I. Report on the Hydroida collected in the Great Australian Bight and other Localities.

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Plates I.-VII.

I.—REPORT ON THE HYDROIDA.

I.—INTRODUCTION.

The Hydroids described in the present Report were obtained by the "Endeavour" at various localities, the most important collection having been dredged in the Great Australian Bight in 1911, no less than seven species out of thirteen then collected being here described as new. A noteworthy feature is the robust character of some of the Plumularians found in this locality, two of the *Aglaopheniæ* and one *Plumularia* reaching fully two feet in height, and comprising an enormous number of individual polypes. The locality, therefore, offers a promising ground for future research among its little-known Hydroid fauna, hitherto practically unexplored.

The following is a list of the species observed, with localities:—

Campanularia pumila, *sp. nov.*—Great Australian Bight.
Sertularella divaricata (*Busk*)—Hunter Group and Great Australian Bight.
Sertularia macrocarpa, *Bale*—Bass Strait.
,, maplestonei, *Bale*—Hunter Group.
,, unguiculata, *Busk*—Bass Strait.
Diphasia subcarinata (*Busk*)—Great Australian Bight.
Synthecium subventricosum, *sp. nov.*—Great Australian Bight.
Plumularia buskii, *Bale*—**Great Australian Bight.**
,, procumbens, *Spencer*—Great Australian Bight.
,, asymmetrica, *sp. nov.*—Great Australian Bight.
Kirchenpaueria producta, *Bale*—Bass Strait.
Halicornopsis elegans (*Lamarck*)—Great Australian Bight.
Aglaophenia megalocarpa, *sp. nov.*—Great Australian Bight.
A. dannevigi, *sp. nov.*—Great Australian Bight.
A. billardi, *sp. nov.*—Great Australian Bight.
A. tasmanica, *sp. nov.*—Oyster Bay, Tasmania.
A. decumbens, *sp. nov.*—Bass Strait.
Halicornaria, intermedia, *sp. nov.*—Oyster Bay, Tasmania.
,, birostrata, *sp. nov.*—Great Australian Bight.
,, urceolifera (*Lamarck*)—Great Australian Bight

The specimens from the Great Australian Bight were received by me in January 1912, and the others at various times prior to that date. Much of the delay in presenting this Report has been due to the time occupied in correspondence with friends in Europe, especially Dr. A. Billard, of Paris, and Dr. C. Hartlaub, of Heligoland, both of whom I have to thank for their kindness in comparing specimens with type forms in European Museums.

II.—DESCRIPTION OF THE GENERA AND SPECIES.

Family CAMPANULARIIDÆ.

Genus Campanularia, *Lamarck*.

Campanularia pumila, *sp. nov.*

(Plate i., figs. 6—8.)

Hydrorhiza slender, filiform, overrunning other hydroids and giving origin at intervals to short very slender peduncles, more or less irregularly undulated at both ends, and sometimes in the intermediate portions; a more distinct spherical segment just below the hydrotheca.

Hydrothecæ small, cylindrical, constricted just above the base, mouth with about eight truncate teeth, the truncate ends very slightly sinuated; teeth a little incurved, peristome often doubled or tripled.

Gonosome:— ?

This exceedingly delicate species has unbranched peduncles of varying length, commonly about as long as the hydrothecæ, and not very strongly undulated. The hydrothecæ are from ·37 to ·44 mm. in length, and ·12 to ·15 in width, the length depending largely on the number of successive renewals of the border. In one calycle the first peristome was about the middle of its length, and the second immediately below the third and final one. In each case the teeth of the second or third circlet corresponded in number and position with those of the original series.

On account of the delicacy and the shrivelled condition of the hydrothecæ I was not able in all cases to count the marginal teeth. In two or three the number was undoubtedly eight, another seemed to have seven, while in no case could the number have varied much from these. In regard to form, the denticulation of the border is precisely as that of *C. spinulosa* would be if the little spines, which in that species spring from the angles of the teeth, were wanting. At the "floor" of the hydrotheca there is a circlet of excessively minute bright points.

Loc.:—Great Australian Bight, parasitic on *Synthecium subventricosum*, 40 to 100 fathoms.

Family SERTULARIIDÆ.

Genus Synthecium, *Allman.*

Synthecium subventricosum, *sp. nov.*

(Plate i., figs. 3—5.)

Hydrophyton usually under one inch in height, monosiphonic, pinnate, many of the pinnæ anastomosing with other parts of the polypidom or continued into stolons; stem-internodes (except at the base) long, each usually bearing a pair of opposite hydrothecæ at its base and summit, with a pair of opposite pinnæ in the middle; those at the base short, bearing a pair of opposite hydrothecæ only. Pinnæ divided into stout internodes, each supporting a pair of hydrothecæ; the first hydrotheca on the proximal side of each pinna much higher than its fellow, those on successive internodes less uneven, till at about the third to the fifth internode they become opposite.

Hydrothecæ tubular, stout, lower part vertical and often somewhat ventricose, distal part curved outward, free part short, aperture circular, margin a little sinuated at the sides and very slightly everted, looking upwards and outwards.

Gonothecæ small, nearly globular, with five to six transverse ridges interrupted in the middle on opposite sides, mouth prominent, conical, aperture small.

Polypidom thin, colourless and transparent, more or less tangled owing to the anastomosing of the pinnæ.

This species is allied to *S. patulum*, from which it may readily be distinguished by the larger, and especially the stouter, hydrothecæ, with their tendency to a ventricose condition, and the distinctly sub-alternate arrangement of those on the proximal parts of the pinnæ. In *S. patulum* it is not unusual for the first hydrotheca on the proximal side of each pinna to be set a little higher than its opposite neighbour; here, however, the irregularity is much more pronounced. Each successive pair comes nearer to a strictly opposite condition, which is sometimes attained by the third pair, sometimes only by the fourth or fifth. Even after this however irregularities are not uncommon, and in some cases the more distal pairs deviate from the normal arrangement in the contrary direction to the proximal.

In comparing my specimens of *S. subventricosum*, *S. patulum*, and *S. orthogonium*, I find differences in the prevailing arrangement of the internodes in all three. *S. patulum* generally has from one to three short proximal internodes, each of which supports a single pair of hydrothecæ; above these the internodes are long, and each bears a pair of pinnæ close to the summit, with a pair of hydrothecæ about the middle. *S. orthogonium* former species rather than to the latter. Campenhausen's figure of the hydrothecæ serves perfectly for *S. orthogonium*, and Allman's figure of the gonangium of his species seems to be only an idealized representation of that of Busk's species, which varies greatly in the degree of development of the transverse ridges.

A feature sometimes very noticeable in *S. subventricosum* is the presence of a distinct lining or inner layer of the hydrotheca-wall, which in many cases has so far become separated from the outer perisarc as to constitute a distinct inner tube, running from the base to the summit of the hydrotheca, and not fitting closely to the outer wall throughout, but more or less detached from it at intervals; especially in such parts as the slight inflation commonly found at the base, and the angle at the upper part of the adcauline side. In the middle portion of the hydrotheca and near the aperture it is usually so intimately united to the outer wall as to be indistinguishable, but it may separate at any portion and become conspicuous through its irregularly crumpled condition. It is observable in many specimens from which all trace of the hydranths and cœnosarc has disappeared, while in other instances no trace of it can be distinguished. It may be connected with the regeneration of the hydranths, though it is often not to be detected in hydrothecæ of which the border has been reduplicated, while it is frequently very distinct in specimens where regeneration does not appear to have taken place.

In many of the hydrothecæ of *S. subventricosum* are found ova, 220-230 μ in length, 165-180 μ in width, perfectly elliptical, yellow in colour, and situated exactly in the bend of the hydrothecæ, to the diameter of which their own is nearly equal. Some are quite fresh-looking, others empty and shrivelled. The polypidoms in which these were found were quite empty otherwise, all traces of the original soft parts having disappeared, both from the trophosome and the gonangia. In a specimen of *S. patulum*, probably from Port Phillip, I found what appeared to be the remains of similar bodies. It would be a singular instinct which should lead some animal to select especially the empty polyparies of *Synthecium* wherein to deposit its eggs, but I can suggest no other explanation.

Loc.:—Great Australian Bight, on large Plumularians, 40 to 100 fathoms.

Genus Diphasia, *Agassiz.*

Diphasia subcarinata *(Busk).*

Sertularia sub-carinata, Busk, Voy. "Rattlesnake," i., 1852, p. 390.

Diphasia sub-carinata, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 102, pl. iv., fig. 1, pl. xix., fig. 18; Kirkpatrick, Sci. Proc. Roy. Dublin Soc., vi. (N.S.), 1890, p. 604; Ritchie, Austr. Mus. Mem., iv., 1911, p. 850.

One of the specimens of *Aglaophenia megalocarpa* had a colony of this species over-running the stem. The hydrothecæ however differ from those of all other specimens which I have seen in having the third (lowest) marginal tooth quite obsolete, so that there is only a bidentate border.

The usual condition of *D. subcarinata* is unbranched, but branched specimens often occur. In such cases the branches spring from normal internodes of the primary shoot, generally below a hydrotheca, but in some cases above; and the arrangement of the hydrothecæ in opposite pairs is the same on the primary shoot as on the branches.

In most specimens there is, inside the angle of flexure of the hydrotheca, a slight transverse ridge or thickening, the rudiment of that which in a more fully developed form is found in the corresponding position in *Sertularia crenata*.

Loc.:—Great Australian Bight, 40 to 100 fathoms.

Genus Sertularia, *Linn.* (in part.)

The *Sertulariæ* collected by the "Endeavour"—*S. macrocarpa*, *S. maplestonei*, *S. unguiculata*—all belong to a well-defined group, of which *S. elongata* may be taken as the type, and which includes also among Australian species *S. recta*, *S. pulchella*, *S. geminata*, *Thuiaria heteromorpha*, and possibly a few others. *S. macrocarpa* was placed by Schneider in his "Dynamena-group," and *S. maplestonei* and *S. elongata* in the "Thuiaria-group," though the three species are identical in habit; and in neither case do the characters of these species conform to the descriptions given by Schneider.

In the Dynamena-group the hydrothecæ are opposite, with only one pair on an internode, and the side branches, when present, spring from one or both sides of a normal internode The essential point is that the giving-off of branches does not in any way disturb the order of the hydrothecæ on the primary shoot, consequently the arrangement is precisely the same on the stem and branches. Typical examples are *S. gracilis*, and *S. pumila*, the first of which generally gives off its branches singly, while in *S. pumila* they are often in opposite pairs. *Diphasia subcarinata* is a common Australian example of this—the most primitive—mode of branching. The ramification of *S. macrocarpa* has no resemblance to this type, but, as I indicated in my original description, agrees precisely with that of *S. elongata* and *S. maplestonei*. The reference of these species to the Thuiaria-group is equally untenable, as they do not bear "from several to many" hydrothecæ on each internode, but Schneider fully recognised that the groups were not sharply defined, and that many species were intermediate.

All the above-named species (with many others) agree in the arrangement of the stem-internodes. Every such internode gives origin at the base to a pinna, which has a single *unpaired* hydrotheca in the axil. Higher up, it bears the regular pair of hydrothecæ, only it will be observed that in most cases the one on the same side as the pinna is higher than the corresponding one on the opposite side, being as it were crowded out of its normal position owing to the presence below it of the pinna with its axillary hydrotheca. In attenuated individuals of some of the species, where the internodes are much elongated, the difference of level may be so great that the paired condition is not at first noticeable.

The mode of ramification just described contrasts strongly with that of the Dynamena-group, and the existence of an entirely different arrangement of the hydrothecæ on the pinnæ, as compared with those on the stem, marks a distinct advance in organisation.

This arrangement of the stem-internodes, (which is especially typical of the genus *Sertularia*), is not confined to the group under consideration, but is found in a number of small delicate forms such as *S. tenuis*, *S. inflata*, and *S. biscuspidata*. They differ from the *S. elongata* group not only in their more delicate texture and small size, but in the fact that their pinnæ are wholly divided into internodes of equal value, and exhibit no tendency towards the production of internodes of the second or third order. They are thus more closely allied to the Dynamena-group, and indeed are typical *Dynamenæ* as understood by Kirchenpauer. The distinction between them and Schneider's Dynamena-group may be well illustrated by the comparison between *S. gracilis* and *S. tenuis*. Both these species are very similar in the form of the hydrothecæ as well as the gonangia, and both may exist in the unbranched condition. But when *S. gracilis* produces side branches the arrangement of the hydrothecæ on the stem is unaltered, and the stem and branches are exactly alike. *S. tenuis* on the other hand, when producing side branches, invariably has them in the form of alternate pinnæ, with the complete differentiation of stem and pinnæ, as in the *S. elongata* group.

The peculiar characteristic of *S. elongata* and its allies consists in the general tendency for the older internodes of the pinnæ (or some of them) to bear two or three or even more pairs of hydrothecæ, while on the distal portions one pair is the rule. The prevalence of longer or shorter internodes in particular specimens examined has led to untenable distinctions being drawn, such as the reference of some members of the group to *Thuiaria* and others to *Sertularia*. *S. elongata*, the most abundant species, may serve to illustrate the habit of the group. In the smallest form, which is also the commonest, and which may average about three-quarters of an inch in height, the whole of the pinnæ may be composed of internodes bearing a single pair. Generally, however, from two to four pinnæ, about the centre, may have a couple of pairs on the first internode, but on no others. So, as the hydrophyton is more robust, we find a larger proportion of the internodes supporting two or more pairs. In the largest specimen which I have in a preparation I find one of the median pinnæ with four pairs on the first internode, two each on the second, third, and fourth, and one on each of the other eight. The nearest pinna on the opposite side has one internode with four pairs, two with two pairs each, and ten with one pair. No other pinna commences with more than three pairs. It is very probable that in larger specimens the development of the longer internodes may be carried still further.

It may be observed, in regard to *S. elongata*, that in these distinctions there is no question of a mere difference of age. The robust forms are on a larger scale than the others from the root up, the hydrothecæ being in proportion to the general size of the polypidom. Further, it is evident that the ultimate height is approximately determined by the time the shoot is half grown, for we find that only a very few pinnæ about the middle reach the maximum development, the succeeding ones then commencing to diminish.

In fairly large specimens of *S. maplestonei* the most ordinary arrangement is for the longest internodes to bear four, or even five pairs, then follow from one to three internodes of two pairs each, and finally from one to five or six with only one pair. In other parts of the same specimen the first internode may bear two or three pairs, and all the rest one pair; and an internode of the second order often comes between two of the first. There seems more tendency than in *S. elongata* for the longer internodes to persist nearly to the end of the pinnæ. I have not met with specimens corresponding with the smallest forms of *S. elongata*, in such it might be expected that internodes of the first order would be more prevalent.

In *S. bidens* the habit is similar to that of *S. maplestonei*, but in such specimens as I have seen the tendency is towards shorter internodes, and in a small specimen all the internodes, with very few exceptions, are of the first order.

S. pulchella has the arrangement much the same as the last.

In *S. geminata* many pinnæ consist mainly of internodes of the second order, others almost entirely of single pairs.

In the commonest form of *S. macrocarpa* all the internodes may have a single pair only, but in other specimens internodes of the second order prevail throughout.

In *S. recta* I have seen no internodes with more than one pair, but I have met with two specimens only, both very small.

S. unguiculata stands by itself in its excessive variability. By far the most abundant form is about the same size as the small variety of *S. elongata* and is a typical *Sertularia*, with very few exceptions to the rule that each internode supports a single pair. Somewhat larger forms differ from these exactly as described under *S. elongata*, to which this species is, so far, strictly parallel, but beyond these we meet with a series of varieties leading up to forms in which there are no short internodes, and a pinna may support a great number of hydrothecæ divided between one or two internodes only. Such forms are in every respect (except in the stem-internodes) typical *Thuiariæ*, yet it is impossible to find any distinct line of demarcation between them and the ordinary varieties.

Thuiaria heteromorpha, according to Allman's account, scarcely differs from *S. unguiculata* except in the absence of the bidentate margin of the hydrotheca. It is not known however if it exhibits such an extreme tendency to variability as is found in the allied species. Allman, recognizing that the hydroid combined the characters of more than one genus, placed it under *Thuiaria*, on the ground that the characters of that genus predominated. Among these characters he included the arrangement of the stem-internodes, but in this he was mistaken, as the arrangement is that of a typical *Sertularia*, only that the internodes are *double*, each being formed by the complete coalescence of two of the stem-internodes described in the foregoing remarks. In *S. unguiculata* single and double internodes occur on the same shoot, and often mixed indiscriminately, and I have little doubt that further examination will prove that the same condition occurs in Allman's species. As I shall presently show there is also a characteristic Thuiarian stem-internode, different in arrangement from that found in the group we are considering.

All the preceding forms are undoubtedly, in my opinion, true *Sertulariæ*, being distinguished from *Thuiaria* by the paired condition of the hydrothecæ, both on the stem and the pinnæ, and by the presence, and frequently the preponderance, of internodes with a single pair. The occurrence of internodes of higher orders on all but the smallest specimens is exactly similar to what takes place in *Sertularella divaricata*. Here the rule is that every internode bears a single hydrotheca, but in specimens of elongated habit we find that not only on the stem, but on parts of the pinnæ, several hydrothecæ may be borne on a single internode. But no one proposes therefore to remove the species from the genus *Sertularella*. In a typical *Thuiaria* the hydrothecæ are not paired but biserial, and an internode very often bears unequal numbers on the two sides;

it even happens sometimes that they may be closer on one side than the other, twelve on one side for example occupying as much space as thirteen on the other. Allman first referred to *Thuiaria* such species as his *T. sertularioides*, a true *Sertularia*, solely on the ground that several pairs of hydrothecæ were carried on a single internode. He afterwards retracted this determination, but some observers have adhered to it, often however somewhat arbitrarily, applying the rule in some cases and not in others. The fact is that in some of the most typical species of *Sertularia* the occurrence of internodes of the second and third order is common, and such is the case with *S. pumila* itself, which nevertheless is always regarded as a typical representative of the genus.

In the few Australian species of *Thuiaria* known to me—*T. lata*, *T. fenestrata*, *T. quadridens*, *T. sinuosa*, *T. subarticulata*—I find a uniform type of stem-division. Each internode supports a pinna and three hydrothecæ, but the arrangement is quite different from that which exists in *S. elongata* and its allies. the pinna is given off from the middle of the internode, there is a hydrotheca below and another above it, and a single one on the opposite side. There is no paired arrangement, so that the unpaired condition of the hydrothecæ is common to the stem and pinnæ. In one or two of these species the nodes may be indistinguishable on the older parts of the stem, but the arrangement of the pinnæ and the hydrothecæ is as described, and on the more recently-formed portions the internodes are distinct. Some of the hydroids here associated are now ranked by most observers under the genus *Sertularella*; to me, however, they appear a thoroughly homogeneous group, and I am quite unable to find any distinction of sufficient importance to justify their separation. *T. lata* and *T. quadridens* doubtless have a very *Sertularella*-like aspect, owing to the regular alternation of the hydrothecæ, which is a necessary result of the narrowness of the pinnæ forcing them into that position. In the broader forms of *T. quadridens*, where the two series have room to develop independently of each other, the arrangement is sometimes subalternate rather than strictly alternate. Those varieties of *S. divaricata* in which several hydrothecæ are carried on a single internode approximate very closely to *T. lata*, yet there is a radical difference readily perceived by studying the development in the terminal portions of the pinnæ. Even in those forms of *S. divaricata* in which the *Thuiaria*-like structure is most apparent—var. *subdichotoma* for example—the newly-formed portions are, so far as I have seen, divided into the single-celled internodes characteristic of the genus. But the nodes, though unmistakeable, are very slightly marked, and as the perisarc thickens with growth many of them become obliterated. This is what takes place also in *Thuiaria sertularioides*, and the recognition of which led Allman to remove the species from *Thuiaria*, in which genus he had at first placed it. In *Thuiaria*, internodes bearing several hydrothecæ are strictly normal, and are developed continuously in the first instance, not formed by the coalescence of a number of originally single-celled internodes as in the varieties of *S. divaricata.* Of course I do not dispute, that these or other forms of *Sertularella* may also develop continuous multiple-celled internodes, thus linking the two genera, but I have never seen an undoubted *Sertularella* in which the typical single-celled internodes were not present in some portions of the polypidom, nor in which the structure was such as to forbid the assumption that *all* the internodes had originated in the same manner. Very commonly the stem of *Sertularella divaricata* is divided by strongly marked nodes into internodes of three hydrothecæ, but between the component hydrothecæ of these internodes are often distinguishable less pronounced constrictions, which evidently remain to indicate where the original nodes have become almost obliterated; while in other varieties of the same species all remain equally distinct. In *Thuiaria*, even in such a species as *T. lata*, not only are the internodes without these vestigial joints, but it is usually obvious that they have never been so divided, on account of the hydrothecæ following each other so closely. Where nodes do occur therefore they necessitate a gap between the hydrothecæ on either side of them which is permanent, and the fact that the hydrothecæ on an internode are so closely crowded and without gaps between them is evidence that the internode has been developed without interruption.

It will of course be apparent from the foregoing remarks that I am here adhering to the principle of classification which bases the generic characters primarily on the grouping of the hydrothecæ, in short that I retain the genera precisely as they were almost universally understood when my earlier papers were written. The majority of observers, while retaining in the main the same principle, have modified the genera in various directions in partial accordance with Levinsen's views, according to which the structure of the individual hydrothecæ (especially the operculum) is of principal importance. I have been reluctant to discard the old classification so long as systematists give it any countenance, especially in view of the fact that many of the Australian species are so imperfectly known that it would be impossible to classify them on Levinsen's system. Even in *S. elongata*, our commonest species, nothing is yet known of the operculum, while in various species which have been often examined, competent observers like Nutting and Levinsen are unable to agree as to the actual structure of this appendage.

While these sheets are passing through the press, however, I have been favored by Professor Levinsen with a copy of his important paper, just issued, entitled "Systematic Studies on the Sertulariidæ." In this work he re-states and elaborates his views as to the primary importance of the operculum in classification, and insists that the mere arrangement of the hydrothecæ is of no generic value whatever. This paper demands the most careful study, and, if its author's conclusions are vindicated, will result in the complete breaking-down of the old generic boundaries and a drastic re-arrangement which, while retaining the old names, will employ them in a sense having no relation to their former meaning. Meanwhile, so long as we continue to accord primary importance to the growth-characters, I think we should do so consistently, hence my objection for example to the reference of *Thuiaria lata* to *Sertularella*. If Levinsen's views be adopted that reference will undoubtedly be correct, but if a systematist accepts (as the majority do) the arrangement of the hydrothecæ as his principal criterion in discriminating between *Sertularia*, *Thuiaria*, *Selaginopsis*, etc., I cannot see why the same principle should not apply to the case in point.

I may add that in Levinsen's system *S. macrocarpa*, *S. maplestonei*, and similar species are referred to a new genus—*Odontotheca*.

SERTULARIA MACROCARPA, *Bale*.

Sertularia macrocarpa, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 80, pl. v., fig. 2, pl. xix., fig. 11; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 232; Jäderholm, Bihang k. svenska vet.-akad. Handlingar, 21, 1896, p. 13; Schneider, Zoolog. Jahrb., x., 1897, p. 523; Calkins, Proc. Boston Soc. Nat. Hist., xxviii., 1899, p. 359.

Two varieties of this species were noted. In the first, which is similar to the original type, the hydrothecæ have their upper side at right angles with the hydrocaulus only on the proximal portions of the pinnæ, but elsewhere they are distinctly ascending, this character becoming more and more pronounced as they approach the distal extremity of the pinna, where they are almost tubular, and directed upward as much as outward. Beyond the last pair the hydrocaulus is commonly continued into a long tubular prolongation, often of three or four internodes, bearing in some cases one or two hydrothecæ, often more or less deformed, but mostly without any. The pinna-internodes each support a single pair of hydrothecæ. The other variety has the stem-internodes longer, the pinnæ comprising internodes bearing each two pairs of hydrothecæ, which may persist throughout, or may be succeeded by a few internodes with a single pair. The upper hydrothecæ have not the subtubular ascending habit found in the type form, nor do the pinnæ run out into long tubular prolongations. A similar variety has been found at Portland.

The jointing of the base of the pinnæ varies greatly in this species. In some individuals the apophysis has a very strongly-marked transverse node in the middle, then it is separated from the pinna by a conspicuous oblique joint, the pinna running down to a sharp point in front of the apophysis, which is continued upward into a similar point. But specimens occur in which these joints are scarcely marked, or even indistinguishable, so that the pinna appears continuous with the stem. Intermediate forms are found, and even in the same specimen the joints may vary considerably in distinctness.

The two species which most resemble *S. macrocarpa* in the form of the hydrothecæ are *S. bidens* and *S. recta*. *S. bidens* is smaller in all its parts, with sharper teeth on the hydrotheca-margin; it is also distinguished by the presence of a small chitinous projection inside the apocauline wall of the hydrotheca, and the absence of the distinct tooth inside the aperture; while the gonangia are of totally distinct forms in the two species.

The likeness to *S. recta* is, in regard to the trophosome, rather closer. The unusual feature of the latter species, noted in my first specimen, is also found in the only other example which I have seen, namely the situation of the two series of hydrothecæ in a single plane, so that there is no distinction of anterior and posterior aspect to the polypidom. I do not however lay too much stress on this, knowing that in some hydroids there is much inconstancy in this particular. The pinnæ of *S. recta* stand off from the internodes at right angles, while those of *S. macrocarpa* form a somewhat smaller angle with the stem. The stem-internodes of *S. recta* are however more strongly zig-zag, so that the inclination of the pinnæ to the general axis of the stem is much the same in the two species. In *S. macrocarpa* the axillary hydrothecæ diverge from the stem at about the same angle as do the pinnæ, so that they lie along the latter; in *S. recta* they stand out midway between the stem and the pinnæ. The internal tooth found in the hydrotheca of *S. macrocarpa* is not present in *S. recta*. I have had some doubt as to whether the two species might not prove to be connected, but according to Bartlett's observations the gonangia of *S. recta* are wholly unlike the large smooth form of those of *S. macrocarpa*, being furnished with annular transverse ridges similar to those found in many species of *Sertularella*.

Loc.—Bass Strait.

SERTULARIA MAPLESTONEI, *Bale.*

Sertularia maplestonei, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 70, pl. vi., fig. 4, pl. xix., fig. 2; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 231.

(Not *Thuiaria maplestonei*, Billard, Arch. Zool. Exp. (4), vii., 1907, p. 349, fig. v.)

These specimens are, so far as the trophosome is concerned, quite similar to those originally described; but the gonangia differ in the development of the angles at the sides of the orifice, which are prolonged upwards into erect tubular horns, attaining in some instances as much as one-fourth the length of the body of the gonangium.

Billard unites *S. bidens* with *S. maplestonei* under the name of *Thuiaria maplestonei*. The two species are undoubtedly closely allied, but the different forms of the hydrothecæ in our specimens justifies, I think, their separation, at least pending the discovery of intermediate forms. My specimens of both species show the small internal process near the base of the hydrothecæ, but I cannot find in any instance the double process higher up on the same side, as seen by Warren and Billard in their African specimens of *S. bidens*. Nor can I find the internal tooth below the margin on the adcauline side, though in some cases the hydrotheca-wall is thickened at this part so as to resemble, in side view, a projecting tooth, a feature common to a number of species.

As to the generic position of these species, I refer to my preceding remarks under *Sertularia*. Their habit is in all respects similar to that of *S. elongata*.

Loc.:—Hunter Group, 15 fathoms; Bass Strait.

SERTULARIA UNGUICULATA, *Busk.*

Sertularia unguiculata, Busk, Voy. "Rattlesnake," 1852, p. 394; Bale. Cat. Austr. Hyd. Zooph., 1884, p. 76, pl. vi., fig. 9-12, pl. xix., fig. 8; *id.*, Proc. Roy. Soc. Vict., vi., (N.S.), 1893, p. 100; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 231; Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 459.

Sertularia, *sp.* ?, Coughtrey, Ann. Mag. Nat. Hist. (4), xvii., 1876, p. 29 (note), pl. iii.

Thuiaria ambigua, D'A. W. Thompson, Ann. Mag. Nat. Hist. (5), iii., 1879, p. 111, pl. xix., fig. 2, 2a; Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 25.

Desmoscyphus unguiculata, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 144, pl. xvii., fig. 5-7.

Dynamena australis, Kirchenpauer, Verhand. K. L.-C. Akad., xxxi., 1864, p. 11, fig. 5 a-c.

Sertularia australis, D'A. W. Thompson, Ann. Mag. Nat. Hist. (5), iii., 1879, p. 105, pl. xvii., fig. 4, 4a; Bale, Cat. Austr. Hyd. Zooph., 1884, p. 72, pl. viii., figs. 7, 8.

Desmoscyphus pectinatus, Allman, "Challenger" Report., Zool., xxiii., Hydroida, Pt. 2, 1888, p. 71, pl. xxxiv., figs., 1—1b.

Sertularia Challengeri, Nutting, Amer. Hydroids, The Sertularidæ, 1904, p. 54, pl. ii., fig. 1, 2; Billard, Ann. Sci. Nat. (9), xi., 1910, p. 19, fig. 6.

? *Thuiaria heteromorpha*, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 147, pl. xx., fig. 1-5.

(Not *Sertularia australis*, Bale, Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 93.)

Two forms of this most variable of the *Sertulariæ*, collected in Bass Strait, represent perhaps the extreme limits of the species in two opposite directions; one, the ordinary small form, about three-quarters of an inch in height, with the most widely divergent hydrothecæ found in any of the varieties; the other, more attenuated in habit than any which I have previously met with, reaching five or six inches in height, and with the hydrothecæ narrow and but slightly divergent.

I have referred previously to the small form (which is the most abundant) as having the internodes of the pinnæ bearing only one pair of hydrothecæ, with the exception of one or two of the proximal internodes on a few of the pinnæ, which bear two pairs. The stem-internodes are short, somewhat zig-zag, with the nodes strongly marked, and the hydrothecæ forming the pair are pretty close to each other; indeed towards the upper part of the stem they are often opposite and in contact, just as on the pinnæ. Throughout the polypidom the hydrothecæ have the upper portion strongly divergent; often the bend outward is quite abrupt, and beyond it the outer side rises in a sweeping upward curve, which is continued to the point of the long outer tooth. The aperture is elliptic and characteristically directed forward and outward, not upward as in *S. macrocarpa* and similar species. The hydrothecæ on the pinnæ are strictly in opposite pairs, and in contact in the front.

Somewhat larger forms differ in the greater prevalence of internodes of the second, third, and higher orders; and with the longer internodes is associated a much less divergent condition of the hydrothecæ borne by them, though in the distal portions, where only a single pair occupies an internode, they may differ little or not at all from those of the smaller form. The stem-internodes, or many of them, are long, supporting two pinnæ and six hydrothecæ, and are especially characteristic of the species. In the smallest variety the stem-internodes are arranged in the typical Sertularian fashion, that is to say each internode bears at its base a pinna with its axillary hydrotheca, and above it a pair of hydrothecæ, usually sub-alternate. In the larger forms we find that a stem-internode generally has on one side a pinna with three hydrothecæ above it, and on the other a hydrotheca near the base, then a pinna, and above the pinna two hydrothecæ. This arrangement was mentioned by Busk (from whom I received a drawing of it), and by later observers, and naturally appeared somewhat bizarre to those who did not notice that the long internodes were simply equivalent to two of the shorter ones united. The nodes are oblique, sloping alternately to right and left when the internodes are single, but in a series of the double internodes, every alternate node being suppressed, the nodes all slope in the same direction. It is not implied that the double internodes are formed from two originally single ones by the obliteration of the dividing node, as often occurs in *Sertularella* and elsewhere; they are, I have no doubt, formed continuously in the first instance. In the smallest forms single stem-internodes are the rule, and often occur exclusively; some of the larger varieties have only the double type, others have single and double ones interspersed without definite order, or more commonly double ones at the base and middle, and single ones near the summit.

Among other varieties we find some in which the pinna-internodes are still longer, and single-paired internodes are few or entirely wanting; even the distal hydrothecæ may be much less divergent, and a transition to the genus *Thuiaria* is shown by the hydrothecæ on the proximal portions of the pinnæ, which are often neither opposite nor distinctly paired, but may vary from opposite to alternate, while they are separated in front. One pinna may have internodes with sixteen or eighteen pairs, all opposite or nearly so, while another on the same stem may have them almost exactly alternate. Another specimen has pinnæ consisting of a single internode, and bearing over twenty pairs of hydrothecæ, all strictly opposite, in contact in front, and with only the mouth portion divergent, in short, not distinguishable from a *Thuiaria*.

The larger specimens collected by the "Endeavour" differ from other varieties in their attenuated condition. The stem-internodes, which are of the double type, are very long, and the two hydrothecæ forming each pair are often widely separated, so that their paired condition is not obvious. The internodes of the pinnæ do not support many pairs—only two or three in the specimens examined—and many of the distal internodes are single-paired; but the pairs are far apart and the hydrothecæ themselves narrow and but little divergent. The teeth are much shorter than in more typical forms.

In most varieties the nodes of the stem are well-marked and constricted, but I have seen specimens in which they are faint and not accompanied by any constriction, so that they are scarcely noticeable.

I have now little doubt that the *Dynamena australis* of Kirchenpauer is identical with the smallest variety of this species. I formerly identified with *D. australis* a hydroid which I had previously regarded as a pinnate form of *S. loculosa* but which I now believe to be *S. inflata* (Versluys), though there is a doubt on the subject until the gonangia are known. Kirchenpauer's description, so far as it goes, agrees entirely with my specimens; and though his figure shows the hydrothecæ too divergent for average examples it agrees passably with some in my possession. Thompson's account is equally applicable, especially in its reference to the internodes of the pinnæ supporting either one or two pairs of hydrothecæ; a feature not noticed by Kirchenpauer.

Sertularia challengeri, Nutting (*Desmoscyphus pectinatus*, Allman), seems also to be no other than the present species. Allman's figure, which represents the pinnæ as divided throughout into single-paired internodes, is not very distinctive, but with the description, may well indicate the small variety. Nutting's description and figure, representing the proximal end of the pinna with more than one pair, is more characteristic, and leaves little doubt as to the identity of the specimen figured.*

Thuiaria heteromorpha, Allman, seems to be distinguished from *S. unguiculata* only by the hydrothecæ, of which the proximal ones are said to have the margin entire, while the distal ones have the border running out into a single point. I am doubtful whether it is not a form of the present species with abbreviated teeth, approaching the slender variety obtained by the "Endeavour." It has the characteristic stem-internodes of the double type.

Loc.—Bass Strait.

* Dr. Kirkpatrick, after referring to Allman's type, now confirms this identification.

GENUS SERTULARELLA, *Gray*.

SERTULARELLA DIVARICATA *(Busk.)*

(Plate ii., figs. 1—9.)

Sertularia divaricata, Busk, Voy. Rattlesnake, 1852, p. 388.

Sertularella divaricata, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 110, pl. iii., fig. 9, pl. xix., fig. 20; *id.* Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 761, pl. xvi., figs. 1—2 (var. *dubia*), p. 761, pl. xvi., figs. 3—4 (var. *subdichotoma*); Schneider, Zool. Jahrb, 10, 1897, p. 525; Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, pp. 23, 27, 38, pl. iii., figs. 15—20; Ritchie, Mem. Austr. Mus., iv., 1911, p. 839 (var. *subdichotoma*).

Sertularella subdichotoma, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 46, pl. xvi., figs. 1—1b; Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 33—38, pl. i., figs. 3, 4, 6—9, 11—16, pl. ii., figs. 10—17, 51—52, pl. iii., figs. 3, 4, 13, 14; *id.* Voy. "Belgica," 1904, p. 6; *id.* Zool. Jahrb., Suppl. vi., Band iii., 1905, p. 629, figs. V[3], W[3]; Jäderholm, Arkiv för Zoologi k. svenska Vetenskapsakad., i., 1903, p. 278, ii., 1904, p. 3, vi., 1910, p. 4; *id.* Schwed. Südpolarexp., 1901—3, vi., 1905, p. 25, pl. ix., fig. 8; Nutting, Amer. Sertularidae, 1904, p. 96, pl. xxii., figs. 8—12; Vanhöffen, Deutsche Südpolarexp., 1901—3, xi., Zool. iii., 1911, p. 326, fig. 41 a—e.

Sertularella Johnstoni, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 109 (in part), pl. iii., fig. 7, pl. xix., fig. 21; *id.* Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 93 (in part); *id.* Proc. Roy. Soc. Vict., vi., N.S., 1893, p. 102; Billard (in part), Ann. Sci. Nat. (9), xi., 1910, p. 13.

(Not *Sertularia Johnstoni*, Gray, Dieff. N. Zealand, ii., 1843 p. 294).

Hydrocaulus monosiphonic, pinnate or bipinnate, or with irregular subdichotomous ramification; the more regular forms with the pinnæ alternate, three hydrothecæ between every two pinnæ on the same side.

Internodes of the stem usually bearing from one to three hydrothecæ; those of the pinnæ generally bearing only one each, but in some varieties often having more than one, especially on the proximal portions of the pinnæ. Many of the pinnæ terminating in long twisted tendrils, which may become attached to other parts of the polypidom.

Hydrothecæ tubular or sub-conical, both series in one plane, or directed more or less forward, and varying considerably in the extent to which they are divergent laterally, often with a somewhat abrupt bend outward; margin with three teeth, one superior and two lateral, and an operculum of three pieces; no internal teeth. An apparent oblique septum crossing the interior of many of the hydrothecæ.

Gonothecæ large, borne on the pinnæ, surrounded by a number of prominent annular ridges except on the back, which is smooth and appressed to the pinna; the extreme distal portion of the gonotheca projecting forward and having the ridges completely annular; aperture excentric, very variable in width, with the lip more or less everted or funnel-shaped.

Under *S. divaricata* I include the species originally described by me under that name, with vars. *dubia* and *subdichotoma* (the latter being synonymous with *S. subdichotoma*, K.) and the variety which I formerly described as the Bass Strait form of *S. johnstoni*, but which, in accordance with Hartlaub's classification, must be considered distinct from that species; together with such varieties as are so closely allied to the foregoing as to preclude, in my opinion their specific separation. The species, so constituted, is extremely variable, in fact out of nine preparations which I possess from various localities no two are completely alike.

The points of difference are—the ramification, the presence or absence of a distinct joint between every two hydrothecæ, the length of the internodes and consequent distance apart of the hydrothecæ, their position in one or two planes, their lateral divergence and whether such divergence is abrupt or gradual, and the extent to which they are adnate; and, as regards the gonangia, their size and form, the number and prominence of their annulations, and especially the size and form of the mouth. The presence of an apparent septum in the hydrotheca, and the tendency of many of the ramules to run out into twisted tendrils, which may become attached to other portions of the polypidom, are characters which, I believe, are found more or less frequently in all the varieties.

The essential character of *S. subdichotoma*, as described by Kirchenpauer, was the irregular ramification as opposed to the pinnate habit of *S. divaricata*. The gonangia were not in question, as neither Busk nor Kirchenpauer were acquainted with the gonangia of *S. divaricata*, and it may be pointed out that it is quite as likely as not that Busk's original species may have had gonangia similar to those of the var. *subdichotoma*, Hartlaub, finding that the ramification was too inconstant to serve as a specific distinction, and accepting my identification of *S. divaricata* as a form with wide-mouthed gonangia, has practically made the possession of a narrow funnel-shaped lip the prime character of *S. subdichotoma*. My examination of numerous specimens shows that neither of these types of gonangium has any exclusive connection with any particular form of trophosome.

In considering the trophosome only, and disregarding the unimportant distinctions between regular and irregular ramification, the varieties may be grouped in two series. In one, which includes the type and var. *subdichotoma*, the internodes are long, and the hydrothecæ therefore are wide apart, and as a rule (though with many exceptions) in one plane and not very widely divergent laterally. The stem-internodes commonly bear about three hydrothecæ, and even on the pinnæ many of the nodes are indistinct or wholly wanting. In the second group the internodes are more distinct and mostly shorter, and the hydrothecæ closer together, their lateral divergence is greater and they are mostly adnate for a less proportion of their length; they are rarely in the same plane, but the two series are in planes which meet at an angle often as small as 90°. The general habit is mostly more bushy and compact than in the first group, but there is no abrupt or considerable gap between the two.

Proceeding now to consider the differences in the gonosome, which are more important, as the case for the separation of *S. subdichotoma* rests upon them, we find that the varieties may here again be separated into two series, but not coinciding with the two series as determined by the trophosome. In one group, of which *S. divaricata* is typical, the aperture of the gonangium is large, with a wide everted lip, more ample in some varieties than in others; in the other series, which includes *S. subdichotoma*, there is a much smaller orifice with a funnel-shaped lip. In four specimens of the first group the diameter of the orifice ranges from ·13 to ·19 mm., in four of the second from ·044 to ·059, while in one form it varies between ·074 and ·089. This last variety, while obviously approaching *S. subdichotoma*, is so far intermediate as to suggest the probability of finding, with further material, a complete range of connecting forms.

The following is a summary of the characters of the nine different specimens of which I have preparations, accompanied by the average dimensions in millimetres.

1. *S. divaricata*, Port Stephens. This is the form which I described as typical in 1884, as it bears the closest resemblance to Busk's description and drawing of any which I have seen. It also agrees well with Hartlaub's account and figures. It has alternate pinnæ arranged in the fashion typical of the species, but with many irregularities, and it is often in parts bipinnate.

The stem-internodes usually bear three hydrothecæ; those of the pinnæ mostly support only one, though the larger pinnæ, which themselves bear secondary pinnæ, tend towards the same structure as the stem. The internodes vary much in length, the distal ones which I measured averaged about ·49 mm., but on the older part some of them reached about ·75 (in all cases the measurements are of internodes with a single hydrotheca only). The hydrothecæ themselves measured from the base to the top of the lateral teeth about ·40, and their diameter at the base of the free portion about ·21. They are adnate about two-thirds of their height, and mostly directed slightly forward, though in other parts of the same colony they may be in the same plane. They are moderately divergent laterally, and occasionally the outward bend is rather abrupt. The free part is tubular, not distinctly conical. The gonangia average about 1·40 to 1·50 in length by ·89 in width; the annulations, of which there are about nine, are very prominent; the aperture has an internal diameter of about ·16 to ·18, with an everted lip about ·19 to ·22 across, and having an irregular ragged edge, as shown by Hartlaub.

2. Great Australian Bight, 1911.—The habit is similar to the last, but the hydrothecæ are a fraction larger (·41 by ·22), with the free part very slightly conical; they are more frequently in a single plane, but many are distinctly directed forward. Some of the single internodes reached about ·90; the distal ones are of the same length as those of No. 1. The gonangia are wanting.

3. Var. *dubia*, Bale, Bondi Bay.—The ramification is pinnate, but irregularities are frequent. The internodes are short, the distal ones only about ·30 and the proximal ·38. The hydrothecæ average ·37 by ·18, and may be in one plane or somewhat directed forward. The gonangia measure about 1·18 by ·67, and differ considerably from all the other varieties, being of greater diameter from back to front and having the top sloping very much downward, so that the summit rises at the back well above the level of the aperture, which is far forward. The annulations number eleven or even twelve, and are more regular and closer than in the other varieties. The aperture is very wide, about ·18 to ·19, and the basin-shaped lip has a diameter of about ·28.

4. Port Phillip, 1890.—The ramification is fairly regular, the internodes strongly marked and somewhat longer than those of var. *dubia*, the hydrothecæ the smallest of any of the varieties (·31 by ·15), and in their more conical form as well as their size they come nearest to *S. johnstoni*. The gonangia, however, are not at all like those of that species. They are about 1·33 by ·74, with eight or nine strong annulations; the aperture is about ·13 to ·15, and the basin-shaped lip reaches ·24 to ·30.

5. Hunter Group.—Similar in habit to Nos. 1 and 2, but rather more slender and with smaller hydrothecæ, which are adnate for a greater part of their length and are mostly in the same plane. Proximal internodes about ·80, distal ·34, hydrothecæ ·37 by ·18, gonangia 1·48 by ·84, with the aperture ·15 or ·16 and the very large and high basin-shaped lip from ·30 to ·37. Annulations about ten.

6. Var. *subdichotoma*, Bale, = *S. subdichotoma*, K., Port Jackson.—Ramification irregular, internodes very long in the proximal portions, distal ones about ·41. Even on the pinnæ many of the nodes are indistinguishable, so that an internode bears several hydrothecæ. As a rule the hydrothecæ are in the same plane, yet on the same shoot some of the branches may have them distinctly directed forward. They are adnate most of their length, with the free part contracted and sub-conical. In some cases the distal extremities were carried out horizontally owing to successive renewals. The gonangia differ little from those of the type except in the distinctive narrow aperture, which measures only about ·059, while the funnel-shaped lip is about ·10 to ·15 across. They measure 1·33 to 1·48 in length, with a diameter of ·67, and have nine or ten annulations.

7. Port Phillip, 1881 (*S. johnstoni*, Bass Strait var., Bale).—This form is of compact bushy habit, distinctly pinnate. The internodes are short, about ·40 on the proximal portions, and ·33 on the distal, and even on the stem they usually bear only one hydrotheca. The hydrothecæ are about ·33 by ·19, free for nearly half their length, with the free part very slightly sub-conical. They are commonly in two planes about 90° apart, only here and there is a branch on which their forward direction is but slight. They are widely divergent laterally. The gonangia are similar to those of var. *subdichotoma*, measuring 1·18 by ·67, with about nine annulations; an aperture of ·044 to ·059, and the lip ·10 to ·15.

8. Port Phillip, 1889.—Nearly like the last. Proximal internodes ·59, distal ·37; hydrothecæ ·38 by ·21; gonangia 1·33 by ·64, with about nine annulations; aperture ·074 to ·089, lip ·13 to ·16.

9. Great Australian Bight, 1911.—Internodes short, ·44 to ·30; hydrothecæ ·33 by ·18; gonangia 1·26 by ·81; aperture ·044 to ·059, lip ·089 to ·15. This form is principally distinguished by the gonangia, which are more top-shaped than the others, and have the annulations, which number about nine, much less prominent, especially the upper ones. The narrow funnel-

shaped lip, which in the other forms rises out of a basin-like concavity formed by the topmost annulation, is here prominently borne on the convex summit of the gonangium, which rises clear above the annulation.

For comparison with the foregoing I add descriptions of the other two closely allied species which I possess, *S. johnstoni* and *S. pygmæa.*

S. johnstoni, New Zealand (Pl. II., fig 10).—This specimen is pinnate, similar in habit to the smaller varieties of *S. divaricata*, and with the internodes, at least on the pinnæ, bearing single hydrothecæ. The latter are sub-conical, adnate a little more than half their height, and directed a little towards the front. They are smaller than those of any of the varieties of *S. divaricata*, being about ·27 mm. in length by ·16 in diameter. In the other characters of the trophosome I find nothing to distinguish the species from *S. divaricata.* The gonangia, however, differ from those of that species in being smaller and of narrower proportions, and in having the annular ridges closer, more numerous, and less prominent. Their length is from about 1·04 to 1·11 mm., their diameter from ·47 to ·52, and the annulations number twelve or thirteen. The aperture is about ·089 in width, and the neck is tubular and rather thick, and in its position distinctly eccentric.

S. pygmæa (Pl. II., fig. 11).—This is distinguished from *S. johnstoni* primarily by the simple habit. The length of the internodes is slightly less,—about ·27 as against ·31,—but their angular form and the narrow, very oblique, and strongly twisted joints are more distinctive. The hydrothecæ average about ·27 by ·16 mm., are less conical than those of *S. johnstoni*, and are mostly in the same plane. The gonangia are about as wide as those of *S. johnstoni*, but considerably shorter, their length being from about ·74 to ·81 mm., and their annulations number about eleven. In their general appearance they resemble those of *S. divaricata* more than those of *S. johnstoni*, owing to the form and prominence of the annulations, which are especially prominent towards the summit. The top one has the perisarc much thickened, forming a deep cylindrical basin, from the bottom of which rises the tubular neck, nearly filling it up. The neck is similar to that of *S. johnstoni*, but owing to the depth of the concavity in which it is situated it rises above the annulation only slightly, or not at all. The gonangia are not closely appressed to the hydrocaulus, as in the allied species, consequently instead of most of the adcauline side being smooth, the annulations completely surround the gonangium, except for a short distance above the base. The aperture is central.

Hartlaub says in his key to the species that *S. divaricata* has gonangia like those of *S. subdichotoma* but with shorter tube. The shortness is apparently proportionate rather than absolute, for according to the figures the greater width in *S. divaricata* is the most conspicuous difference. The wide bowl-shaped mouth of No. 5 in the foregoing list is in fact higher than any of the narrow funnel-shaped forms. My identification of the var. *subdichotoma* with *S. subdichotoma*, K., is verified by Hartlaub.

Comparison of the nine forms which I have described convinces me that they must all be referred to *S. divaricata*, unless we take such a restricted view of the species as would result in other forms, as well as var. *subdichotoma*, being accorded specific rank. Var. *dubia*, owing to the difference in the gonangia, seems to me to be at least as distinct as var. *subdichotoma*, and in some measure to make an approach to *S. johnstoni*.

No. 7, which is practically identical with var. *subdichotoma* so far as the gonangium is concerned, resembles it perhaps least of all the varieties in the trophosome. Some of the forms which have been referred to *S. subdichotoma* should probably be ranked under the typical *S. divaricata*, *e.g.* the form mentioned by Jäderholm in his report on the Swedish South Polar Expedition, which he says has a wide aperture, a characteristic of the type, not of var. *subdichotoma*.

Several other species have been founded on distinctions which seem scarcely sufficient to take them out of range of *S. divaricata*, as here defined. *S. magellanica*, M.-T. is considered by Hartlaub to be synonymous with *S. subdichotoma*, and *S. cumberlandica*, Jäderholm, is referred by Vanhöffen to the same form. These, and a number of others closely related, are not included among the synonyms, as I have had no opportunity of examining them.

I formerly suggested that it might be found necessary to unite *S. divaricata* to *S. johnstoni*. For the present I regard them as different species, rather on Hartlaub's authority than from my own observations, as I have seen no specimens of *S. johnstoni* other than that described above, which appears to me sufficiently distinct. But according to New Zealand observers *S. johnstoni* seems to vary considerably. Hilgendorf's account is rather contradictory. He describes the gonangia as large, with from six to ten ridges, but he also states that the gonangia of *Thuiaria subarticulata* have six to eight ribs "exactly as in *S. johnstoni* though here the ribs are much fewer."

Billard ranks *S. divaricata* as a synonym of *S. johnstoni*, but as he does not include *S. subdichotoma* also among the synonyms, he evidently considers it a distinct species. Assuming such to be the case, the inclusion of *S. divaricata* would be untenable, since the most intimate relationship of *S. divaricata* is with *S. subdichotoma*, not with *S. johnstoni*.

The accurate and detailed description by Hartlaub leaves little room for further remarks on the structure of the species. The principal point on which my observations do not agree precisely with those of Hartlaub is in regard to the jointing of the hydrocaulus. I have not found, either in *S. divaricata* or *S. johnstoni* that the normal condition is for the internodes to support several hydrothecæ. Setting aside the question as to the original condition of the internodes—to which I have referred on a former page—I have found in the polypidoms of *S. johnstoni* and of most of the varieties here ranked under *S. divaricata* that the typical condition of the genus—one hydrotheca to each internode — is the rule, and the opposite condition quite exceptional. In *S. divaricata*, type, longer internodes are more frequent, and in var. *subdichotoma* they preponderate, so that often the only parts where single-celled internodes are to be found are the latest-formed distal portions. Here the perisarc is extremely thin and delicate, contrasting strongly with the much thicker portions which are but little older, and it can easily be understood how readily the faintly-marked nodes may disappear in the process of growth. There are no internal teeth in the hydrotheca, but the apocauline wall is often thickened at the margin between the lateral teeth, which gives it when seen in side view almost the aspect of an internal marginal tooth. The oblique internal septum is not comparable to the permanent intrathecal ridge of *S. crenata* or the Plumularians, but seems to be an almost membranous film of extreme delicacy, easily detached, and leaving a slight mark on the hydrotheca wall after its disappearance.

The gonangia are more complicated structures than those of the *rugosa*-group, where the annular ridges are simple undulations of the gonangium-wall. Here they are more or less thickened, forming a ring of a cup-like form, from within the margin of which rises the next undulation, while the ring is extended in the form of a narrow flounce-like film, projecting upward. Just below this the perisarc is generally marked with delicate wavy striæ, or sometimes faint reticulations. At the summit of the gonangium, which leans forward away from the hydrocaulus the ridges are completely annular, but on the lower part they are wanting at the back. After passing round the sides of the gonangium they generally take an upward course and gradually thin out and disappear. The back is smooth or with a few irregular lines, or sometimes so closely fitted against the branch above it that the perisarc takes the exact print of the hydrotheca at the back.

Loc.—Hunter group, 15 fathoms; Great Australian Bight, 40 to 100 fathoms.

FAMILY PLUMULARIIDÆ.

GENUS PLUMULARIA, *Lamarck* (in part).

PLUMULARIA BUSKII, *Bale.*

Plumularia Buskii, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 125, pl. x., fig. 3, pl. xix., figs. 34—35; Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, pp. 94, 108. Hartlaub, Zool. Jahrb., xiv., 1901, p. 374, pl. xxii., figs. 22, 32, 36. Ritchie, Proc. Zool. Soc., 1910, p. 832. Thornely, Rept. to the Govt. of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar, Suppl. Rept. viii., 1904, p. 120.

Several specimens of this species were obtained, which do not differ in any important particular from those already described, and on some of them the characteristic female gonangia were present. I have formerly described these as three-sided, with one wide and two narrow sides, the edges being rounded, but it would perhaps be more correct to describe them as having a turgid dorsum and a more flattened ventral surface. The longitudinal ridge of the dorsum often rises higher at the summit of the gonangium than does the opposite side. The two series of large moveable sarcothecæ which run up the dorsal surface are somewhat irregularly arranged; they generally number five or six in each series, with a single one near the top and in the central line.

The similarity of the gonangia to those of *P. obconica*, Kirchenpauer (in which however there are said to be at most about half as many sarcothecæ), led me to ask Dr. Hartlaub to compare a specimen with Kirchenpauer's types, which he has very kindly done. He found the types insufficiently preserved to admit of certain identification, but he was able to satisfy himself that if not actually identical with *P. buskii* they bore an exceedingly close resemblance to it, notwithstanding the difference of Kirchenpauer's figures. The plicate condition of the hydrothecæ noted by that observer is almost certainly the mere effect of drying, and the sarcothecæ agree with those of *P. buskii*, and not with Kirchenpauer's figures. The small sarcotheca behind the hydrotheca was not distinguishable, but this may have been due to the bad state of the specimens.

P. armata, Allman, is an allied species, Allman's figures, which represent the anterior sarcothecæ as extremely slender bodies being, according to Billard, unlike the actual structure, which resembles that of *P. campanula*. The gonothecæ are remarkably like those figured by Kirchenpauer, having only four to six sarcothecæ disposed in a sinuous line down the dorsum. Dr. Hartlaub does not mention the gonothecæ of *P. obconica*, so it is probable that he did not observe them. If *P. obconica* is the same as *P. buskii*, Kirchenpauer's figures of the gonotheca must be as incorrect as those of the trophosome, or else it must vary remarkably.

Both Kirchenpauer and Allman expressly state that the male gonothecæ are without nematophores; those of *P. buskii* have two near the base.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Plumularia procumbens, *Spencer*.

Plumularia procumbens, Spencer, Trans. Roy. Soc. Vict., ii., 1891, p. 130, pls. xxi.—xxiii. Bale, Proc. Roy. Soc. Vict., vi. (n.s.), 1893, p. 115, pl. v., figs 11-12.

The material included a single specimen of *P. procumbens* a species which is quite different in habit from any other of the Australian Plumulariæ. When in fluid or balsam the hydrocladia are scarcely visible to the naked eye, so delicate and minute are they, but the multitude of small branchlets, springing from all sides of the larger branches, give the zoophyte a peculiar bushy or bristly aspect that is very characteristic. As in most other species the short intermediate internodes of the hydrocladia bear each a nematophore, therein differing from the original specimens, collected in Port Phillip by the late Mr. J. B. Wilson, in which, with rare exceptions, these short internodes were unarmed. The pitcher-shaped hydrothecæ are quite minute, and the supracalycine sarcothecæ are in proportion very large, their length being about the same as that of the hydrothecæ.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Plumularia asymmetrica, *sp. nov.*

(Plate iv., figs 2-3).

Hydrophyton about two feet in height, polysiphonic, with numerous ascending branches facing in the same direction, each springing from an internode of the primary jointed stem immediately above a hydrocladium; ultimate branches pinnately arranged, divided into internodes of very varying lengths, each bearing from one to many alternate short hydrocladia, which are supported on short processes of the branch making with it an angle of about 35°-40°, and which are divided by slightly oblique joints into internodes, each of which bears a hydrotheca and has about five strong internal annular ridges.

Hydrothecæ lying along the internode, sub-tubular, curving slightly upward and in the distal part recurved towards the internode; a strong intrathecal ridge springing from the front of the hydrotheca a little below the middle, and directed somewhat forward; distal part of the hydrotheca (about one-third of its length) free, but with the whole of the lower side sinuated down to the hydrocladium, the two sides of the free part asymmetrical, one being rounded off, the other produced forward into a large angular lobe.

Sarcothecæ bithalamic, canaliculate, moveable, the terminal cups narrow; one, on an angular prominence of the hydrocladium, below each hydrotheca, one at each side above (under the free part of the hydrotheca), two abreast on each of the processes supporting the hydrocladia, one behind and one in front of the rachis just below each axil, and others at irregular intervals along the rachis. A crateriform prominence on each hydrocladium-process.

Gonosome.—Gonothecæ on the apophyses of the hydrocladia, small (about twice the length of the hydrothecæ), regularly pear-shaped, tapering gradually to the base and slightly flattened at the top, delicate and colourless, almost membranous. A cluster of rounded highly refractive granules near the aperture.

Colour.—Light fawn.

I received two specimens of this remarkable species (perhaps the largest of the genus), both nearly two feet in height. One comprised a main stem and comparatively few branches, all on the upper half, while the other was branched profusely for about the upper three-fourths of its height, having a lateral spread of over a foot near the summit. The base of this specimen is a dense spongy fibrous mass of conical form, between two and three inches in diameter at the area of attachment, and of about the same height. From the apex of this rise two stems, each about one-fifth of an inch in diameter, one however is broken off short, the other bearing the polypidom described above, which, as the branches tend to spread laterally, assumes a flabellate form. The hydrothecæ differ from those of all other species known to

(Not *Aglaophenia crucialis*, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, pl. i., fig 8. Bale, Cat. Austr. Hyd. Zooph., 1884, pl. xviii., fig 8.)

(Not *Thecocarpus crucialis*, A. Billard, Ann. Sci. Nat., Zool. (9), v., 1907, p. 328, figs. 3, 4.)

The *Aglaophenia crucialis* of Lamouroux, an inadequately described species, was supposed by earlier writers (not however by De Blainville) to be identical with the *Plumularia brachiata* of Lamarck, and the synonymy was generally accepted until Dr. Billard ascertained by examining the original types that they were distinct species. As two or three Hydroids described in the present paper, as well as *A. macrocarpa*, previously described by me, are very closely allied to *A. crucialis*, some reference to that species may be of interest as a preliminary to treating of the forms before us.

I am not aware that any full description of the typical *A. crucialis*, or any figure of the structure, has been published. Billard, concluding from the figures and description of *A. macrocarpa* that it was identical with *A. crucialis*, contented himself with announcing the synonymy. Ritchie, in his Report on the "Thetis" Collection, gives a photograph of the polypidom, and many details of the structure. Dr. Billard informs me that he thinks from Ritchie's description that his specimens were typical. A form differing somewhat from the others is recorded, but Ritchie considered it only a variety; it is said to be distinguished from the rest by its more dumpy hydrothecæ and internodes. Lamouroux' description only states that the polypidom is sparsely branched, with the branches in opposite pairs, and that the colour is a light fawn. Ritchie's figure and description indicate that the branches are divaricate at a wide angle and that they may be re-branched to the third degree, while the two series of branches are in planes meeting at a wide angle. The branches arise from the hydrocladiate tube. The hydrothecæ are as in *A. macrocarpa*, but the margin varies considerably "the characteristic broad lateral lobe especially exhibiting stages of decrease in size, so that in some specimens it has become obsolete." The corbulæ are described as resembling those of *A. macrocarpa*, but the margins of the leaflets "frequently rise into very pronounced crests."

A sketch of one of the best-preserved hydrothecæ of Lamouroux' type, for which I have to thank Dr. Billard, shows the border nearly like that of *A. macrocarpa*, while the median sarcotheca more resembles that of the form which I have named *A. tasmanica*.

Of the species hereinafter described *A. tasmanica* and *A. billardi* were successively submitted by me to Dr. Billard in order to obtain his opinion as to their identity or otherwise with *A. crucialis.* After carefully examining them he considered that the first, while differing from *A. crucialis* in some minor particulars, might be considered specifically identical with it, and that the second could be regarded as a distinct species, though very closely allied. I have, however, judged it more convenient to consider *A. tasmanica* also distinct, at least provisionally, and subject to its reduction to the rank of a variety (either of *A. crucialis* or *A. billardi),* should further investigation show the advisability of such a classification. I should indeed have no hesitation in regarding *A. tasmanica* as distinct from *A. macrocarpa,* if these forms only were in question, but it is at present doubtful how far they may be linked by intermediate forms such as Ritchie seems to have observed. Not only have I had no opportunity of observing typical forms of *A. crucialis,* but I have not seen a complete specimen of *A. macrocarpa,* but only two fragments, that from which I originally described it, and another which Mr. R. Etheridge, Junr., was good enough to send me recently from the Australian Museum for comparison. Moreover, these two specimens differed considerably in colour and ramification, though identical otherwise. The first had, as I indicated in my original description, no opposite branches, but two on the same side, while it was of a deep red-brown colour, almost black in the stem and branches. The other specimen has two pairs of opposite branches, and is almost colourless. It is just possible, however, that the colour may have been discharged by the fluid in which it had been preserved, especially as a *Halicornaria* parasitic upon it—*H. thetidis,* Ritchie—appeared equally bleached. But Ritchie does not mention the colour, either of *H. thetidis* or *A. crucialis.*

Aglaophenia billardi, *sp. nov.*

(Plate iii., fig 3 ; Plate vi., fig 3.)

Hydrophyton polysiphonic, about a foot in height, sparingly branched above; branches mostly in opposite pairs, both series in one plane and all facing one way, forming angles with the stem of about 45° ; each branch springing from an internode of the primary jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at angles of about 40°, nodes slightly oblique.

Hydrothecæ long, at an angle of about 30°, nearly cylindrical in their distal half, narrowed towards the base, a slight fold or ridge near the base on the adcauline side, directed a little

A pair of branches originates from two successive internodes, and they are therefore not opposite in the strict sense, though to the naked eye, and when swathed, as they soon are, by the enveloping supplementary tubes, they appear practically opposite. They spring slightly towards the front, but soon bend back sufficiently to bring both series virtually into one plane. The occurrence of unpaired branches may be due in some cases to the production of a single one only, but more often probably, to the loss of one of a pair. As in all the allied forms seen by me, the proximal part of a branch consists of several short internodes (in this species sometimes as many as a dozen), each of which bears a median sarcotheca only. Ritchie's statement that in *A. crucialis* the branches bear on their proximal internodes a series of *hydrothecæ* only, is probably a slip.

The hydrothecæ nearly resemble those of *A. tasmanica* except in their size and proportions. Their length averages about ·45 mm. as against ·37, but their median width in front view is only about ·15, while that of *A. tasmanica* is about ·19. A little variation occurs in the marginal outline, but in the most typical specimens there is a minute denticle or undulation between the anterior tooth and each of the lateral ones, while between these and the lateral sarcothecæ the border is nearly straight except for two small convexities. The margin differs from that of the next species in the presence of the angular lobes behind the lateral sarcothecæ.

The anterior sarcothecæ are shorter, but more prominent than those of *A. tasmanica*, but in these characters, as well as in the canaliculate aperture, they agree with those of *A. macrocarpa.*

Some later specimens, received from the Australian Museum, enable me to supplement the account of the gonosome, and to recognize in the structure of the corbulæ an instance of sexual dimorphism not previously noticed. Torrey and Ann Martin, have pointed out that in a number of species which are known to possess two forms of corbulæ those containing the female gonophores are completely closed, except for a series of apertures at the bases of the leaflets, while in the male type the leaflets are separated for a portion of their length, or even throughout. In *A. billardi* the corbulæ of both sexes are, so far as I have seen, closed throughout (always excepting the series of large openings at the bases of the leaflets), but there is a great difference in the extent to which the protective armature is developed. In the female corbula the distal sides of the leaves are continued past the line of union with the next leaf and turned outward, being continued into a free lateral wing which is widened upward in the form of a large spreading secondary leaf, rising above the corbula and curving forward over it, and having its edges fringed with sarcothecæ. The lateral spur-like projections from the distal edges of the corbula-ribs near the base are large and prominent, and are armed with eight or ten, or even more, sarcothecæ. In the Museum specimens, however, I found narrower corbulæ, with the lateral spurs reduced to short stumps carrying only three or four sarcothecæ, while the free borders of the leaves were very narrow and the superior foliaceous extensions entirely wanting, or only very slightly developed. In some specimens fortunately the gonophores were sufficiently preserved to enable the sex to be recognized, and in all such cases I found that the corbulæ with the large secondary leaves contained female gonophores in various stages of development, and in some cases planulæ ready to emerge, while all those of the other type contained male sporosacs.

I have no doubt that a similar differentiation will be found in the other species nearly allied to *A. billardi*. In *A. tasmanica* I have found the female gonophores present in corbulæ which even exceed those of *A. billardi* in the extent to which the secondary structures are developed, but I have not yet seen the male corbulæ. Ritchie mentions that in his specimens of *A. crucialis* "the margins of the leaflets frequently rise into very pronounced crests." In *A. macrocarpa* I have seen only one specimen with corbulæ, which, from analogy with those of *A. billardi*, are probably male. It may be noted too that in these corbulæ the distal portions of the leaves do not quite meet in parts, so that a number of small openings are left between them, as in some of the forms mentioned by Torrey. *A. dannevigi* has corbulæ which differ among themselves in a fashion corresponding to that of *A. billardi*, though not in such a marked degree, and in this case also the difference is presumably sexual. In another (undescribed) species, not at all closely related to any of the foregoing, the sexes are easily distinguishable, and here also the female corbulæ are marked by the far greater development of the structures in question. It is evident that none of the species which possess these appendages can be considered sufficiently known until both sexes have been identified.

In *A. billardi* (as also in *A. tasmanica*) the substance of the corbula-leaves, like that of the hydrothecæ, is nearly or quite colourless, and the crests have a somewhat flaccid appearance, being often bent about irregularly, yet the perisarc is really very thick, or rather it consists of two laminæ forming a hollow wall, and separated by a considerable interval. The corbula reaches a great length, one or two specimens which I observed measuring between 17 and 18 mm., and comprising about thirty-six pairs of leaflets ; many however, are less than half this length.

Loc.—Great Australian Bight, 40 to 100 fathoms.

AGLAOPHENIA TASMANICA, *sp. nov.*

(Plate iii., fig. 2; Plate vi., fig. 2.)

Hydrophyton polysiphonic, about a foot in height, sparingly branched above; branches mostly in opposite pairs, both series in one plane and all facing one way, forming angles with the stem of about 50°; each branch springing from an internode of the primary jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed towards the front and rising at angles of about 40°, nodes slightly oblique.

Hydrothecæ at an angle of about 30°, nearly cylindrical in their distal half, narrowed towards the base, a slight fold or ridge near the base on the adcauline side, directed a little forwards; some with a blunt rounded tooth projecting into the cavity from the front, a little above the base; border with a sharp pointed anterior tooth, and a triangular tooth on each side near the front, the rest of the border rather sinuous at the sides but not forming elevated lobes ; no angular lobes behind the lateral sarcothecæ; back excavated, adnate. Hydrothecal internodes with septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ.

Mesial sarcothecæ two-thirds to six-sevenths as long as the hydrothecæ, closely adnate throughout, aperture simple, perpendicular to the hydrotheca or slightly oblique. Lateral sarcothecæ tubular, directed forward and outward, scarcely projecting beyond the hydrotheca-margin ; aperture small, round, canaliculate. Cauline sarcothecæ broad, completely open above, two on the rachis at the base of each hydrocladium.

Gonangial pinnæ mostly in pairs, with the first three or four internodes bearing sarcothecæ only. Corbula (female) long, consisting of up to about fifteen pairs (or more?) of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets, which unite to form a closed corbula; the distal margin of each leaflet continued a little beyond the line of union so as to form a free-edged narrow extension or wing, bordered with sarcothecæ and continued upwards into a very large crest above the corbula, having both edges free and bordered with sarcothecæ; a lateral spur or secondary leaflet projecting outwards and forwards from the distal edge of each rib just above its origin, bearing two series of sarcothecæ (up to six or seven on each side) but no hydrothecæ.

Colour.—Light fawn.

Two or three specimens were obtained, the largest being about a foot in height, and dividing into two main stems, one of which is broken off. It is about 3 mm. thick near the base and 2 mm. above the division. The existing stem is bare for about half its height to the lowest remaining branches, where the hydrocladia also commence. There is first a single branch, then a pair, about 18 mm. higher a second pair, and a third pair about 50 mm. above the second. One of the branches of the second pair is longer than the others (about 110 mm.); about 25 mm. up it bears a very small branch, 12 mm. higher a larger one (on the same side), then two opposite pairs at pretty regular intervals. All the branches face in the same direction and commence with several internodes bearing median sarcothecæ only. The hydrocladia often attain 20 to 25 mm. in length.

The hydrothecæ are very similar to those of *A. billardi*, but differ in their proportions, as described under that species. The mesial sarcotheca is closely adnate throughout, not projecting as in all the allied forms.

Only the female corbulæ were seen. They resemble those of *A. billardi* but are usually more luxuriantly developed, the superior crests, as well as the lateral spurs, being larger, and supplied with a greater number of sarcothecæ.

Loc.—Oyster Bay, Tasmania, 20 fathoms.

I now proceed to summarize the differences and resemblances between the three forms which I have examined, namely *A. macrocarpa*, *A. tasmanica* and *A. billardi*, with, so far as I can ascertain, the corresponding particulars for *A. crucialis*.

As to ramification, the general type is the same in all these species, the branches being mostly in pairs and practically opposite. In reality each pair springs from two successive internodes of the hydrocladiate tube. Too much reliance must not be placed on the paired condition, as unpaired branches are often found. In well-grown specimens the lower part of the stem is denuded of both branches and hydrocladia.

In *A. crucialis* the hydrocaulus seems, considering the size of the polypidom, rather slender, at least in the distal portion, which retains the hydrocladia. The pairs of branches are widely divergent from the stem or the parent branch; Ritchie says "almost at right angles," but his photograph shows much variation in this respect, from 90° to about 60°, while some of the secondary branches have an angle of only about 45°. It is to be noted that before an accurate notion can be obtained as to the character of the branching in most species they must, if dry, be immersed in water to make them resume their natural form. According to Ritchie, the two series of branches, are in two planes meeting at a wide angle.

A. tasmanica is a good deal like *A. crucialis* in habit, my specimens having comparatively slender stems about a foot high, and bare about half way up. The branches have an angle of about 50° or 55°. Both series are in one plane and all face in the same direction.

A. billardi is very similar to the last; in my specimens the hydrocladia and branches are confined to the top three inches, the stems being about a foot in height. The branches are less divergent, being at angles of about 45°, otherwise the habit is much the same.

Of *A. macrocarpa* the best specimen is about three inches in height and broken off both above and below. It bears on the upper half two pairs of branches, and has the hydrocladia extending down to about the origin of the first pair. The stem and branches, especially the former, are much stouter and more rigid than any which I have seen on the hydrocladiate portions of the other species.

The branches, though subject to much irregularity, are mostly in opposite pairs, and not in the same plane; they diverge from the sides of the stem at angles of about 55° or 60°, and are also, at their origin, directed well forward, so as to take them out of the plane of the stem; they soon, however, take a characteristic curve upward, becoming erect, and even in some cases incurved in the distal portions (Pl. i., figs. 1 and 2). The habit thus differs from that of the two other species, in which the whole polypidom is flat and the branches straight and comparatively slender. Associated with the habit of *A. macrocarpa*, however, is a further peculiarity, namely that the anterior aspect of the branches, from which the hydrocladia spring, faces that of the stem or parent branch, contrary to the condition in *A. tasmanica*, *A. billardi*, and indeed in all species known to me in which the polypidom occupies a single plane, where the stem and all the branches normally face the same way, so that such species are easily seen, even by the naked eye, to have a "back" and a "front" to the polypidom as a whole.

Which of these types of growth characterises the typical *A. crucialis* it is at présent impossible for me to determine.

In regard to colour, *A. crucialis*, *A. tasmanica* and *A. billardi* agree in being of a light fawn-brown. My original specimen of *A. macrocarpa* is of a very dark red-brown, and other specimens in the Australian Museum are described as "dark brown," but as already mentioned the specimen lent to me by the Curator is very pale, whether naturally or from the operation of some bleaching agent is unknown.

The general form of the hydrothecæ is very similar in all these species. In *A. macrocarpa* they range from ·29 to ·33 mm. in length, in *A. tasmanica* from ·35 to ·39, and in *A. billardi* from ·41 to ·48, the last-named being, however, narrower in front view than either of the others. *A. crucialis* ranges according to Billard, from ·31 to ·34 mm., but Ritchie says from ·27 to ·34. In *A. macrocarpa* each side of the border has near the front a single triangular tooth, and between it and the lateral sarcotheca there is a large smooth-edged convex lobe, sometimes much developed. In *A. tasmanica* and *A. billardi* (as seen in exact side view), this lobe is not visible, and the border between the lateral tooth and the lateral sarcothecæ is straight, except for slight sinuations, as mentioned in the descriptions. The two angular lobes, which in *A. billardi* are situated behind the lateral sarcothecæ, are not developed in *A. macrocarpa* and *A. tasmanica*. The intrathecal tooth, first noted by Ritchie, is found in many of the hydrothecæ of both *A. tasmanica* and *A. billardi*, though in both it is often wanting; in *A. macrocarpa* I have not found it so far.

There is a characteristic difference between the mesial sarcotheca of *A. tasmanica* and those of the other two forms. In *A. macrocarpa* and *A. billardi* this organ rises at a wider angle than does the front of the hydrotheca, so that the terminal portion is distinctly prominent, the sarcotheca does not much exceed half the length of the hydrotheca, and the aperture is more or less oblique, being obviously formed by the transverse terminal aperture cutting into the lateral one. In *A. tasmanica* the sarcotheca, though considerably longer, does not project, but continues adnate to the hydrotheca throughout its length, it is often slightly swollen at the end, and it is abruptly truncate at an angle perpendicular or nearly so to the hydrotheca. The lateral sarcothecæ do not differ much; those of *A. macrocarpa* are conspicuously directed outward, the others somewhat less so.

The hydrotheca of *A. crucialis*, according to Billard, most resembles that of *A. macrocarpa*, but Ritchie describes the lateral lobes as obsolete in many of his specimens. I do not find much variation in this particular in any of the forms described above, if care is taken that the hydrothecæ are viewed in exact profile, though *A. tasmanica* and *A. billardi* may exhibit such lobes when lying obliquely. The mesial sarcotheca, in Dr. Billard's sketch, resembles that of *A. tasmanica*, except that the aperture is more oblique.

Reference to the descriptions of the corbulæ of *A. tasmanica* and *A. billardi* will show that there is no difference except such as is due to the somewhat more luxuriant growth of the former, as evidenced in the fuller development of the lateral spurs, and also of the superior crests. In *A. macrocarpa* the male corbulæ only have been observed, and these in but a single specimen; their leaflets do not meet continuously, but on the upper part of the corbula they become separate at intervals, *both* edges being fringed with sarcothecæ at those parts.

So far as *A. tasmanica*, *A. billardi*, and *A. macrocarpa* are concerned the foregoing descriptions will I think suffice for their discrimination, but *A. crucialis*, as described by Mr. Ritchie, seems to combine some of the characters which differentiate these forms, *e.g.*, the size of the hydrothecæ, the form of the hydrotheca-margin, and the structure of the corbula. It is not stated whether the differences referred to are found in the same colonies; if so an extent of variability would be indicated which might require that *A. tasmanica* at least should be recognized as within the range of variation of *A. crucialis*; otherwise it is possible that more than one type is represented in the specimens. But undoubtedly the three forms which I have described are amply distinguished from one another, so far as present information shows, whatever may be their relations with Lamouroux' species, not yet completely elucidated.

AGLAOPHENIA DANNEVIGI, *sp. nov.*

(Plate iii., fig. 4; Plate vi., fig. 4.)

Hydrophyton polysiphonic, two feet or more in height, stems thick, densely and profusely branched from near the base to the summit; young branches mostly in opposite pairs, their anterior aspect facing that of the parent branch, ascending at an angle of about 20° laterally, and projecting forward at about the same angle; each branch springing from an internode of the primary jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at an angle of about 40°; nodes slightly oblique.

Hydrothecæ at an angle of about 40°, nearly cylindrical in their distal half, narrowed towards the base; a very slight fold or ridge near the base on the adcauline side, directed a little forward; border with a large pointed straight or slightly incurved anterior tooth, and a large triangular tooth near the middle of each side; an angular lobe at each side behind the lateral sarcotheca; back excavated, adnate. Hydrothecal internodes with the two septal ridges usually scarcely indicated, but with the thickenings at the base of the intrathecal fold and the lateral sarcothecæ conspicuous.

Mesial sarcothecæ about three-fourths the length of the hydrothecæ and adnate throughout, aperture oblique. Lateral sarcothecæ tubular, directed forward and slightly outward, scarcely projecting beyond the hydrotheca-margin, aperture small, round, canaliculate. Cauline sarcothecæ broad, completely open above, very thin, two on the rachis at the base of each hydrocladium.

Gonangial pinnæ generally in pairs, each replacing a hydrocladium, with the first four or five internodes bearing sarcothecæ only. Corbulæ (female) long, cylindrical, consisting of up to about twenty pairs of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets which unite to form a closed corbula; the distal margin of each leaflet continued a little beyond the line of union so as to form a free-edged narrow extension or wing bordered with sarcothecæ and mostly more or less widened upward, especially in those about the middle of the corbula, which expand into a wide lobe with sarcothecæ on both edges; a large stout lateral spur projecting outward and forward from the distal edge of each rib just above its origin and bearing about six sarcothecæ but no hydrothecæ; the end of the rachis projecting a little beyond the corbula, curved upward, armed with sarcothecæ: (male) rather narrower, with the free lobes of the leaflets only slightly developed or entirely wanting, lateral spurs much smaller; the main leaflets becoming gradually shortened and finally separate in the distal part of the corbula, till at the end they are abbreviated close down to the lateral spurs.

Colour.—Bright chestnut brown.

The original example of this magnificent species is by far the finest specimen of any Hydroid which I have met with. It springs from a dense spongy mass of hydrorhizal filaments, measuring about four inches in one direction by one and a half in another, and two inches high to a point where it subdivides; the two divisions extending upwards for about three inches further, around the bases of the two main trunks on which the colony is borne. One of these trunks, before emerging from the spongy mass, has already divided into half a dozen branches, each averaging about $2\frac{1}{2}$ mm. in diameter; the other, which commences to branch a little higher up, is about 9 mm. through. The polypidom, which slightly exceeds two feet in height, is branched and re-branched most exuberantly, and is bare only near the base, the hydrocladiate portion forming a dense bush about fifteen inches in lateral spread, and between two and three inches through in the dried specimen.

As in the last two species a pair of branches originates from two successive internodes of the hydrocladiate tube, but they are here much less divergent, rising at angles of as little as 20°, while they stand out in front in a plane of about the same angle. Thus a branch of three or four inches in length may have about three pairs, each of which lies in a plane cutting that of the parent branch at about 20°. When dry they are usually more divergent, and in any case there is considerable variation, but most of the young branches are as described. When older they tend to diverge more, and the thicker branches are apt to be very irregular, partly by the process of development, and often no doubt through some of the branches being lost. A very noteworthy character is the reversal of the aspect of the young branches, so that their hydrocladia have the front facing the front of the parent branch, hence the polypidom has not a distinct anterior and posterior aspect, like *A. tasmanica* and *A. billardi*, in which the branches all face in the same direction. The peculiar mode of branching in the present species results in the young branches coming between the branch from which they spring and the penultimate branch, it is easily understood therefore how through the repetition of this process the ramification will become very dense. In some cases a very small branch is found springing from a part of an old thick branch otherwise bare, apparently a new growth; the inference would be that such branches must spring from the supplementary tubes by which the primary stem is enclosed, but I have not been able to verify this. The hydrocladia reach a length of about three-quarters of an inch. As in the allied forms the branches commence with a series of internodes (about half a dozen) bearing only sarcothecæ.

The minute structure indicates a distinct relationship with the *A. crucialis* group, notwithstanding the total difference in habit.

The hydrothecæ are of the same type, making however a somewhat wider angle with the supporting internode. The median tooth is longer and thicker, the lateral teeth larger and more in the middle; the two angular lobes behind the lateral sarcothecæ as in *A. billardi*. The aperture of the anterior sarcotheca is oblique. The lateral sarcothecæ are only slightly divergent laterally, and they seem to differ somewhat from the other forms, especially in a slight thickening at the foot of the front wall. The intrathecal fold is excessively feeble, but the thickening at its base, as also at the base of the lateral sarcothecæ, is very pronounced, owing to its deep colour, nevertheless the annular septal ridges which usually originate at these points are generally absent, though occasionally slightly indicated, especially in the less mature hydrocladia.

The first specimen obtained was without the gonosome, but a second example, collected in the autumn, bore numerous corbulæ, and others received still more recently from the Australian Museum, show that there is in this species a distinction between the sexes similar in character to that which exists in the last two. The female corbulæ have the superior free lobes very robust, but not nearly so large as in those of *A. billardi* and *A. tasmanica;* they do not form large overlapping crests, but mostly rise only about as high as the upper surface of the corbula. The lateral spurs are long and stout, but with fewer sarcothecæ than those of the other species, where they are set closer together. The end of the gonocladium forms a stout prolongation curving up round the end of the corbula like the prow of a boat. The male corbulæ have the protective structures less developed, but they are also distinguished, in all the specimens examined, by the leaflets becoming so much reduced at the distal end of the corbula that the latter narrows away to the point so as to have a caudate aspect to the naked eye. For most of its length the corbula is closed, though here and there interstices may be seen where the leaves fail to meet; towards the end however, the much abbreviated leaflets are separate. The fragmentary appearance of the corbula at this part at first seemed to me the result of decay, but finding it general and apparently limited to the male corbulæ, I am now inclined to regard it as normal, more especially as the few corbulæ which I have seen of *A. macrocarpa*, the most nearly allied species, agree in this particular.* Between the male corbulæ of these two species I

*A similar condition of the open male corbula of *A. diegensis* is figured by Torrey and Ann Martin in their paper on "Sexual Dimorphism in Aglaophenia," University of California Publications, Zoology, vol. 3, p. 48, fig. 2.

find very little difference, except in regard to the sarcothecæ. In *A. dannevigi* the line of union of two leaflets in the middle of the corbula generally bears about three, in *A. macrocarpa* there are five or six in the corresponding position, the sarcothecæ being smaller and closer together. In the latter species they are usually widest in the middle, with the aperture small and circular, but having a deep narrow lateral sinuation; in the former they are cup-like, expanding up to the aperture, which is very wide and oblique, with the margin smooth or somewhat irregular. These distinctions are very definite in the specimens before me, but whether they are constant is hardly a matter of certainty while so few examples of *A. macrocarpa* are available.

The female corbulæ were in many cases crowded with gonophores, but the male were empty. They evidently open by the splitting of the upper side along the median line, and in the narrower distal portion.

In all the foregoing species the corbulæ, like the branches, originate in two successive internodes of the rachis, taking the place which would otherwise be occupied by two hydrocladia. They also follow the same rule as the branches in regard to the direction in which they face. Thus in *A. billardi* and *A. tasmanica* the corbula faces mainly forward, like the branches, which all front in the same direction; while in *A. dannevigi* and *A. macrocarpa*, where the branches have their anterior aspect turned towards the rachis from which they spring, the corbulæ have a corresponding directicn. When therefore a fertile specimen is laid on a slide with the hydrocladia facing upward, the corbulæ will, unless twisted from their normal position, face downward towards the slide.

Loc.- –Great Australian Bight, 40 to 100 fathoms.

AGLAOPHENIA MEGALOCARPA, *sp. nov.*

(Plate iv., fig. 1; Plate vi., fig. 5.)

Hydrophyton polysiphonic, two feet or more in height, with numerous branches, mostly on the upper half; branches alternate or irregular, forming an angle with the stem of about 45-50°; each branch springing from an internode of the primary jointed stem, opposite to a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at an angle of about 40°; nodes slightly oblique.

Hydrothecæ appearing doubled on themselves, being divided by a strong intrathecal ridge which starts from the back angle of the lateral sarcothecæ and proceeds backwards parallel with the hydrocladium half way through the hydrotheca, having its free edge thickened and giving origin to a faintly indicated fold which crosses the upper part of the hydrotheca towards the anterior tooth; distal part of the hydrotheca set at an angle of about 40° to the internode; border with a median anterior tooth, which is bifid, the smaller point somewhat incurved, the larger forming an acute crest above it; two large teeth on each side, and a third narrow pointed one at the junction with the lateral sarcotheca; back entire, adnate. Hydrothecal internode with two very short septal ridges (often scarcely indicated), one opposite the proximal extremity of the hydrotheca, the other about the middle of the internode.

Mesial sarcothecæ about half the length of the hydrothecæ, adnate throughout, terminal and lateral apertures confluent, forming an oblique canaliculate aperture. Lateral sarcothecæ sub-tubular, sharply recurved, completely open in front, margin on a level with that of the hydrotheca or slightly projecting. Cauline sarcothecæ broader than laterals, completely open above, two on the rachis at the base of each hydrocladium and a third at the back of each axil. A crateriform prominence on each hydrocladium-process.

Gonangial pinnæ with the first three or four internodes bearing nearly normal hydrothecæ, generally followed by one or two bearing more modified hydrothecæ (mostly without mesial sarcothecæ). Corbula very long (sometimes over 18 mm.), curved, consisting of up to nearly forty pairs of broad leaflets, which unite to form a closed corbula, the junction-lines smooth, marked by slightly thickened ridges. Basal part of each leaflet with a row of sarcothecæ along the lower and distal margins, just above which is an opening filled by a small modified hydrotheca. A very large broad rounded secondary leaf rising from the upper part of each corbula-leaf, free except at the base, directed obliquely forward and fringed with sarcothecæ. A row of sarcothecæ usually running up each leaf of the corbula proper, starting from the point where the secondary leaflet originates.

Colour.—Red-brown.

This fine species is unique in several of its characters, notably in the form of the hydrothecæ and the direction of the intrathecal ridge, and in the enormous corbulæ. In its height (fully two feet), it vies with the last species, but is a slender form, with comparatively few branches. In the larger of the two colonies examined a spongy root-mass, some two inches in diameter, gives origin to half a dozen distinct stems, averaging about 2 mm. in diameter, of which three attain the maximum height. The branches, which mostly occur on the upper half or two-thirds of the stem, are usually in two series and alternate, nearly in the same plane, and attaining up to eight or ten inches in length; they often face in the same direction but this character seems inconstant. Secondary branches are abundant, and a few small ones of the third order were observed. There is however, much irregularity in the ramification, especially in the distance apart of the branches, which may be from one to three or four inches. The proximal part of a branch may include as many as twenty internodes on which only sarcothecæ are borne. While the branches have their origin in the hydrocladiate tube they do not, as in all the preceding species, take the place of a hydrocladium, but, at least in the few young branches which I examined, they are supported on the same internode with a hydrocladium, and opposite to it.

No other species, so far as I am aware, shares in the peculiar construction of the hydrotheca which is found in the form before us. The aperture by which the cavity of the hydrotheca communicates with that of the internode is not situated as usual at the proximal end of the hydrotheca, but at the opposite extremity, just under and between the lateral sarcothecæ. Above this entry is the intrathecal ridge, which runs directly backwards half through the hydrotheca, and around which the latter is abruptly recurved, being thus divided into two compartments, a narrow proximal one, and a much wider distal one. The hydranth therefore will be completely doubled upon itself around the intrathecal ridge. It is interesting to note that the lateral sarcothecæ are doubled back in a somewhat similar fashion, their openings into the internode being far forward so that the sarcostyles will be recurved like the hydranths. In the presence of a sarcotheca behind each axil we have a feature usually characteristic of *Halicornaria*. The two cauline sarcothecæ on the front of the rachis are set further apart than in most species, the inferior one being close to the lower end of the internode.

The corbulæ are beautiful structures, varying in length from about half to three-quarters of an inch, one specimen measuring seven-eighths, or considerably larger, I believe, than any other species is known to possess. They are when mature of a deep reddish-brown colour, and of firm robust texture, not subject to distortion in drying. The openings near the base of the leaflets are very small. and entirely occupied by the modified hydrothecæ, which do not in any way resemble those on the hydrocladia, being very small, straight, and tubular, with the margin irregularly crenate, and accompanied by a pair of very similar lateral sarcothecæ. A striking feature of the corbula is the double series of large convex secondary leaflets which rise from the surface of the primary corbula-leaves, arching over and overlapping those in front of them. Similar structures, but much less regular and symmetrical, occur in *A. crucialis* and other species, where they are formed by a development of the free margins of the component leaves; here however, they originate independently, and are not continuations of the margins. The lines of union of the corbula-leaves are smooth, and not bordered by rows of sarcothecæ, but such a row usually runs up the leaflet from the point at which the crest-leaflet starts.

Loc.—Great Australian Bight, 40 to 100 fathoms.

AGLAOPHENIA DECUMBENS, *sp. nov.*

(Plate iv., fig. 4; Plate vi., fig. 6.)

Hydrophyton lax, slender, polysiphonic, about four or five inches in height, sparingly branched; branches springing from the supplementary tubes, mostly in the distal portions of the colony, irregular, forming angles with the stem of about 45°. Hydrocladia slender, alternate, one on each internode, both series directed towards the front, and rising at an angle of about 40°, nodes transverse.

Hydrothecæ long, parallel with the hydrocladium, a slight fold or ridge near the base on the adcauline side, directed a little forwards; border with a median anterior tooth, bent outward, and four nearly equal regular shallow triangular teeth on each side, the last pair behind the lateral sarcothecæ; back adnate. Hydrothecal internodes with curved septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ.

Mesial sarcothecæ a little longer than the hydrothecæ, directed very much forward, free part projecting beyond the hydrotheca-margin, tubular, with distinct terminal and lateral apertures, and an aperture communicating with the interior of the sarcotheca. Lateral sarcothecæ subtubular, directed forward and outward, rising about as high as the hydrotheca-margin; terminal and lateral apertures distinct or united. Cauline sarcothecæ large, canaliculate, two on the rachis at the base of each hydrocladium.

Gonosome—?

Colour.—Light brown, stem and branches darker.

There is some doubt as to whether this species is identical with the *A. brevicaulis*, Kirchenpauer. That species is described as having a very thick but short stem, from the summit of which spring several long slender branches, but the figure conveys the idea rather of a group of five or six stems with their bases all bound together in a fascicle by hydrorhiza-like filaments. The present specimen resembles a single one of these stems, and it has one or two filaments adhering an inch or so above the point at which it has been broken off. A characteristic feature is the condition of the anterior tooth of the hydrotheca, which is everted and stands immediately opposite the lateral orifice of the anterior sarcotheca, just as in Kirchenpauer's species. On the other hand the form of the hydrotheca in Kirchenpauer's figure is very different, being much shorter. Dr. Hartlaub obligingly undertook to examine Kirchenpauer's type, but the specimen turned out to be merely *A. divaricata.* That species certainly has the hydrothecæ more like the figure in their general form, but they do not have the anterior tooth everted ordinarily, and the habit-figure does not resemble *A. divaricata.* The figure of the hydrotheca is bad, whether intended for *A. divaricata* or the present species, and under the circumstances it is impossible to say whether Kirchenpauer has described an aberrant form of *A. divaricata*, or whether an error has been made in labelling the type specimen.

The whole polypidom is lax and slender, the compound stem consisting of few tubes. As in *A. divaricata* the branches spring from the accessory tubes, and commence with a series of about ten internodes bearing sarcothecæ only. The internodes of the hydrocladia are unusually slender. In some parts of the colony the anterior teeth of the hydrothecæ were without the characteristic outward bend, but as this bend is found in the portions where the perisarc is most perfectly preserved, I conclude that it is the typical form.

Loc.—Bass' Strait

Genus Halicornaria, *Busk.*

Halicornaria birostrata, *sp. nov.*

(Plate iv., fig. 5; Plate vii., fig. 6.)

Hydrocaulus monosiphonic (unbranched?) about five inches in height; hydrocladia alternate, one on an internode, at an angle of about 45°, and both series directed towards the front; nodes transverse or scarcely oblique.

Hydrothecæ long, tubular, proximal part parallel with the internode, distal part recurved upward, a narrow anterior intrathecal ridge immediately below the aperture; border entire in front and behind, a large angular lobe at each side about the middle, everted horizontally, and a less pronounced lobe further back; back of hydrotheca free, more elevated than the front, so that the aperture is oblique; the aperture into the hydrocladium with two or three minute denticles on the margin. No septal ridges in the internode.

Mesial sarcothecæ as long as the hydrothecæ or longer, free for more than half their length, the free part diverging widely from the hydrotheca and overhanging its aperture; free portion sometimes single but more often dividing into two distinct tubular branches, which diverge widely from each other laterally; terminal apertures small, lateral aperture large, adjoining the hydrotheca. Lateral sarcothecæ saccate, adnate, with a small tubular aperture directed forwards and outwards, distinct from the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonothecæ about three times the length of the hydrothecæ, campanulate, truncate, membranous, springing from the bases of the hydrocladia.

Colour.—Light fawn, stems darker.

The specimens comprised numerous shoots, all unbranched, and are to the naked eye indistinguishable from *H. urceolifera*, which is also found on *A. megalocarpa*. In the form of the hydrothecæ and the mesial sarcothecæ it is quite distinct from all the known Australian species, but it has the characters, common to all of them, of the monosiphonic habit, the absence of septal ridges in the internode, the sarcothecæ at the back of the axils, and the denticles on the margin of the opening from the internode to the hydrotheca, which, by analogy with *sarcopore*, might be termed *hydropore*.

The most striking characteristic of the species consists in the bifurcated mesial sarcothecæ. There is much variation in these appendages, some only forking close to the ends, others much further back, and many remaining simple. As a rule those near the two extremities of the hydrocladia are the less developed. The lateral sarcothecæ have the tubular mouth longer and directed more forward as they approach the ends of the hydrocladia; a condition found also in many other species.

The position of the intrathecal ridge, between the hydrotheca-lip and the mesial sarcotheca, has not been observed in any Australian species described hitherto, though common in *Aglaophenia* and *Lytocarpus*. The oblique aperture of the hydrothecæ is also peculiar, in being lowest on the anterior side, the obliquity in this type of hydrotheca being usually in the opposite direction. In side view there is visible a small linear mark on the adcauline wall of the hydrotheca which is seen in front view to be caused by a rather thick band crossing the floor of the hydrotheca from side to side, and forming apparently the rudiment of a posterior ridge.

The gonothecæ are of a thin membranous character, quite colourless, and so delicate that all of them have become more or less shrivelled and distorted in drying. It is evident however, that they are of the same flat-topped type as we find in *H. longirostris* and *H. urceolifera.*

On one of my specimens a few of the lowest internodes support two hydrocladia each, which are nearly opposite. As I could find no other similar specimens among those which I examined, I conclude that the condition was abnormal.

Loc.—Great Australian Bight, on stems of *Aglaophenia megalocarpa*, 40 to 100 fathoms.

HALICORNARIA URCEOLIFERA *(Lamarck)*, *var.* SCANDENS, *var. nov.*

(Plate v., fig. 4; Plate vii., fig. 5.)

Plumularia urceolifera, Lamarck, Anim. sans Vert., ii., 1816, p. 125.

Aglaophenia urceolifera, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 29.

Halicornaria urceolifera, Billard, Ann. Sci. Nat, Zool. (9), v., 1907, p. 324, fig. 1.

Hydrocaulus monosiphonic (unbranched?), about five inches in height; hydrocladia alternate, one or two on an internode, at an angle of about 45°, and both series directed towards the front; nodes transverse.

Hydrothecæ cup-shaped, deep, set at an angle of about 40°, without intrathecal ridge; border with a small anterior tooth which, along with the part of the hydrotheca-wall immediately below it, is abruptly bent inward, the first tooth on each side large, erect, a large triangular tooth or lobe near the middle on each side, everted almost horizontally, and another lobe, more rounded, adjoining each lateral sarcotheca ; back entire, adnate ; the aperture into the hydrocladium with a few minute denticles on the margin. **No septal ridges in the internode.**

Mesial sarcothecæ about two-thirds the length of the hydrothecæ, projecting free portion short, but with the terminal and lateral apertures generally distinct ; terminal aperture very small, circular, rarely replaced by two still smaller, side by side. Lateral sarcothecæ adnate, saccate, with one or two tubular apertures, one directed downwards at right angles with the hydrotheca, the other, when present, directed upwards and forwards, but commonly merged completely in the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonothecæ about three times the length of the hydrothecæ, campanulate, truncate. "Ses vessies, courtes urcéolées et nombreuses, sont sessiles sur le rachis, entre les pinnules" (Lamarck).

Colour.—Light fawn, stems darker.

The description and figures of *H. urceolifera* given by Billard sufficiently resemble these specimens to permit of their reference to Lamarck's species, though the type specimen seems to be a larger form (25 centimetres in height), and there are some minor differences. The hydrothecæ are broader, in front view, than those of any other species known to me. A very characteristic feature, in side view, is the abrupt bending-in of that portion of the hydrotheca which includes the anterior tooth, while the two teeth next to it remain erect. The front view is no less distinctive, the three teeth referred to appearing in that aspect as nearly equal and very near together, contrasting strongly with the nearly allied species, *H. prolifera* and others, which in front view show the median tooth standing alone, with the first pair of laterals sloping outwards and comparatively distant. The median tooth is not thickened nor crested, but merely a lobe of the hydrotheca-wall. The lateral sarcothecæ much resemble those of *H. ascidioides*, but the free front margin is often cut back so far as to obliterate the upper circular aperture. In those near the ends of the hydrocladia the lower aperture becomes gradually more distinctly tubular, and directed more forward. The mesial sarcothecæ have the terminal and lateral apertures generally distinct, a rather exceptional condition when the apertures are so closely approximated as in this species. The single circular terminal aperture seemed at first to mark a distinction between the specimens and Billard's figure, which shows two such apertures; close examination of a number of specimens however revealed a few instances in which the single orifice was replaced by two abreast, exactly as Billard shows them.

The modification of the hydrothecæ at the proximal ends of the hydrocladia, common to many species, is in certain specimens of *H. urceolifera*, carried further than I have seen it elsewhere. The first hydrotheca presents a smooth even rim with all trace of denticulation wanting, except as regards the anterior tooth, which is not at all reduced. The next hydrotheca is less modified, and so on successively, the normal form not being attained till the fourth, or even the fifth hydrotheca.

I have not seen the gonothecæ, but Billard's figure shows that they are of the obconic truncate form frequent in the genus.

Later specimens received from the Australian Museum differ somewhat from that described above, and appear to agree pretty closely with Lamarck's type. The present form may conveniently be distinguished as *var. scandens*, from its climbing habit, which apparently is not shared by the larger form.

The species has not, I believe, been observed hitherto since Lamarck described it from the Indian Ocean in 1816.

Loc.—Great Australian Bight, on stems of *Aglaophenia megalocarpa* and *A. billardi*, 40 to 100 fathoms.

HALICORNARIA INTERMEDIA, *sp. nov.*

(Plate v., fig. 2; Plate vii., fig. 4.)

Hydrocaulus monosiphonic, about 8-10 inches in height, dividing dichotomously once or several times; branches in one plane and facing the same way, divergent at an angle of about 75°; hydrocladia alternate or sub-alternate, two on an internode, at an angle of about 65°-70°, both series nearly in the same plane; nodes slightly oblique.

Hydrothecæ sub-cylindrical, broader near the base, set at an angle of about 60° and almost facing the front; a strong intrathecal ridge proceeding from about the middle of the front of the cell obliquely downwards to about its centre, border entire in front or with an indistinct median tooth, and a broad free rounded lobe behind, three teeth on each side, the centre one large and everted, the others more or less tending towards an obsolete condition; the aperture into the hydrocladium with a few minute denticles on the margin. No septal ridges in the internode.

Mesial sarcothecæ adnate to the hydrothecæ as far as the margin; free part short, slender, curved forward, terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two circular apertures, one directed forward, the other upward; both often more or less confluent with the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonosome—?

Colour.—Reddish-brown.

This species closely resembles *H. baileyi* and *H. furcata*, between which it is to some extent intermediate. It may have to be classed ultimately as a variety of *H. furcata*, when our knowledge of the two forms is more extended; at present it may be provisionally regarded as a distinct species.

A large colony of it was found accompanying *Aglaophenia tasmanica*, but whether it had commenced as a parasite on that species, after the fashion of so many of its congeners, was impossible to determine, the stems being matted together with other growths. It divides in a purely dichotomous fashion, and in most cases with considerable regularity, each division bifurcating again at the same distance as its fellow from the previous bifurcation. One specimen has divided four times, all at regular distances, so that the final number of divisions is sixteen.

In the widely divergent branches and hydrocladia, the latter being almost at right angles, it nearly resembles *H. furcata*, and both species differ from *H. baileyi*, in which the hydrocladia are more ascending as well as more directed forwards. The hydrothecæ of the three species are much alike, but those of *H. furcata* are broader in front view (in proportion to their length), than in either of the others. The internodes are longer in *H. intermedia* than in the others, and the hydrothecæ on the proximal parts of the hydrocladia, with their internodes, are rather broader in front view than the more distal ones.

In *H. baileyi* the base of each mesial sarcotheca springs directly from the back of the next hydrotheca, in the other two species there is a distinct interval between; in other words the back of the hydrotheca does not quite extend to the end of the internode. In the "Catalogue of the Australian Hydroid Zoophytes" it is stated in error, under *H. baileyi*, that *H. furcata* is similar in this respect; they are, however, figured correctly. The central lateral teeth of the hydrotheca are somewhat shorter and less everted in *H. intermedia* than in the other species, and the border is not quite so low at the sides. In all three species the first hydrotheca on each hydrocladium differs from the rest in having the aperture quite horizontal, and the lateral teeth nearly obsolete, one generally more so than the other.

Each species has its own characteristic condition of the axils at the bifurcations. In *H. furcata* each axil is generally occupied by a hydrocladium of one internode, the hydrotheca on which is without a mesial sarcotheca. This hydrocladium springs from the back of the axil; the usual cauline sarcothecæ in front are wanting, but there is a pair at the back, seated one on each side of the base of the hydrocladium, and facing outwards. Of *H. intermedia* I examined a number of specimens, but in none were these short hydrocladia present; there are however, in all cases a pair of divergent cauline sarcothecæ behind the axil, approximate at the base or completely united and confluent, but in either case communicating with the interior of the hydrocaulus by a single large orifice. *H. baileyi* has behind the axil in the only specimen available for examination a pair of sarcothecæ close together at the base, narrower than in *H. intermedia* and directed more upward; it has also a sarcotheca in front below the axil, and below this a perforation with a fragmentary border, probably also a more rudimentary sarcotheca.

The most salient feature which distinguishes *H. intermedia* from its nearest ally, *H. furcata*, is its large size and robust habit, with its long hydrocladia, reaching about 18 mm. in length (those of *H. furcata* being much shorter). In the minute structure of *H. intermedia* the greater length of the hydrothecal internodes, and the consequent less crowded condition of the hydrothecæ, furnish the most striking distinction. The internodes average about ·41 mm., and those of *H. furcata* about ·31. The difference is not so much in the hydrothecæ as in the internodes, accordingly it will be observed that in a front view the hydrothecæ of *H. furcata* are closer together, the proximal ends of the hydrothecæ being just over the nodes, while in *H. intermedia* there is an intervening space. I have not seen in *H. furcata* the noticeable narrowing of the hydrothecæ and their internodes, which in *H. intermedia* occurs towards the ends of the hydrocladia, and the hydrothecæ of the latter species do not so completely face the anterior side of the polypidom.

The colony of *H. intermedia* consisted of a good many shoots, and among the specimens which I examined I did not observe much variation; of *H. furcata* and *H. baileyi*, however, I have seen no specimens except the one of each from which I originally described them.

Loc.—Oyster Bay, Tasmania, 20 fathoms.

Genus Halicornopsis, *Bale.*

Halicornopsis elegans *(Lamarck).*

Plumularia elegans, Lamarck, Anim. sans Vert., ii., 1816, p. 129.

Aglaophenia elegans, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 169; Encyclop. Méth., Zooph., 1824, p. 16.

Aglaophenia avicularis, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 33, pls. i. and iii., fig. 3.

Halicornopsis avicularis, Bale, Journ. Micro. Soc. Vict., ii., 1881, p. 26, pl. xiii., fig. 3; Cat. Austr. Hyd. Zooph., 1884. p. 185, pl. x., figs. 1, 2, pl. xix., fig. 32; Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, pp. 90, 101. Marktanner. Turneretscher, Ann. k.k. Hofmus. Wien. v., 1890, p. 279.

Azygoplon rostratum, Allman, Rep. Sci. Results "Challenger" Exp., Zool., vii., 1883, p. 54, pl. xix, fig. 1-3.

Halicornopsis elegans, Billard, Ann. Sci. Nat., Zool., (9) v., 1907, p. 323; Comp. Rend., cxlvii., 1908, p. 940; Ann. Sci. Nat., Zool., (9), ix., 1909, p. 329; *Ibid*, (9) xi., 1910, p. 44. Ritchie, Mem. Austr. Mus., iv., 1911, p. 855, pl. lxxxix., fig. 1.

The first account of this species which was of any value was that of Kirchenpauer, who described it as new in 1872, under the name of *Aglaophenia avicularis.* Later it was successively described as new by myself and Allman, under the respective names of *Halicornopsis avicularis* and *Azygoplon rostratum*; but Billard, in 1907, announced from his examination of the type specimens that it was identical with the *Plumularia elegans*, Lamarck, a species which had been described both by Lamarck and Lamouroux, but not in such a way as to render it identifiable. None of the descriptions were complete and correct in all particulars, while one important feature—the presence of a median sarcostyle behind the hydrotheca—remained unnoticed till pointed out by Ritchie; and I have further observed, in examining specimens collected by the "Endeavour" in the Great Australian Bight, that this sarcostyle is not always naked, as described by Ritchie, but is, sometimes at least, protected by a sarcotheca of the most rudimentary form.

The hydrophyton, in the young state, is monosiphonic, but afterwards becomes fascicled in the older portions. The branches, which are not in any regular order, spring from the internodes of the stem or older branches, not taking the place of a hydrocladium, but originating opposite one. There is much irregularity in the arrangement of the first few internodes of a branch. Following the stem-process which supports the branch, there is frequently but one very short internode bearing a sarcotheca only, before the hydrocladia-bearing internodes commence; in other cases the first internode is much longer, with two or three median sarcothecæ, and sometimes a hydrocladium also. The process itself has usually two sarcothecæ, both on a level and widely apart; sometimes only one is present however, and in Ritchie's specimens there were three.

The hydrocladiate tube is mostly composed of single or double internodes, supporting respectively one or two of the alternate hydrocladia. In some specimens the shorter internodes predominate, in others the longer, and frequently the two forms are interspersed at random, while in other cases all the internodes may be alike. I have observed instances in which the first two or three hydrocladiate internodes of a branch are more elongated still, supporting each three hydrocladia.

The hydrocladia are at an angle of 45° or somewhat less, and are directed somewhat forward. Their internodes have the perisarc, at the distal extremity, produced a little forward so as to form a thin, delicate, collar-like extension, surrounding the node, and continued into two narrow webs which run backward along the upper side of the internode, to join the sides of the hydrotheca. Midway between these, and under the back of the hydrotheca, is situated the sarcopore. This orifice is obvious enough in a front view of the hydrocladium, but owing to the back of the hydrotheca being immediately above it, it appears closed in, and resembles a circular thin area, for which I mistook it until Ritchie called attention to its true nature. On one of the "Endeavour" specimens, which, when cleaned with liquor potassæ and mounted in glycerine, was absolutely colourless and of glassy transparency, I was able not only to verify Ritchie's observation, but to discover a distinct sarcotheca (if the term may be applied to a structure so rudimentary), just over the orifice. As seen in front view it is simply a tongue-shaped flap of the perisarc, of excessive delicacy and tenuity, visible through the back of the hydrotheca, and usually projecting slightly beyond it. In lateral view, being seen edge-wise, it appears strictly linear, and is arched over the sarcopore in an almost semi-circular form. Careful examination discloses the presence of this structure in several of my other specimens, but there are some in which I have not succeeded in finding it.

Apart from these peculiarities the hydrotheca differs considerably from that of ordinary Statopleans. Its rostrum is formed, not, as is usual, by the anterior sarcotheca, but by a prolongation of the hydrotheca itself, somewhat as in *Aglaophenia formosa* (Busk). Here, however, the front of the rostrum is closed in by a thin wall, which is continued downward into the cavity of the hydrotheca, forming an anterior intrathecal ridge, and terminating in a thickened margin. In the first hydrotheca of each hydrocladium this rostrum is commonly much reduced. On each side of the hydrotheca-margin there is a small rounded lobe, and running from the intrathecal ridge to this lobe is a broad curvilinear band, distinguished from the rest of the hydrotheca by a difference in thickness (the band being apparently thinner). The back of the hydrotheca is broadly sinuated.

The anterior sarcotheca is short, and situated opposite the base of the rostrum; at first sight it would appear to originate from the internode and to run up the front of the hydrotheca, as in an ordinary *Aglaophenia*; closer observation, however, shows that what might be taken for the proximal part of the sarcotheca is really a process from the internode, not specially devoted to the sarcotheca, but forming the channel of communication between the cavity of the hydrocaulus and that of the hydrotheca, which connect by means of a small opening into the hydrotheca (the *hydropore*) situated at the top of this process. Opposite to this opening, and crowning the summit of the process, is the sarcotheca, which is short, scoop-shaped, and entirely open on the inner side. The position of the hydrotheca is similar to that seen in some *Plumulariæ (e.g. P. goldsteini)*, in which the widening of the proximal end of the internode, to embrace the base of the hydrotheca, is carried to such an extent as to form a distinct process, in the axil of which the hydrotheca is situated.

The cauline sarcothecæ are small and inconspicuous. There is one on the rachis, just above the hydrocladium, another, often very difficult to make out, on the base of the latter, while a third, as Ritchie has pointed out, is found in the axil.

The gonothecæ, which are borne on the bases of the hydrocladia, and are often turned alternately to left and right, are somewhat irregularly ovate thick-walled capsules, showing no trace of operculum or orifice. In places where they have been detached a small basin-shaped portion of the base is often left behind, it would seem probable therefore that the opening so formed may be the normal channel of exit of the contents.

The colour of the zoophyte varies a good deal, ranging from a very light brown to a reddish tint. The hydrothecæ measure from the point of the rostrum to the furthest point of the adcauline side from ·34 mm. (in the proximal ones) to ·52 mm. Single internodes of the rachis range from ·33 to ·59 mm., double ones from ·52 to 1·2 mm., hydrothecal internodes from ·3 to ·36 mm.

Though decidedly Statoplean in habit, the species seems, in its minute structure, at least as nearly allied to the Eleutheroplea. The situation of the hydrotheca in the axil of a process from the internode, is, as already mentioned, a distinctly Plumularian character, and the mesial sarcotheca is also very similar to those of some of the Eleutheroplea. And in the median sarcostyle behind the hydrotheca we have a character by which the species is closely allied to some of the species of *Plumularia*, as well as to the series of forms which have been grouped under the genus *Kirchenpaueria*.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Genus Kirchenpaueria, *Jickeli*.

Kirchenpaueria producta *Bale*.

Plumularia producta, Bale, Journ. Micro. Soc. Vict., ii., 1881, p. 39, pl. xv., fig. 3; Cat. Austr. Hydr. Zooph., 1884, p. 133, pl. x., fig. 4; Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 96. Inaba, Zool. Mag. (Tokyo), No. 34, 1891, p. —— figs. 69-70.

Azygoplon productum, Bale, Proc. Linn. Soc. N.S. Wales, (2) iii., 1888, p. 774, pl. xix., fig. 1-5.

Kirchenpaueria producta, Bale, Proc. Roy. Soc. Vict., (N.S.) vi., 1893, p. 111.

Halicornaria producta, Torrey, Univ. California Publ., i., 1902, p. 75, pl. x., fig. 95.

Diplocheilus productus, Torrey, Univ. California Publ., ii., 1904, p. 35. Stechow, Abh. math.-phys. Klasse k. Bayer Akad. Wissensch., I. Suppl. Band, 1909, pp. 88, 89.

One or two specimens were found growing on some of the larger Hydroids, and not differing in any important particular from the type.

In some examples of this species, which I have examined since my descriptions were published, I find the opening of the hydrotheca, as seen in front view, less narrowed than I have figured it. In most cases however, the sides of the hydrothecæ, owing to their excessive delicacy, are more or less bent or distorted, even when they have never been dried, so that it is not easy to find specimens which have kept their shape perfectly. But I have not in any case found the aperture distinctly circular, as in *K. mirabilis.*

Torrey retains for this species and *K. mirabilis*, on grounds which I consider untenable, the generic name of *Diplocheilus*, Allman, in which he has been followed by several other observers; while Billard on the other hand has argued in favour of relegating them to the genus *Plumularia.*

Torrey's remarks are as follows—"According to Jickeli's figure the hydroid for which he erects the genus is an eleutheroplean plumularian—probably a *Plumularia*—with nematophores broken away. The frequent absence of nematophores in species which characteristically possess them and the absence of any other distinguishing characters remove the slender claims to priority over *Diplocheilus* which have been made for this inadequate genus."

With the statement that Jickeli's figure represents an Eleutheroplean I fully agree, but I do not infer, as Torrey apparently does, that *K. producta* is therefore not referable to the genus; on the contrary, I am now convinced that the species is not only an Eleutheroplean but a true *Plumularia*, unless the characters assigned by Jickeli to his genus suffice for its separation.

The further statement that the figure represents a specimen with the nematophores broken off is unwarranted. In reality all the species which are known to agree with Jickeli's in possessing naked sarcostyles agree with it also in being unprovided with lateral sarcothecæ.

The remark that "the absence of any other distinguishing characters" (that is other than the absence of the lateral nematophores), removes the claim to priority of the genus is equally unfortunate. Other characters are *not* absent, indeed it is precisely on these other characters, namely the possession of naked sarcostyles and the rudimentary condition of the anterior sarcothecæ, that the genus was founded, Jickeli laying no stress on the absence of the lateral sarcothecæ. But Torrey, while disallowing Jickeli's genus on the ground of its inadequacy, proceeds to re-establish the genus *Diplocheilus*, basing it on precisely the same characters that Jickeli established his genus upon. Such a position is of course untenable, and it is obvious that if *Kirchenpaueria* is inadequate *Diplocheilus*, being completely synonymous with it, must be equally inadequate.

But if observers ultimately agree to accept the genus, then, notwithstanding that Jickeli's account of it is clear, correct, and unmistakable, while Allman founded his genus on a misinterpretation of structure, priority, if ascertainable, must decide which name is to stand. I have not been able to settle this question. The prefatory note to Allman's "Report on the Hydroida dredged by H.M.S. 'Challenger' during the years 1873-76; part i., Plumulariadæ" is dated the 20th July, 1883, but I have no means of ascertaining how long a period elapsed between that date and the actual time of publication. Nor can I find the precise date of publication of Jickeli's paper in the "Morphologisches Jahrbuch," though there is a notice of it in the "Journal of the Royal Microscopical Society" for August 1883. The probability is that Jickeli has priority, but in any case the merit of correctly defining the genus rests with him, and is ample warrant for preferring the name given by him until the question of priority can be settled.

The following species are referable to the genus *Kirchenpaueria*, *Plumularia pinnata* (Linn.), *P. similis*, Hincks, *P. hians*, Marktanner-Turneretscher, *P. producta*, Bale, *Diplocheilus mirabilis*, Allman, and *D. allmani*, Torrey. While they all agree in the possession of naked sarcostyles and the absence of the lateral nematophores, the last three differ from the others in having an intrathecal ridge, anterior in position, just below the lip. It was on a misinterpretation of this ridge in *D. mirabilis* that Allman founded his genus; there is however nothing peculiar about its form, which is precisely the same as found in many Statopleans and in some typical *Plumulariæ*, for example in *Lytocarpus philippinus*, *Aglaophenia plumosa*, and *Plumularia balei*, Bartlett. The presence of the intrathecal ridge is mentioned by Torrey in his description of the genus, but it has never been regarded by observers as of generic importance, and all the larger genera of the Plumularidæ,—*Aglaophenia*, *Lytocarpus*, *Halicornaria*, and *Plumularia*—comprise species both with and without this characteristic.

Whether the genus *Kirchenpaueria* is sufficiently distinct or whether all the species should, as Billard suggests, be referred to *Plumularia*, is a question which I leave to others to determine, though the fact that these few species agree among themselves and differ from all the other forms of *Plumularia* in such important characters, must have some weight. To one feature however,—the form of the anterior sarcothecæ—I attach no importance. They are—in *K. producta* and *K. mirabilis*—merely the ordinary fixed anterior sarcothecæ, modified by the terminal loculus being very widely expanded and very shallow; in short, they are saucer-shaped rather than cup-shaped. Jickeli calls them dish-shaped continuations of the perisarc. Moreover they vary, and I have seen them in *K. producta* scarcely differing from the ordinary form found in such species as *P. campanula*. In the case for the retention of the genus it is doubtless a weak point that it rests on the concurrence of two distinct features—the presence of naked sarcostyles and the absence of the supracalycine nematophores—and that there appears to be no necessary reason why these characteristics should always be found associated, as however, they are in all the species yet known.

Loc.—Bass Strait.

EXPLANATION OF PLATE I.

Fig. 1. *Aglaophenia macrocarpa*, Bale, from an incomplete specimen in the Australian Museum, to show ramification. Natural size.

Fig. 2. The same, seen laterally.

Fig. 3. *Synthecium subventricosum*, sp. nov.; x 40.

Fig. 4. *Synthecium subventricosum*, sp. nov.; x 40.

Fig. 5. *Synthecium subventricosum*, sp. nov.; x 40. Gonotheca.

Fig. 6. *Campanularia pumila*, sp. nov.; x 40.

Fig. 7. *Campanularia pumila*, sp. nov.; x 40. With double and triple peristome.

Fig. 8. *Campanularia pumila*, sp. nov.; x 80. With double peristome.

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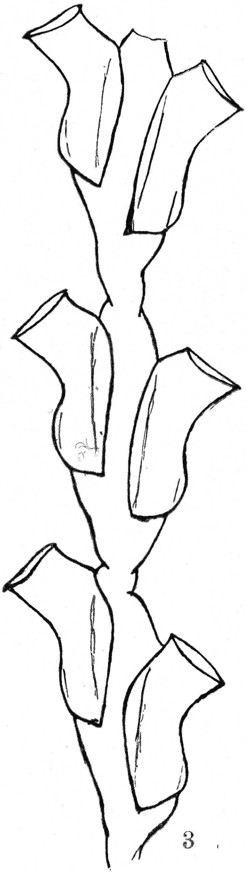

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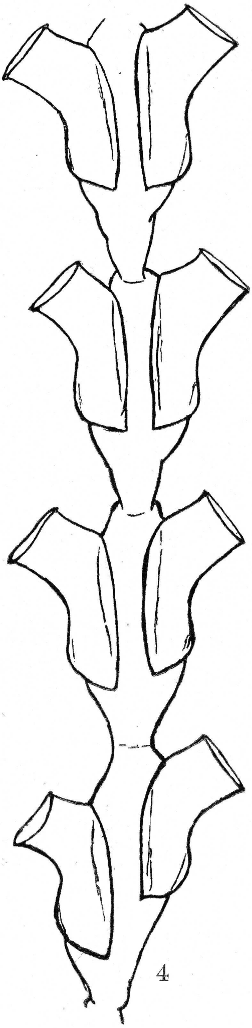

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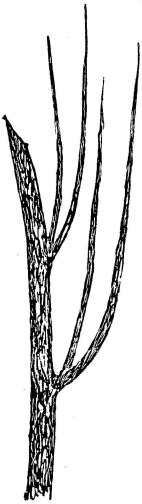

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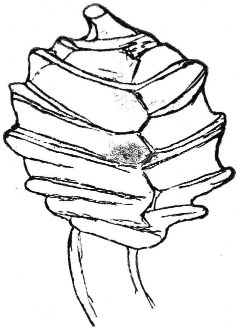

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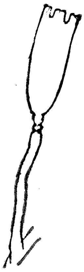

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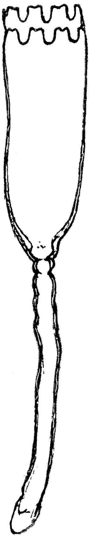

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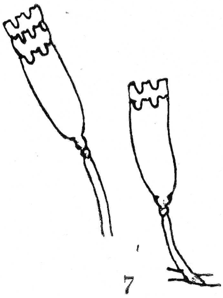

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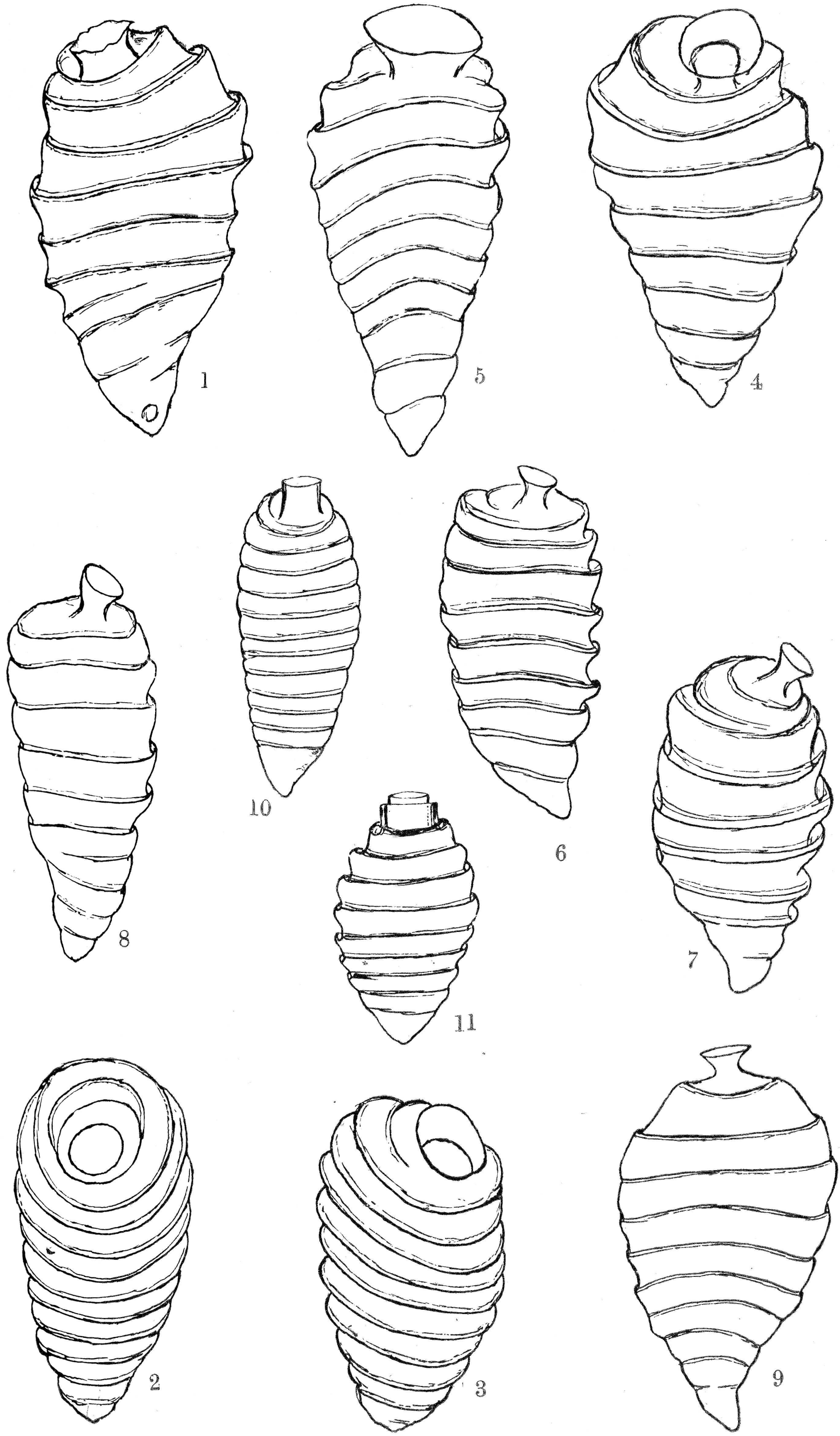
W. M. BALE, del.

EXPLANATION OF PLATE II.

Gonothecæ of *Sertularella divaricata* (Busk), and allied forms; x 40.

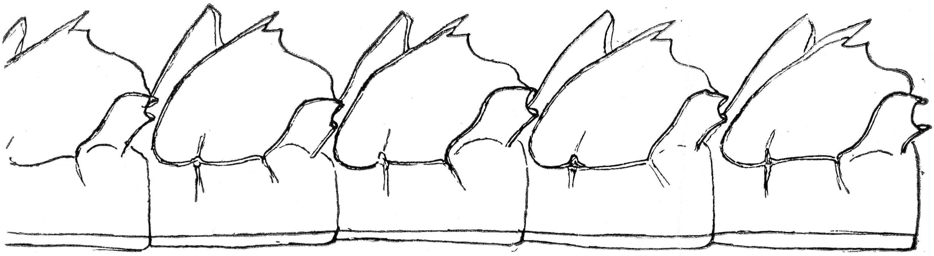
Fig. 1. *Sertularella divaricata* (Busk). Port Stephens.
Fig. 2. *Sertularella divaricata*, *var. dubia*, Bale. Bondi.
Fig. 3. The same.
Fig. 4. *Sertularella divaricata*, *var.* Port Phillip, 1890.
Fig. 5. *Sertularella divaricata*, *var.* Hunter Group.
Fig. 6. *Sertularella divaricata*, *var. subdichotoma*, Bale, (= *S. subdichotoma* Kirchenpauer.)
Fig. 7. *Sertularella divaricata*, *var.* Port Phillip, 1881. (= *S. johnstoni*, Bass Strait variety, Bale).
Fig. 8. *Sertularella divaricata*, *var.* Port Phillip, 1889.
Fig. 9. *Sertularella divaricata*, *var.* Great Australian Bight.
Fig. 10. *Sertularella johnstoni* (Gray). New Zealand.
Fig. 11. *Sertularella pygmæa*, Bale. Port Phillip.



W. M. BALE, del.

EXPLANATION OF PLATE III.

Fig. 1. *Aglaophenia macrocarpa*, Bale.
Fig. 2. *Aglaophenia tasmanica*, sp. nov.
Fig. 3. *Aglaophenia billardi*, sp. nov.
Fig. 4. *Aglaophenia dannevigi*, sp. nov.
Figs. 1-4 x 80.



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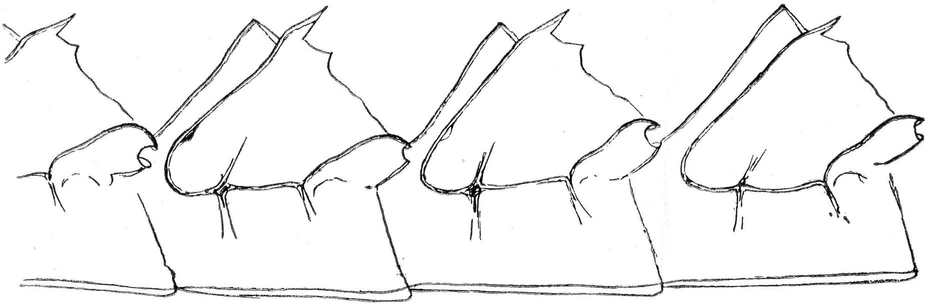

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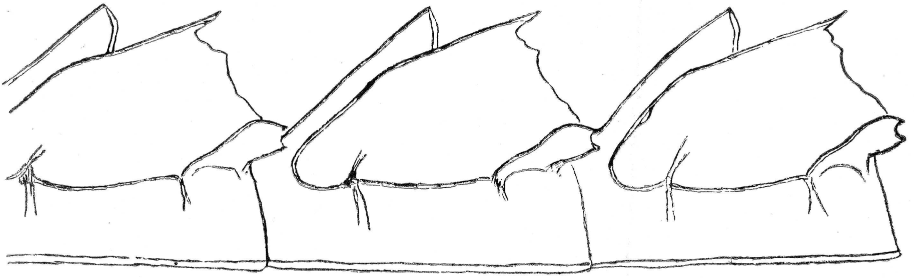

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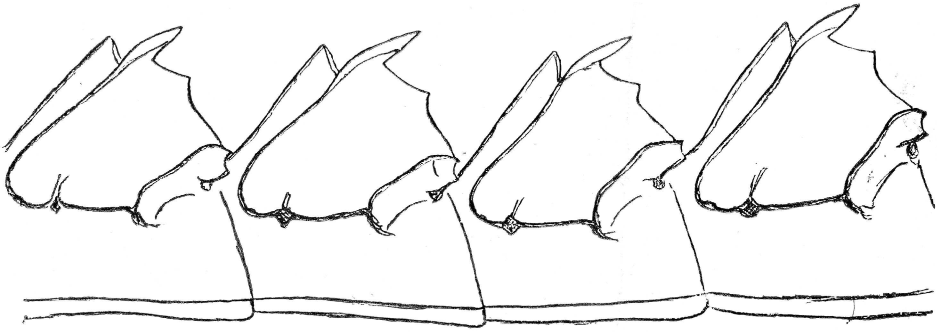

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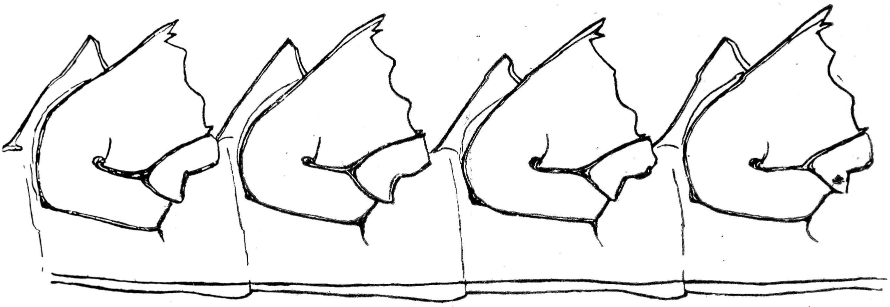
W. M. Bale, del.

EXPLANATION OF PLATE IV.

Fig. 1. *Aglaophenia megalocarpa*, sp. nov.
Fig. 2. *Plumularia asymmetrica*, sp. nov. Front view.
Fig. 3. *Plumularia asymmetrica*, sp. nov. Side view.
Fig. 4. *Agloaphenia decumbens*, sp. nov.
Fig. 5. *Halicornaria birostrata*, sp. nov.
Figs. 1-5 x 80.



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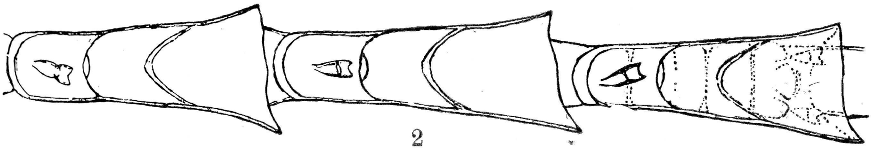

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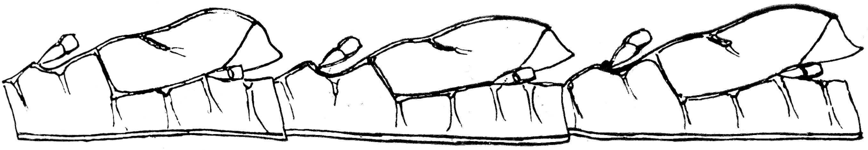

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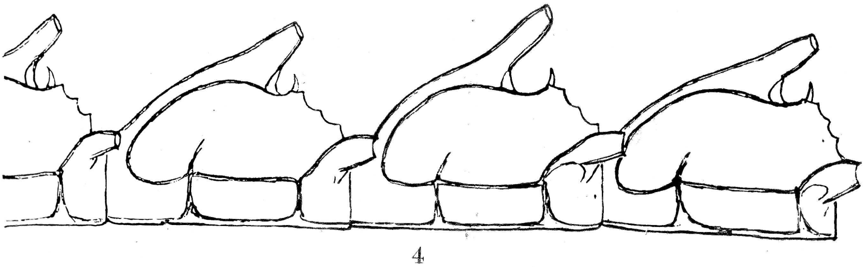

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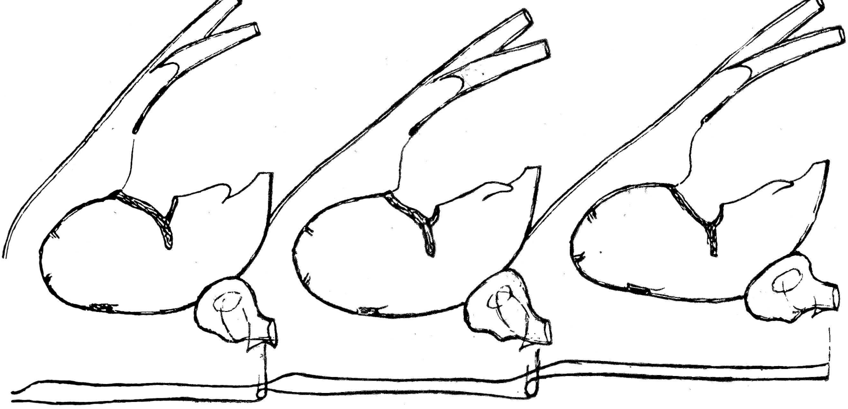

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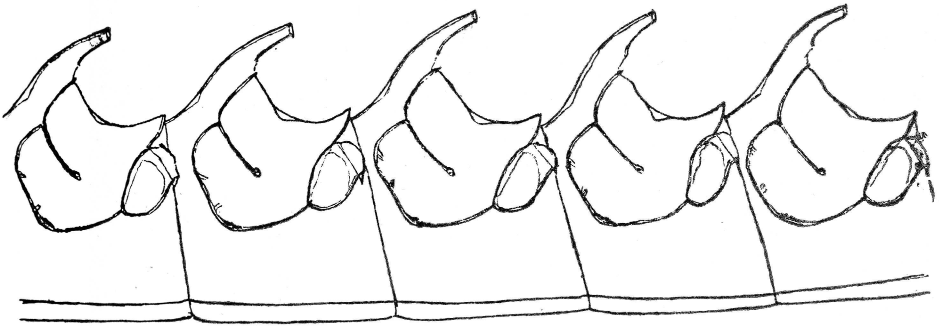
W. M. Bale, del.

EXPLANATION OF PLATE V.

Fig. 1. *Halicornaria baileyi*, Bale.
Fig. 2. *Halicornaria intermedia*, sp. nov.
Fig. 3. *Halicornaria furcata*, Bale.
Fig. 4. *Halicornaria urceolifera* (Lamarck)
Figs. 1-4 x 80.



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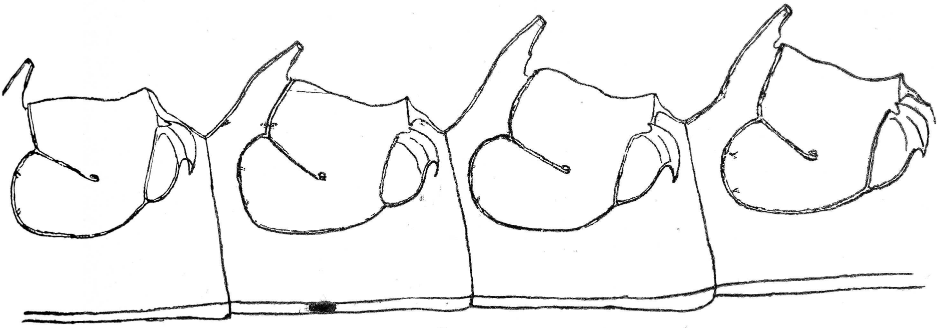

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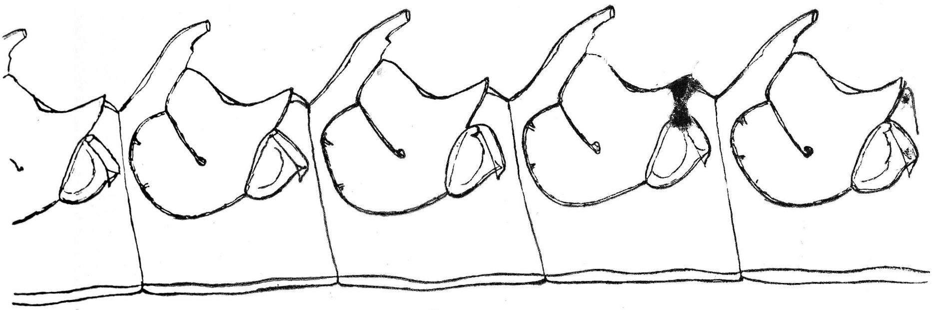

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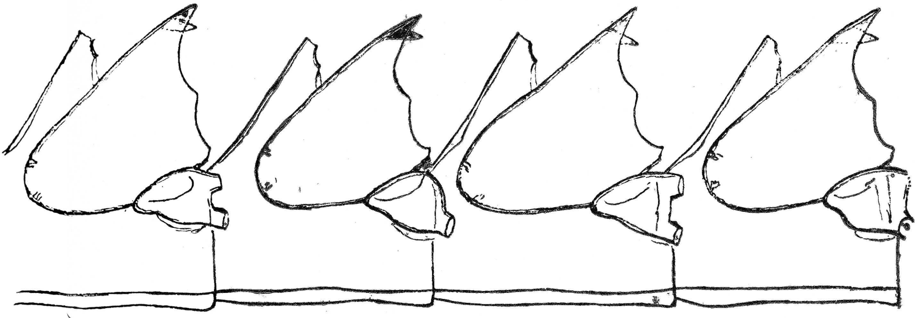

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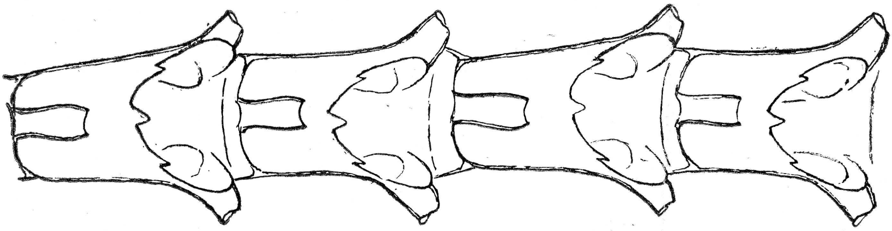
W. M. BALE, del.

EXPLANATION OF PLATE VI.

Fig. 1. *Aglaophenia macrocarpa*, Bale.
Fig. 2. *Aglaophenia tasmanica*, sp. nov.
Fig. 3. *Aglaophenia billardi*, sp. nov.
Fig. 4. *Aglaophenia dannevigi*, sp. nov.
Fig. 5. *Aglaophenia megalocarpa*, sp. nov.
Fig. 6. *Aglaophenia decumbens*, sp. nov.
Figs. 1-6 x 80.



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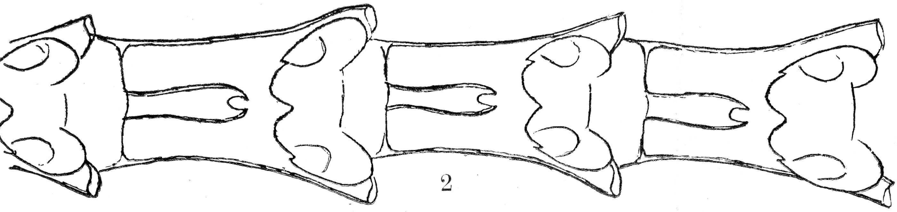

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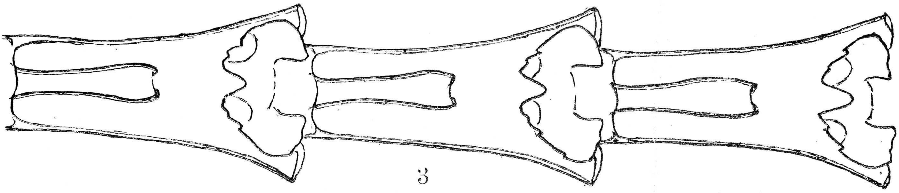

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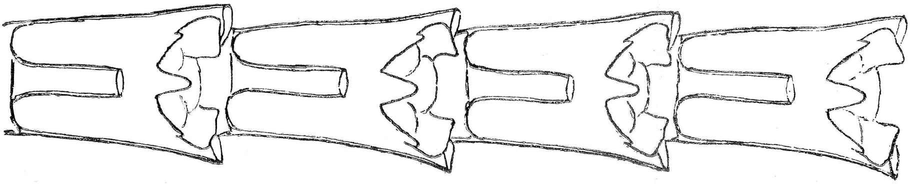

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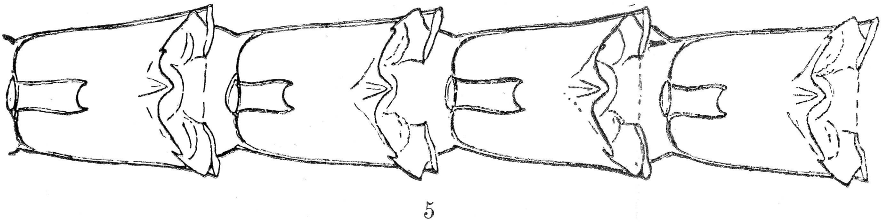

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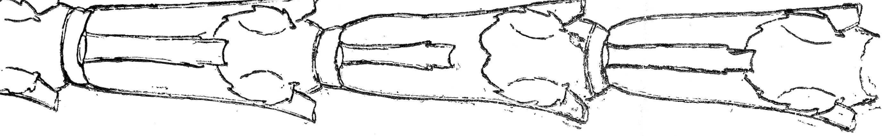

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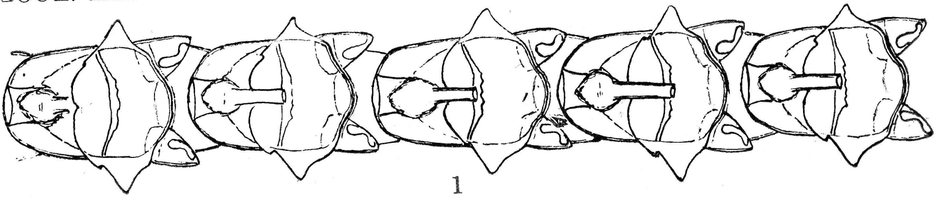
W. M. BALE, del.

EXPLANATION OF PLATE VII.

Fig. 1. *Halicornaria baileyi*, Bale.
Fig. 2. *Halicornaria furcata*, Bale.
Fig. 3. *Halicornaria intermedia*, sp. nov.
Proximal end of hydrocladium.
Fig. 4. *Halicornaria intermedia*, sp. nov.
Distal portion of hydrocladium.
Fig. 5. *Halicornaria urceolifera* (Lamarck).
The specimen figured is of the maximum width; the hydrocladia are usually narrower, often no wider than those of *H. furcata*.
Fig. 6. *Halicornaria birostrata*, sp. nov.
Figs. 1-6 x 80.



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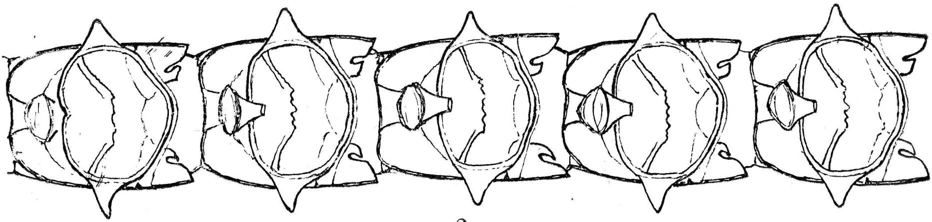

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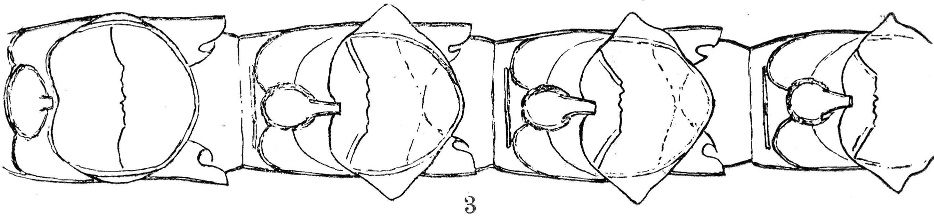

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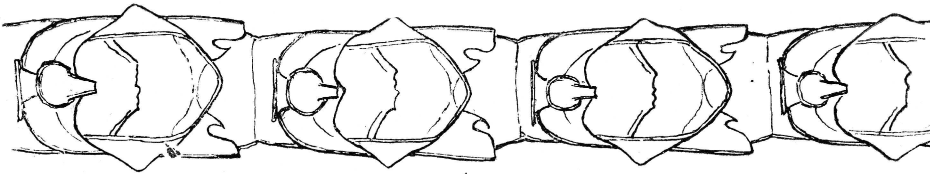

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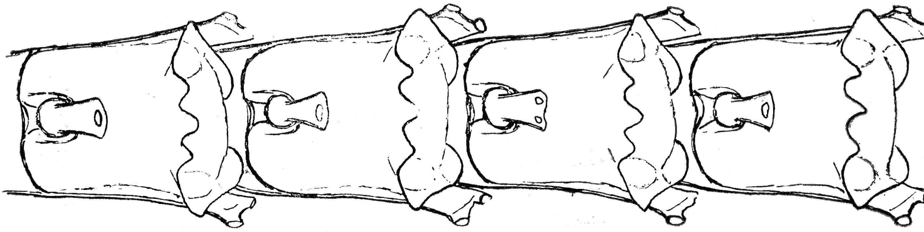

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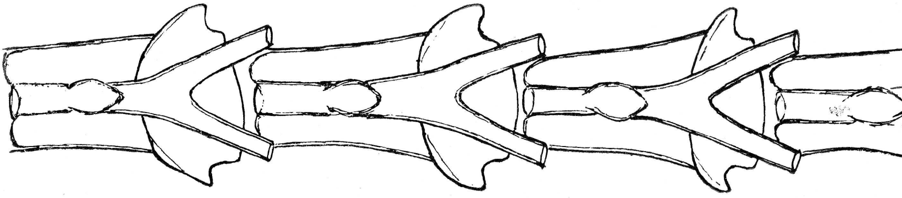

6

W. M. BALE, del.