part being sharply recurved

upon the lower. The anterior one is fixed and very unlike the corresponding one in *P. obliqua*, &c., and might, on a casual view, be taken for a part of the pinna supporting the calcycle. As the calycles are set at right angles to the plane of the hydrocaulus they can be seen only in back or front view when the polypidom is laid flat on a slide, unless pressure be used. They readily fall off when the polypidom is kept dry.

PLUMULARIA AUSTRALIS, *Kirch.* Plate xii, fig. 7–8; plate xix, fig. 43–44.

Plumularia (*Monopyxis*) *obliqua*, var. *australis*, Kirch., Abh. ver. Hamb. VI (fig).

Hydrorhiza very broad, with transverse markings along the margins; hydrocaulus monosiphonic, unbranched, about one-fifth of an inch in height; stem very slender, pinnæ alternate, each borne near the summit of an internode, and supporting a single hydrotheca, distal part curved from under the base of the hydrotheca, smooth, swollen at the summit on the inner side. Hydrothecæ rounded at the base, compressed laterally, aperture at right angles to the cell and pinna, margin sinuated behind down to the summit of the pinna, which is produced into an intrathecal ridge extending about half across the cell, and curving slightly downwards; aperture opening into the pinna situated at the back of the hydrotheca. Sarcothecæ monothalamic, canaliculate, stout at the bases, one below each hydrotheca, fixed, its oblique aperture almost appressed to the base of the cell; one at each side above the hydrotheca, abruptly recurved, and open on the convex upper side from the recurved extremity to nearly the base; one in each axil, simple, bract-like.

Gonothecæ, one or two on a stem, springing close to the base, six to eight times as long as the hydrothecæ, convex behind, the convex front bulging out considerably in advance of the vertical aperture, margin everted.

Color, yellowish.

Hab.—Portland (Mr. Maplestone); Port Philip (Kirchenpauer).

This species has been described by Kirchenpauer as a variety of *P. obliqua*, with which however it has no very close affinity. Its general structure is similar to that of *P. compressa*, especially as regards the peculiar sarcothecæ, all of which are identical in form with the corresponding ones of that species. The calycles of *P. australis* however are not set with their long axes at right angles to the plane of the pinnæ; they also differ from those of *P. compressa* in having the aperture of communication with the cavity of the pinna situated at the back instead of below, in being more rounded at the base, in not rising so far above the summit of the pinna, and in the possession of a well-developed intrathecal ridge. The whole hydrosoma is much smaller than that of *P. compressa*, and is perhaps the smallest known in the genus. Kirchenpauer has overlooked the axillary sarcothecæ, and has mistaken the anterior ones for processes of the pinna, serving to support the calycles.

Doubtful Species.

The three following species are insufficiently characterized, and it is not clear from the description whether they belong to the Plumularian or the Aglaophenian section of Lamarck's genus:—

Plumularia filamentosa, *Lamk.*

Lamk., An. s. Vert.; Blainv. Man. d'Act.

Shoots numerous, filiform, erect, branching; branches at the summit pinnate, spiniform; pinnules short, secund.

B. var. Shoots very long, filamentous.

Hab.—The Southern seas.

Forms a tuft of filiform shoots; brown or blackish, and, as it were, spiniferous, and about 12 centimetres in height. In the variety *B* the shoots are much longer and more fragile. The pinnules of the spines are short, serrate.—(Lamarck.)

Kirchenpauer says that this species is from South Australia, and belongs to the typical *Aglaopheniæ*. The reason for so placing it is not apparent, the diagnosis being insufficient even to denote the genus with certainty.

PLUMULARIA SULCATA, *Lamk.*

Lamk., An. s. Vert.; Blainv., Man. d'Act.

Stem branched, sulcate; branches erect; lateral branchlets distant, subpinnate; celluliferous on one side.

Hab.—The Southern seas.

This species is slender and loose in all its parts. Its stem and branches are marked by longitudinal, wavy furrows. Height, 15 or 16 centimetres.—(LAMARCK.)

PLUMULARIA SCABRA, *Lamk.*

Lamk., An. s. Vert.; Blainv., Man. d'Act.

Lower shoots naked, muricate-scabrous, upper ones cymosely branched; branches pinnate, ascending; cellules very minute.

Hab.—The Southern Seas.

The peculiar aspect of this species eminently distinguishes it. Its naked scabrous stems, branching in a cyme towards the summit, its fine serrate ascending pinnules, and its extremely small cellules are characteristic. Height, twelve centimetres.—(LAMARCK.)

Kirchenpauer conjectures that this species may be the same as his *A. urens*, which I think unlikely, as the calycles of that species do not appear to be remarkably small.

ANTENNULARIA, *Lamarck.*

An. s. Vert.

NEMERTESIA, Lamouroux, Bull. Phil. 1812.

HETEROPYXIS, Heller (in part), Zooph. u. Echin. des. Adr. Meeres (for *H. tetrasticha.*)

Zoophyte plant-like; stems simple or branching, jointed, clothed with verticillate branchlets, and rooted by a mass of fibres; hydrothecæ cup-shaped; nematophores bithalamic, distributed along the stem [*and branchlets*]*; gonothecæ axillary, unilateral.*—(HINCKS.)

The present genus differs from *Plumularia* solely in the arrangement of the polypiferous ramules, which instead of being biserial are arranged in regular whorls round the stem. Kirchenpauer, who adopts Lamouroux' name for the genus, divides it into two sub-genera, *Antennularia* and *Heteropyxis*, based, as in *Plumularia*, on the presence or absence of a joint between each calycle and the median sarcotheca above it. The distinction

however often breaks down in some of the species, and I have a specimen from New Zealand which might with almost equal propriety be placed in either section, so variable is it in this particular.

ANTENNULARIA CYLINDRICA, *n. sp.* Plate x, fig. 7. (A.M.)

Hydrocaulus monosiphonic, stem stout, divided into internodes, each bearing from one to three whorls of ramuli, each whorl consisting of three, which alternate in position with those above and below. Ramuli ascending, at a small angle with the stem, a hydrotheca on each internode. Hydrothecæ tubular, adnate to the hydrocaulus throughout their length, and parallel with it; aperture at right angles, slightly sinuated towards the back. Sarcothecæ bithalamic, canaliculate, slender at the base; one below each hydrotheca and one at each side above, about five in and around each axil.

Gonothecæ?

Color, brown.

Hab.—Port Curtis, 5-7 fathoms (Mr. Haswell).

I have seen only one specimen, which is about 3 inches in height, but is incomplete. The calycles, with the ramuli supporting them, are very similar to those of *Plumularia cylindrica* (Kirchenpauer).

DOUBTFUL SPECIES.

The following species has not been figured, nor described with sufficient detail to admit of its identification:—

ANTENNULARIA CYMODOCEA, *Busk.*
Rept. British Association, 1850.

Stem simple, ramules biserial, the two series alternating.

Hab.—South Africa, Australia, &c.—(BUSK.)

The above description would appear at first sight to belong to a *Plumularia* with alternate pinnæ, but this cannot be the case as the species is placed by Busk under *Antennularia*. It is probably meant that the ramules are in pairs on opposite sides of the stem, each pair alternating in position with

the pairs above and below, so that the longitudinal arrangement would be quadriserial. Such an arrangement exists in *A. decussata*, Kirchenpauer, and as that species is found at the Cape of Good Hope it may probably be identical with Busk's. So far as I am aware no other species is known with the ramules similarly arranged.

AGLAOPHENIA, *Lamouroux* (in part).
Bull. Phil., 1812.

PLUMULARIA, Lamarck (in part). An. s. Vert.
AGLAOPHENIA, M'Crady.

Shoots plumose, pinnate, often branched, rooted by a filiform stolon; hydrothecæ generally toothed or lobed at the margin; a median anterior and two lateral sarcothecæ connected with each hydrotheca, no others along the polypiferous ramules; gonothecæ enclosed in corbulæ, or borne on specially-modified pinnæ.

The genus *Aglaophenia*, as limited by M'Crady, and adopted by Agassiz and Hincks, has been still further subdivided by Professor Allman and later writers, their subdivisions depending mainly on the structure of the gonosome. The following remarks, relating to the trophosome, are applicable to almost all the genera.

Owing to the closeness of the pinnæ the species have usually a feather-like aspect, contrasting strongly with the lighter and more open habit of the *Plumulariæ*. The movable cup- or wine-glass-shaped sarcothecæ, so characteristic of that genus and *Antennularia*, are absent in *Aglaophenia* and *Halicornaria*, but every calycle is furnished with three sarcothecæ, one anterior and two lateral, which are partly attached to it and partly to the hydrocaulus. These organs vary considerably in form, but are generally more or less sac-like or tubular, and the anterior one may be very short or may attain two or three times the length of the calycle. It has normally two apertures, one lateral, immediately above the calycle, the other terminal; when the sarcotheca is long these apertures are usually distinct from each other; when, on the other hand, it is short, they are brought into juxtaposition, and become more or less confluent, in which case the

sarcotheca is said to be canaliculate. The presence of two orifices in the mesial sarcotheca was made by Kirchenpauer (in 1872), one of the principal characters of his sub-genus *Macrorhynchia*, but, as I have pointed out elsewhere,* it is a feature common to almost all the species. The fact of the two apertures becoming united is merely a necessary consequence of the shortening of the sarcotheca, and is of no structural importance whatever, and even in such species as *A. parvula* the terminal aperture retains in great part its circular form, though interrupted where the lateral aperture joins it. The whole gradation between the canaliculate sarcotheca and that with distinct apertures may sometimes be seen within the limits of a single species; for example, in *H. prolifera* the sarcotheca is usually double the length of the calycle, and the apertures are widely separated; when, however, the sarcotheca is considerably shortened the apertures are united by a crack in the front, and when it is still more abbreviated they become as completely confluent as in *A. pluma*. The foregoing remarks apply in every particular to the lateral sarcothecæ also, though, so far as I am aware, the presence of more than one orifice in these organs had not been noticed till I pointed it out in the paper above alluded to. The union of the two apertures is easily seen in *A. pluma* and its allies, and the small form of *H. longirostris* shows the same gradations in the laterals that *H. prolifera* does in the anterior sarcothecæ. It should be noted, however, that in some species the laterals have more than two apertures. In the group to which *H. superba* belongs the whole front edge of the sarcotheca is free, and in addition there are two (or sometimes more) small circular apertures close to the margin, which in *H. ascidioides* are usually distinct, but in most of the species are united to the broad lateral aperture, or more or less merged in it.† In many species there is an opening by which the

* Journal of the Microscopical Society of Victoria, 1882.

† I have seen only one species in which the sole aperture of the sarcothecæ did not give evidence of being formed by the union of the terminal and lateral orifices, namely, *A. myriophyllum*, all the sarcothecæ of which are truncated close down to the calycle, so that the lateral aperture is necessarily suppressed entirely.

cavity of the median sarcotheca communicates with that of the calycle. There are no sarcothecæ scattered along the ramules which bear the polypites, other than those attached to the calycles, but there are two on the main stem at the base of each pinna, and often more. This has been overlooked by Mr. Hincks, who says, in his generic description, that the nematophores are only developed in connection with the hydrothecæ.

The Australian species of *Aglaophenia* are divisible into several well-marked groups, which may be readily distinguished by the structure of the trophosome.

1. In the first group there are two or three folds in the hydrothecal internode; and the calycles, which are horizontal with the pinnæ, have the distal part abruptly recurved, so that the aperture is vertical, the contiguous walls of the recurved portion and of the lower part of the cell being sometimes united to form a narrow ridge. There is also a constriction or rudimentary intrathecal ridge, immediately in front of the aperture which connects the calycle with the cavity of the pinna. There is a communication between the calycle and the mesial sarcotheca. The sarcothecæ are all tubular, with two distinct external apertures; the laterals nearly erect, usually rising above the calycle, the margin of which forms a large angular lobe at each side; *A. urens* has a sarcotheca on the basal part of each pinna. The gonothecæ in *A. urens* are borne singly on scattered pinnæ, which are modified and abbreviated above; in *A. plumosa* they are produced in well-developed open corbulæ, composed of pinnules armed with two series of large sarcothecæ. The reproduction of *A. longicornis*, *A. squarrosa*, and *A. rubens* is unknown.

2. In this group the structure of the calycles is essentially the same as in the last, but the recurved portion is much more completely united with the proximal part, resulting in a wide intrathecal ridge projecting down almost through the calycle; the margins are sub-crenate, and the lateral sarcothecæ do not rise above the calycle. There are two or three folds in the hydrothecal internodes. In *A. phœnicea* the gonangial ramules

occupy the place of every third pinna on each side of the fertile branches, each being recurved above the single gonotheca, and bearing two series of large sarcothecæ; the other species, *A. Huxleyi*, has an open corbula, each pinnule of which, according to Mr. Busk, has a single branch near the bottom.

3. In the next group the hydrothecal internode has one or two folds; the calycles have a toothed margin; the mesial sarcotheca is of moderate length, with two external apertures and a third communicating with the calycle; the laterals are tubular or subconical, with two distinct apertures; there is an intrathecal ridge about the middle of the calycle, on the side next the pinna, and below it the cavities of the calycle and pinna are continuous; in other words, the aperture which unites them extends completely from side to side. There is an open corbula, formed by two series of vaulted pinnules armed with large nematophores along each side. *A. divaricata* and *A. ramosa* belong to this group.

4. The fourth section consists of the typical *Aglaopheniæ*, such as *A. pluma*. The calycle has a toothed margin, and a rudimentary intrathecal ridge near the base on the side next the pinna; there are two folds in the hydrothecal internode; the anterior sarcotheca is short and canaliculate, as are also the laterals; there is generally in this group an aperture between the calycle and the anterior sarcotheca, but this does not appear to be the case in *A. delicatula*. *A. parvula* and *A. delicatula* are the only Australian species which I have seen; in the latter the reproduction is unknown, in the former the corbula may consist of four or five pairs of broad leaflets, free from each other and armed with a series of short tubular sarcothecæ along each margin; or the leaflets may be united to form a closed pod, the lines of junction being marked by a single series of sarcothecæ. *A. crucialis* also appears to belong to this section.

5. *A. Macgillivrayi* is one out of the three or four species which compose the sub-genus *Pachyrhynchia* of Kirchenpauer, and are distinguished by the great thickness of the sarcothecæ, which in lateral view are nearly as thick as the calycle (in *A.*

spicata the median is thicker).* The terminal portion of the median sarcotheca is, in *A. Macgillivrayi*, quite distinct from the lower part, and in the two species figured by Kirchenpauer the structure appears to be similar. There are several folds in the hydrothecal internode, but (so far as can be judged from the figures) no intrathecal ridge. The margin of the calycle is entire. The gonothecæ are borne in closed corbulæ.†

The first subdivision of the genus with which I am acquainted was that of Kirchenpauer, who arranged the species in four sub-genera. The first of these (*Calathophora*) contained the species of which *A. pluma* is the type, the calycles being toothed, and the gonothecæ produced in closed corbulæ. The second (*Pachyrhynchia*), which also has the corbulæ closed, corresponds with the fifth section described above. The third (*Lytocarpia*) contains those forms which are provided with an open corbula, like *A. divaricata*. The fourth and largest sub-genus (*Macrorhynchia*) comprises the species in which there is no corbula, and the gonothecæ are borne on specially modified pinnæ, and which were erroneously supposed to be peculiar in the possession of two external apertures to the anterior sarcotheca. This arrangement, it will be seen, ignores all those species in which the gonothecæ are borne on the main stem or on ordinary unaltered pinnæ; such species are, however, included among the *Macrorhynchiæ*.

The genus *Halicornaria*, originally proposed by Mr. Busk for the species now classed under *Plumularia*, as well as for the *Aglaopheniæ* which bear unprotected gonothecæ, has been modified by Professor Allman so as to comprise those species which resemble *Aglaophenia* in the trophosome, but which never have the gonothecæ enclosed in corbulæ or protected by special gonangial ramuli. Those which are so protected are included in *Aglaophenia*, and I have also placed under that genus the forms

* *A. spicata* is not assigned an Australian habitat by Lamouroux, who originally described it, nor by Kirchenpauer.

† Such species as I have not mentioned are insufficiently known to enable them to be allotted with certainty, and some of them may not be referable to any of the types enumerated.

in which the gonangial pinnæ are abbreviated above the gonotheca, and otherwise modified, deeming that the species in which the pinnules are *slightly* altered are more suitably associated with those in which they are *more* altered than with those in which they are not modified at all. In whatever way, however, we divide the species, the distinctions will appear somewhat artificial, such is the regular gradation between the forms with unprotected gonangia and those with corbulæ. We have first the species in which the gonothecæ are borne on the stem or on ordinary hydrocladia, from which the transition is easy to those which have the gonangial pinnæ of the usual type below the gonothecæ, but shortened above and furnished with from one to six or eight pairs of nematophores; and very close to these comes *A. phœnicea*, in which every third pinna on each side of a fertile branch bears a gonotheca, above which it is armed with large nematophores, and recurved so as to form a protection to the gonotheca. In *A. patula* (Kirchenpauer) every *second* pinna is thus modified. In these species the recurved pinnæ, alternately springing from each side, make of the whole branch a kind of corbula intermixed with the hydrocladia. In *Pleurocarpa* (Fewkes) the gonangial pinnæ are all brought together near the proximal end of the branch, forming a distinct open corbula, while the distal part of the branch bears the ordinary hydrothecal pinnæ; and it needs only the suppression of this distal portion to make the structure agree with that of *A. divaricata* and similar species. In some of the corbulæ of *A. parvula* the number of pinnules is reduced to four or five pairs, which take the form of broad leaflets, and are separate from each other, or attached only at one or two points, while in others of the same species the leaflets are united for their whole length, forming a closed pod. An intermediate form occurs in *A. vitiana* (Kirchenpauer), where the leaflets are lobed at the margins, and attached to each other at the lobes, the interstices being open. Various other modifications of the corbula occur, and in several genera the gonothecæ are protected by singular and beautiful structures of a different character, such as the *phylactogonia* of *Cladocarpus* (Allman), which are branched

filaments armed with nematophores, and springing from the basal part of the pinnæ; and filaments of a similar nature, but unbranched, which, as already mentioned, are arranged in whorls at the tips of the branches of *Hippurella* (Allman). Another remarkable gonosome is that of *Callicarpa* (Fewkes), in which a kind of corbula is formed of a number of verticillate primary branches, each dividing into four secondary ramules, the whole composing a structure resembling a spike of barley. These genera, as well as others, are absolutely indistinguishable from *Aglaophenia* or *Halicornaria* by the trophosome only, and it is quite possible that some of our Australian species may be referable to some of them. In the absence of the gonosomes, however, I have of necessity ranked all the uncertain species provisionally under *Aglaophenia*, except in those cases where close general similarity to known species of *Halicornaria* appeared to justify a reference to that genus. It should be noted, nevertheless, that species which bear a close resemblance to each other as far as the trophosome is concerned, may differ entirely in the gonosome, and this is particularly noticeable in the group to which *A. plumosa* belongs. *A. plumosa*, *A. urens*, and *Halicornaria setosa* (Armstrong), have calycles and nematophores very nearly alike; but the first has an open corbula, the second produces the gonangia on scattered modified pinnæ, and the third on the main stem—the pinnæ being unaltered.

AGLAOPHENIA PLUMOSA, *Bale.* Plate xiv, fig. 5; plate xvii, fig. 12. (A.M.)

Journ. Mic. Soc. Vict., II. (fig.)

Hydrocaulus monosiphonic, usually unbranched, about an inch in height; pinnæ approximate, alternate, one on each internode, both series springing almost from the front of the stem. Hydrothecæ parallel with the pinna in their longest diameter, a fold or constriction crossing the cell near the base in a direction vertical to the pinna, a short stout intrathecal ridge projecting down into

the cell between the front of the aperture and the mesial sarcotheca; aperture vertical, each side forming a large angular lobe, a nearly erect pointed tooth or lobe in front, back excacated down to the pinna. Hydrothecal internodes smaller at the proximal end, with two folds or constrictions; one transverse, opposite the constriction of the hydrotheca; the other directed obliquely forward from the base of the lateral sarcothecæ; generally a third midway between them. Mesial sarcotheca nearly double the height of the hydrotheca, adnate to it nearly as far as the margin and mainly rising from it, free part projecting forward, somewhat swollen between the summit and the lateral aperture; with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as the margin and rising above it, inclined at about the same angle as the mesial sarcotheca, but with the free part usually directed more forward; terminal and lateral apertures distinct. Cauline sarcothecæ conical, with terminal and lateral apertures united; two on the stem at the base of each pinna.

Gonangial pinnæ recurved, with 15–20 pairs of alternate pinnules, each borne on a short internode, and furnished with two lateral series of sarcothecæ, similar to the mesial ones on the hydrothecæ; sarcothecæ opposite or sub-alternate, the two proximal ones on the distal side of each pinnule without corresponding ones on the opposite side; pinnules jointed above the proximal sarcotheca, which is larger than the others and often bifid; two sarcothecæ on the pinna at the base of each pinnule. The two series of pinnules slightly arched, meeting at the tips and forming an open corbula. A single hydrotheca below the corbula.

Color, light brown.

Hab.—Aldinga, S.A. (Mr. Smeaton); Portland (Mr. Maplestone); Williamstown; Queenscliff.

Except in very small specimens the pinnæ are usually recurved, giving the polypidom a graceful plume-like aspect.

Many of the shoots bear two or three corbulæ, which are constructed on the same general type as those of *A. divaricata*, but are finer and more delicate, with the pinnules less arched, so that the corbula is slightly compressed.

AGLAOPHENIA URENS, *Kirchenpauer*. Plate xiv, fig. 6; plate xvii, fig. 9. (A.M.)

Plumularia scabra, Lamk., An. s. Vert.; Blainv., Man. d'Act.?

Aglaophenia urens, Kirch., Abh. ver. Hamb. V. (fig.)

Hydrocaulus polysiphonic, branched, 5 or 6 inches in height; pinnæ close, short, alternate, one on each internode, both series springing from the front of the stem. Hydrothecæ parallel with the pinna in their longest diameter; basal part constricted on the side next the pinna; deeply constricted between the aperture and the mesial sarcotheca, and abruptly recurved, so that the aperture is nearly vertical; aperture wide, the sides slightly elevated, with a scarcely perceptible angle in the middle of each, a small tooth in front, back slightly sinuated, free. Hydrothecal internodes with two slight divergent folds or constrictions—one nearly opposite the basal constriction of the hydrotheca; the other at the base of the lateral sarcothecæ. Mesial sarcotheca nearly double the height of the hydrotheca, adnate to it nearly as far as the constriction on the upper side, and mainly rising from it; free part projecting forward, tapering; with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as the margin and rising above it, inclined at about the same angle as the mesial sarcotheca, but with the free part usually directed more forward; terminal and lateral apertures distinct. Cauline sarcothecæ conical, with terminal and lateral apertures sometimes united—two on the stem at the base of each pinna, and one on the pinna itself.

Gonothecæ borne singly on modified pinnæ (Kirchenpauer).

Color, greyish brown.

Hab.—Java Sea; Batang; Brisbane; (Kirchenpauer): Pt. Stephens; Pt. Denison; (Mr. Haswell).

It is with some hesitation that this species is identified with *A. urens*, as the branches are not so divergent as in Kirchenpauer's figure and description. The distance between the recurved margin of the calycle and the mesial sarcotheca is much less than in the figure referred to, but agrees with the description. I have not met with the gonothecæ; those of *A. urens*, as figured by Kirchenpauer, are borne close to the termination of much shortened, scattered pinnæ. This species seems scarcely distinct from *Halicornaria saccaria*, Allman.

AGLAOPHENIA SQUARROSA, *Kirchenpauer*. Plate xviii, fig. 10.

Abh. ver. Hamb. V (fig.).

Shoots polysiphonic, woody, branching, branches scattered, squarrose; branchlets pinnate, pinnules very short, setaceous; hydrothecæ saccate, interrupted, aperture vertical, nematothecæ and nematocalyces conical.

Hab.—Port Denison.

The stiff, woody, strongly-branched stem has much the look of an Antipathes, since, in their dried condition, the pinnules with their hydrothecæ are hardly observable; they are quite short, bristle-like, and lie all on one side, and are also only placed on the most external thin twigs, while the stem and branches appear bare, or clothed with downy hairs. The hydrothecæ, of which, at the utmost, four or five are found on the short pinnules, form a strongly bent sac with an anteriorly-directed vertical opening. The nematotheca appears scarcely to touch the rachis, being placed on the hydrotheca. Lamarck's short diagnosis of his *P. scabra* would suit this species, also *S. fruticans*, Pallas, but both appear to be other species. The present specimens were received by Dr. Sonder with Algæ from Australia.—(KIRCHENPAUER.)

AGLAOPHENIA RUBENS, *Kirchenpauer*. Plate xviii, fig. 9.
Abh. ver. Hamb. V. (fig.)

Shoots polysiphonic, branched, branches and branchlets scattered, pinnate, pinnules long, patent; hydrothecæ saccate, interrupted; aperture sub-vertical, ligulate; nematothecæ tubular.

Hab.—Port Denison.

The stem proper, which is comparatively short and thick, and composed of loosely connected tubes, bears several long thin branches and branchlets, which are also made up of several tubes. On these are placed fine long pinnate branchlets. The stem and branches are dark brown, the thin branchlets and pinnules reddish. The hydrotheca has also here the form of an introrsely geniculate sac, but the opening is not quite vertical. The nematotheca, which is tubular, passes by its broad base into the rachis. This Plumularian also was received by Dr. Sonder from Australia with Algæ.—(KIRCHENPAUER.)

AGLAOPHENIA LONGICORNIS, *Busk*. Plate xiv, fig. 7–8; plate xvii, fig. 5. (A.M.)

Plumularia longicornis, Busk, Voy. of Rattlesn.

Aglaophenia longicornis, Kirch., Abh. ver. Hamb. V. (fig.)

Hydrocaulus polysiphonic, 5 or 6 inches in height, sometimes sparingly branched, bipinnate, stem jointed at long and irregular intervals; pinnæ regular, alternate, the first two internodes on each without pinnules, and divided from the rest of the pinna by a long oblique flexible joint, internodes bearing from one to fifteen or sixteen pinnules, the longer ones near the proximal end; pinnules close, alternate, $\frac{1}{16}$–$\frac{1}{12}$ of an inch in length, borne on the stem as well as on the pinnæ, and both series springing from the front. Hydrothecæ parallel with the pinnule in their longest diameter, a fold or constriction crossing the cell near the base in a direction vertical to the pinnule; deeply constricted between the aperture and the mesial sarcotheca, and abruptly recurved so that the aperture is vertical; aperture

expanding, sub-crenate, each side forming a large erect angular lobe, front entire or with a small erect tooth, back free, with two teeth adnate to the lateral sarcothecæ, and one between them. Hydrothecal internode with two strong folds or constrictions, one opposite the basal constriction of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca long and slender, adnate to the front of the hydrotheca for a great part of its height, and rising mainly from it; free part inclined forward at a varying angle, not tapering, sometimes slightly enlarged at the end, with distinct terminal and lateral tubular apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ long, slender, tubular, curving upwards from under the hydrotheca, adnate up to the margin and rising above it; free part either erect or more or less abruptly curved forward, with two or three apertures, the third when present being tubular, and projecting forward from the base, immediately below the ordinary lateral aperture. Cauline sarcothecæ sub-conical, with two apertures; two at the base of each pinnule, and one on each of the two proximal internodes of the pinnæ.

Gonothecæ?

Color, pale brownish.

Hab.—Prince of Wales Channel, Torres St., 9 fathoms; (Busk): Singapore (Kirchenpauer): Fitzroy Id., 12 fathoms; Albany passage, 9 fathoms; (Mr. Haswell).

According to Mr. Busk the polypidom is unbranched, or with a single branch given off near the base. The mesial sarcothecæ are usually very long, but vary considerably in length, also in the extent to which they are inclined forward. Kirchenpauer's figure of the calycle is in the highest degree erroneous, it being shown with a short anterior sarcotheca and a circular entire aperture. The pinnæ are usually about three quarters of an inch in length, and, with their closely-set fringes of short pinnules, give the polypidom, as Mr. Busk remarks, exactly the appearance of a silky quill feather. The lateral sarcothecæ (which are very long and slender) often have in addition to the simple lateral aperture near the base a projecting tubular por-

tion with a third orifice. This part is frequently developed on only one of the lateral sarcothecæ of a pair, and is often absent altogether; when absent, the ordinary lateral aperture is usually somewhat prominent, with the margin everted. The teeth at the back of the calycle may be large and pointed, or only rudimentary.

AGLAOPHENIA PHŒNICEA, *Busk.* Plate xv, fig. 1-5; plate xvii, fig. 1-4; plate xix, fig. 31. (A.M.)

Plumularia phœnicea, Busk, Voy. of Rattlesn.

Aglaophenia rostrata, Kirch., Abh. ver. Hamb., V (fig.)?

Hydrocaulus polysiphonic, 5 or 6 inches in height, sometimes sparingly branched, bipinnate; pinnæ distant, irregular, opposite to alternate, divided very obscurely into internodes, each bearing a single pinnule; pinnules approximate, alternate, borne on the stem as well as on the pinnæ, and both series springing from the front. Hydrothecæ parallel with the pinnule in their longest diameter, a slight constriction near the base on the side next the pinnule, an intrathecal ridge projecting downwards from between the front of the aperture and the mesial sarcotheca nearly through the cell; aperture at a small angle with the pinnule, sub-crenate, each side forming a broad subangular lobe, front entire, a rounded lobe behind, sometimes produced into a tooth; aperture between cell and pinnule smooth or slightly denticulated. Hydrothecal internode with two divergent folds or constrictions, one nearly opposite the basal constriction of the hydrotheca, the other at the base of the lateral sarcothecæ, generally a third midway between them. Mesial sarcotheca long, adnate to the front of the hydrotheca nearly as far as the aperture and mainly rising from it, free part variable in length, slightly tapering, projecting forward at a varying angle, with distinct terminal and lateral apertures, and a small orifice opening into the hydrotheca. Lateral sarcothecæ, conical or tubular, either adnate and directed upwards, or large, free, and projecting downwards from the hydrotheca;

terminal and lateral apertures distinct. Cauline sarcothecæ similar to the laterals, but wider; two at the base of each pinnule.

Gonothecæ lenticular, borne singly on every third pinnule of each series (on the fertile pinnæ), a single hydrotheca below the gonotheca, the rest of the pinnule recurved over the rachis armed with two series of long sarcothecæ like the mesials.

Color, light brown.

Hab.—Prince of Wales Channel, Torres St. (Busk): Singapore? (Kirchenpauer): Holborn Id., 20 fathoms; Port Denison; Port Molle, 14-15 fathoms; Gloucester Passage; (Mr. Haswell): Pt. Darwin.

This species is remarkably variable in some of its characteristics. In a specimen from Mr. Busk the lateral sarcothecæ are nearly erect and closely adnate to the calycle, except near the ends of the pinnules, where they are larger, free, and directed forwards. A specimen from the Port Darwin cable agrees with Mr. Busk's, except in having longer anterior sarcothecæ; but in all the other specimens the laterals are large, free, and projecting downwards from the hydrotheca, except those near the ends, which are directed forwards, as in the other form. The distinction, however, appears to be only varietal, especially as specimens may be found in which some of the sarcothecæ exhibit a tendency towards an intermediate state. In the type form the back of the calycle consists of a small lobe, which in the other varieties is produced into an erect tooth. The specimens from Holborn Island and Pt. Denison are slenderer throughout than the rest, with the constrictions in the hydrothecal internodes much less strongly marked; those from Pt. Molle are much like the type except in the form and position of the lateral sarcothecæ; while the one from Gloucester Passage differs from all the others in having the teeth and lobes of the cell-margin much sharper and more produced, and the mesial sarcothecæ strongly curved forwards. Mr. Busk says that many of the branches have a piebald aspect, or are mottled with dark purple patches, which, when wetted, present a beautiful crimson color; this color, however,

appears not to be permanent. The primary pinnæ are long and irregular, not specially jointed to the stem, and are simply branches pinnately arranged; they are given off from the secondary tubes which are added behind the original stem. The partial septa of the hydrothecal internode vary from slight folds like those of *A. pluma* to strong thickenings completely encircling the interior of the pinna.

AGLAOPHENIA HUXLEYI, *Busk.* Plate xv, fig. 6; plate xvii, fig. 8. (A.M.)

Aglaophenia angulosa, Lamx., Hist. Polyp. Flex., Encyc. Méth.?
Plumularia angulosa, Lamk., An. s. Vert.; Blainv., Man. d'Act.?
Plumularia Huxleyi, Busk, Voy. of Rattlesn.

Hydrocaulus polysiphonic, attaining a height of 20 inches, main stem flexuose, branches arranged spirally, given off at each angular flexure; pinnæ alternate, close, one on each internode of the branches; both series springing from the front. Hydrothecæ cup-shaped, lower half abruptly contracted in front, an intrathecal ridge projecting downwards from the front of the mesial sarcotheca nearly through the cell; aperture vertical, sub-crenate, sides not elevated, back broadly sinuated nearly down to the pinna, a small prominent acute tooth in front. Hydrothecal internode with two slight folds or constrictions, one near the base of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca about double the height of the hydrotheca, adnate to it as far as the aperture and mainly rising from it, free part beak-like, curved forwards, rapidly narrowing upwards from back to front, but widened laterally at the summit; canaliculate, with a minute orifice opening into the hydrotheca. Lateral sarcothecæ short and broad, adnate, directed downwards from the hydrotheca, with a wide opening extending under the whole front margin. Cauline sarcothecæ short and wide, canaliculate, two on the stem at the base of each pinna.

Costæ of ovarian receptacle numerous, each with a single branch near the bottom, and beset with small, cup-like processes; not connected by a membrane (Busk).

Color, yellowish brown.

Hab.—Port Curtis (Mr. Busk): Port Molle, 15 fathoms; Pt. Denison; (Mr. Haswell).

This is the species described as *P. Huxleyi* by Mr. Busk, who refers it to a *Plumularia* figured by Huxley in the Philosophical Transactions for 1849; there is, however, an error in the reference, as Huxley's figure belongs to a very different species. *P. Huxleyi* is probably the same as *A. angulosa* of Lamouroux.* In each of the numerous tubes of the compound branches is a longitudinal series of small oblong cells or cavities, each opening outwards by a circular lateral aperture at the summit; similar cells, but somewhat different in shape, occur in *A. myriophyllum*. I have not seen the corbula, and quote Mr. Busk's description of it.

AGLAOPHENIA DIVARICATA, *Busk*, plate xv, figs. 7, 8; plate xvii, figs. 6, 7. (A.M.)

Plumularia divaricata, Busk, Voy. of Rattlesn.

Aglaophenia ramosa, Kirch. (not Busk), Abh. ver. Hamb. VI (fig.)

Aglaophenia M'Coyi, Bale, Journ. Micr. Soc. Vict. ii (fig.)

Hydrocaulus polysiphonic, four or five inches in height, much branched, branches widely divergent on all sides, pinnæ approximate, alternate, one on each internode, both series borne towards the front of the stem. Hydrothecæ cup-shaped, deep, set at an angle of about 45°, a small intrathecal ridge projecting into the cell from about the middle of the lower side, with a fold from it partly crossing the hydrotheca, basal part of the hydrotheca not separated from the cavity of the pinna; aperture with four teeth on each side, and a long incurved one in front often bearing an erect secondary tooth, back adnate. Hydrothecal internode with a transverse fold or constriction continuous with the intrathecal ridge, and sometimes a second placed opposite the base of the lateral sarcothecæ. Mesial sarcotheca variable in

* "Cellules cupuliformes, avec un appendice inférieur, assez long, courbés en arc."—Lamouroux.

length, projecting, adnate to the hydrotheca as far as the margin, and mainly rising from it, free part tapering, sometimes erect, and with the summit widened laterally, with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ sub-conical, adnate up to the margin of the hydrotheca, with a short free part directed forwards, those at the ends of the pinnæ much enlarged; lateral and terminal orifices distinct. Cauline sarcothecæ similar to the laterals, large, two on the stem at the base of each pinna.

Gonangial pinnæ with 15–20 pairs of alternate pinnules, each borne on a short internode, and furnished with two lateral series of sarcothecæ, resembling the laterals on the hydrothecæ, but much larger; sarcothecæ opposite, the two proximal ones on the distal side of each pinnule without corresponding ones on the opposite side; pinnules with obscure joints, plainer between the first and second sarcothecæ; two sarcothecæ on the pinna at the base of each pinnule. The two series of pinnules much arched, meeting at the tips, and forming an open corbula. A single hydrotheca below the corbula.

Color, dark brown, almost black when dry.

Hab.—Bass' Sts. (Busk); Portland (Mr. Maplestone); Griffiths' Point (Mr. Goldstein); Brighton, S.A. (Mr. Smeaton); Wilson's Promontory, and George Town, Tas. (Kirchenpauer); Pt. Jackson (Mr. Haswell); Queenscliff; Williamstown.

This is the commonest species of *Aglaophenia* in the neighbourhood of Bass' Straits. Mr. Busk's description is quite sufficient for identification, nevertheless Kirchenpauer has referred the species to the *P. ramosa* of the same author, while assigning *A. divaricata* to a different section of the genus. In the original description the calycle is described as being furnished with three teeth on each side (*A. ramosa* having four), with which description Kirchenpauer agrees; in reality however there are four on each side, but the pair next the back are small, and often quite concealed by the lateral sarcothecæ in a side view. Though Kirchenpauer finds only three teeth on each side he has figured four; his figure however is incorrect in several other particulars.

A divaricata is readily distinguished from the other species found in the same localities by its numerous divergent branches and its very dark color. The stem is slender, and at its thickest part consists only of two or three tubes added to the original jointed stem. Specimens forwarded to Mr. Busk have been authenticated by him. The specimen from Pt. Jackson differs somewhat from the ordinary form, the anterior tooth of the calycle being much smaller, and the hydrothecal internode having a second fold or partial septum, which is opposite the base of the lateral sarcothecæ.

Another variety, formerly described by me as a distinct species, under the name of *A. M'Coyi*, must, in view of the subsequent occurrence of numerous intermediate specimens, be united with *A. divaricata*, the description of which I have altered so as to include it. It differs from the type in the longer more erect mesial sarcotheca, with its expanded summit, in the secondary tooth or crest on the median tooth of the calycle, and in the fuller development of the intrathecal ridge. (See plate xv, fig 7; and plate xvii, fig. 6.)

AGLAOPHENIA RAMOSA, *Busk*. Plate xviii, fig. 15-16.

Plumularia ramosa, Busk, Voy. of Rattlesn.

Cells cup-shaped, deep, rounded at bottom, margin elevated on the sides, expanding, with four teeth on each side, the first and second in front much expanded, acute, incurved at the point; a long, slender, incurved central tooth in front; margin entire behind. Rostrum not continued to the rachis, adnate the whole length of the cell, wide and projecting, narrowed to the point, which is tubular; opening oblique; longer than the cell; lateral processes conical, short, tubular, closely adnate.

Costæ of ovarian receptacle with short, opposite, tubular branches, not connected by a membrane.

Hab.—Swan Id., Banks' St., on beach.

Colour greyish brown, polypidom 4-5 inches high, much branched, branches irregular, divaricate, rising in great numbers

almost immediately from the mass of radical fibres. A beautiful species, and the ovarian receptacles very interesting. (BUSK.)

I have not seen any specimens of *A. ramosa*, and cannot make out clearly, from the sketches I have seen, what are the precise characters which separate it from *A. divaricata*, which it very closely resembles. The color of the two species however is different. Professor Allman appears to have overlooked this species when describing the Hydroida of the Gulf Stream, as he has bestowed the same name upon another species of *Aglaophenia*.

AGLAOPHENIA PARVULA, *Bale*. Plate xiv, fig. 3; plate xvii, fig. 10. (A.M.)

Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, unbranched, attaining a height of about three quarters of an inch; pinnæ close, alternate, one on each internode, both series springing from the front of the stem. Hydrothecæ urceolate, narrowed towards the base, set at an angle of about 35°; a fold or constriction crossing the cell near the base in a direction vertical to the pinna; aperture with five teeth on each side, the first from the front everted, and an incurved slender one in front, back entire, adnate. Hydrothecal internodes narrowest at the proximal end, with two folds or constrictions, one transverse, opposite the fold in the hydrotheca, the other directed obliquely forward from the base of the lateral sarcothecæ. Mesial sarcotheca about as long as the hydrotheca, projecting, adnate to the hydrotheca to within a short distance from the aperture, and mainly rising from it; obliquely truncate, canaliculate, with an orifice opening into the hydrotheca. Lateral sarcothecæ short, canaliculate, terminal aperture directed forwards, the teeth of the hydrotheca projecting beyond them. Cauline sarcothecæ similar to the laterals, two on the stem below each pinna, and one at each side of the axil (forming a pair).

Gonangial pinna bearing a single hydrotheca below the corbula, with a joint above and below it, the rest of the pinna not

distinctly jointed. Corbulæ of two kinds—(a) with six or seven pairs of broad leaflets completely united and forming a closed pod, the distal edge of each leaflet fringed with short, stout, tubular, canaliculate sarcothecæ; a free pinnule springing from the proximal rib of the corbula on one side, directed forwards parallel with the pinna and near it, with a series of sarcothecæ on each side:—(b) with all the leaflets free, bordered with sarcothecæ on both edges, forming an open corbula.

Color, light yellowish brown.

Hab.—Queenscliff; Portland (Mr. Maplestone).

This species is very closely allied to *A. pluma*, Lin., but is distinguished by differences in the form and arrangement of the teeth of the calycle, also by having five on each side, the second of which however is often folded behind the third, so that under a low power they appear like one tooth. The first on each side are the only ones noticeably everted. *A. parvula* is usually about half an inch in height, and is remarkable for the different modifications of the corbula.

AGLAOPHENIA PLUMA, *Lin.* Plate xviii, fig. 17.

"*The Podded Coralline*," Ellis, Corall. (fig.)

Sertularia pluma, Lin. Syst.; Pall., Elench.; Esper, Pflanz. Sert. (fig.); Lister, Phil. Trans. 1834.

Aglaophenia pluma, Lamx., Hist. Pol. Flex.; Agas., N.H.U.S.; Hincks, Brit. Hyd. Zooph. (fig.)

Plumularia cristata, Lamk., An. s. Vert.; Johnst., B. Zooph. (fig.)

Pennaria pluma, Oken, Lehrb. Natur.

STEM recurved, smooth, dark brown; pinnæ alternate, simple, one to each internode, approximate, springing from the front of the stem; HYDROTHECÆ *cup-shaped, expanding above, aperture patulous, with a strongly denticulated and somewhat everted margin;* NEMATOPHORES *tubular*, channelled, *the lateral small and not*

projecting much; the anterior stout, adnate through great part of its length, free at the extremity, which projects but slightly; GONOTHECÆ oviform, protected by a pod-shaped receptacle, formed by the union of a number of crested ribs, and occupying the place of a pinna.—(HINCKS.)

Hab.—Australia, (Kirchenpauer): Great Britain; Belgium; La Charente; Bay of Naples; Messina; Mossel Bay, S. Africa.

This species, which sometimes attains a height of 3 inches, differs little in minute structure from *A. parvula*, but the margin of the hydrotheca has fewer teeth, and those near the back are not so projecting. The free pinnule which in *A. parvula* springs from the proximal rib of the closed corbula is absent in *A. pluma*. Kirchenpauer does not mention his authority for recording this as an Australian species.

AGLAOPHENIA DELICATULA, *Busk*. Plate xiv, fig. 4; plate xvii, fig. 11. (A.M.)

Plumularia delicatula, Busk, Voy. of Rattlesn.

Hydrocaulus monosiphonic, unbranched, attaining a height of about 2 inches; pinnæ close, alternate, one on each internode, both series springing from the front of the stem. Hydrothecæ urceolate, contracted at the base, set at an angle of about 45°; a fold or constriction crossing the cell near the base in a direction vertical to the pinna; aperture somewhat contracted, with two broad, erect, pointed teeth on each side and a small one in front, back entire, adnate. Hydrothecal internodes with two folds or constrictions, one transverse, opposite the fold in the hydrotheca, the other directed obliquely forward from the base of the lateral sarcothecæ. Mesial sarcotheca about as long as the hydrotheca, projecting, adnate to the hydrotheca as far forward as the aperture, and mainly rising from it; canaliculate. Lateral sarcothecæ tubular, canaliculate, rising above the hydrotheca, terminal aperture directed forwards and outwards. Cauline sarcothecæ similar to the laterals, two on the stem below each pinna, and one at each side of the axil (forming a pair).

Corbulæ?

Color, pale brownish; stems darker.

Hab.—Prince of Wales Channel, Torres' St. (Mr. Busk); Port Curtis (Mr. Haswell).

A. delicatula belongs to the group of which *A. pluma* is the type, but I have failed to find in my specimens the orifice which in that and the allied species unites the cavity of the hydrotheca with that of the anterior sarcotheca.

AGLAOPHENIA CRUCIALIS, *Lamx.* Plate xviii, fig. 8.

Aglaophenia crucialis, Lx., Hist. Polyp. Flex., Encyc. Méth.; Kirch., Abh. ver. Hamb. V. (fig.)

Plumularia brachiata, Lamk., An. s. Vert.; Blainv. Man. d'Act.

Plumularia crucialis, Blainv., Man. d'Act.

Stem straight, but little branched; branches opposite and divergent; colour, light fawn; height, one to two decimetres.

Seas of Australasia.—(LAMOUROUX.)

The striking peculiarity of this species is in having the opposite ramules not on the sides of the stem but on common points of it, so that these ramules are truly geminate. These same ramules are very open, growing in somewhat distant pairs, and the inferior are the longest. The vesicles [corbulæ] are elongated, cylindrical, ringed, with the rings serrate. Height, 25 to 30 centimetres.—(LAMARCK.)

AGLAOPHENIA FORMOSA, *Busk.* Plate xviii, fig. 7.

Plumularia formosa, Busk, Rept. Brit. Assn., 1850.

Aglaophenia formosa, Kirch., Abh. ver. Hamb., V. (fig.)

Zoophyte erect, pinnate, sub-incurvate; cellules crenate, dentate, anterior tooth elongated, aculeate at each side of the base; anterior process of the rachis canaliculate below; lateral processes of the rachis canaliculate, short.

Ovarian capsules elongated, costate.

Hab.—South Africa.—(Busk).

Kirchenpauer represents this species with an erect stem about 7 inches in height, and a single very small branch near the summit, the long, gracefully incurved pinnæ extending almost from the base upward. Professor Allman states that *A. formosa* is found in Australia and New Zealand.

AGLAOPHENIA AURITA, *Busk*. Plate xviii, figs. 18, 19.

Plumularia aurita, Busk, Voy. of Rattlesn.

Cells cup-shaped, tapering at bottom, constricted just below the top, mouth at an angle of 45°, circular, margin sub-crenate, plicate, with three folds on each side, with a wide, shallow notch in front, and entire behind. Rostrum slender, attenuated below, adnate up to the cell-summit, contracted, tubular; lateral processes very long, expanding, rising far above the margin of the cell, conical, tubular.

Hab.—Off Cumberland Id., 27 fathoms.

Bright brown, 2–3 inches high, with straight pinnate fronds; pinnæ or branches not opposite nor regularly alternate, divaricate at right angles.—(Busk.)

AGLAOPHENIA BREVIROSTRIS, *Busk*.

Plumularia brevirostris, Busk, Voy. of Rattlesn.

Cell sub-tubular, curved; mouth expanded, with two equal acute teeth on each side, and a longer narrow and slightly incurved central one in front. Rostrum small, conical, projecting, about half the length of the cell; lateral processes small, recurved at an angle; canalicular.

Hab.—Off Cumberland Ids., 27 fathoms.

Color, dirty white. In habit and to the naked eye very much like *P. aurita*; its growth, however, appears to be longer and less regular. The difference in the cell is very great.—(Busk.)

AGLAOPHENIA MACGILLIVRAYI, *Busk*. Plate xviii, figs. 12-14.

Plumularia MacGillivrayi, Busk, Voy. of Rattlesn.

Cells campanulate, deep, rounded at the bottom, margin subplicate, entire. Rostrum large, rising from the cell, adnate the whole length of, and as long as, the cell; the upper third constitutes a cup, distinct from the lower portion, lateral processes adnate, wide, short, curved upwards, canalicular or tubular.

Costæ of ovarian receptacles connected by a membranous expansion.

Hab.—Louisiade Archipelago, reef at low water.

Colour bright brownish buff. Polypidom 6-7 inches high, consisting of a strong central stem giving off opposite branches at regular intervals and bifariously disposed. Pinnules about ⅛ inch long, closely set.—(BUSK.)

AGLAOPHENIA RAMULOSA, *Kirch*. Plate xviii, fig. 11.

Abh. ver. Hamb., V. (fig.)

Stem monosiphonic, minute, branching; branchlets scattered, short, divergent; hydrothecæ cyathiform, aperture dentate; nematothecæ and nematocalyces tubular.

Hab.—Port Lincoln.

A single specimen about 1½ inch in length in the Berlin Museum, where it has erroneously been determined by me as *Plumularia ramosa*, Busk. The present species, which is beset with a few short pinnate branches, is distinguished from the latter by the difference in habit, and more particularly by the two-mouthed nematotheca which characterises the sub-genus *Macrorhynchia*. The hydrotheca is beaker-shaped, and its border provided with six sharp denticles, of which the two anterior are the longest.—(KIRCHENPAUER.)

By reference to *Aglaophenia divaricata* it will be seen that Kirchenpauer subsequently mistook that species for *A. ramosa*, Busk.

AGLAOPHENIA BREVICAULIS, *Kirchenpauer*. Plate xviii, fig. 6.
Abh. ver. Hamb. V. (fig.)

Stem polysiphonic, short, branches and branchlets filiform, slender, sub-dichotomous, long, branchlets monosiphonic, patent; hydrothecæ urceolate, aperture dentate; nematothecæ and nematocalyces tubular.

Hab.—Ballina.

The stem, which is quite short, consists of numerous convoluted tubules, some of which, as short offshoots, form the roots, which however, separate off from the stem again as single tubes. These branchlets are very long and slender, and most of them divide almost dichotomously, especially towards the ends. The secondary branchlets so formed are placed at a distance from one another. The stem and the lower part of the branches are bare, the upper part and the secondary branchlets beset with short pinnules directed usually towards the same side. The pinnules are dark brown, the branchlets on which they are placed almost black. The hydrothecæ are urn-shaped, strongly dilated, and their border regularly toothed; on each side three teeth, of which the middle one is somewhat larger than the others; anteriorly, where the nematotheca is situated, there is a seventh tooth, or, rather, a small rounded lobe, which arches over the adjacent opening of the nematotheca, to a certain extent roofing it over, but not closing it. Gonothecæ were not present in the specimens, which Dr. Sonder received from the Melbourne Museum. The largest of these specimens measures from the root to the apex of the longest branchlet almost 9 inches, of which only 2 inches are taken up by the stem.

According to the description which Pallas gives of his *P. speciosa* (a species unknown to me), in which, as in the present case, the middle of the three teeth on each side of the calycle is

the largest, *P. speciosa* appears to be nearly related to the present species, as well in respect to the hydrothecæ as to the short pinnules which bear them; it grows, however, only as isolated pinnæ.—(KIRCHENPAUER.)

DOUBTFUL SPECIES.

The following species are insufficiently characterized:—

AGLAOPHENIA FLEXUOSA, *Lamx.*

Aglaophenia flexuosa, Lamx., Hist. Polyp. Flex., Encyc. Méth.
Plumularia flexuosa, Lamk., An. s. Vert.; Blainv., Man. d'Act.

Stem cylindrical, flexuous, branching; branches recurved above, as well as the pinnules; cellules dentate, longer than the inferior appendix; height, 12 to 15 centimetres; color, bright fawn.

East Indies.—(LAMOUROUX.)

Kirchenpauer mentions South Africa and Australia as habitats for th species, but gives no figure, and does not mention his authority for its identi fication. There is certainly nothing in the above description which would enable it to be recognised.

AGLAOPHENIA FIMBRIATA, *Lamk.*

Plumularia fimbriata, Lamk., An. s. Vert.; Blainv., Man. d'Act.

Stem and branches pinnately fringed; branches alternate, bifarious, patent; pinnules very close, ciliiform.

Hab.—The Southern seas.

It is smaller than the preceding species [*A. crucialis*, *Lx.*], and its alternate branches are more frequent, and its cilia-like pinnules more open. Its vesicles are almost the same.—(LAMARCK.)

This is included by Kirchenpauer among the doubtful species as *A. fimbriata*, Lamouroux, but I have failed to find any mention of it in that author's works. It appears as *Plumularia fimbriata* in Lamarck's Animaux sans Vertèbres, and from his statement that the vesicles (corbuls) resemble those of *A. crucialis* it is obviously an *Aglaophenia*.

AGLAOPHENIA GLUTINOSA, *Lamx.*

Aglaophenia glutinosa, Lx., Hist. Polyp. Flex., Encyc. Méth.
Plumularia gelatinosa, Lk., An. s. Vert.; Blainv., Man. d'Act.

Stems simple, shrubby, and pinnate; pinnules approximate and alternate; cellules without visible appendix; colour, brilliant red; height, 6 to 8 centimetres.

Seas of India and Australasia.—(LAMOUROUX.)

Genus doubtful, but probably a *Plumularia*.

HALICORNARIA, Busk (modified).

AGLAOPHENIA, Lamx. (in part).

PLUMULARIA, Lamk. (in part).

Shoots plumose, pinnate, often branched, rooted by a filiform stolon; hydrothecæ generally toothed or lobed at the margin; a median anterior and two lateral sarcothecæ connected with each hydrotheca, no others along the polypiferous ramules; gonothecæ naked, on the main stem or the unaltered pinnæ.

Professor Allman has given two definitions of the genus *Halicornaria;* according to one of them the gonothecæ are "not included in corbulæ, or protected by gonangial branches,"* the other description adds "but carried on the common stem, or on more or less modified hydrothecal pinnæ."† Such a species as *Aglaophenia phœnicea,* in which every third pinna of each side of the fertile branch bears a single hydrotheca, and then the gonotheca, the remainder of the pinna being without hydrothecæ, but armed with nematophores and recurved over the gonotheca, would evidently be excluded from the genus, but Professor Allman includes in it such species as *A. urens,* in which the gonangial ramule bears two or three hydrothecæ below the gonotheca, and is abbreviated above, and supplied with only one or two pairs of nematophores. It seems to me that such species should be placed together, either under *Aglaophenia* or in a distinct genus, and I have therefore retained them in *Aglaophenia,* assigning to *Halicornaria* only those species in which the gonothecæ are borne on the main stem, or on pinnæ which are not modified in any way. It must, however, be observed that in most of the species so assigned the gonosome is unknown, and they are therefore only provisionally placed; at the same time these species are so closely allied in general structure that there is the strongest probability of their further agreeing in the gonosome.

* Trans. Zool. Soc., Vol. VIII, part 8.

† Journ. Lin. Soc., Vol. XII (Zoology).

In the first of the two groups into which they may be divided there is only one species of which the gonothecæ have been observed; and in the second group (all the members of which are very closely allied), I have not met with any gonothecæ, but in one species there are scars on the basal part of the pinnæ showing where they have fallen off, and an American member of this group (*H. speciosa*) has been described by Professor Allman as having the gonangia borne close to the bases of the ordinary pinnæ. None of the species here described have a communication between the mesial sarcotheca and the calycle, and all of them have a cauline sarcotheca at the *back* of each axil. In every case the aperture by which the cavity of the hydrotheca communicates with that of the pinna has a number of minute denticles projecting from its margin into the calycle.

1. The first group is characterized by the total absence of the intrathecal ridge in the calycle, and of the folds or partial septa which cross the hydrothecal internodes in many Plumularians. The margin of the calycle is toothed, the mesial sarcotheca is usually very long, with the two orifices distinct, and the laterals are short, not erect, with two apertures (sometimes united). Besides the two sarcothecæ in front of the stem at the base of each pinna, there is one at the back of the axil. To this group belong *H. longirostris*, *H. humilis*, *H. prolifera*, and *H. ilicistoma*. The gonothecæ are known in *H. longirostris* only; they are naked, borne on the ordinary unaltered pinnæ, close to the base.

2. In the next section the hydrothecal internodes are without folds, but there is an intrathecal ridge springing from about the middle of the front of the calycle, and extending about half across it parallel with the aperture. The calycle is set on the pinna at a wide angle, and has three teeth on each side, the first and third of which however are often more or less obsolete. The mesial sarcothecæ are of the same type as those of the last section, but vary greatly in length. The laterals have the front margin free, and have in addition (when most fully developed)

two or rarely more small circular orifices, which in some of the species become completely merged in the wide marginal aperture. The cauline sarcothecæ agree with those of the first section. The species are *H. superba*, *H. ascidioides*, *H. Baileyi*, *H. furcata*, *H. hians*, and *H. Haswellii*. The gonothecæ are unknown, but their position is indicated in some specimens of *H. ascidioides* by circular scars on the bases of the ordinary pinnæ, precisely as in *H. longirostris*.

HALICORNARIA SUPERBA, *Bale*. Plate xiii, fig. 1; plate xvi, fig. 4. (A.M.)

Aglaophenia superba, Bale, Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, 6 or 8 inches in height, seldom branched; pinnæ close, alternate or sub-alternate, two on each internode. Hydrothecæ cup-shaped, set at an angle of about 60°, upper part somewhat bent upwards from the pinna; a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture entire in front, or with a rudimentary anterior tooth, a broad free rounded lobe behind, three teeth on each side, somewhat everted, the pair next the back often obsolete; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, its total height about double that of the hydrotheca, upper part curved and generally produced forwards, nearly parallel with the pinna, terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two circular or sub-tubular apertures, one directed forwards, the other upwards, both often united with the wide lateral aperture, and the upper one often completely confluent with it. Cauline sarcothecæ similar to the laterals, two on the stem in front, and one behind each pinna.

Gonothecæ?

Color, bright brown.

Hab.—Griffiths' Point (Mr. Goldstein); Queenscliff.

This, the largest species found on the Southern Coast, sends up clusters of handsome plumose stems, occasionally slightly branched, and pinnated throughout a great part of their length. The teeth of the calycle vary somewhat in form, and the mesial sarcothecæ are considerably longer in some specimens than in others. The superior orifices of the lateral sarcothecæ may be either distinctly tubular, or completely merged in the wide lateral aperture.

HALICORNARIA ASCIDIOIDES, *Bale.* Plate xiii, fig. 2; plate xvi, fig. 1. (A.M.)

Aglaophenia ascidioides, Bale, Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, seldom branched, about 2 inches in height, pinnæ close, opposite, two on each internode. Hydrothecæ sub-cylindrical, set at an angle of about 60°; a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture with a small incurved tooth in front, and a long erect one behind, three teeth on each side, somewhat everted, the pair next the back often obsolete; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, its total height about double that of the hydrotheca, upper part curved and produced forward parallel with the pinna till it nearly reaches the next sarcotheca; terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two (rarely three or four) tubular apertures, one directed downwards at right angles with the hydrotheca, the other upwards in a line with it, both sometimes united with the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the stem in front, and one behind each pinna.

Gonothecæ springing from the bases of the ordinary pinnæ, form unknown.

Color, brownish red.

H. superba is the nearest ally of the present species, which however is easily distinguished by the form of the calycle, with the presence of a distinct anterior and a long erect posterior tooth; the reddish colour is also distinctive. The pinnæ, which are sometimes irregular in length, are opposite in all the specimens which I have seen, though in all the other species which bear two pinnæ on each internode they are either alternate or sub-alternate. The sarcothecæ on the stem often have four sub-tubular orifices bordering the free margin, while the similar apertures in the laterals do not, so far as I have observed, become confluent with the wide lateral aperture, as they are apt to do in the allied species, though they are sometimes united with it by a narrow channel.

HALICORNARIA BAILEYI, *n. sp.* Plate xiii, fig. 4; plate xvi, fig. 2. (A.M.)

Hydrocaulus monosiphonic, 2 or 3 inches in height, branched; pinnæ not close, alternate or sub-alternate, two on each internode, both series directed forward. Hydrothecæ sub-cylindrical, broader near the base, set at an angle of about 60°, and facing towards the front; a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to about its centre; aperture with a small central tooth in front, and a broad free rounded lobe behind, three teeth on each side, the centre one large and pointed, everted horizontally, the other two often obsolete; aperture between cell and pinna with one or two minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, free part about half as long as the hydrotheca, tapering, curved forward; terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two circular apertures, one directed forwards, the other upwards, both more or less confluent with the wide lateral aperture. Cauline sarcothecæ similar to the laterals; two on the stem in front, and one behind each pinna.

Gonothecæ ?

Color, deep reddish brown.

Hab.—Schnapper Point, Pt. Philip (Mr. J. F. Bailey).

In this species, and also in *H. furcata*, the back of each calycle is adnate to the anterior sarcotheca of the next, nearly up to the margin, and more elevated than the sides. The only specimen of *H. Baileyi* which I have seen has five or six ascending branches, and is somewhat stiff in appearance.

HALICORNARIA FURCATA, *n. sp.* Plate xiii, fig. 3 ; plate xvi, fig. 5. (A.M.)

Hydrocaulus monosiphonic, 2 or 3 inches in height, stem thick, dichotomously branched ; branches in one plane, mostly bifurcating about half an inch from the summit, the divergent branchlets incurved towards each other at the tips ; pinnæ not close, alternate or sub-alternate ; two on each internode, divergent almost at right angles, both series nearly in the same plane, shortening rapidly towards the tips of the branches. Hydrothecæ sub-cylindrical, broader near the base, set at an angle of 60°, and facing the front ; a strong intrathecal ridge proceeding from about the middle of the front of the cell obliquely downwards to about its centre ; aperture entire in front, with a broad free rounded lobe behind ; three teeth on each side, the centre one large and pointed, everted horizontally, the other two generally obsolete ; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, free part short, slender, tapering, curved forward, terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two circular apertures, one directed forwards, the other upwards, both more or less confluent with the wide lateral aperture. Cauline sarcothecæ similar to the laterals—two on the stem in front, and one behind each pinna.

Gonothecæ ?

Color, deep brown, stems very dark.

Hab.—Broughton Ids., off Port Stephens, 25 fathoms (Mr. Haswell).

This species resembles *H. Baileyi* in the form of the calycles, but has a much thicker stem, with both series of pinnæ (as well as the branches) almost in the same plane; it is further distinguished from the latter species by the strongly-divergent pinnæ and the peculiar furcation of the branches, resembling that of certain species of *Ceramium* and other Florideæ. In the axil of each of these forks is usually seated a hydrotheca, distinguished from the rest by the absence of the anterior nematophore. The calycles are borne on the front of the pinnæ, and their apertures are therefore almost exactly facing the observer when the polypidom is examined in front view.

HALICORNARIA HIANS, *Busk.* Plate xiii, fig. 6; plate xvi, fig. 7.

Plumularia hians, Busk, Voy. of Rattlesn.

Hydrocaulus monosiphonic, about 6 inches in height; pinnæ approximate, alternate or sub-alternate, two on each internode. Hydrothecæ wide apart, sub-cylindrical, wider above, set at an angle of about 55°; a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture entire in front, three large teeth on each side, directed somewhat towards the back of the cell, back entire, free; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca nearly up to the margin, free part small, pointed, canaliculate, scarcely rising as high as the teeth of the hydrotheca. Lateral sarcothecæ small, adnate, saccate, with a wide lateral aperture in which the circular ones are completely merged. Cauline sarcothecæ similar to the laterals—two on the stem in front, and one behind each pinna.

Gonothecæ?

Color, bright brown.

Hab.—Prince of Wales' Channel, Torres St. (Mr. Busk).

Very similar to the next species, but differing in several characteristics, the most noteworthy of which is the presence of a gap between every two calycles. An occasional sarcotheca may be seen on the stem in which the two circular orifices distinctive of this group may be recognized, but, as a rule, they are both entirely confluent with the lateral aperture. The stem has a somewhat fibrous appearance, and, according to Mr. Busk, is "simply pinnulate."

HALICORNARIA HASWELLII, *n. sp.* Plate xiii, fig. 5; plate xvi, fig. 8. (A.M.)

Hydrocaulus monosiphonic, stem jointed at long and irregular intervals, pinnæ approximate, alternate. Hydrothecæ sub-cylindrical, wider above, set at an angle of about 55°, a strong intrathecal ridge proceeding from the middle of the front of the cell obliquely downwards to its centre; aperture notched in front, with three teeth on each side directed towards the back of the cell, the central pair sharp, the first sometimes obsolete, back entire, free; aperture between cell and pinna with one or two minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, free part short, tapering, terminal and lateral apertures distinct, the former oblique. Lateral sarcothecæ small, adnate, saccate, with a wide lateral aperture in which the circular ones are completely merged. Cauline sarcothecæ similar to the laterals, two on the stem in front and one behind each pinna.

Gonothecæ?

Color, bright brown.

Hab.—Port Curtis, 5 fathoms (Mr. Haswell).

The only specimen which I possess is unbranched and under 2 inches in height, but it may be incomplete. Though closely allied to *H. hians*, it is readily distinguished by the calycles being close together, also by their smaller and sharper teeth and by

the obliquely truncate anterior sarcotheca with its two distinct orifices; of these the lateral extends below the margin of the hydrotheca, which is therefore notched in front. The lateral sarcothecæ are precisely similar to those of *H. hians*. The stem is fibrous-looking in both species, but that of *H. Haswellii* is peculiar in being jointed at long and irregular intervals only, at least such is the case in my single specimen.

HALICORNARIA LONGIROSTRIS, *Kirchenpauer*. Plate xiii, fig. 7; plate xvi, fig. 3; plate xix, fig. 30. (A.M.)

Aglaophenia longirostris, Kirch., Abh. ver. Hamb. V. (fig.)

Aglaophenia Thompsoni, Bale, Journ. Mic. Soc. Vict., II. (fig.)

Hydrocaulus monosphonic, half an inch to two inches in height, slightly branched, branches in the same plane; pinnæ close, alternate or sub-alternate, one or two on each internode. Hydrothecæ cup-shaped, narrow towards the base, set at an angle of about 50°; aperture with an incurved tooth in front, and a broad free rounded lobe behind, three prominent erect teeth on each side, the first and second longer and more widely separated than the others; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internodes without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, its total height about double that of the hydrotheca, upper part curved and generally produced forward parallel with the pinna, nearly equal in thickness throughout, terminal and lateral apertures distinct. Lateral sarcothecæ small, adnate, ovate, truncate or tubular in front; lateral and terminal orifices sometimes confluent. Cauline sarcothecæ similar to the laterals, two on the stem in front and one behind each pinna.

Gonothecæ delicate, almost membranous, small, pyriform, truncate, borne on the ordinary pinnæ at the base, one on each pinna for most of the length of the fertile branch.

Color, light greyish or yellowish-brown.

Hab.—S. Australia (Mr. Smeaton); Portland (Mr. Maplestone); Griffiths' Point (Mr. Goldstein); Queenscliff.

The form described by Kirchenpauer is unbranched and about half an inch in height, and is common enough, growing parasitically on *A. divaricata*, many specimens of which bear a considerable number of the small light-brown shoots, contrasting strongly with their own dark colour. *H. Thompsoni* is much larger and not parasitic, growing in large tufts, and when I described it, appeared to me distinct from the parasitic form, of which I had then only a few specimens somewhat shrivelled; but better specimens since obtained seem identical in structure, and in some cases approximate in size, with the larger form, consequently I unite them as one species. Neither the calycle nor the anterior sarcotheca are erect enough in Kirchenpauer's figure, and there is no trace of the lateral sarcothecæ. Some of my specimens agree with Kirchenpauer's in having one pinna to each internode, but in most stems there are two on each, as is always the case so far as I have seen in the large variety.

HALICORNARIA HUMILIS, *n. sp.* Plate xiii, fig. 8; plate xvi, fig. 6.

Hydrocaulus monosiphonic, about one-third of an inch in height, pinnate or undivided; pinnæ alternate, approximate, one on each internode. Hydrothecæ cup-shaped, deep, set at an angle of about 40°; aperture with a slightly incurved tooth in front, back free, without teeth, three erect teeth on each side; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising mainly from the pinna, adnate to the front of the hydrotheca for half to three-fourths the height of the latter, projecting from it and directed forward, free part about as long as the hydrotheca, nearly equal in thickness throughout, terminal and lateral apertures distinct. Lateral sarcothecæ small, ovate,

tubular in front, lateral and terminal orifices usually distinct. Cauline sarcothecæ similar to the laterals, two on the stem in front and one behind each pinna.

Gonothecæ?

Color, light yellowish-brown.

Hab.—Queenscliff; Schnapper Point; parasitic on *H. ascidioides*, *H. Baileyi*, and *H. ilicistoma*.

Very similar to the small parasitic form of *H. longirostris*, but the calycle forms a lower angle with the pinna than in that species, and the lobe at the back of the margin is wanting, while the mesial sarcotheca is less erect and is not adnate up to the anterior tooth. The transparent hydrorhiza runs up behind the stem of the polypidom on which it is parasitic, and gives off a number of simple polypiferous ramuli which usually alternate with the pinnæ of its host, while here and there a small pinnated stem is produced. The anterior sarcothecæ are often much shortened, especially on the simple ramuli, which, in general, appear somewhat stunted in development as compared with the pinnate shoots. Probably the smallest known species of the Aglaophenian group.

HALICORNARIA PROLIFERA, *Bale.* Plate xiv, fig. 1; plate xvi, fig. 10. (A.M.)

Aglaophenia prolifera, Bale, Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, 4 or 5 inches in height, branched, branches in the same plane; pinnæ close, alternate or sub-alternate, two on each internode. Hydrothecæ cup-shaped, deep, narrow towards the base, set at an angle of about 35°; aperture with a nearly erect tooth in front and three on each side, the first and second everted, back entire, free or adnate; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca about double the height of the hydrotheca, adnate to it as far as the margin and mainly rising from it, free part projecting, curved forward, tapering slightly, lateral and terminal orifices

usually distinct. Lateral sarcothecæ flask-shaped, adnate, with a circular sub-tubular orifice directed downwards from the hydrotheca and outwards, and distinct from the wide lateral aperture. Cauline sarcothecæ similar to the laterals, but with two or three circular orifices bordering the free margin, two on the stem in front, and one behind each pinna.

Gonothecæ?

Color, deep brown.

Hab.—Queenscliff.

The original description was taken from specimens in which the anterior sarcothecæ were considerably abbreviated, so much so that in many cases the two apertures are confluent, or are united by a narrow slit; but in robust and well-developed specimens they are much longer and curved gracefully forward. The branches are sometimes all on one side of the stem, and small ones may be given off almost at the summit.

HALICORNARIA ILICISTOMA, *Bale*, Plate xiv, fig. 2; plate xvi, fig. 9. (A.M.)

Aglaophenia ilicistoma, Bale, Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, seldom branched, 1 to 2 inches in height; pinnæ close, alternate or sub-alternate, two on each internode. Hydrothecæ cup-shaped, set at an angle of about 55°; aperture with a large incurved tooth in front, and a broad rounded lobe behind; six teeth on each side, the first, fourth, and fifth from the front everted, the second, third, and sixth incurved; the sixth on each side placed towards the back, and curved forwards so that they appear in lateral view like one median tooth; aperture between cell and pinna surrounded by minute slender denticles. Hydrothecal internode without constrictions. Mesial sarcotheca rising from the pinna, adnate to the front of the hydrotheca as far as the margin, its total height about double that of the hydrotheca; upper part curved and produced forward parallel with the pinna till it approaches the next sarcotheca in

front, terminal and lateral apertures distinct. Lateral sarcothecæ short, ovate, adnate, sub-tubular in front, lateral and terminal orifices distinct. Cauline sarcothecæ similar to the laterals, two on the stem in front and one behind each pinna.

Gonothecæ?

Color, light grayish brown.

Hab.—Robe, S.A. (Mr. Smeaton); Queenscliff.

The tips of the pinnæ are gracefully curved, and the peculiar arrangement of the teeth of the calycles gives the polypidom a very pretty appearance when seen in front view. Without microscopical examination this species might be mistaken for *H. longirostris*.

HALICORNOPSIS, *Bale*.

Journ. Mic. Soc. Vict., II.

Hydrocaulus pinnate; hydrothecæ with a fixed anterior sarcotheca, lateral sarcothecæ absent.

Gonothecæ not borne in corbulæ, nor on modified pinnæ.

The distinctive feature of this genus is the absence of the lateral sarcothecæ, which in *Aglaophenia* and *Halicornaria* are attached to the calycles.

HALICORNOPSIS AVICULARIS, *Kirch.*, plate x, fig. 1-2; plate xix, fig. 32. (A.M.)

Aglaophenia avicularis, Kirch., Abh. ver. Hamb. V (fig.)

Halicornopsis avicularis, Bale, Journ. Mic. Soc. Vict., II (fig.)

Hydrocaulus monosiphonic, 5 or 6 inches in height, much branched; pinnæ alternate, approximate, either one or two on an internode. Hydrothecæ cup-shaped, shallow, set at an angle of about 45°, the margin expanding, sinuated behind, with three teeth, two lateral and one anterior, the latter long,

beak-like in lateral view, tubular, with the inner side produced downwards into the hydrotheca, forming an intrathecal ridge. Hydrothecal internode without constrictions. Sarcothecæ short, bract-like, one rising a little above the middle of the front of the hydrotheca, and subtending an orifice in it, and two on the stem at the base of each pinna.

Gonothecæ entire, ovate, pedunculate, springing from the pinnæ at their junction with the stem, and forming a row along the front of it.

Color, light brown.

Hab.—Robe and Pt. Elliott, S.A. (Mr. Smeaton); Griffiths Point (Mr. Goldstein); Portland (Mr. Maplestone); Bass' St.; Hobarton (Kirchenpauer); Queenscliff.

My original description of this species was published before I was aware that Kirchenpauer had already described it under the same specific name. He classes it as a typical *Aglaophenia*, and says that the nematocalyces (lateral sarcothecæ) are minute; his figure however shows them entirely wanting, as is really the case. According to the same description the hydrocaulus is polysiphonic, but this is decidedly not the case in any of the numerous specimens which I have examined. The calycle is peculiar in the structure of the anterior tooth, which is long and tubular, with the inner wall continued downwards into the body of the cell, forming a ridge or incomplete partition.

Sub-order III.—ELEUTHEROBLASTEA.

HYDRINA, Ehrenberg, Cor. roth. Meer.; Johnston, B.Z.

HYDRIDÆ, Huxley, Oceanic Hydrozoa.

GYMNOTOKA (in part), Carus. Handb. d. Zool.

GYMNOCHROA, Hincks, Brit. Hyd. Zooph.

ELEUTHEROBLASTEA, Allman, Mon. of the Gymnoblastic Hydroids.

HYDRIDÆ, Hincks.

Characters the same as those of the genus Hydra.

HYDRA, Lin.

Polypites locomotive, single, destitute of polypary, cylindrical or sub-cylindrical, with a single series of filiform tentacula round the mouth, and a discoid adhesive base. Gonozooids always fixed, developed in the body-walls.—(HINCKS.)

I have not met with any account of the Australian *Hydræ*, and only one species has come under my observation. I have never heard of *H. viridis*, or any green species having been seen.

HYDRA OLIGACTIS, *Pallas.*

"*Long-armed fresh-water polype*," Ellis, Corall. (fig.)

Hydra oligactis, Pall., Elench.; Johnst., B.Z. (fig.); Hincks, Brit. Hyd. Zooph. (fig.)

Hydra fusca, Linn. Syst.

Hydra verrucosa, Templeton, An. Nat. Hist. IX (fig.).

POLYPITES brownish; *the lower part of the body suddenly attenuated, so as to form a kind of peduncle; tentacles* 6-8, *capable of great extension*, to several times as long the body.—(HINCKS.)

The single species of *Hydra*, which is common round Melbourne, appears to me to be identical with *H. oligactis*, though the attenuation of the lower part of the body is by no means so conspicuous (except during gemmation) as shown in Mr. Hincks' figures of the English species, and the number of the tentacles is often fewer. The body of the polypite, when fully extended, may be about half an inch in length, and no thicker than a horsehair; its colour, when seen thus, is usually a flesh tint, but when contracted it is considerably darker. When gemmation begins the body becomes proportionately thicker above the lowest bud, while the part between that bud and the hydrorhiza becomes much attenuated, the peduncle being often so slender as to be almost colourless and semi-transparent. The tentacles are generally six in number, but not uncommonly there are only five, and I have seen specimens with seven and eight. They increase in length for some weeks after the polypite becomes detached, and become so slender when extended that it is impossible to trace them to their termination except in a very favorable light. I have not known them to exceed about 3 inches in length, the body, at the same time, measuring somewhat less than half an inch. Those of English specimens are said by some authors to attain a length of 7 or 8 inches.

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(All synonyms are in italics.)

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9. Sertularella divaricata, Busk (Port Stephens).

(All magnified 40 diameters.)

* All the figures, except those in Plates II, VIII, IX, and XVIII, are original, and have been drawn with the aid of the camera lucida, from specimens immersed in Canada balsam or in fluid, and viewed as transparent objects. The figures to which Mr. Busk's ame is appended are copied from unpublished drawings whic that gentleman has kindly forwarded to me.

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(All magnified 40 diameters.)

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(All magnified 40 diameters.)

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(All magnified 80 diameters.)

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5. Plumularia delicatula, Bale (Griffiths' Point).
6. Plumularia filicaulis, Poeppig (Victoria).
7. Do do stemless variety (Portland).
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(All magnified 80 diameters.)

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(All magnified 80 diameters).

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(All magnified 80 diameters.)

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4. Do do do var. (Holborn Island).
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(All magnified 80 diameters.)

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3. Halicornaria longirostris, Kirch. (Queenscliff).
4. Halicornaria superba, Bale (Queenscliff).
5. Halicornaria furcata, n. sp. (Broughton Island).
6. Halicornaria humilis, n. sp. (Queenscliff).
7. Halicornaria hians, Busk (from one of Mr. Busk's specimens).
8. Halicornaria Haswellii, n. sp. (Port Curtis).
9. Halicornaria ilicistoma, Bale (Queenscliff).
10. Halicornaria prolifera, Bale (Queenscliff).

(All magnified 80 diameters.)

Plate XVII.

1. Aglaophenia phœnicea, Busk (from one of Mr. Busk's specimens).
2. Do do do var. (Port Denison).
3. Do do do var. (Gloucester Passage).
4. Do do do var. (Port Molle).
5. Aglaophenia longicornis, Busk (Port Curtis).
6. Aglaophenia McCoyi, Bale (Queenscliff).
7. Aglaophenia divaricata, Busk (Queenscliff).
8. Aglaophenia Huxleyi, Busk (Port Molle).
9. Aglaophenia urens (?), Kirch. (Port Stephens).
10. Aglaophenia parvula, Bale (Queenscliff).
11. Aglaophenia delicatula, Busk (Port Curtis).
12. Aglaophenia plumosa, Bale (Queenscliff).

(All magnified 80 diameters.)

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10. Aglaophenia squarrosa, Kirch. (after Kirchenpauer).
11. Aglaophenia ramulosa, Kirch. (after Kirchenpauer).
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4, 5. Sertularia bispinosa, Gray.
6. Sertularia trispinosa, Coughtrey.
7. Sertularia elongata, Lamx.
8. Sertularia unguiculata, Busk.
9. Sertularia loculosa, Busk.
10. Sertularia pulchella, D'A. W. T.
11. Sertularia macrocarpa, n. sp.
12. Sertularia minima, D'A. W. T.
13. Do do robust var.
14. Sertularia minuta, Bale.
15. Sertularia geminata, n. sp.
16. { Sertularia divergens, Lamx.
{ Sertularia tenuis, n. sp.
17. Sertularia tuba, n. sp.
18. Diphasia sub-carinata, Busk.
19. Sertularella pygmæa, Bale.
20. Sertularella divaricata, Busk.
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22, 23. Sertularella neglecta, D'A. W. T.
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25. Sertularella polyzonias, Lin.
26. Sertularella lævis, Bale.
27. Sertularella indivisa, Bale.
28. Sertularella solidula, Bale.
29. Campanularia tincta, Hincks.
30. Halicornaria longirostris, Kirch.
31. Aglaophenia phœnicea, Busk.
32. Halicornopsis avicularis, Kirch.
33. Idia pristis, Lamx.
34–5. Plumularia Buskii, n. sp.
36. Plumularia setaceoides, Bale.
37. Plumularia pulchella, Bale.
38. Lineolaria spinulosa, Hincks.
39, 40. Plumularia compressa, Bale.
41, 42. Plumularia filicaulis, Poeppig.
43, 44. Plumularia australis, Kirch.

(All magnified 20 diameters.)

Sydney: Thomas Richards, Government Printer.—1884.

Plate I.

1. Campanularia rufa, n. sp. (Holborn Island), × 40.

2. C. marginata, n. sp. (Queenscliff), × 20.

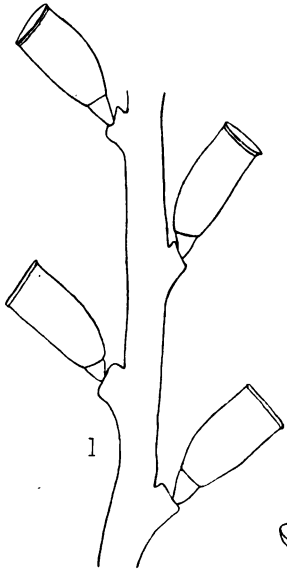
3. C. Costata, n. sp. (Port Darwin), × 20.

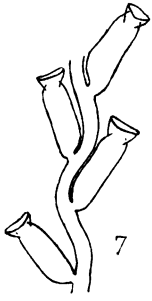
4–6. C. tincta, Hincks (Portland), × 40.

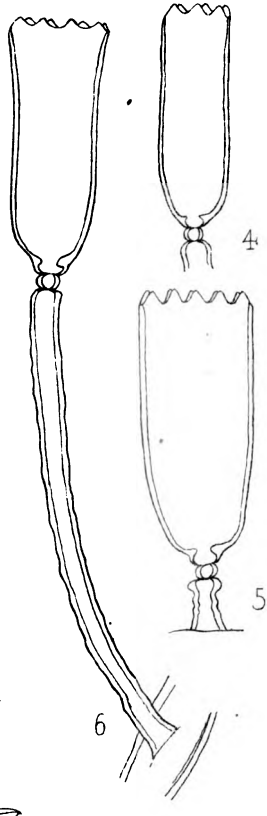
7. Lineolaria flexuosa, n. sp. (Williamstown), × 40.

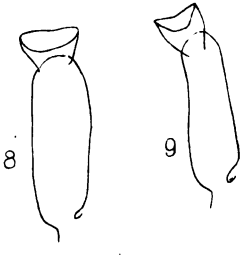
8, 9. Do. × 80.

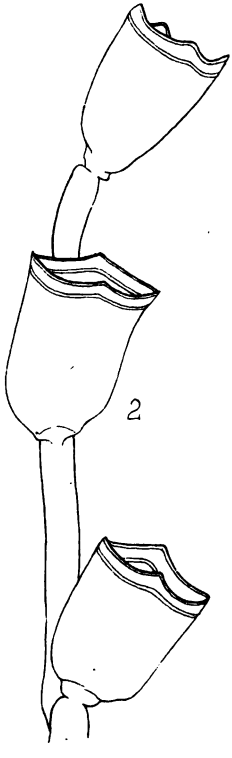
10, 11. L. spinulosa, Hincks (Portland), × 40.

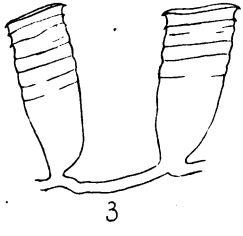


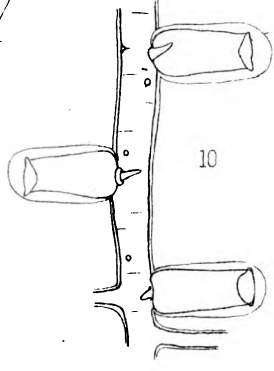












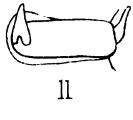
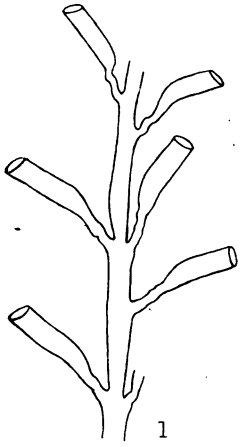


Plate II.

1. Lafëoa fruticosa, Sars (after Hincks).
2. Obelia geniculata, Lin. (after Hincks).
3. Campanularia Torresii, Busk (after Busk).
4. C. undulata, Lx. (after Lx.)
5. C. antipathes, Lx. (after Lx.)
6. C. macrocyttara, Lx. (after Lx.)
7. C. lairii, Lx. (after Lx.)
8. C. reptans, Lx. (after Lx.)
9. C. urnigera, Lx. (after Lx.)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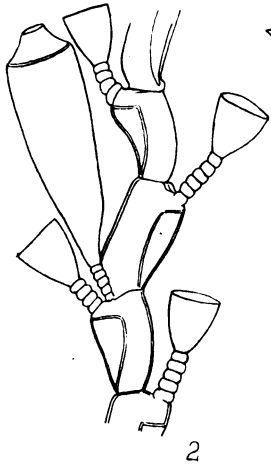
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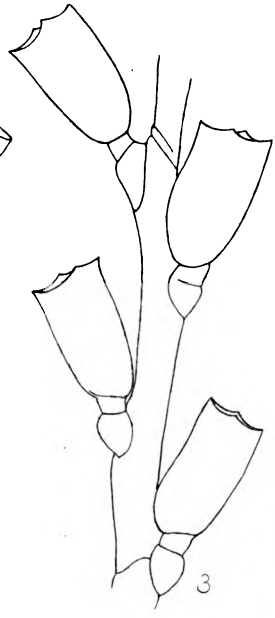
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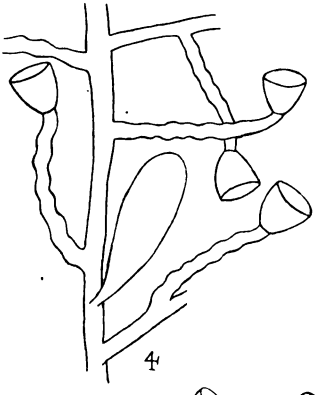
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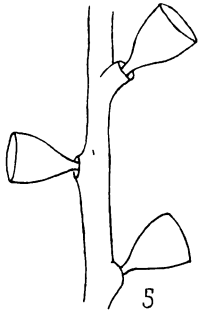
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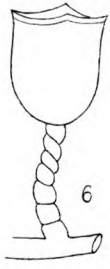
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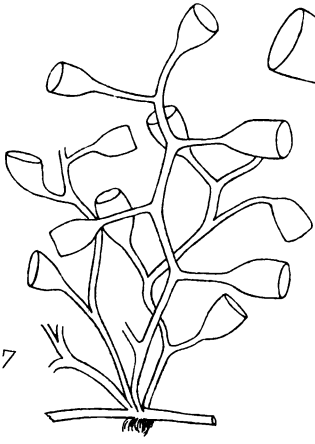
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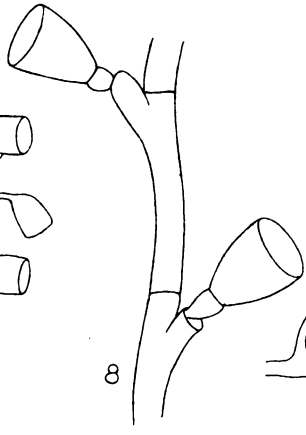
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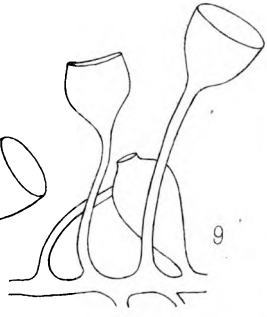
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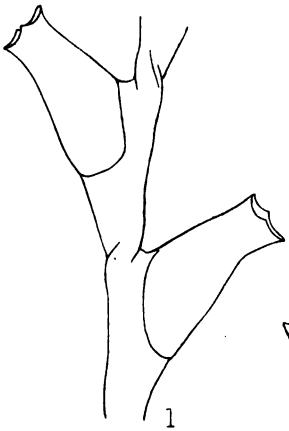
Plate III.

1. Sertularella simplex, Hutton (Williamstown).
2. S. lævis, Bale (Williamstown).
3. S. neglecta, D'A.W.T. (Queenscliff).
4. S. macrotheca, Bale (Griffiths Point).
5. S. indivisa, Bale (Williamstown).
6. S. solidula, Bale (Williamstown).
7. S. Johnstoni, Gray (Queenscliff).
8. S. pygmæa, Bale (Queenscliff).
9. S. divaricata, Busk (Port Stephens).

× 10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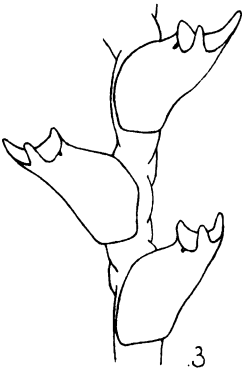
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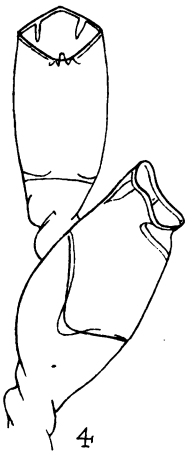
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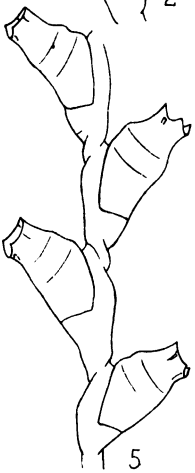
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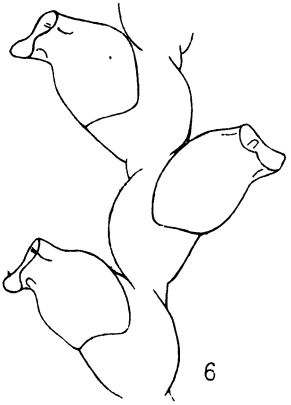
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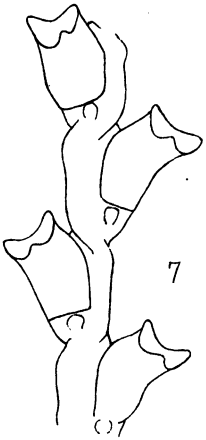
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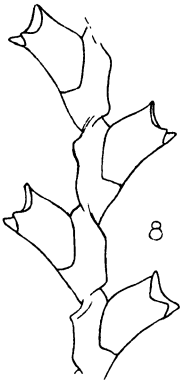
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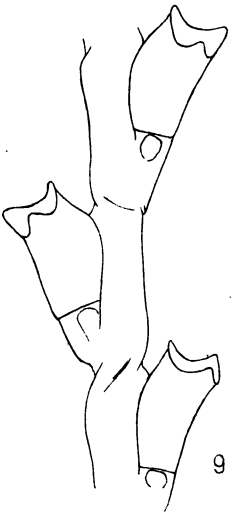
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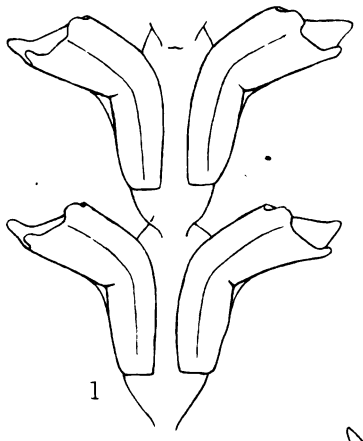
Plate IV.

1. Diphasia sub-carinata, Busk (Griffiths Point), × 40.
2. Sertularia crenata, n. sp. (Schnapper Point), × 40.
3. S. minuta, Bale (Sorrento), × 40.
4. Do × 80.
5. S. loculosa, Busk (Queenscliff), × 40.
6. Do var. (Queenscliff), × 40.
7. S. acanthostoma, Bale (South Australia), × 40.
8. Do × 125.
9. S. minima, D'A.W.T. (Williamstown), × 40.
10. Do robust var. = S. pumiloides, Bale (Queenscliff), × 40.
11. S. tuba, n. sp. (Queenscliff), × 40.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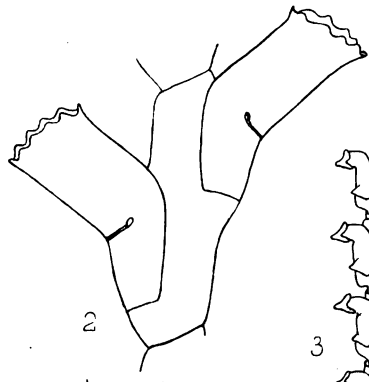
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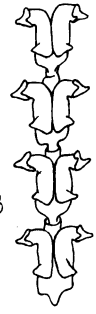
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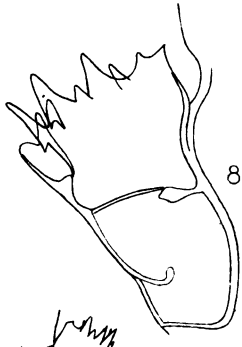
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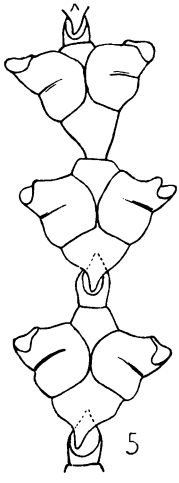
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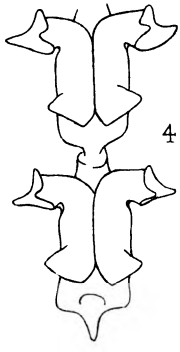
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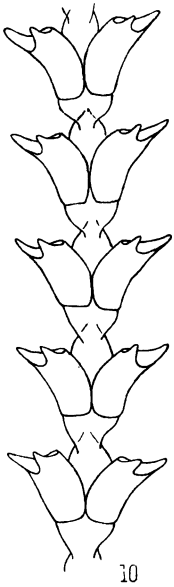
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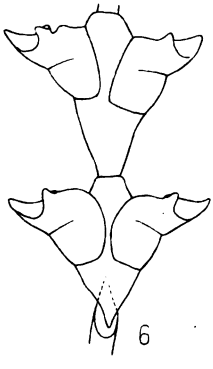
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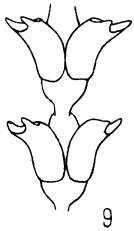
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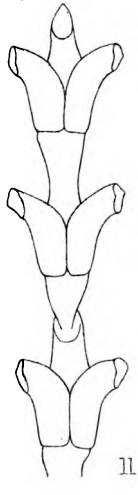
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Plate V.

1. Sertularia recta, Bale (South Australia).
2. S. macrocarpa, n. sp. (Queenscliff).
3. S. divergens, Lamx., part of pinna (Williamstown).
4. S. tenuis, n. sp., part of pinna (Williamstown).
5. Do simple shoot (Williamstown).
6, 7. S. geminata, n. sp. (Queenscliff).
8. S. trigonostoma, Busk (Albany Passage).
9. S. bicornis, Bale (Queenscliff).
10. S. patula, Busk (Williamstown).

× 40

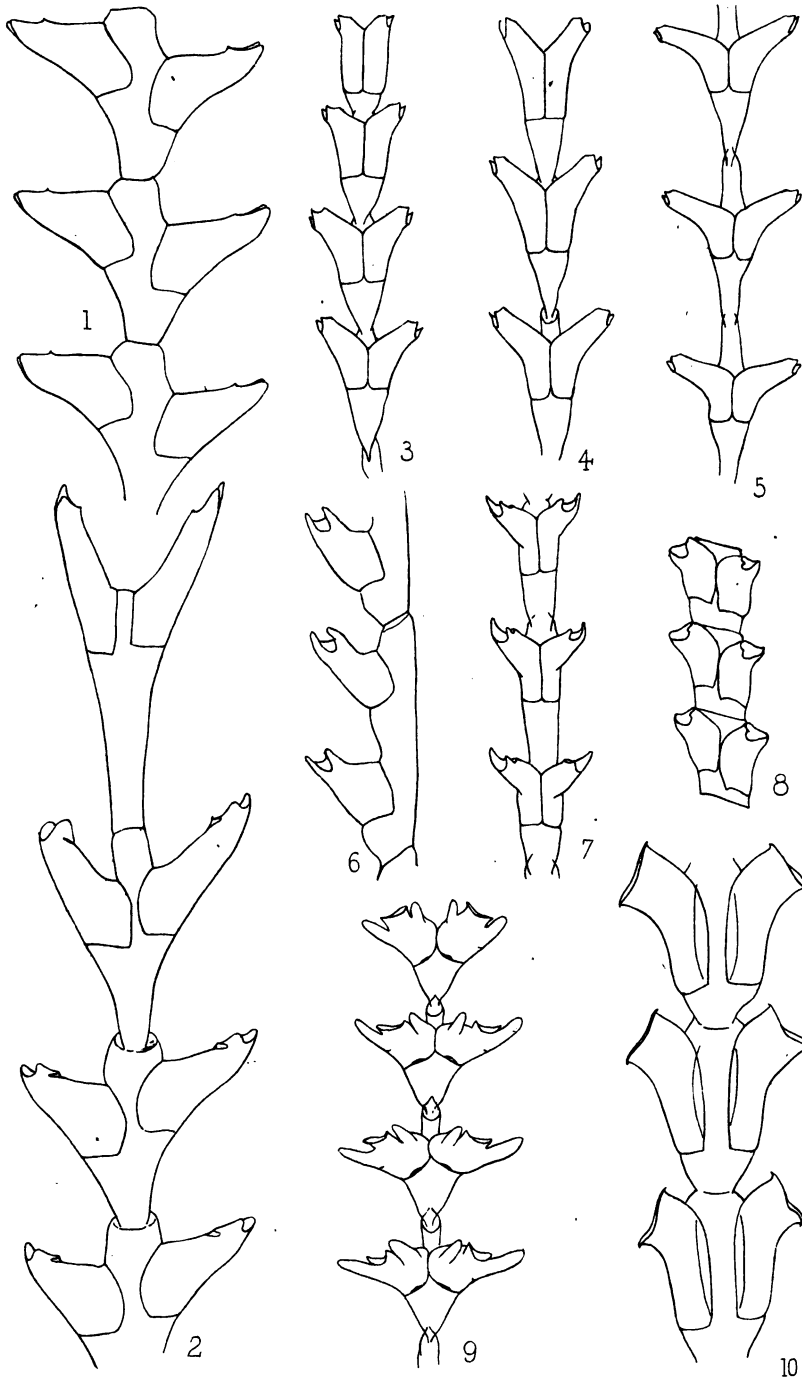
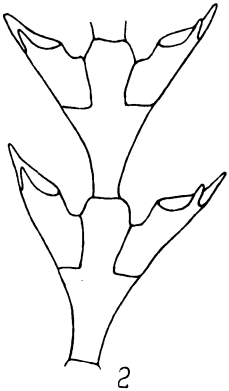


Plate VI.

1. Sertularia operculata, Lin. (Queenscliff).
2. S. bispinosa, Gray (New Zealand).
3. S. trispinosa, Coughtrey (New Zealand).
4. S. Maplestonei, n. sp.
5. S. pulchela, D'A.W.T. (South Australia).
6. S. bidens, n. sp. (Queenscliff).
7. S. elongata, Lx., large var. (Queenscliff).
8. Do smaller var. (Queenscliff).
9. S. unguiculata, Busk, proximal part of a pinna with three series of calycles (Portland).
10. Do distal part of same pinna.
11, 12. Do distal and proximal portions of pinna of the common large form (Queenscliff).

× 40

1



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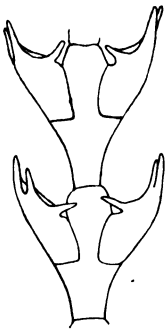

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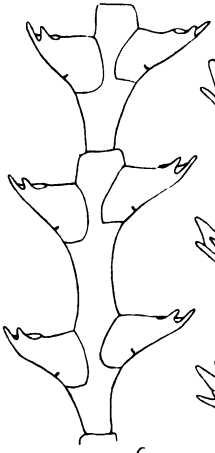

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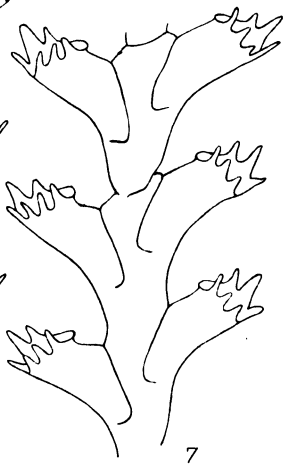

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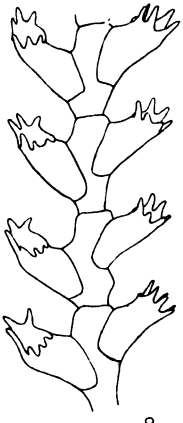

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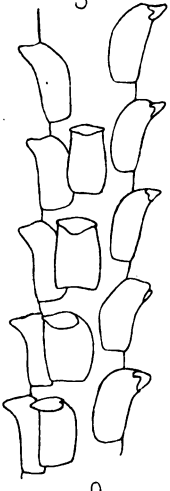

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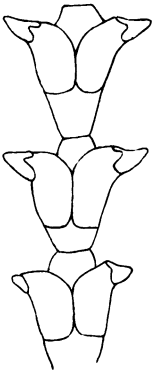

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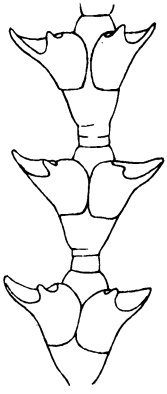

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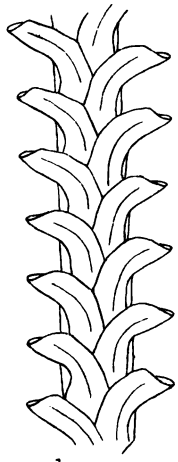
Plate VII.

1. Idia pristis, Lx. (Fitzroy Island), × 25.
2. Do narrow var. (Port Curtis) ? × 25.
3. Pasythea quadridentata, Ellis & Sol. (Port Stephens), × 40.
4. Thuiaria lata, Bale (Queenscliff), × 25.
5. T. quadridens, n. sp. (Holborn Island), × 25.
6. Do (Port Curtis), × 25.
7. T. fenestrata, n. sp. (Albany Passage), × 25.



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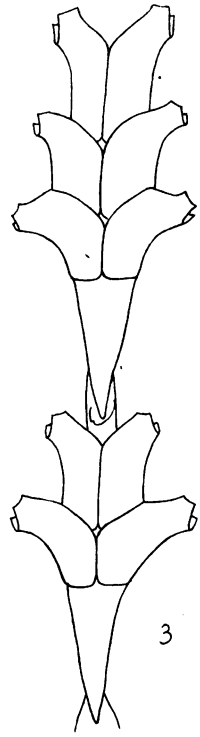

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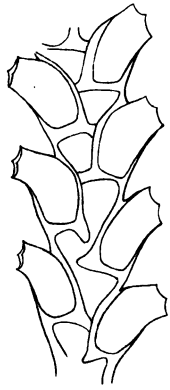

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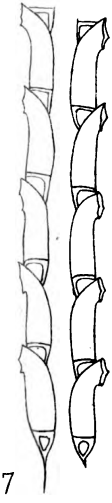

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Plate VIII.

1. Sertularia flexilis, D'A. W.T. (after Thompson).

2, 3. S. insignis, D'A. W.T. (after Thompson).

4. S. ramosa, D'A. W.T. (after Thompson).

5, 6. S. penna, K. (after Kirchenfrauer).

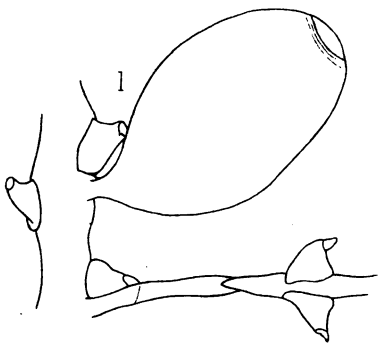
7, 8. S. australis, K. (after Kirch.), fig. 8 much reduced.

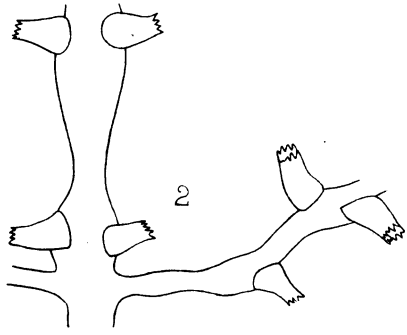
9. S. conferta, K. (after Kirch.)

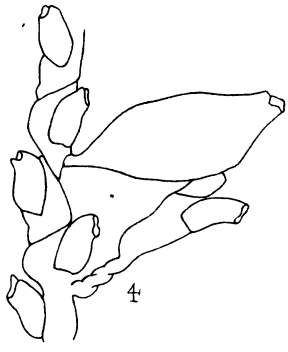
10. S. grosse-dentata, K. (after Kirch.), reduced.

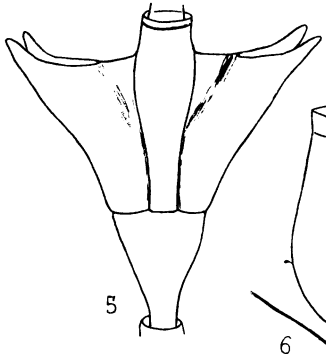
11. S. arbuscula, Lx. (after Lamx.)

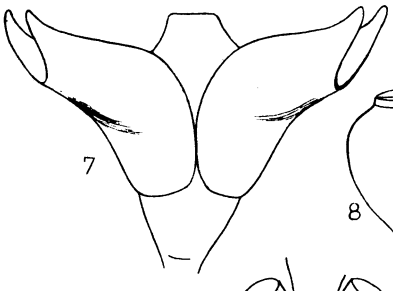
12. S. tubiformis, Lx. (after Lamx.)

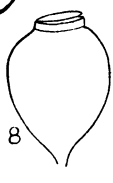


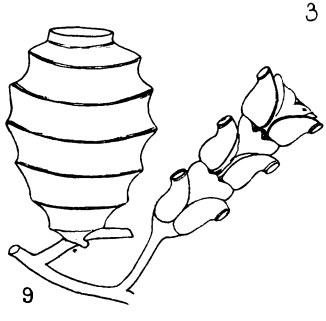


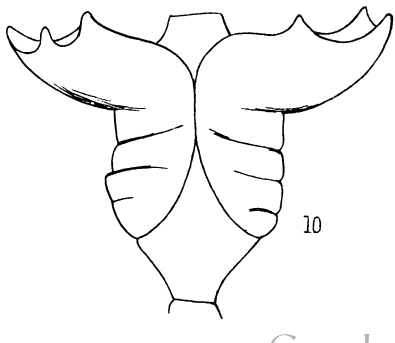


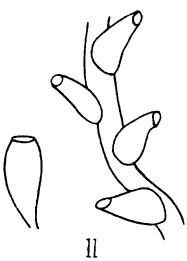












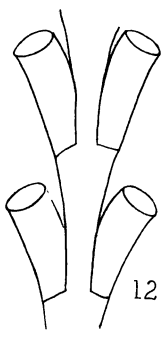


Plate IX.

1. Diphasia pinnata, Pallas (after Hincks).
2. D. attenuata, Hincks (after Hincks).
3–5. D. digitalis, Busk (after Busk).
6–9. D. mutulata, Busk (after Busk).
10. Sertularia tridentata, Busk (after Busk).
11. S. orthogonia, Busk (after Busk).
12. S. loculosa, Busk (after Busk).
13. Pasythea hexodon, Busk (after Busk).
14. Thuiaria fenestrata, n. sp. gon. (after Busk), reduced.

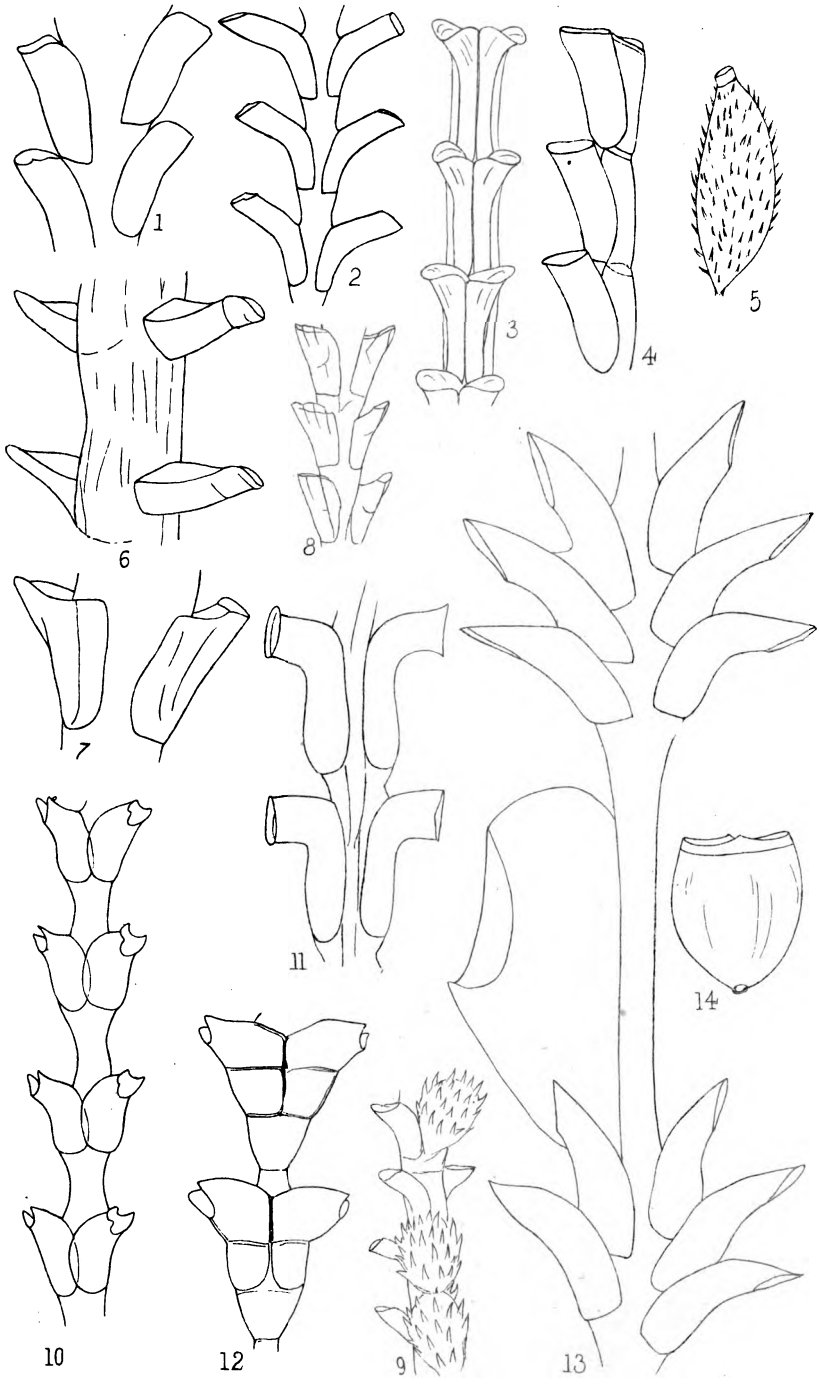


Plate X.

1, 2. Halicornopsis avicularis, Kirch. (Queenscliff).

3. P. buskii, n. sp. (Griffiths Point).

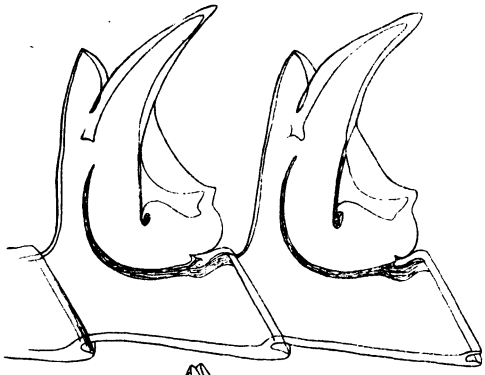
4. P. producta, Bale (Queenscliff).

5. P. campanula, Busk (Holborn Island).

6. P. aglaophenoides, n. sp. (Broughton Islands).

7. Antennularia cylindrica, n. sp. (Port Curtis).

× 80



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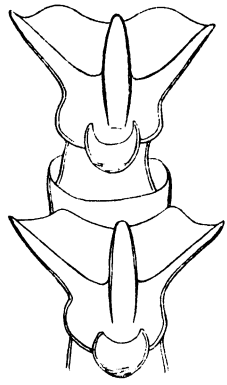

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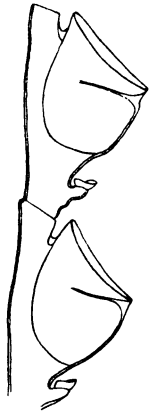

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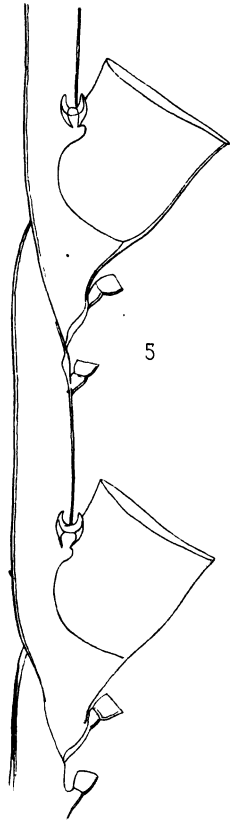

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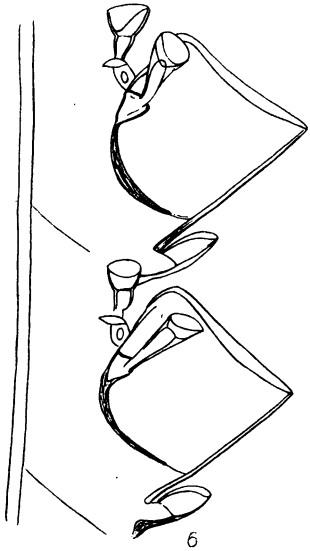

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7

Plate XI.

1. Plumularia cornuta, n. sp. (Holborn Island).
2. Do (Port Molle).
3. P. Ramsayi, n. sp. (Albany Passage).
4. Do (Port Denison).
5. P. delicatula, Bale (Griffiths Point).
6. P. filicaulis, Poeppig (lateral sarcothecæ absent or lost).
7. Do stemless form (Portland).
8. P. setaceoides, Bale (Williamstown).
9. P. Goldsteini, Bale (Queenscliff).

× 80

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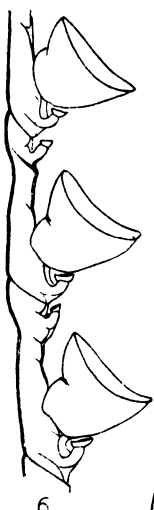

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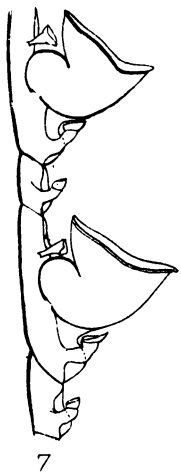

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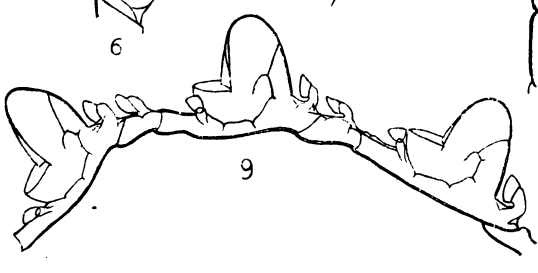

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Plate XII.

1. Plumularia obliqua, Saunders (Williamstown).

2, 3. Do stout var. (Portland).

4, 5. P. hyalina, Bale (Queenscliff).

6. P. pulchella, Bale (Queenscliff).

7, 8. P. australis, Kirch. (Portland).

9, 10. P. compressa, Bale (South Australia).

11, 12. P. spinulosa, Bale (Queenscliff).

× 80

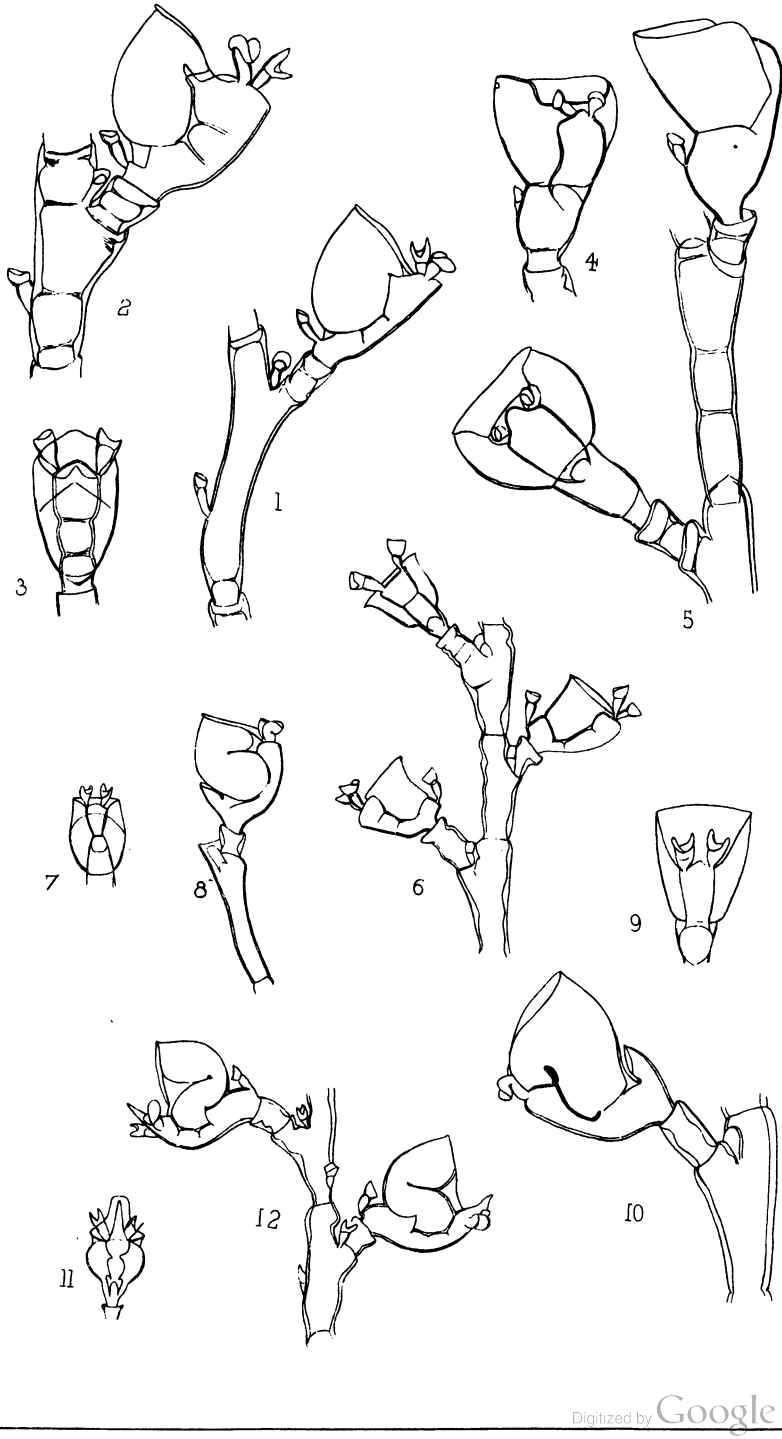
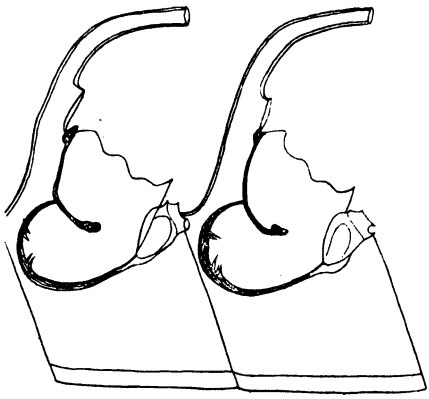


Plate XIII.

1. Halicornaria superba, Bale (Queenscliff).
2. H. ascidioides, Bale (Queenscliff).
3. H. furcata, n. sp. (Broughton Island).
4. H. Baileyi, n. sp. (Schnapper Point).
5. H. Haswellii, n. sp. (Port Curtis).
6. H. hians, Busk.
7. H. longirostris, Kirch. (Queenscliff).
8. H. humilis, n. sp. (Queenscliff).

× 80



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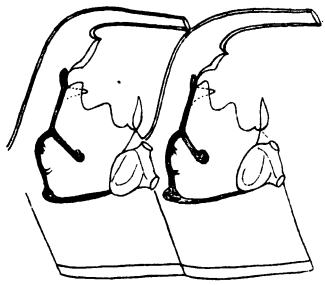

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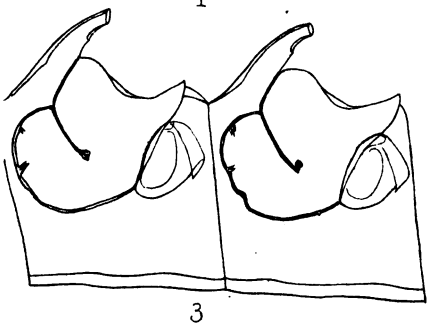

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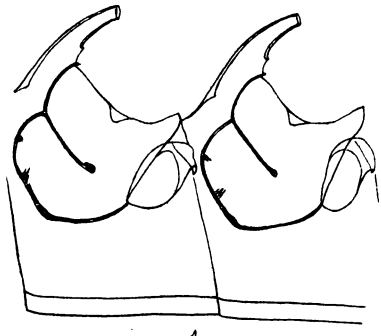

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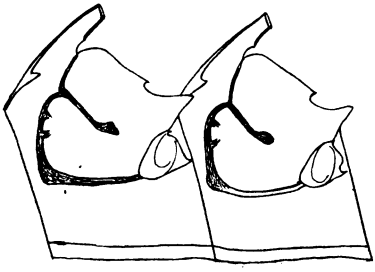

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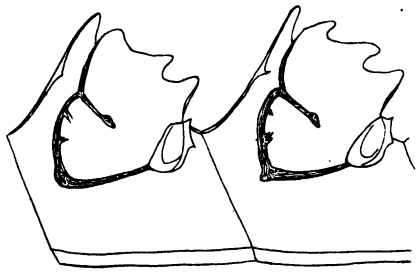

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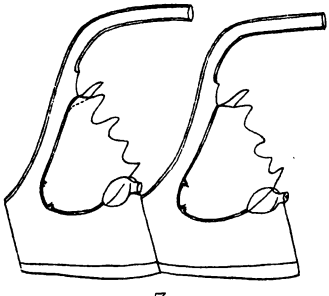

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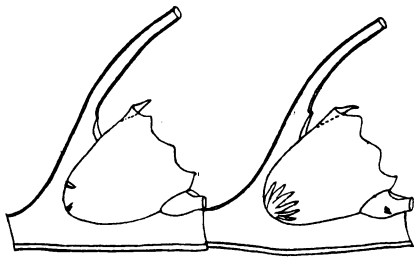

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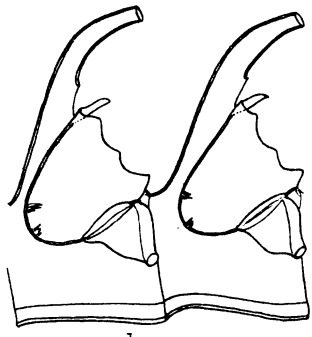
Plate XIV.

1. Halicornaria prolifera, Bale (Queenscliff).
2. H. ilicistoma, Bale (Queenscliff).
3. Aglaophenia parvula, Bale (Queenscliff).
4. A. delicatula, Busk (Port Curtis).
5. A. plumosa, Bale (Queenscliff).
6. A. urens, Kirch. (Port Stephens).
7. A. longicornis, Busk (Port Curtis).
8. Do (Port Curtis).

× 80



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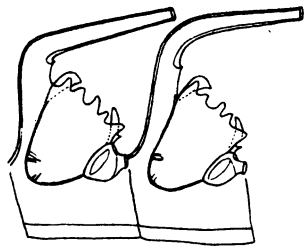

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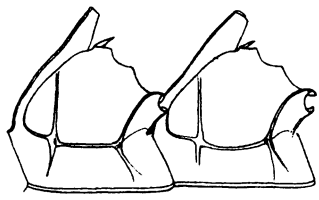

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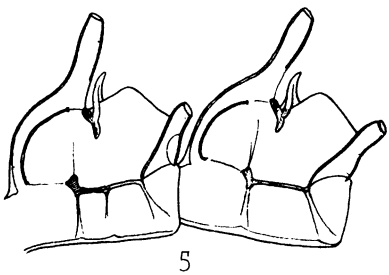

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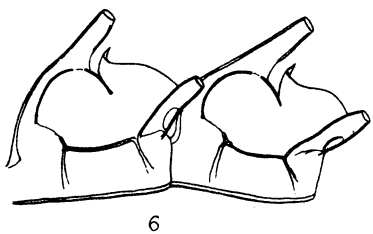

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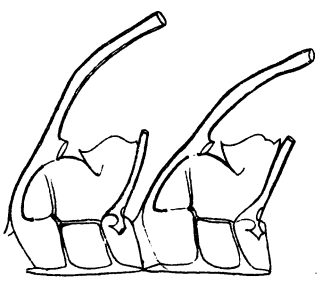

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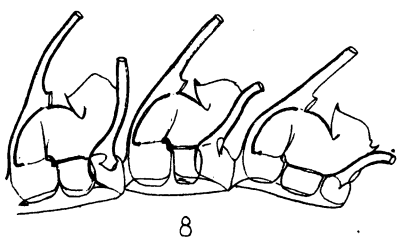

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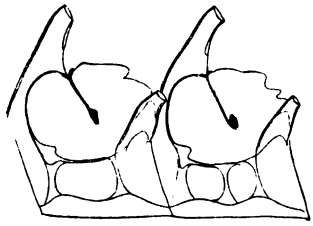
Plate XV.

1. Aglaophenia phœnicea, Busk (from one of Busk's specimens).
2. Do (variety from Port Darwin).
3. Do (variety from Port Molle).
4. Do (variety from Holborn Island).
5. Do (variety from Gloucester Passage).
6. A. Huxleyi, Busk (Port Molle).
7. A. McCoyi, Bale (Queenscliff).
8. A. divaricata, Busk (Queenscliff).

× 80



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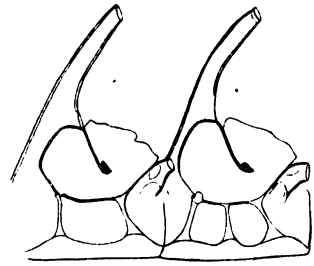

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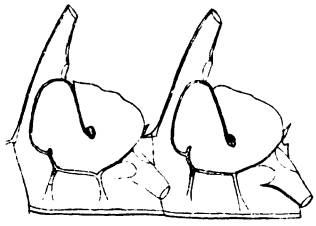

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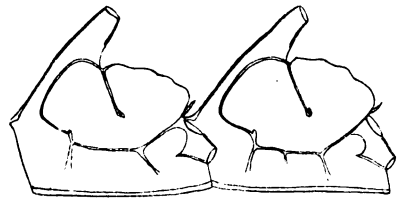

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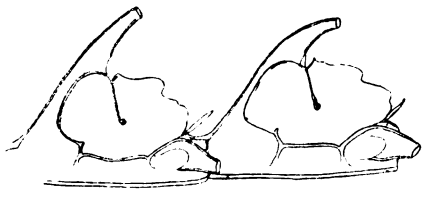

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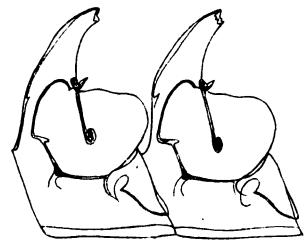

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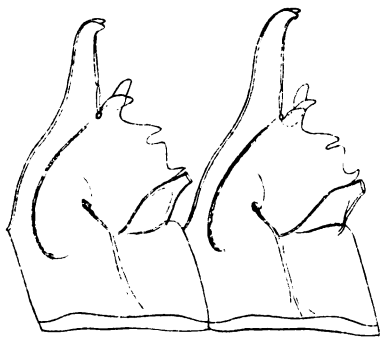

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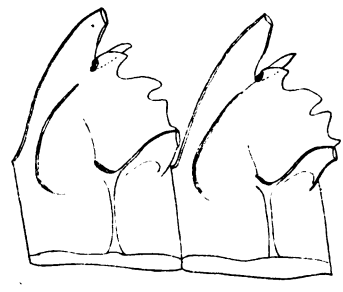

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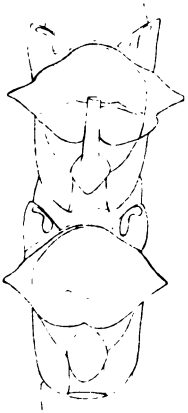
Plate XVI.

1. Halicornaria ascidioides, Bale (Queenscliff).
2. H. Baileyi, n. sp. (Schnapper Point).
3. H. longirostris, Kirch. (Queenscliff).
4. H. superba, Bale (Queenscliff).
5. H. furcata, n. sp. (Broughton Islands).
6. H. humilis, n. sp. (Queenscliff).
7. H. hians, Busk (from one of Busk's specimens).
8. H. Haswellii, n. sp. (Port Curtis).
9. H. ilicistoma, Bale (Queenscliff).
10. H. prolifera, Bale (Queenscliff).

× 80

1



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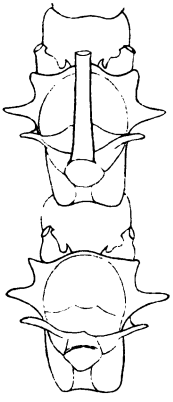

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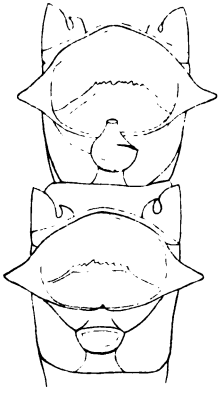

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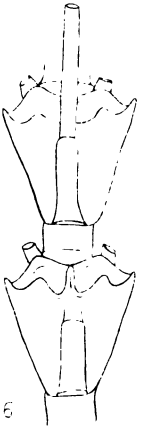

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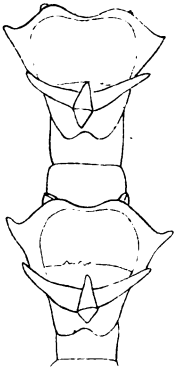

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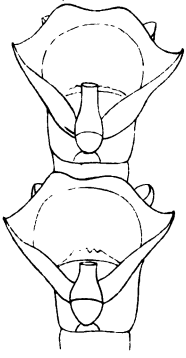

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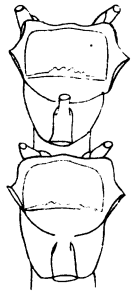
Plate XVII.

1. Aglaophenia phœnicea (from one of Busk's specimens)
2. Do (var. from Port Denison).
3. Do (var. from Gloucester Passage).
4. Do (var. from Port Molle).
5. A. longicornis, Busk (Port Curtis).
6. A. McCoyi, Bale (Queenscliff).
7. A. divaricata, Busk (Queenscliff).
8. A. Huxleyi, Busk (Port Molle).
9. A. urens, Kirch.? (Port Stephens).
10. A. parvula, Bale (Queenscliff).
11. A. delicatula, Busk (Port Curtis).
12. A. plumosa, Bale (Queenscliff).

× 80



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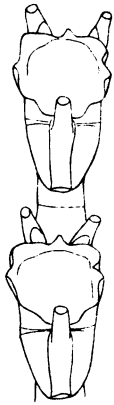

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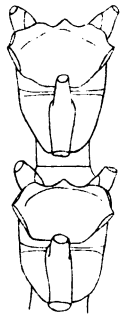

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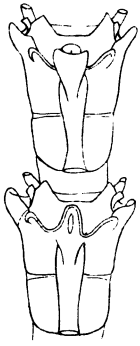

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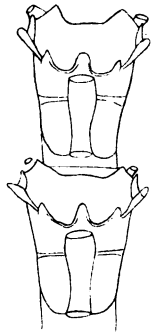

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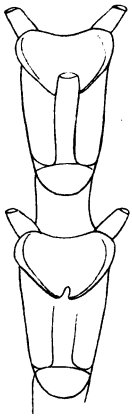

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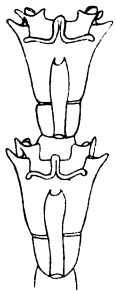

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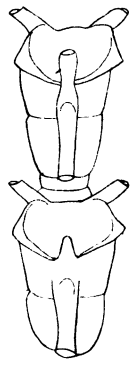

12

Plate XVIII.

1, 2. Plumularia badia, Kirch. (after K.)

3, 4. P. obconica, Kirch. (after K.)

5. P. effusa, Busk (after Kirch).

6. Aglaophenia brevicaulis, Kirch. (after Kirch).

7. A. formosa, Busk (after Kirch).

8. A. crucialis, Lamx. (after Kirch).

9. A. rubens, Kirch. (after K.)

10. A. squarrosa, Kirch. (after K.)

11. A. ramulosa, Kirch. (after K.)

12–14. A. Mac Gillivrayi, Busk (after Busk).

15, 16. A. ramosa, Busk (after Busk).

17. A. pluma, Lin. (after Hincks).

18, 19. A. aurita, Busk (after Busk).

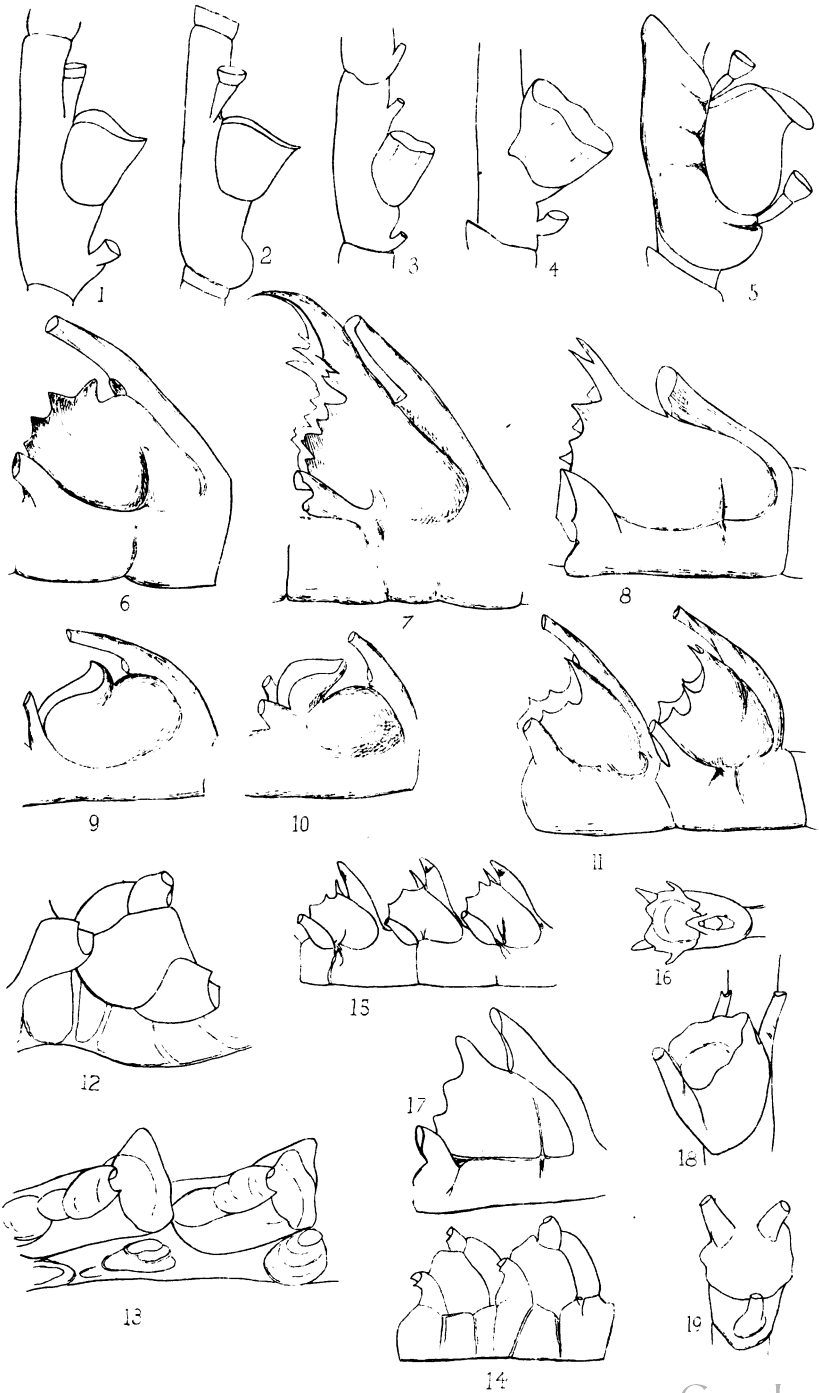

Plate XIX.

1. S. bidens.
2. S. Maplestonei.
3. S. operculata.
4, 5. S. bispinosa.
6. S. trispinosa.
7. S. elongata.
8. S. unguiculata.
9. S. loculosa.
10. S. pulchella.
11. S. macrocarpa.
12. S. minima.
13. Do robust var.
14. S. minuta.
15. S. geminata.
16. S. divergens and S. tenuis.
17. S. tuba.
18. D. sub-carinata.
19. S. pygmæa.
20. S. divaricata.
21. S. Johnstoni.
22. S. neglecta.
23. Do
24. S. macrotheca.
25. S. simplex.
26. S. lævis.
27. S. indivisa.
28. S. solidula.
29. C. tincta.
30. H. longirostris.
31. A. phœnicea.
32. H. avicularis.
33. I. pristis.
34. P. Buskii.
35. Do
36. P. setaceoides.
37. P. pulchela.
38. L. spinulosa.
39, 40. P. compressa.
41, 42. P. filicaulis.
43, 44. P. australis.