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Biological Results of the Fishing Experiments carried on by the F.I.S. "Endeavour," 1909-14.

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REPORT ON THE HYDROIDA.

PART III.

I.—INTRODUCTION.

IN this third and concluding Report on the Hydroida collected by the "Endeavour" are enumerated all the species observed (except two or three forms represented only by very imperfect specimens), with their localities, and, in the case of those not already dealt with, their synonymy and such other notes as it is thought might be of interest. Under the names of species which have been described in Parts I and II will be found references to the pages of those parts where they are treated of, with, in some cases, further remarks on specimens observed later.

Altogether sixty-four species or varieties are represented in the collections, of which twenty-two species and four varieties were considered to be new. All of these were described in the two former Reports, except *Sertularella tasmanica*, *S. undulata*, *Sertularia pusilla*, *Nemertesia ciliata*, var. *cruciata*, *Aglaophenia divaricata*, var. *cystifera*, and *Cladocarpella multiseptata*, which are the only new forms described in the present Report. In two or three instances the new material has enabled me to describe the gonangia of other species of which the gonosome was previously unknown.

The following is a list of the species observed :—

Order GYMNOBLASTEA.

Family HYDROCERATINIDÆ.

Clathrozoon wilsoni, Spencer.

Order CALYPTOBLASTEA.

Family CAMPANULARIIDÆ.

Campanularia pumila, Bale.

Family CAMPANULINIDÆ.

Thyroscyphus marginatus, Bale.
Thyroscyphus simplex (Lamouroux).

Family HALECIIDÆ.

Halecium flexile, Allman.

Family LAFOËIDÆ.

Perisiphonia exserta (Busk).
Cryptolaria arboriformis, Ritchie.
Cryptolaria angulata, Bale.
Hebella calcarata (L. Agassiz).
Hebella calcarata (L. Agassiz), var. *contorta*, Marktanner-Turneretscher.
Lafoëa gracillima (Alder).

Family SERTULARIIDÆ.

Sertularella gaudichaudi (Lamouroux).
Sertularella gayi (Lamouroux).
Sertularella tasmanica, sp. nov.
Sertularella undulata, sp. nov.
Sertularella indivisa, Bale.
Sertularella neglecta, Thompson.
Sertularella divaricata (Busk).
Sertularella adpressa, Ritchie.
Sertularella lata (Bale).
Thuiaria sinuosa, Bale.
Synthecium subventricosum, Bale.
Hypopyxis distans, Bale.
Selaginopsis dichotoma (Allman).
Diphasia subcarinata (Busk).
Sertularia minima, Thompson.
Sertularia pusilla, nom. nov.
Sertularia loculosa, Bale.
Sertularia operculata, Linné.
Sertularia elongata, Lamouroux.
Sertularia unguiculata, Busk.
Sertularia geminata, Bale.
Sertularia maplestonei, Bale.
Sertularia macrocarpa, Bale.

Family PLUMULARIIDÆ.

Plumularia campanula, Busk.
Plumularia zygocladia, Bale.
Plumularia buski, Bale.
Plumularia procumbens, Spencer.
Plumularia sulcata, Lamarck.
Plumularia asymmetrica, Bale.
Nemertesia ciliata, Bale.
Nemertesia ciliata, Bale, var. *cruciata*, var. nov.
Kirchenpaueria producta, Bale.
Halicornopsis elegans (Lamarck).

Hydroida, but not always with success. Of the more important papers which I have been unable to obtain, most refer to northern species; in one or two cases, however, notably in that of Professor D'A. W. Thompson's Report on the Hydroida of the "Vega" Expedition, all my efforts to secure copies have failed, and I mention the circumstance in case any of the species which I have described as new may prove identical with any therein described. A list of the literature to which reference is made will be found at the end of this Report.

IV.—Description of the Genera and Species.

Order GYMNOBLASTEA.

Family HYDROCERATINIDÆ.

Genus Clathrozoon, *Spencer.*

Clathrozoon wilsoni, *Spencer.*

Clathrozoon wilsoni, Spencer, Trans. Roy. Soc. Vict., ii., 1891, pp. 121-129, pls. xvii.-xx. *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 96. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 810.

Some very robust colonies were collected, attaining a height of over a foot.

Locs.—South Australian coast.

Great Australian Bight, 80-100 fathoms.

Order CALYPTOBLASTEA.

Family CAMPANULARIIDÆ.

Genus Campanularia, *Lamarck.*

Campanularia pumila, *Bale.*

Campanularia pumila, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 4, pl. i., figs. 6-8.

A *Campanularia* in the Lamarckian sense, but wanting the gonosome.

Loc.—Great Australian Bight, parasitic on *Synthecium subventricosum*, Bale, 40-100 fathoms.

Family CAMPANULINIDÆ.

Genus THYROSCYPHUS, *Allman*.

THYROSCYPHUS MARGINATUS, *Bale*.

Campanularia marginata, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 54, pl. i., fig. 2. *Id.*, Bartlett, Geelong Nat., (2), iii., 1907, p. 62, fig. —.

" *Campanularia* " *marginata*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 289.

Thyroscyphus marginatus, Bale, Proc. Roy. Soc. Vict., (n.s.), xxvii., 1914, p. 91.

The specimens, like all others hitherto observed, are without the gonosome.

Loc.—Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

THYROSCYPHUS SIMPLEX (*Lamouroux*).

Laomedea simplex, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 206. *Id.*, Deslongch., Encyc. Méth., Zooph., 1824, p. 482.

Campanularia simplex, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 58.

Campanularia tridentata, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 98, pl. iii., fig. 3.

Sertularella tridentata, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 46, fig. 21.

Thyroscyphus tridentatus, Hartlaub, Zool. Jahrb., xiv., 1901, p. 369, pl. xxi., fig. 14, pl. xxii., fig. 23. *Id.*, Ritchie, Trans. Roy. Soc. Edin., xlvii., 1909, p. 74, fig. 1-1b.

Thyroscyphus simplex, Billard, C. R. Acad. Sci., cxlviii., 1909, p. 1065; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 312. *Id.*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 292. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 288.

Parascyphus simplex, Ritchie, Ann. Scot. Nat. Hist. Edinb., xx., 1911, p. 160, fig. 1.

This species, which was previously known only from Australia and New Zealand, has been recorded by Ritchie from the British coast and the South Atlantic. The present specimens include the gonangia, hitherto unknown. These are borne on the lower part of the shoots, and, in my

specimens, vary from one to four. They are of an elongated ovate form, smooth, apparently not compressed, and the top is rounded, with a small circular aperture, which has the rim thickened, but not forming an elevated collar. Their length is about 1.4 mm., their diameter at the widest part, which is not far from the summit, about .6 mm.

Locs.—Forty miles west of Kingston, South Australia, 30 fathoms.

Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Family HALECIIDÆ.

Genus HALECIUM, *Oken.*

HALECIUM FLEXILE, *Allman.*

Halecium flexile, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 11, pl. v., fig. 2, 2a. *Id.*, Jäderholm, Arkiv. f. Zool. k. svenska Vetenskapsakad., i., 1903, p. 265. *Id.*, Thornely, Report on Pearl Fisheries of the Gulf of Manaar, Suppl. Rep. viii., 1904, p. 112. *Id.*, Hartlaub, Zool. Jahrb., Suppl. vi., iii., 1905, p. 611, figs. J3, K3. *Id.*, Jäderholm, Schwedischen Südpolarexp., v., 1905, p. 13. *Id.*, Billard, C.R. Acad. Sci., cxlvii., 1908, p. 1355; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 3. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 811. *Id.*, Stechow, Abh. math.-phys. Klasse der K. Bayer Akad. der Wissensch., iii. Suppl.-Bd., 1913, p. 81, figs. 45-49. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 286.

Halecium gracile, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 759, pl. xiv., figs. 1-3; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 99. *Id.*, Clarke, Bull. Mus. Comp. Zool. Harvard, xxv., 1894, p. 74. *Id.*, Jäderholm, Arkiv. f. Zool. k. svenska Vetenskapsakad., i., 1903, p. 266, pl. xii., figs. 2-3. *Id.*, Billard, Actes Soc. Linn. Bordeaux, lxi., 1906, p. 70; *Id.*, Billard, Bull. Mus. d'Hist. Nat., 1906, p. 329; *Id.*, Billard, Exp. Antarct. franç., 1906, p. 10; *Id.*, Billard, Exp. Sci. du "Travailleur" et du "Talisman", viii., 1906, p. 163. *Id.*, Motz-Kossowska, Arch. Zool. exp. et gén., (5), vi., 1911, p. 335, figs. vii.-viii.

Halecium parvulum, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 760, pl. xiv., figs. 4-5. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 218, pl. iii., fig. 22. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 461.

Halecium balei, Fraser, Bull. Lab. Nat. Hist. State Univ. Iowa, vi., 1911, p. 46.

No. 16, *Halecium sp.*, Inaba, Zool. Mag. Tokyo, 1890, figs. 41-45.

Not *Halecium gracile*, Verrill, Report on the Invertebrate Animals of Vineyard Sound, 1874, p. 729. *Id.*, Nutting, Bull, U. S. Fish. Comm., 1901, p. 358, fig. 54.

The specimens observed were small and monosiphonic, agreeing with the form originally described by me as *H. gracile*. In treating it as synonymous with the much larger *H. flexile* of Allman, I follow Billard, who has examined the type in the " Challenger " collection.

Locs.—Forty miles west of Kingston, South Australia, 30 fathoms.

Ten miles north of Circular Head, Tasmania.

Family LAFOËIDÆ.

The species here referred to the Lafoëidæ belong to the genera *Perisiphonia*, *Cryptolaria*, *Hebella*, and *Lafoëa*. These genera, with others nearly allied to them, are generally recognised as members of the family ; Levinsen, however, giving it a more comprehensive signification, would assign to it also " the species referred to *Synthecium*, *Hypopyxis*, *Staurotheca*, and the inoperculate species referred to *Dictyocladium*, *Selaginopsis*, *Sertularia* and *Sertularella*."[1] Species belonging to these groups are dealt with in this Report under the Sertulariidæ.

Genus PERISIPHONIA, *Allman.*

PERISIPHONIA EXSERTA (*Busk*).

Cryptolaria exserta, Busk, Quart. Journ. Micro. Sci., vi., 1858, p. 130, pl. xix., fig. 3-3b.

Perisiphonia filicula, Allman, Rep. Sci. Results " Challenger " Exped., Zool., xxiii., 1888, Hydroida, pt. II., p. 44, pl. xxii., figs. 1-4.

Zygophylax (*Perisiphonia*) *filicula*, Clarke, Mem. Mus. Comp. Zool. Harvard, xxxv., 1907, p. 16.

Perisiphonia exserta, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 834, pl. lxxxvii., fig. 3. *Id.*, Stechow, Abh. math.-phys. Klasse K. Bayer Akad. der Wissensch., iii. Suppl.-Bd., 1913, p. 117. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 290.

1. Levinsen—Systematic Studies on the Sertulariidæ—Vidensk. Medd fra den naturh. Foren, lxiv., 1913, p. 286.

Cryptolaria exserta was described by Busk in one of the series of papers entitled "Zoophytology" which were published in the "Quarterly Journal of Microscopical Science" during his co-editorship. J. Y. Johnson, whose name has been commonly, but erroneously, appended to the species, had no connection with it beyond sending the specimens from Madeira to Mr. Busk.

Ritchie, after examining "Challenger" specimens of *P. filicula*, Allman, is satisfied of their identity with *P. exserta*, but dissents from the suggestion of Pictet and Bedot that *P. pectinata*, Allman, is not distinct from *P. filicula*. Ritchie enumerates a number of discrepancies between the "Challenger" specimens and Allman's description and figure, and in each instance the present specimens confirm Ritchie's account.

To the previous descriptions I may add, with regard to the ramification, that the pinnæ, which to the naked eye appear opposite, do not originate at precisely the same level, but one is higher than the other by the length of a hydrotheca. Sometimes a secondary pinna springs from a primary one close to its origin.

The gonosome has not been observed hitherto, unless, as Ritchie thinks probable, Pictet and Bedot's *P. pectinata* is really to be referred to the present species. Coppiniæ were present on one or two of our specimens, extending to over half an inch in length. The cells are sharply polygonal, except the short distal portion, which projects in the form of a small rounded dome; the aperture is small and circular, and one side of the rim is produced into a conical horn. From among the cells spring many crooked slender filaments, each supporting a few distant sarcothecæ.

Locs.—Oyster Bay, Tasmania, 60 fathoms.

Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

Thirty-five miles south east of Bruni Island, Tasmania, 150-230 fathoms.

Genus CRYPTOLARIA, *Busk.*

CRYPTOLARIA ARBORIFORMIS, *Ritchie.*

Cryptolaria arboriformis, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 824, pl. lxxxiv., fig. 1, pl. lxxxvii., fig. 7. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 289.

Specimens of this hydroid were obtained which fully agreed with Ritchie's account in regard to the weather-beaten aspect

and the dark brown colour. These, however, were overrun by a species of *Lafoëa*, the stolons of which so completely swathed the hydrosoma that no portion of the supplementary tube system of the *Cryptolaria* was visible except at the extremities of some of the smaller branches. I am indebted to Mr. Briggs for portions of his specimens from Thouin or Wineglass Bay, near Freycinet Peninsula, Tasmania, which being free from the *Lafoëa*, enable me to observe the normal structure.

These specimens are pale in colour, the dark brown seen in the "Endeavour" specimens residing mainly in the stolons of the *Lafoëa*. In both cases I found a few very young lateral branches, which exhibited the structure before the supplementary tubes had enveloped them.

A branch at its origin consists of a single slender tube of a length about equal to that of a hydrotheca. On the formation of the first hydrotheca the branch abruptly doubles its width, the hydrotheca being about equal to the axial tube in diameter. The hydrotheca is directly in line with the proximal part of the axial tube, which makes a sharp curve round its base. By the time the second hydrotheca is formed fasciculation has commenced, two delicate stolons being given off from the base of the first hydrotheca, one on each side, and running along the branch outward. Other tubes originate from the later-formed hydrothecæ, and these, together with tubes which proceed from the stem along the branch, make up the fascicle. In the "Endeavour" specimens I observed a couple of very young branches, of two to three hydrothecæ, on which the *Lafoëa* had not yet encroached; these displayed the two first supplementary tubes, but had not developed further, and in none of these specimens could any other portion be found available for observation without hindrance by the *Lafoëa*, which so completely invested the polypary that almost every branch was swathed with it nearly or quite to the extremity, even the latest-formed hydrotheca often supporting a hydrotheca of the *Lafoëa*. Even the gonangia become completely covered by the parasite, which apparently by its close investment, prevents the development of the fascicle-tubes of the *Cryptolaria* to a great extent. The most advanced *Lafoëa*-stolons are generally nearly straight, but on the older portions, and where they have a wider area on which to spread, as on the gonangia, they are most tortuous in their ramifications.

To Ritchie's account of the hydrothecæ I would only add that in some specimens they are continued outward somewhat

further than he describes them, and as the produced portion continues in a uniform curve it follows that the aperture is directed outward instead of upward ; I have even seen instances where a still further prolongation results in the aperture looking somewhat downward. In these cases the extension of the hydrotheca is due to the necessity of keeping the aperture free when surrounded by a very dense fasciculation.

The gonangia (which have not previously been observed) are borne along the stem or the main branches, often in a longitudinal series and sometimes on both sides. They are adnate in their entire length, and may even overlap. Their length much exceeds their width, average specimens reaching about 2.2 mm., with a diameter of only about .3 mm. The summit is arched over, and the sub-terminal orifice, which is directed outward, is transversely elliptical. Occasionally the arched top is continued in a uniform curve, so that the aperture looks downward. Being adnate to the hydrocaulus they follow its direction, so that if, for example, they meet with a branch in the course of their growth they continue along it, and are accordingly bent at nearly a right angle. In some instances they are in an inverted position. The fascicle-tubes run over them, and often envelop them completely, except the aperture, and in the " Endeavour " specimens the stolons of the *Lafoëa* cover them with a tortuous network, often of more than one layer.

Six or seven gonozooids were observed, in each case only one in a gonangium. From the base of the capsule rises the blastostyle, which bears the gonozooid on one side at a short distance up, and is then continued in the form of a very slender cord till it nears the orifice, where it gradually expands into the conical plug usually found in that position. The gonozooid is very small relatively to the size of the gonangium, none of those seen attaining more than about .45 mm. in length. The two or three which were in the best condition for examination appeared to have four longitudinal radial canals, and a four-lobed orifice.

I have not observed the large round openings said by Ritchie to exist between the fascicle-tubes, but round openings are common in the " Endeavour " specimens ; these, however, are superficial, and consist of the bases of *Lafoëa* hydrothecæ which have been broken off. It is just possible that Ritchie's specimens may have been invested by *Lafoëa*-stolons from which the hydrothecæ had been lost ; this would account for the round openings as well as for the dark colour. No one

observing such a specimen would imagine the brown stolons to be other than an integral part of the *Cryptolaria*.

Locs.—Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Twenty-one miles N. 62° E. of Babel Island, Bass Strait, 74 fathoms.

Cryptolaria angulata, *Bale.*

Cryptolaria angulata, Bale, Biological Results " Endeavour," ii., 4, 1914, p. 166, pl. xxxv., fig. 1.

Locs.—Great Australian Bight, 100 fathoms.

Great Australian Bight, Long. 127° 20′ E., 180 fathoms.

Genus Hebella, *Allman.*

Hebella calcarata (*L. Agassiz*).

Laodicea calcarata, L. Agassiz, Contr. Nat. Hist. U.S., iv., 1862, p. 350.

Lafoëa calcarata, A. Agassiz, N. Amer. Acalephæ, 1865, p. 122, figs. 184-194. *Id.*, Hargitt, Amer. Nat., xxxv., 1901, p. 387, fig. 24.

Lafoëa scandens, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 758, pl. xiii., figs. 16-19. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 341, fig. 21.

Hebella scandens, Marktanner-Turneretscher, Ann. K.K. Hofmus. Wien, v., 1890, p. 214, pl. iii., fig. 16. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 460. *Id.*, Campenhausen, Abh. Senckenb. naturf. Gesellsch. Frankfurt-a-M., 1897, p. 307? *Id.*, Hartlaub, Zool. Jahrb., Suppl. vi., iii., 1905, p. 587. *Id.*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 285. *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), xxvi., 1913, p. 117, pl. xii., fig. 10.

Lictorella scandens, Borradaile, Fauna & Geogr. Maldive & Laccadive Archipel., ii., 1905, p. 840.

Hebella cylindrica (in part), Pictet, Rev. suisse Zool., i., 1893, p. 41, pl. ii., fig. 36. *Id.*, Versluys, Mém. Soc. Zool. France, xii., 1899, p. 31.

Lafoëa calcarata (in part), Billard, Bull. Mus. d'Hist. Nat., 1904, p. 481; *Id.*, Billard, Exp. Sci. du " Travailleur " et du " Talisman," viii., 1906, p. 174.

Hebella calcarata (in part), Billard, Arch. Zool. exp. et gén., (4), vii., 1907, p. 339. *Id.*, Ritchie, Proc. Zool. Soc., 1910, p. 810. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 816.

Hebella calcarata, Nutting, Bull. U.S. Fish. Comm., xix., 1901, pp. 353, 378, figs. 56, 94. *Id.*, Fraser, Bull. Bureau of Fisheries, xxx., 1912, p. 371, fig. 34.

Not *Lafoëa cylindrica*, von Lendenfeld, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 912, pl. xl., figs. 4-5.

In my paper in the " Proceedings of the Royal Society of Victoria "[1] for 1913 I have given reasons for concluding that Pictet and subsequent observers were almost certainly wrong in identifying *H. scandens* (Bale) with *H. cylindrica* (von Lendenfeld), while suspending judgment with regard to its identity with *Hebella calcarata* (Agassiz). Since then I have, through the kindness of Dr. Fraser, received specimens of *H. calcarata*, comparison of which with *H. scandens* shows that the affinity between the two forms is even closer than the published descriptions would seem to indicate. I cannot resist the conclusion that (unless differences in the gonosome should be discovered) they must be regarded as varieties of a single species.

The hydrothecæ are quite similar, and I found a single mature gonotheca of *H. calcarata*, which did not differ perceptibly from those of *H. scandens*. The distinctions practically narrow themselves down to the unbranched habit of the former, while *H. scandens* branches freely, and to the frequent arrangement of the hydrothecæ of *H. calcarata* in opposite pairs, while those of *H. scandens* are always single. The typical *H. calcarata* usually occurs on opposite-celled Sertularians, and its general rule of growth (subject, however, to many exceptions), is that the creeping stem runs up the front of the hydrocaulus of the host, and gives off a pair of opposite or nearly opposite hydrothecæ just above those of the latter. *H. scandens* is mostly found on *Sertularella divaricata*, and, when it makes its nearest approach to regularity, gives off a single hydrotheca above each of those of the *Sertularella*. It would appear reasonable to assume that the difference is simply an accommodation to the habit of the host-species ; I have, however, met with one or two cases where the host was an opposite-celled Sertularian while the hydrothecæ of the *Hebella* were in no case opposite.

On the other hand, I found on a specimen of *Pasythea* from Bondi, New South Wales, a single colony which had the

1. Bale—Proc. Roy. Soc. Vict., (n.s.), xxvi., 1913, pp. 118-120.

hydrothecæ opposite, just as in the American forms, from which they differed only in their somewhat smaller size.

In Marktanner-Turneretscher's specimens the hydrothecæ do not seem to be opposite or in pairs, although growing on an opposite-celled *Synthecium*. Warren shows the hydrothecæ in pairs, nearly opposite, on a subalternate-celled *Thuiaria*.

From Fraser's account it seems doubtful whether the description of *H. calcarata* as unbranched is justified. Probably the unbranched condition is due to the fact that the specimens examined were usually on hydroid hosts which were themselves unbranched. In *H. scandens* branching occurs freely. On *Sertularella* it runs up the rachis, and not only does it send off side branches to the successive pinnæ, but on a single pinna it very often divides into two, one running up each side, and in many instances these are united by short transverse ramules.

While most of my specimens have been found on *Sertularella divaricata*, I have met with single colonies on *Diphasia subcarinata*, *Sertularia macrocarpa*, *Thyroscyphus tridentatus*, and, as already mentioned, a smaller form on *Pasythea quadridentata*. Marktanner-Turneretscher found specimens on *Synthecium campylocarpum*, and Ritchie on *S. orthogonium* (the same species *?*), and *Sertularella adpressa*. Borradaile's examples were on *Synthecium tubiger* (=*S. orthogonium ?*); Billard's on *Thuiaria tubuliformis* and *Thyroscyphus vitiensis*; Pictet's on *Sertularia vegæ* and *S. tubitheca*; and Warren's on *Thuiaria tubuliformis*. American specimens are most common on *Sertularia cornicina* and *Pasythea quadridentata*.

My specimens of *H. scandens* have the hydrothecæ mostly from .52 to .56 mm. in length, with widths of from .16 to .19 mm.; the American specimens of *H. calcarata* average about .59 mm. long and .19 mm. wide, and the small form from Bondi, New South Wales, is only about .44 mm. long and .15 mm. wide.

Loc.—Forty miles west of Kingston, South Australia, 30 fathoms, on *Thyroscyphus tridentatus*.

Hebella calcarata (*L. Agassiz*),

var. contorta, *Marktanner-Turneretscher*.

Hebella contorta, Marktanner-Turneretscher, Ann. K.K. Hofmus. Wien, v., 1890, p. 215, pl. iii., fig. 17a, b.
Id., Campenhausen, Abh. Senckenb. naturf. Ges.

Frankfurt-a-M., 1897, p. 307. *Id.*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 285, pl. v., figs. 16, 17.

Hebella cylindrica (in part), Pictet, Rev. suisse Zool., i., 1893, p. 41.

Hebella scandens (in part), Bale, Proc. Roy. Soc. Vict., (n.s.), xxvi., 1913, p. 117.

Not *Lafoëa cylindrica*, von Lendenfeld, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 912, pl. xl., figs. 4-5.

(See also, under *H. calcarata*, references to Billard and Ritchie, who rank *H. contorta* as a synomyn of *H. calcarata*).

There is room for a difference of opinion as to whether *H. contorta*, which is distinguished from *H. calcarata* by the smaller size and somewhat twisted form of the hydrothecæ, should be regarded as a distinct species. My specimens do not fully agree with Marktanner-Turneretscher's account, the hydrothecæ being only about .37-.40 mm. in length as against .46 mm., while the diameters are the same (about .15 mm.); they are also rather less twisted (and in some cases not at all). I have found them only on *Sertularia unguiculata*, and the habit is peculiar, in that the main creeping stolon, which runs up the rachis of the *Sertularia*, bears no hydrothecæ, but gives origin only to lateral branches, which run along the pinnæ of the host, and from which spring the hydrothecæ. Generally each pinna has its branch, for so far as the *Hebella* extends, and it is curious to observe how the stolon directs its growth from each pinna to the next; after giving off a branch to one pinna it grows diagonally across the broad rachis of the host straight to the base of the next, where it again branches, and so on in a succession of zig-zags till it terminates, or till it assumes a less regular course. Occasionally it divides into a number of small stolons, which anastomose freely, forming a network. The branches which run along the pinnæ of the host are not usually central, but seem to prefer the side, and although the hydrothecæ of the *Sertularia* are in opposite pairs, I have not in any case seen those of the *Hebella* paired. Sometimes an alternate disposition can be discerned, successive hydrothecæ springing slightly to right and left on the slender stolon.

Loc.—Ten miles north of Circular Head, Tasmania, on *Sertularia unguiculata*.

Genus Lafoëa, *Lamouroux.*

Lafoëa gracillima (*Alder*).

Campanularia gracillima, Alder, Ann. Mag. Nat. Hist., (2), xviii., 1856, p. 361, pl. xiv., figs. 5, 6 ; *Id.*, Alder, Trans. Tynes. Nat. F. Club, iii., 1857, p. 129, pl. vi., figs. 5, 6.

Lafoëa gracillima, G. O. Sars, Vidensk.-Selsk. Forhandl., 1873, p. 115, pl. iv., figs. 19-21. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 217, pl. iii., figs. 18, 19. *Id.*, Bonnevie, Norweg. N. Atl. Exped., Hydr., 1899, pp. 64, 65, pl. v., fig. 2a. *Id.*, Nutting, Bull. U.S. Fish. Comm., 1901, p. 356, fig. 49. *Id.*, Hartlaub, Zool. Jahrb., xiv., 1901, p. 358, pl. xxi., figs. 1-3 ; *Id.*, Hartlaub, Zool. Jahrb., Suppl. vi., iii., 1905, p. 594, fig. P2. *Id.*, Jäderholm, K. svenska Vet.-Akad. Handl., xxviii., 1902, p. 9 ; *Id.*, Jäderholm, Schwed. Südpolarexp., v., 1905, p. 21, pl. ix., figs. 2-3 ; *Id.*, Jäderholm, Mém. Acad. Imp. Sci. St. Peters., (8), Classe Phys.-Math., xviii., 1908, p. 13, pl. ii., fig. 15; *Id.*, Jäderholm, K. svenska Vetenskapsakad. Handl., xlv., 1909, p. 74, pl. vii., figs. 6-8. *Id.*, Clarke, Mem. Mus. Comp. Zool. Harvard, xxxv., 1907, p. 13. *Id.*, Ritchie, Trans. Roy. Soc. Edin., xlv., 1907, p. 531 ; *Id.*, Ritchie, Trans. Roy. Soc. Edin., xlvii., 1909, p. 76, fig. 2 ; *Id.*, Ritchie, Rec. Ind. Mus., v., 1910, p. 8 ; *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 817. *Id.*, Billard, Exp. Sci. du " Travailleur " et du " Talisman ", viii., 1906, p. 176. *Id.*, Broch, Fauna Arctica, v., 1909, p. 156, figs. 17-18. *Id.*, Fraser, Bull. Lab. Nat. Hist. State Univ. Iowa, vi., 1911, p. 52. *Id.*, Vanhöffen, Deutsche Südpolarexp., xi., 1910, p. 312. *Id.*, Kramp, Danmark-Exp. til Grønlands Nordostkyst, v., 1911, p. 371.

Calicella fruticosa, Hincks, Ann. Mag. Nat. Hist., (3), viii., 1861, p. 293.

Lafoëa fruticosa, Hincks, Hist. Brit. Hydroid Zooph., 1868, p. 202 (in part), pl. xli., fig. 2, 2a (not 2b). *Id.*, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 64, pl. ii., fig. 1 (after Hincks). *Id.*, Thompson, Hydr. Zooph. of the " William Barents " Exped., 1884, p. 7, pl. i., figs. 17, 18. *Id.*, Allman, Rep. Sci. Results " Challenger " Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 34, pl. xvi., fig. 2, 2a.

Lafoëa capillaris, G. O. Sars, Vidensk.-Selsk. Forhandl., 1873, p. 115, pl. iv., figs. 22-24.

Hincks, in his "British Hydroid Zoophytes,"[1] treated *L. gracillima* (though with some doubt) as a variety of *L. fruticosa* (Sars), but observers in the northern seas, who are familiar with both forms, are now practically unanimous in rejecting the determination. Following Hincks I included *L. fruticosa* in the "Catalogue" as an Australian species, but *L. gracillima* must now take its place. Allman and Thompson have also followed Hincks' nomenclature.

Hincks writes:—"I have examined the *Lafoëa* from Bass's Straits in Mr. Busk's collection, referred to by Alder (North. & Durh. Cat.), and have little doubt that it is identical with the present species." Alder had written:—"A *Campanularia* from Bass's Straits, of which Mr. Busk has kindly sent me a drawing, is very similar to this, if not identical." The hydroid from Bass Strait, which Busk mentioned in the "Voyage of the Rattlesnake," under the name of *Campanularia dumosa* is presumably that referred to by Alder and Hincks.

Family SERTULARIIDÆ.

In the First Part of this Report I have dealt with the Sertulariidæ from the point of view which was usually adopted prior to 1893, when systematists were agreed that the proper basis for generic distinction was the mode in which the hydrothecæ are arranged in the colony. This unanimity was disturbed in 1893, when Levinsen advanced the view that a truly natural arrangement must depend on certain characters of the individual hydrothecæ, namely the opercular structure and the correlated condition of the hydrotheca-margin. The views propounded by Levinsen were at once adopted by several observers (mostly those whose principal work lay among the northern species), but were rejected by others; and in 1897 Schneider, in his paper on the hydroids of Rovigno, strongly upheld the validity of the system founded on the arrangement of the hydrothecæ, or what Levinsen calls the colonial or zoarial characters.

Ever since Levinsen put forward his views the classification of the Sertulariidæ has been in a condition which can only be described as chaotic. Many observers, while unprepared to accept his conclusions without reserve, have nevertheless felt obliged to recognise their validity to a greater or less extent, dependent on individual opinion, and the result has been that few are precisely in accord on all points, so that there are almost as many systems of classification as there are observers.

1. Hincks—Hist. Brit. Hydroid Zooph., 1868, p. 202.

In his last work—" Systematic Studies on the Sertulariidæ " (which only reached me after much of Part I. was in print), Levinsen combats the objections which have been made to his system, and recapitulates and further elaborates his views at considerable length, and with such force and cogency as can scarcely fail to impress any student of the Sertulariidæ who examines them. Levinsen relies entirely on the opercular apparatus for his generic distinctions, disregarding altogether the colonial characters ; so that he recognises, for instance, no distinction between a *Pasythea* and a *Sertularia*, or between a *Sertularella* and a *Selaginopsis*, if the opercula are alike in each case.

Of course, it does not necessarily follow from the acceptance of Levinsen's views regarding the importance of the operculum that his genera must be adopted throughout. Admitting that the colonial characters are of secondary significance, they may still be considered, and undoubtedly will, by some observers, be considered sufficiently important to furnish grounds for generic distinctions. This is evidently the opinion of Dr. Stechow, who has, since the date of Levinsen's last paper, published a list of the genera of the Hydroida,[1] in which, while mainly adopting Levinsen's divisions, he has included such genera as *Pasythea*, *Selaginopsis*, and *Dictyocladium*, which Levinsen expressly declares to be merely species of *Sertularia*, *Thuiaria*, and *Sertularella*. This combination, or intermixture of two diverse systems would logically lead to the further multiplication of genera, as will be apparent if we consider, for example, the characters of *Pasythea*. The hydrothecæ of this genus are not always paired, as Stechow describes them ; in *P. quadridentata* the paired condition exists, in *P. hexodon* it does not. I pointed out long ago that according to the colonial characters *P. quadridentata* is allied to *Sertularia*, while *P. hexodon* was as obviously akin to *Thuiaria*. The same conclusion may be arrived at from the zooecial characters, and Levinsen accordingly classes the former species as a *Sertularia*, and the latter as a *Thuiaria*. Now, if we admit, as Stechow does, that the differences between the opercula in *Sertularia*, *Odontotheca*, and *Thuiaria* are valid generic characters, then we must, on the same principle, admit that *P. hexodon* should be placed in a genus distinct from *P. quadridentata*, since the difference between these two species is precisely the same as that between *Sertularia* and *Thuiaria*. The same principle applies to *Dictyocladium* and *Selaginopsis* ; obviously a *Selaginopsis* with an operculum should be placed in a different

1. Stechow—Hydroidpolypen der japanischen Ostküste, II., 1913.

genus from a *Selaginopsis* without one; here, however, as Stechow accepts the presence of some form of operculum as a primary character of the whole family, it must be assumed that he excludes such species now assigned to *Dictyocladium* and *Selaginopsis* as are inoperculate; only he has then provided in his system no place for these species, any more than for the inoperculate species hitherto included in the genera *Sertularia* and *Sertularella*.

What has doubtless contributed largely to the reluctance of systematists to adopt Levinsen's views is the difficulty often found in determining the nature of the operculum in species with which we are only partially acquainted, and of which we may often examine many specimens without being able to detect any trace of such a structure, or, where such traces are visible, to ascertain the true form.

For example I have mentioned elsewhere that in *Thyroscyphus marginatus* one sometimes finds empty hydrothecæ with opercula sufficiently preserved to enable their character to be clearly made out, while in other cases hydrothecæ are found containing the hydranths in good condition but entirely devoid of opercula. Levinsen's contention that he can discern from the form of the hydrotheca-margin what that of the operculum has been, is no doubt correct in general, but I have seen hydrothecæ as to which I was quite unable to satisfy myself from the form of the border whether they belonged to Levinsen's genus *Odontotheca* or to *Sertularia*.

In regard to these two genera, I have great doubt as to the sufficiency of the distinction between them. In both cases the border of the hydrotheca has two lateral teeth, between which are two sinuses, the adcauline the larger in *Odontotheca*, the abcauline in *Sertularia*; in each sinus is fixed an opercular membrane. In *Sertularia* the abcauline membrane is, in most species, provided with a free distal valvular portion, which is wanting in *Odontotheca*. As, however, it is stated that some species of *Sertularia* are without the usual free valvular portion, while some species of *Odontotheca* possess it, it seems very doubtful whether the differences are sufficient to justify the creation of a new genus. The same remark applies to the genus *Hydrallmania*, as modified by Levinsen in accordance with the opercular characters; and I may add that even according to the colonial characters I see no sufficient ground for this genus: the hydrothecæ are as truly biserial as in the rest of the family, though both series are seated so near to the front as to be very nearly (but not exactly) in one line.

Considering, now, that notwithstanding differences of opinion as to details, it is generally agreed that the opercular characters must, to a greater or less extent, be utilised in limiting the genera, it appears that there are only two courses logically open to us. The first is to follow Levinsen in abandoning entirely the colonial characters. Then *Pasythea quadridentata* becomes a *Sertularia*, and *P. hexodon* a *Thuiaria*, while the species ascribed to *Selaginopsis* and *Dictyocladium* must be divided between *Sertularia*, *Sertularella*, *Thuiaria*, and a genus of Lafoëidæ for the inoperculate forms. The other course is to combine the colonial and the zooecial characters, as Stechow has done, but in that case we cannot follow him in retaining the old groups *Pasythea*, *Selaginopsis*, and *Dictyocladium*, each as a single genus. *P. hexodon* must be separated from *P. quadridentata* on exactly equal grounds to those on which *Thuiaria* is separated from *Sertularia*. *Selaginopsis* (with *Dictyocladium*) must be split up into several genera, according as the operculum resembles that of *Sertularia*, *Sertularella*, *Thuiaria*, and possibly yet other types, while in any case the inoperculate forms must be referred to a separate genus. It is doubtless true that characters which are of generic value in one group of species may be less constant and of minor importance in another, but in the particular case before us it is impossible to maintain that where the opercular characters have a generic value in the biserial forms, the identical characters should have less importance in multiserial forms.

I do not look forward to any early unanimity on these points, but Levinsen's arguments, and the numerous instances cited by him of transition-forms between the biserial and the multiserial forms, furnish very strong support to his views. Again, in such a form as *Pasythea hexodon*, how does the arrangement of the hydrothecæ in separate companies differ from the arrangement in many species of *Thuiaria* except that in the former the companies are separated by longer intervals ? And in *P. quadridentata* we have in the one species every gradation from the typical form to a variety which differs in no respect from a true *Sertularia*.

Of course there are in some instances special characters, unconnected either with the hydrothecal arrangement or the opercular structure, which may be regarded as of generic importance, and here again unanimity of opinion is not likely to be soon arrived at. For example, the old genus *Dictyocladium* seems to me, as to Levinsen, to consist merely of a few species united by the trivial character of their union into a network by anastoming stolons, a feature often found in

species of *Sertularella* and *Thuiaria*. *Thecocladium* is another genus founded on the regular occurrence of a feature not at all uncommon in other forms. *Hypopyxis*, as I have pointed out in Part II, is to be referred to Levinsen's genus *Thuiaria*, unless, which is doubtful, the pouch-like appendages should prove to be, as Allman supposed, sarcothecæ.

As the most convenient course, in the present unsettled state of the classification, the family is here taken to include the genera which it has been customary to assign to it, and the genera themselves are taken for the most part in their old signification. They comprise species of *Sertularia*, *Sertularella*, *Thuiaria*, *Selaginopsis* (*Dictyocladium*), *Hypopyxis*, and *Synthecium*. The last-named genus must, according to Levinsen, be removed to the Lafoëidæ, in consequence of the absence of an operculum, but Stechow regards the Synthecidæ as a distinct family. *Sertularia elongata*, and a number of other species in which also the hydrotheca-margin has six or more teeth but no operculum, are excluded by Levinsen from the Sertularidæ, and are unprovided for in Stechow's classification; for these species I propose the new genus LEVINSENIA. I follow Billard in placing *Dictyocladium dichotomum*, Allman, under *Selaginopsis*; according to Levinsen's system it would be referred to *Sertularella*. Several of the *Sertulariæ* would come under Levinsen's genus *Odontotheca*, which I am disinclined to accept. And I may here remark that even if it be admitted that this genus is sufficiently distinct from *Sertularia*, the name *Odontotheca* has no claim to acceptance. The type is *S. operculata*, and L. Agassiz in 1862 proposed the genus *Amphisbetia* for this very species; the latter name therefore has priority, and should be adopted if it is considered desirable to separate *S. operculata* and its immediate allies from the other *Sertulariæ*.

Genus LEVINSENIA, *gen. nov.*

Hydrophyton branched or rarely simple, hydrothecæ biserial, apertures with numerous teeth, operculum absent.

While it is still doubtful to what extent observers generally will accept the principles of classification enunciated by Levinsen, there is no doubt that the nature of the opercular structures must henceforth be regarded as of the first importance.

Regarding two of the species for which the genus *Levinsenia* is proposed Levinsen remarks as follows:—[1] "An opercular apparatus has not hitherto been found in *Sert. elongata* and

1. Levinsen—Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 265.

S. huttoni, both of which have the hydrothecal margin with 6-7 teeth, and if they possess an operculum I am most inclined to think that it consists of as many valves as there are teeth. In either case these two species cannot be referred to any of the hitherto described genera." It may also be observed that in Stechow's recent summary of the genera no place is found for *S. elongata* or its allies. It will probably be conceded therefore that there is justification for the establishment of a genus for such species as are excluded from the Sertulariidæ (as restricted) by the absence of an operculum, while the conspicuous denticulation of the hydrotheca-margin distinguishes them, if less decisively, from the genus *Synthecium*. If such a genus be not admitted the only alternative would seem to be the modification of the latter genus to make it include these forms.

According to Stechow's arrangement the family Synthecidæ comprises three genera—*Lytoscyphus*, *Synthecium* and *Hypopyxis*. I believe that the latter genus is erroneously associated with the Synthecidæ, as I have pointed out in discussing *H. distans*.[1] The genus now proposed will take its place beside *Synthecium*, and, as will be shown further on, there are not wanting signs of a connection between them more intimate than would be supposed at first sight.

It must be recognised that some of the forms which I now refer to *Levinsenia* have not been sufficiently examined to make it certain that they never develop an operculum, but some undoubtedly do not, and the others sufficiently resemble them to warrant their association pending fuller examination.

Besides the two species mentioned by Levinsen,—*S. elongata* and *S. huttoni*—I assign to *Levinsenia S. pluridentata* (Kirchenpauer), *S. insignis* Thompson, *S. acanthostoma* Bale, *S. crenata* Bale, along with the species described by Billard as possibly a sexual form of *S. elongata*, and which may in the meantime be described as *S. billardi*.[2] Of these *S. elongata* is most widely known, and it has been examined by several observers, who have not in any case noted the presence of an operculum. I have a beautifully mounted specimen, stained, and with the hydranths expanded as in life, and I cannot detect any trace of an opercular structure. Billard says nothing as to the presence or absence of an operculum in the form described by him. *S. acanthostoma* has been studied histologically by Warren, who says that there is not a trace of operculum. I believe this is the only member

1 Bale—Biological Results "Endeavour," ii., 4, 1914, p. 167
2 Billard—Ann. Sci. Nat., Zool., (9), xi., 1910, p. 22, fig. 8.

of the group which has been subjected to a similarly searching examination. Of *S. crenata* I have seen only one or two specimens, in which I found no opercula. Whether *S. insignis* and *S. pluridentata* have an operculum has not been determined.

S. elongata is dealt with elsewhere in this Report, and in Part I, and as I have pointed out, it agrees precisely in habit with a number of other species which by Levinsen would be divided between the genera *Sertularia* and *Odontotheca*. If the teeth ever number other than six (as implied by Hutton and Coughtrey), it must I think be only an abnormal condition, which I have never met with. They are symmetrical, in so far that there are three on each side of the hydrotheca, yet the two sides are not absolutely alike, as the distal portions of the hydrothecæ are somewhat bent in such a way as to make the apertures face toward one side of the colony, so that, like most *Sertulariæ*, but unlike *S. acanthostoma*, the polypary has a distinct front and back aspect. This turning forward of the hydrothecæ is very pronounced in some specimens, but scarcely traceable in others, and when it occurs it is confined to the hydrothecæ on one side of the pinna. The teeth vary a good deal in length, and there is a rather wide extent of the border on the adcauline side free from them, while no median tooth is present.

In *S. billardi*, (which has the hydrothecæ very different in form from those of *S. elongata*, and more like those of *S. macrocarpa* and *S. bidens*), there are nine teeth. As in *S. elongata*, there is a gap between those nearest the adcauline margin, and as the number is odd, it follows that either the two sides are not symmetrical, or that there is a median tooth on the abcauline margin and four on each side. The latter appears from the figure to be the actual arrangement.

S. acanthostoma has no median tooth either on the adcauline or the opposite border, but has eight on each side, which correspond to those opposite them in all respects, so that the denticulation is quite regular, like that of an *Aglaophenia*, and the hydrothecæ are in one plane, and both aspects of the polypidom are alike.

S. pluridentata is described by Kirchenpauer without the number of teeth being specified. So far as can be judged from the figure there appears to be a median tooth both on the adcauline and abcauline borders, with three others on each side.

S. insignis is said by Thompson to have "about six" teeth.

S. huttoni is described as having "seven or eight" teeth.

S. crenata has ten teeth, more uniform in size than those of most of the preceding species. There is a median tooth on both the adcauline and the abcauline borders, and four on each side, the median teeth, however, are shorter than the rest, and sometimes tend to become obsolete.

Four of the species in the foregoing list agree in having a similar habit, not, I think, found elsewhere among the members of the old genus *Sertularia*. The pinnæ are in pairs and opposite, and associated with this character is the unusual feature that the hydrothecæ on the rachis are opposite, while those on the pinnæ are subalternate. They have the further character in common that the first hydrothecal internode on each pinna bears a single hydrotheca only, which is on the lower side. These species are *S. insignis*, *S. acanthostoma*, *S. huttoni*, and *S. billardi*. I think it very probable, however, that *S. insignis* and *S. huttoni*, which are respectively recorded from Australia and New Zealand, are one and the same.

S. pluridentata is, in the form of the hydrothecæ, very nearly allied to *S. acanthostoma*, but the pinnæ are irregular, not opposite.

In *S. crenata* the pinnæ are distinctly alternate. In the type specimen the rachis is divided alternately into internodes which support a single pinna with its axillary hydrotheca, or a pair of hydrothecæ only ; these obviously represent the ordinary Sertularian internode (as found in *S. elongata*), divided into two by a secondary node. The hydrothecæ on the pinnæ are subalternate, and, as in the oppositely-branched species, the first hydrothecal internode on each supports but one hydrotheca, on the lower side.

In the original specimen of *S. crenata* the teeth were all well developed, except that the two median ones were sometimes much reduced. But I have a specimen from an unknown locality, which I am doubtful whether to regard as a variety of *S. crenata* or as a merely abnormal colony, in which all the teeth are either much reduced, being indicated mostly only by slight undulations of the border, or are totally absent. In one or two hydrothecæ there are four of these undulations on each side, representing the eight lateral teeth of the normal form, and the median teeth are feebly indicated. In most cases, however, the latter are wholly wanting, and the lateral sinuations are very slight

and irregular, while in others the sides are quite smooth, though usually a little more elevated than the points where the median teeth would ordinarily be situated; there is therefore nothing to distinguish the border of such a form from that of a *Synthecium*. The hydrothecæ in question are not immature, but of normal size, and though probably to be regarded simply as a pathological variation, they are none the less significant as indicating the affinities of the species.

Genus DIPHASIA, *Agassiz*.

DIPHASIA SUBCARINATA (*Busk*).

Diphasia subcarinata, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 7 (synonymy).

This species, owing to its possession of an opercular valve consisting of a single adcauline flap, seems to be quite properly placed in the genus *Diphasia*, notwithstanding that Levinsen makes the absence of teeth on the hydrotheca-margin a characteristic of the genus (while admitting, however, that *D. digitalis* (Busk) has two feeble lateral teeth). *D. subcarinata* has very distinct and well-developed teeth, generally three in number, though in some of the "Endeavour" specimens one is sometimes obsolete.

The opercular membranes are very delicate, and many specimens are without a trace of them, but I have some in which they are retained, and it is a very peculiar feature that in many cases there are two distinct opercula, quite similar, but widely separated, one being situated about the middle of the divergent distal half of the hydrotheca, and the other just inside the aperture. The valve itself is simple, and does not extend fully across the hydrothecal cavity, but only about two-thirds of the distance. I have also seen more than two opercula; this, however, was in hydrothecæ in which a regeneration had occurred, and the two normal valves had been retained, while two new ones had been developed.

Locs.—Great Australian Bight, 40-100 fathoms.

Off Devonport and Launceston, Tasmania.

Forty miles west of Kingston, South Australia, 30 fathoms.

Twenty miles east of King Island, Bass Strait.

Genus SYNTHECIUM, *Allman*.

SYNTHECIUM SUBVENTRICOSUM, *Bale*.

Synthecium subventricosum, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 5, pl. i., figs. 3-5.

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

Genus HYPOPYXIS, *Allman*.

HYPOPYXIS DISTANS, *Bale*.

Hypopyxis distans, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 167, pl. xxxv., figs. 2-5.

Unless further research should prove the pouch-like structures peculiar to this hydroid to be of greater importance than at present appears, it seems to me that the retention of the genus will not be justified. In that case the species will fall naturally into the genus *Thuiaria*, as understood by Levinsen. I have referred to the close correspondence between *H. distans* and *Sertularia tuba* (which latter Levinsen mentions among the *Thuiariæ*), and I may add that the chitinous prolongations below the hydrothecæ ("stalk-marks") are quite similar in the two forms, though in my figure of *S. tuba*, (being the superficial view only), they do not appear.

I have examined many hydrothecæ of *H. distans*, in the hope of finding some clue to the significance of the hydrothecal pouches, but have not succeeded. As to their origin, it is clear from their appearance in optical sections that their inner wall is composed of two layers of perisarc which are united. It is as if an invagination of the perisarc had occurred just above the base of the hydrotheca, directed upward, and that the two adjacent walls of the invagination had united, forming an erect perisarcal ridge, which is the inner wall of the pouch; or (which would have the same optical effect), as if a pouch-shaped protrusion of the hydrothecal wall had been directed downward, overlapping that part of the hydrotheca below it, and becoming closely united therewith. Whichever has happened, the whole has been ensheathed in a thin outer layer of perisarc, and the pouch remains as an extremely contracted chamber completely continuous with the general cavity of the hydrotheca.

Locs.—Great Australian Bight, Long. 126° 45¼′ E., 190-320 fathoms; Long. 130° 40′ E., 160 fathoms; Long. 127° 20′ E., 180 fathoms.

Genus SELAGINOPSIS, *Allman.*

SELAGINOPSIS DICHOTOMA (*Allman*).

Dictyocladium dichotomum, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 77, pl. xxxvi., fig. 2, 2a. *Id.*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 277.

Selaginopsis dichotoma, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 16, fig. 5.

Hydrophyton monosiphonic, four or five inches in height, in one plane, and forming a network by the anastomosing of the numerous dichotomous divisions; jointed usually at the origin of the branches, rarely elsewhere.

Hydrothecæ spirally arranged, each fifth one completing the spiral, so that there are four longitudinal series; tubular, stout, curved outwards, adnate most of their length, or with one-third part free, very often continued outwards by five or six renewals for a distance equal to fully half their original length; border very delicate, with three deep emarginations and a three-valved operculum.

Gonothecæ large, ellipsoid, erect, springing from the inner side of one of the branches just above a bifurcation, and occupying the axil; encircled by a very wide spiral wing, the perisarc of which is double, with numerous internal radial thickenings; mouth a narrow tube, slightly expanded at the end.

The description and figure of this interesting species in the "Challenger" Report are incorrect in a number of particulars, especially in regard to the form and arrangement of the hydrothecæ and gonothecæ. Billard has already pointed out some of these inaccuracies.

All the subdivisions of a colony are in one plane, as shown by Allman, and are united into a reticulum by frequent anastomoses. The ramification is strictly dichotomous, the two members of a bifurcation being about equal, and divergent at a similar angle. A distinct constriction occurs at the origin of one or both, and few other joints exist. The branches are extended beyond the hydrothecate portion into twisted tendrils, which terminate in attachment to the aperture of a hydrotheca on another branch.

With regard to the arrangement of the hydrothecæ, Billard justly remarks that while they are, as Allman indicates, in four rows, they are nearly equidistant, and not in groups of four, as shown in Allman's figure. A series of five makes a

complete turn of the stem, the fifth being in line with the first. There are some irregularities, and as the hydrothecæ are nearer to those next them than to those above and below, the quadriserial arrangement is not conspicuous.

The hydrothecæ are not of the slender, round-based, flask-like form shown in the original figure, they are on the contrary rather stout, and when the free portion is short they resemble those of a typical *Thuiaria*. They vary notably in the length of the free portion; in some fragments of the "Challenger" type, for which I have to thank Dr. Kirkpatrick, it is very short; in the "Endeavour" specimens it is often fully one-third of the entire length. This takes no account of the increase by regenerations, which in the "Endeavour" specimens is very considerable, as it also is in the "Challenger" specimen figured by Billard. Allman's description of the hydrothecæ as having a "small circular even orifice" is inaccurate. The fact is that the delicacy and collapsibility of the perisarc at the orifice, together with the confused appearance caused by the remains of successive renewals, makes it generally difficult to determine the original form. Billard concludes that it is probably bilabiate. After examining many hydrothecæ, I have been able to fully satisfy myself in several cases that the border has three deep emarginations, between which it forms triangular sharp points. The aperture, as seen on looking directly into it, is somewhat triangular, but with the angles more or less rounded off, and one marginal point is at the top, and the other two at the lower corners. In the lines marking successive renewals, the points only are usually obvious, and the upper one often less so than the others. In the best specimens the three-valved operculum was very distinct. It will be apparent that the form of the aperture and the operculum is practically the same as in a typical *Sertularella*, such as *S. divaricata*, differing only in the extreme delicacy of the perisarc and in the slightly deeper emarginations.

The peduncles of the gonothecæ do not spring from the axils, as shown in Allman's figure. The gonotheca is erect and central between the two branches at a bifurcation, but the peduncle springs laterally from one of the branches, a little above the axil; it is noteworthy also that in all the portions of colonies examined all the gonothecæ spring from the same side of the bifurcations.

The frill-like appendages surrounding the gonotheca are very wide, and as Billard has noted, they are strengthened by numerous radial internal thickenings. Surrounding the upper

part of the capsule they present a singular resemblance to the old-fashioned ruff. A remarkable feature not hitherto noticed is that instead of a series of annulations such as are generally found in species of *Sertularella*, we have here a regular continuous spiral, making, when perfect, about seven or eight complete turns round the gonotheca. The terminal part of the topmost whorl rises quite abruptly at one side of the tubular neck, which it almost equals in height; it is here nearly erect, but as it descends towards the middle part of the gonotheca it spreads more outwards: towards the base it becomes narrower and finally ceases. In a few cases, especially near the base of the gonotheca, the continuity of the spiral may become interrupted, and two or three complete annulations may be found.

Besides *D. dichotomum* several other species have been referred to the genus *Dictyocladium*. As for *D. flabellum*, Nutting, and *D. reticulatum*, Kirchenpauer, Levinsen has already pointed out that they belong to the genus *Sertularella*, as defined by him, and it will be apparent from the foregoing description that *D. dichotomum* must keep them company. But according to Hickson and Gravely the hydroid named by them *Dictyocladium fuscum* (which Vanhöffen says is identical with *Selaginopsis affinis*, Jäderholm), has no operculum, and therefore cannot be associated with the three above mentioned. Whatever classification be adopted, I have at least no hesitation in rejecting the genus *Dictyocladium*, which is founded on no better ground than that of the colony forming a flabellate structure, united into a network by the anastomoses of the branches.

Locs.—Off South Cape, Tasmania, 75 fathoms.

Thirty-five miles south-east of Bruni Island, Tasmania, 150-230 fathoms.

Genus SERTULARIA, *Linné.*

Of the species here grouped provisionally under the old genus *Sertularia*, *S. minima* and *S. pusilla* form, with their allies *S. minuta* and *S. muelleri*, a distinct section characterised by the possession of orifices in the hydrocaulus, generally associated with tubular processes resembling minute sarcothecæ. They are small unbranched forms, with the opercular structure of *Sertularia* (Levinsen).

S. loculosa is a member of the group of which *S. marginata* (Kirchenpauer), better known as *S. inflata* (Versluys), is the most familiar representative. This also belongs to Levinsen's *Sertularia*.

Two pinnate forms belonging to the same section are *S. unguiculata* and *S. geminata*.

S. operculata is the type of Levinsen's proposed genus *Odontotheca*, as of Agassiz' earlier *Amphisbetia*, and with it, on account of the opercular characters, Levinsen has associated *S. macrocarpa* and *S. maplestonei*. The two latter are pinnate species, while *S. operculata*, with its allies *S. bispinosa* and *S. trispinosa*, and perhaps one or two others, form a sub-group distinguished from the other species by the peculiar ramification.

S. elongata, in which the hydrothecæ have six marginal teeth and no operculum, belongs to the proposed new genus *Levinsenia*.

Sertularia minima, *Thompson.*

Sertularia minima, Thompson, Ann. Mag. Nat. Hist., (5), iii., 1879, p. 104, pl. xvii., fig. 3-3b. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 89, pl. iv., figs. 9-10, pl. xix., figs. 12-13 ; *Id.*, Bale, Trans. and Proc. Roy. Soc. Vict., xxiii., 1886, p. 109. *Id.*, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 138, pl. xiii., figs. 3-4. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 231. *Id.*, Whitelegge in Etheridge, Mem. Aust . Mus., ii., 1889, p. 41. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 462. *Id.*, Hilgendorf, Trans. N.Z. Inst., xxx., 1897, p. 209, pl. xx., fig. 1, 1a. *Id.*, Jäderholm, Schwed. Südpolarexp., v., 1905, p. 24, pl. ix., figs. 4-5. *Id.*, Thornely, Journ. Linn. Soc., Zool., xxxi., 1908, p. 83. *Id.*, Billard, C. R. Acad. Sci., cxlviii., 1909, p. 194 ; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 17. *Id.*, Jäderholm, Ark. för Zool., vi., 1910, p. 3, pl. i., fig. 2. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 845. *Id.* Mulder and Trebilcock, Geelong Nat., (2), vi., 1914, p. 39, pl. iv., figs. 2-3a, 5-6.

Synthecium gracilis, Coughtrey, Trans. N.Z. Inst., vii., 1874, p. 286, pl. xx., figs. 26-31.

Sertularia pumila, Coughtrey, Trans. N.Z. Inst., viii., 1875, p. 301 ; *Id.*, Coughtrey, Ann. Mag. Nat. Hist., (4), xvii., 1876, p. 29.

Sertularia pumiloides, Bale, Journ. Micro. Soc. Vict., ii., 1881, pp. 21, 45, pl. xii., fig. 2.

Odontotheca minima, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 308.

? *Sertularia crinoidea*, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 141, pl. xvi., figs. 1-2.

S. minima is the best-known representative of a small group of species—comprising also *S. minuta*, *S. muelleri*, and *S. pusilla*—which agree in the simple habit, the bidentate hydrothecæ, and the squat high-shouldered compressed gonothecæ ; and which also agree, as pointed out by Mulder and Trebilcock in a recent paper (cited above), in the presence near the base of the internodes of small circular orifices, generally associated with delicate tubular appendages projecting externally, and described as resembling rudimentary sarcothecæ.

In the type form the hydrorhiza has the transverse markings along the edges, consisting of perisarcal thickenings, which are familiar to observers as occurring in many small Sertularians and Plumularians, but in some forms these are wanting. In typical specimens from Port Phillip, Victoria, I find very few of the orifices above referred to ; on some shoots none were present, on others I found one only, situated at or close to the base of the first internode. The lower internodes are commonly rather broader at the base than the rest, tending towards a rectangular form, and the orifices are mostly just at the angle. The tubules are quite rudimentary, consisting of an extremely narrow projecting rim. A New Zealand specimen is very similar, but the orifices are found here and there on other internodes than the proximal ones ; the little receptacles are somewhat more developed, and are tubular or slightly expanding.

The variety formerly described as *S. pumiloides* is larger in all its parts, both in the trophosome and the gonangia. Its hydrorhiza may be a simple filiform tube, or, as in a specimen from Queenscliff, Victoria, may have a series of lateral contractions, so that it appears scalloped along both margins. The little tubes are as in the last-mentioned form, and rare except on the proximal internodes.

Another form, which we may call var. *intermedia*, links the present species with *S. minuta*. Its internodes are compact and square at the base, and the hydrothecæ have a decided constriction and oblique fold on the outer side, a little above the base. These characters are very commonly found in the proximal internodes of the type form ; here, however, they are more pronounced and extend throughout. The tubules are well-developed, slightly expanding, projecting from the lower angles, and, as in *S. minuta*, they occur on both sides and on all or nearly all the internodes. The hydrorhiza is typical.

Fuller investigation will be necessary to determine the true function of the apertures or receptacles described above, also to ascertain whether they are sufficiently constant to be of service in the discrimination of species or varieties. In my specimens of *S. muelleri* they are fairly frequent, but though the circular smooth-edged orifices are distinct enough I failed to find any trace of tubes surrounding them ; indeed they often have, in this species, the appearance of being closed in by an excessively thin pellicle of perisarc. It is just possible that they may correspond to the minute conical protuberances found on the apophyses of many Plumularians, the function of which is doubtful.

S. furcata, Trask, is evidently very closely allied to *S. minima*, and judging from some of the published figures of the former it seems possible that the two species may ultimately have to be united.

Billard, who has examined the type of *S. crinoidea*, Allman, is of opinion that it is not specifically distinct from *S. minima*.

Loc.—Nuyts Archipelago, Great Australian Bight, 10 fathoms.

Sertularia pusilla, *nom. nov.*

(Plate xlvi., figs. 3-6.)

Sertularia minima, Thompson, var. *tubatheca*, Mulder and Trebilcock, Geelong Nat., (2), vi., 1914, p. 40, pl. iv., fig. 1-1d.

Not *Sertularia tubitheca*, Allman, Mem. Mus. Comp. Zool. Harvard, v., 1877, p. 24, pl. xvi., figs. 5-6.

Shoots about 6-8 mm. in height, unbranched, sometimes divided into regular internodes, each bearing one pair of hydrothecæ, but often with nodes indistinct or quite wanting on parts of the hydrocaulus or throughout.

Hydrothecæ in pairs, opposite, tubular, regularly curved, mostly in contact in front, separate behind, moderately divergent ; aperture looking outward and upward, with two pointed angular lateral lobes.

Minute tubular sarcothecæ (?) on the lower portions of some of the internodes.

Gonothecæ one on a shoot, borne by the proximal internode ; somewhat compressed, ovate or oblong, with the shoulders rounded, and a distinct collar, very slightly elevated, with minute internal denticles.

A fragment or two of this species were found among debris from some of the material which had been dried, and the locality is doubtful.

It would come under the genus *Sertularia*, as restricted by Levinsen.

SERTULARIA UNGUICULATA, *Busk.*

Sertularia unguiculata, Bale, Biological Results "Endeavour," ii., 1, 1914, pp. 11, 16 (synonymy).

According to Levinsen's classification this species would remain in the genus *Sertularia*.

The teeth of the hydrothecæ vary extremely in length. They are usually longest in the small forms with widely divergent hydrothecæ, the outer tooth especially having the characteristic claw-like form very pronounced. But in the long slender variety mentioned in Part I. many of the hydrothecæ on the proximal portions of the pinnæ have the teeth so much abbreviated that when viewed in front the border might, without careful examination, be supposed entire ; at the same time the more distal hydrothecæ might at the first glance be deemed to have the outer tooth only, the inner one being much blunter and seen foreshortened. The closer examination of this form strengthens my surmise that the *Thuiaria heteromorpha* of Allman may be only a variety of *S. unguiculata* analogous to the above-mentioned.

The hydranths have about 20 tentacles.

Locs.—Ten miles north of Circular Head, Tasmania.

Eastern Slope, Bass Strait, 80-300 fathoms.

SERTULARIA GEMINATA, *Bale.*

Sertularia geminata, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 78, pl. v., figs. 6-7, pl. xix., fig. 15 ; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 10. *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 22. *Id.*, Mulder and Trebilcock, Geelong Nat., (2), vi., 1914, p. 6.

Desmoscyphus orifissus, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 143, pl. xvii., figs. 1-4.

Allman's habit-figure of *D. orifissus* represents *S. geminata* very perfectly, but the magnified figure shows the hydrothecæ much inflated at the base, on which account Allman considered his specimens distinct. Billard, however, after examining the "Challenger" types, reports that they do not agree with the figure, and are not separable from *S. geminata*.

The species appears to conform to the characters of the genus *Sertularia*, as restricted by Levinsen.

Locs.—South coast of South Australia.

Twenty miles east of King Island, Bass Strait.

SERTULARIA OPERCULATA, *Linné*.

"*Sea-Hair*," Ellis, Corall., 1755, p. 8, pl. iii., fig. 6.

Sertularia operculata, Linné, Syst. Nat., 1758, p. 808. *Id.*, Ellis and Solander, Zooph., 1786, p. 39. *Id.*, Esper, Fortsetz. der Pflanz., 1794-1806, ii., pl. iv., figs. 1-2. *Id.*, Lamarck, Anim. sans Vert., ii., 1816, p. 118. *Id.*, Johnston, Brit. Zooph., 2nd ed., 1847, p. 77, pl. xiv., fig. 2-2a. *Id.*, Busk, Voy. "Rattlesnake," i., 1852, p. 392. *Id.*, Hincks, Brit. Hydr. Zooph., 1868, p. 263, pl. liv., figs. a-c. *Id.*, Thompson, Ann. Mag. Nat. Hist., (5), iii., 1879, p. 106 (in part). *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 67, pl. vi., fig. i., pl. xix., fig. 3. *Id.*, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 61, pl. xxx., fig. 1-1a. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus., Wien, v., 1890, p. 231. *Id.*, Pfeffer, Ergeb. deutscher Polarexp., Allg. Theil., ii., 1892, p. 116. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 462. *Id.*, Jäderholm, Arkiv. för Zool., i., 1903, p. 284. *Id.*, Nutting, Amer. Hydr., Sert., 1904, p. 54, pl. ii., figs. 3-5. *Id.*, Hartlaub, Zool. Jahrb., Suppl. vi., iii., 1905, p. 664, figs. Y^4, Z^4, A^5. *Id.*, Bartlett, Geelong Nat., (2), iii., 1907, p. 60, fig. —. *Id.*, Billard, Ann. Sci. Nat., Zool., (9), vi., 1907, p. 218; *Id.*, Billard, C. R. Acad. Sci., cxlviii., 1909, p. 1065; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 323; *Id.*, Billard, Ann., Sci. Nat., Zool., (9), xi., 1910, p. 18. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 305. *Id.*, Ritchie, Trans. Roy. Soc. Edinb., xlvii., 1909, p. 82. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 295.

Sertularia usneoides, Pallas, Elench., 1766, p. 132.

Nigellastrum usneoides, Oken, Lehrb. der Naturg., 3 Teil, Zool., i., 1815, p. 93.

Sertularia serra, Lamarck, Anim. sans Vert., ii., 1816, p. 118.

Dynamena serra, Blainville, Man. d'Act., 1834, p. 484.

Dynamena brevicella, Lamouroux, Encyc. Méth., Zooph., 1824, p. 288. *Id.*, Quoy et Gaimard, 1824, p. 613.

Dynamena pulchella, D'Orbigny, has usually been considered another synonym, but Nutting, who regarded it as identical with *S. furcata*, Trask, treats it as distinct. The identity of *D. pulchella* and *S. furcata* cannot now, I think, be maintained; the former is, as Fraser has pointed out, much and irregularly branched, and attains a length of a quarter of a metre, while its hydrothecæ differ from those of *S. operculata* only in having the two teeth about equal. *S. furcata*, on the other hand, is shown by the accounts of Clark, Torrey, Fraser, and Stechow to be a dwarf unbranched form of the *Desmoscyphus*-type. There is no doubt that *D. pulchella* is identical with *S. operculata*, or at least very closely allied to it; as for *S. furcata*, I cannot see any definite distinction between it and *S. minima*.

Billard regards *S. crinis*, Allman, as identical with *S. operculata*, having found on examination of Allman's types that the form of the hydrothecæ and the gonothecæ is the same as in the latter species; and he remarks that it suffices to see Allman's figures to recognise the identity of the two. This, however, can only apply to the minute structure, the habit of *S. crinis* being very different from that of *S. operculata*. In the latter, as already mentioned, there is no distinction between stem and branches, all the ramifications of the colony being alike. In *S. crinis*, according to Allman's figure, there is a main stem four or five inches in height, with several principal branches, from which arise numerous tufted dichotomously divided branchlets. On the stem and main branches the hydrothecæ are from about five to fifteen times as distant from each other as are those on the small branchlets. Dr. Kirkpatrick, who has kindly examined the type for me, states that there is a distinct main stem from origin to apex, consisting of long smooth internodes apparently without or with only one pair of hydrothecæ. These peculiarities seem sufficient to establish the claim of *S. crinis* to rank, if not as a separate species, at least as a distinct variety of *S operculata*, the latter view being taken by Dr. Kirkpatrick.

Locs.—Twenty miles east of King Island, Bass Strait.

Off Devonport, Tasmania.

Ten miles north of Circular Head, Tasmania.

SERTULARIA MAPLESTONEI, *Bale.*

Sertularia maplestonei, Bale, Biological Results " Endeavour," ii., 1, 1914, p. 16 (synonymy).

Odontotheca maplestonei, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 308.

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

SERTULARIA MACROCARPA, *Bale.*

Sertularia macrocarpa, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 14 (synonymy).

Odontotheca macrocarpa, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 308.

Loc.—Bass Strait.

SERTULARIA ELONGATA, *Lamouroux.*

Sertularia elongata, Lamouroux, Hist. Pol. Cor. Flex., 1816, p. 189, pl. v., fig. 3-3c. *Id.*, Deslongschamps, Encycl. Méth., Zooph., 1824, p. 681. *Id.*, Krauss, Cor. und Zooph. der Südsee, 1837, p. 29. *Id.*, Busk, Voy. "Rattlesnake," i., 1852, p. 388. *Id.*, Thompson, Ann. Mag. Nat. Hist., (5), iii., 1879, p. 107, pl. xviii., fig. 2-2c. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 75, pl. vi., figs. 7-8, pl. xix., fig. 7; *Id.*, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 770; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, pp. 8-10. *Id.*, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 140, pl. xv., figs. 1-6. *Id.*, Marktanner-Turneretscher, Ann. K.K. Hofmus. Wien, v., 1890, p. 230. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 461. *Id.*, Hilgendorf, Trans. N.Z. Inst., xxx., 1897, p. 208, pl. xix., fig. 3-3b. *Id.*, Billard, Ann. Sci. Nat., Zool., (9), vi., 1907, p. 217, fig. 2; *Id.*, Billard, C. R. Acad. Sci., clxviii., 1909, p. 1065; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 323; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 22, fig. 9 (not 8). *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 845. *Id.*, Mulder and Trebilcock, Geelong Nat. Vict., (2), vi., 1914, p. 8, pl. i., figs. 7-10.

Sertularia scandens, Lamouroux, Hist. Pol. Cor. Flex., 1816, p. 189.

Sertularia lycopodium, Lamarck, Anim. sans Vert., 1816, p. 117.

Sertularia millefolium, Lamarck, Anim. sans Vert., 1816, p. 116.

Dynamene abietinoides, Gray in Dieffenbach, Travels in New Zealand, ii., 1843, p. 294.

Sertularia abietinoides, Hutton, Trans. N.Z. Inst., v., 1872, p. 257. *Id.*, Coughtrey, Trans. N.Z. Inst., vii., 1874, p. 285, pl. xx., figs. 16, 18-20; *Id.*, Coughtrey, Trans. N.Z. Inst., viii., 1875, p. 300. *Id.*, Pfeffer, Erg. d. deutscher Polarexp., ii., 1892, p. 116.

Most specimens of *S. elongata* can be definitely assigned to either the large or the small variety, though intermediate forms occur. The two varieties were by Lamouroux named respectively *S. elongata* and *S. scandens*, and by Lamarck *S. lycopodium* and *S. millefolium*. I have referred to this species in Part I[1], and it has been so often described that little need be said of it here. No operculum has been detected, consequently in the system of classification proposed by Levinsen it is excluded from the genus. The hydranths have about 16-18 tentacles.

Billard, in his Revision of part of the British Museum Hydroids, (Ann. Sci. Nat., Zool., (9), xi., 1910, page 22), has described some colonies which he found among clusters of *Sertularia elongata* from Australia in the Bowerbank Collection, and which, owing to this association, he has hesitated to describe as a new species, though they differ from *S. elongata* in the opposite ramification, in the opposite position of the cauline hydrothecæ, in the number of the marginal teeth, as well as the form of the hydrothecæ, in the presence of an unpaired hydrotheca on the proximal part of each pinna, and finally in the totally different form of the gonangia Billard thinks it just possible that this may be a curious case of sexual dimorphism.

I do not think this theory tenable, for several reasons. In the first place, of course, is the fact of the complete unlikeness of the two species in every detail. This of itself should, I think, be considered conclusive against any evidence short of tracing the two to the same hydrorhiza. Then it must be remembered that *S. elongata* is an extremely common species, the most abundant indeed on the southern Australian coast, and it is scarcely credible that one of its sexual forms should have hitherto escaped observation except in this single instance, especially as the difference in the ramification would be apparent to the naked eye.

Another important consideration is that this is not an entirely isolated form, but is a representative of a group of species, all of which agree in their most characteristic features. Billard refers to one of these—*S. huttoni*, Marktanner-Turneretscher—and to this may be added *S. acanthostoma*, Bale, and *S. insignis*, Thompson.

1. Bale—Biological Results "Endeavour," ii., 1, 1914, p. 9.

Further reference to these and other related forms will be found under the description of the proposed genus *Levinsenia*, all the species of which have six or more teeth on the hydrotheca-margin, and, so far as is known, no operculum.

Loc.—Nuyts Archipelago, Great Australian Bight, 10 fathoms.

Genus THUIARIA, *Fleming*.

THUIARIA SINUOSA, *Bale*.

Thuiaria sinuosa, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 772, pl. xviii., figs. 9, 10 ; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 12. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 844, pl. lxxxv., fig. 4. *Id.*, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 297. *Id.*, Mulder and Trebilcock, Geelong Nat., (2), vi., 1914, p. 9. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 294, pl. xxv., fig. 1.

Though obviously belonging to this species the specimens differ from the type in having the curvature of the hydrothecæ very slight or, more commonly, entirely wanting. The apertures are ill-defined, in consequence of the extreme delicacy of the perisarc towards the margin.

Locs.—Great Australian Bight, Long. 127° E., 100 fathoms.

Shoalhaven Bight, New South Wales, 15-45 fathoms.

Genus SERTULARELLA, *Gray*.

Though Levinsen's views regarding the genus *Sertularella* are to some extent combated by Nutting and other observers, who demur to admitting multiserial species (*Dictyocladium*), and admit some which Levinsen would exclude, there appears to be practical unanimity regarding those forms which have the characteristic three- or four-valved operculum and a biserial and alternate arrangement of the hydrothecæ ; even when their division into long internodes supporting numerous hydrothecæ would bring them strictly within the limits of the genus *Thuiaria*, as formerly understood. Such species, included in the present collection, are *Thuiaria lata* and *Sertularella adpressa*, which are certainly not, at any stage of their growth, divided into single-celled internodes, the feature which I have urged in Part I. should be regarded as characteristic of the genus, from the point of view of the colonial characters. Accordingly I now rank these forms in the genus *Sertularella*, and this I consider tantamount to admitting that *all* biserial forms with the characteristic

opercular structure should be so placed; for although the alternate arrangement of the hydrothecæ is insisted on by some, it can scarcely be maintained that a species possessing the other characters should be excluded simply because the hydrothecæ are not alternate.

The species in this collection may be accordingly divided into two main groups: the typical *Sertularellæ*, in which each internode supports one hydrotheca, and the species above-named, with numerous hydrothecæ on an internode; *S. divaricata*, in some of its forms, is distinctly intermediate. If Levinsen's grouping be strictly followed *Dictyocladium dichotomum* will represent a third section.

SERTULARELLA GAUDICHAUDI (*Lamouroux*).

Sertularia gaudichaudi, Lamouroux, Quoy et Gaimard, p. 615, pl. xc., figs. 4, 5.

? *Sertularia picta*, Meyen, Nov. Act. Leop.-Car. Acad., xvi., Suppl. i., 1834, p. 201, pl. xxxiv., figs. 1-3. *Id.*, Hartlaub., Abh. Nat. Ver. Hamb., xvi., 1900, p. 77, pl. v., fig. 14, pl. vi., figs. 17, 18, 20.

Sertularella polyzonias, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 104, pl. iii., fig. 1, pl. xix., fig. 25; *Id.*, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 763. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 291, fig. 5 A, B, pl. lxvii., figs. 18-20. *Id.*, Stechow, Zool. Jahrb., xxxii., 1912, p. 358.

Sertularia laxa, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., 1888, Hydroida, pt. II., p. 55, pl. xxvi., fig. 2, 2a. *Id.*, Pictet et Bedot, Res. camp. scient. Prince de Monaco, fasc. xviii., 1900, p. 22.

Sertularella mediterranea, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, pp. 86, 47, fig. 22, pl. v., figs. 10, 11, 15, 16.

Sertularia polyzonias (in part), Vanhöffen, Deutsche Südpolar-Exp. 1901-1903, xi., Zool. iii., 1911, p. 322, fig. 39.

Sertularella gaudichaudi, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 317, fig. 5; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 11; *Id.*, Billard, Arch. de. Zool. exp. et gén., 51, 1912, p. 464.

?? Not *Sertularella polyzonias* (Linné).

The relations between *Sertularella mediterranea*, Hartlaub (which Billard finds to be identical with *Sertularia gaudichaudi*, Lamouroux) and *S. polyzonias* are greatly in

doubt. Stechow, Warren, and Vanhöffen regard them as belonging to one species, but Billard considers *S. mediterranea* as sufficiently distinguished by the presence of internal teeth in the hydrotheca. This, however, is not in accordance with the definitions of Hartlaub, who says that *S. polyzonias* also possesses these appendages, though they are not so strongly developed as in *S. mediterranea*, and *may* be entirely wanting. He mentions further that he has seen specimens which he is in doubt whether to place under *S. mediterranea* or *S. polyzonias*. All this may be regarded as favouring the view of those observers who consider the two species identical; but on the other hand it seems equally reasonable to suppose that Hartlaub was wrong in assigning to *S. polyzonias* any of the specimens with internal teeth, and that Billard's view is the correct one. Stechow's reason for believing the species the same was that he had found specimens with internal teeth—therefore to be referred to *S. mediterranea*—but with an external marsupium on the gonotheca, the latter condition being characteristic of *S. polyzonias*. This, however, is quite in accordance with Hartlaub's statement that *S. polyzonias* may have internal teeth, which both Stechow and Billard omit to notice.

The position then seems to be that Hartlaub makes the presence or absence of the marsupium the prime specific character, while Billard regards the internal teeth as of more importance.

Dr. Ritchie, who has kindly sent me British specimens of *S. polyzonias*, informs me that he has examined colonies of that species from a number of widely separated localities, and has in no case found internal teeth present.

All the Australian specimens which I have so far observed possess these teeth, and therefore conform to Billard's description of *S. gaudichaudi* (*S. mediterranea*); I therefore refer them to that species, leaving for future settlement the question of its identity or otherwise with *S. polyzonias*.

I only saw one fragment among the "Endeavour" material, and am doubtful as to its locality; it agreed, however, with Port Phillip specimens which I formerly described as *S. polyzonias*. The shoots are simple or with few and irregular branches, given off below the hydrothecæ, just as in *S. polyzonias*[1]; the hydrothecæ are adnate for about half their length. In certain minor particulars they differ from Billard's description; thus the hydrothecæ are in one plane

1. In the specimen of *S. polyzonias* sent to me from Scotland by Dr. Ritchie, about half the branches spring from the interior of hydrothecæ.

(but this agrees with *S. mediterranea*), the base of the branches is only slightly twisted, or not at all, and the annulation of the gonotheca extends over a greater part of its length. According to Billard the typical *S. gaudichaudi* and *S. mediterranea* have the outer tooth of the hydrotheca longer than the others, so that the aperture appears oblique ; this character is present in our specimens to such a slight extent as to be scarcely noticeable, and in many hydrothecæ it is not discernible at all. All these characters are of known inconstancy, and the differences would not justify a specific separation. The gonothecæ may have either three or four pointed teeth on the summit, and this in the same shoot.[1] The type form, according to Billard, has four, while the form described by Allman as *S. laxa* is said to have three. It is on Billard's authority that the latter is referred to *S. gaudichaudi*.

It is noticeable that in this species, although there are four marginal teeth, the internal ones number only three, and the same condition obtains in *S. microgona* and *S. angulosa*, as well as in the species next to be described. Hartlaub, it is true, describes *S. mediterranea* as having *four* internal teeth, but as he does not draw any distinction in regard to this character between that species and the internally toothed forms which he refers to *S. polyzonias*, it seems permissible to suspect that this is an oversight. The Bass Strait specimen with internal teeth, which he refers to *S. polyzonias*, is probably the same as the present form. All my specimens are distinctly smaller throughout than British examples of *S. polyzonias*.

The distinction between *S. polyzonias* and *S. gaudichaudi*, if finally upheld, will invalidate the record of the former as a member of the Australian fauna. Its inclusion in the "Catalogue of the Australian Hydroid Zoophytes" was solely on the evidence of specimens with internal teeth (though this feature was not observed till later), and I am not aware of any other record of the occurrence of *S. polyzonias* in Australia except Hartlaub's, referred to above. Up to the present, therefore, the existence of the typical *S. polyzonias* has not been established, and it is quite probable that many others of the locality-records which have contributed to procure for it the character of ubiquity may have also referred to forms such as that here classed as *S. gaudichaudi*.

1. In a single shoot of *S. polyzonias* I find gonangia with three, four, and five teeth.

SERTULARELLA TASMANICA, *sp. nov.*

(Plate xlvi., fig. 2.)

Hydrocaulus about one inch in height (or more ?), stem fascicled towards the base, branches irregularly pinnate, springing from below the hydrothecæ; stem and branches divided by oblique twisted joints into long internodes, each bearing a hydrotheca close to the summit; proximal internodes of the branches very long, smooth or slightly undulated at their origin.

Hydrothecæ in a single plane, large, divergent, urceolate, adnate for more than half their length; border slightly expanding, with four marginal teeth; three strong internal vertical teeth, two below the two upper emarginations of the border and the third below the abcauline marginal tooth.

Gonosome—?

This species has the general habit of *S. polyzonias* and *S. gaudichaudi*, with the latter of which I was at first inclined to place it. It is distinguished by the fasciculation of the stem, which, however, did not extend far above the base. The fascicle is formed, as Hartlaub points out in the case of allied species, by the development of supplementary tubes which originate at various points on the stem and grow downward. The hydrothecæ are larger than those of *S. gaudichaudi*, their usual length being, between extreme points, about .815 mm., and they also differ from those of that species in having a much larger proportion—nearly two-thirds—of their length adnate. The border is of the same form as that of *S. polyzonias*, and transverse to the hydrotheca; only rarely is there discernible a slight tendency to the obliquity which, according to Billard, is a feature of *S. gaudichaudi*. The internal vertical processes are large and prominent. The portion of the internode below the hydrotheca is very variable in length, about .450 mm. being common; the first internode of a branch, however, is much longer, sometimes attaining as much as 1.8 mm. between its origin and the base of the first hydrotheca. These internodes may have a few faint undulations close to their origin, but are more commonly quite smooth.

Loc.—Off South Cape, Tasmania, 75 fathoms.

SERTULARELLA GAYI (*Lamouroux*).

Sertularia gayi, Lamouroux, Exp. Méth., 1821, p. 12, pl. 66, figs. 8-9. *Id.*, Deslongchamps, Encyc. Meth., Zooph., 1824, p. 682. *Id.*, Milne-Edwards, Lamarck's Anim. sans Vert., 2nd ed., ii., 1836, p. 152.

Sertularella gayi, Hincks, Brit. Hydr. Zooph., 1868, pp. 237, 238, fig. 29, pl. 46, fig. 2. *Id.*, Verrill, Amer. Jour. Sci. and Arts, (3), v., 1873, pp. 9, 14. *Id.*, Allman, Trans. Zool. Soc., viii., 1874, pp. 471, 474, pl. lxvi., fig. 3, 3a (var. *robusta*); *Id.*, Allman, Mem. Mus. Comp. Zool. Harvard, v., 1877, p. 22, pl. xv., figs. 3-5 (var. *robusta*). *Id.*, Sars, Bidr. til Kunds. om Norg. Hydr., 1874, p. 109. *Id.*, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 41. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 61. *Id.*, Nutting, American Hydroids, pt. II., Sertularidæ, 1904, p. 78, pl. xiv., figs. 1-7. *Id.*, Billard, Exp. Sci. du "Travailleur" et du "Talisman," Hydroides, viii., 1906, p. 184, fig. 9, p. 185 (var. *robusta* and var. *elongata*). *Id.*, Jäderholm, Kungl. svenska Vetenskapsakad. Handl., 45, 1909, p. 100, pl. xi., fig. 13.

Sertularia ericoides var., Pallas, Elench., 1766, p. 127.

Sertularia polyzonias var. β, Johnston, Brit. Zooph., 2nd ed., 1847, p. 61, pl. x., fig. 2.

Sertularella annulata, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 52, pl. xxiv., fig. 2, 2a. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 54.

Sertularella Gayi (Lamouroux), var. *Allmani*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 10, fig. 3.

The hydrothecæ are large and nearly smooth, with very inconspicuous teeth; the gonothecæ with the annulations irregular, often almost wanting, and usually with three short teeth on the summit.

Loc.—Eastern slope, Bass Strait, 80-300 fathoms.

SERTULARELLA UNDULATA, *sp. nov.*

(Plate xlvi., fig. 1.)

Hydrocaulus unbranched, about ¼ inch in height, divided by oblique twisted joints into internodes of very variable length, each supporting a hydrotheca at the summit and having its lower portion strongly undulated.

Hydrothecæ short, stout, free for half their length or more, proximal half smooth, distal half with a strong annular ridge or shoulder, above which the hydrotheca is somewhat narrower, and a second slighter annulation close to the wide aperture, border square, with four small teeth, between which are shallow emarginations; no internal teeth.

Gonosome.—?

A small colony of this species was found growing on one of the specimens of *S. tasmanica*. The longest shoots consisted of seven or eight internodes. The hydrothecæ are seated high on the internodes, the tops of which reach only to about their middle. The first internode is about as long as the hydrotheca; the more distal ones may attain more than twice their length. Below the hydrothecæ, and for a distance equal to about the length of the latter, the internodes are narrowed downwards; the rest of their length is slender and of about uniform thickness, and for the most part strongly undulated; the undulations often extending up nearly as far as the hydrotheca.

The hydrothecæ have no distinct annulations below the shoulder, which is a somewhat prominent annular ridge, and above which the hydrotheca is rather abruptly contracted, but to a slight extent only; between the shoulder and the aperture is another annulation, which is of about the same diameter as the expanded border. The width of the aperture from point to point is very little less than that of the hydrotheca at its thickest portion, a rather exceptional condition among the quadridentate species. The emarginations of the border do not usually run in a uniform curve from point to point, but are somewhat flattened (as seen in profile), and the teeth are more or less nipple-shaped.

One of the shoots is continued into a stolon, and on this are borne a new shoot and also two isolated single hydrothecæ.

Loc.—Off South Cape, Tasmania, 75 fathoms.

SERTULARELLA INDIVISA, *Bale*.

Sertularella indivisa, Bale, Journ. Micro. Soc. Vict., ii., 1881, p. 24, pl. xii., fig. 7; *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 105, pl. iii., fig. 5, pl. xix., fig. 27; *Id.*, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, pp. 764, 765. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 224. *Id.*, Billard, Bull. Mus. d'Hist. nat., 1905, p. 334.

Sertularella solidula, Bale, Journ. Micr. Soc. Vict., ii., 1881, p. 24, pl. xii., fig. 8; *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 106, pl. iii., fig. 6, pl. xix., fig. 28; *Id.*, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, pp. 764, 765. *Id.*, Whitelegge in Etheridge, Mem. Austr. Mus., ii., 1889, p. 41. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, pp. 71, 41, 56, 76, 125, pl. iv., figs. 3, 13, 14, 27, pl. vi., fig. 13; *Id.*, Hartlaub, Zool. Jahrb., xiv., 1901, p. 371. *Id.*, Stechow, Abh. math.-phys.

Klasse K. Bayer Akad. Wissensch., iii. Suppl.-Bd., 1913, p. 136, figs. 108-110; (*Sertularella*, No. 10, Inaba, Zool. Mag. Tokyo, 1890, figs. 26-28).

Sertularella variabilis, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 764, pl. xv., figs. 5-9. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1890, p. 66.

Sertularella Sieboldi, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 49, pl. xvi., fig. 5, 5a. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 69, pl. iv., fig. 12.

Sertularella Mülleri, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 49, pl. xvi., fig. 7-7b. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 70, pl. ii., figs. 43-45, 59.

Not *S. indivisa*, Stechow, Abh. math.-phys. Klasse K. Bayer Akad. Wissensch., iii. Suppl.-Bd., 1913, p. 134, figs. 106, 107; (*Sertularella* No. 9, Inaba, Zool. Mag. Tokyo, 1890, figs. 22-25).

Hartlaub has united *S. indivisa*, *S. solidula*, and *S. variabilis* under the name of *S. solidula*, and in view of the extreme range of variation found among these forms, I cannot but concur in his judgment. The species, however, must be named *S. indivisa* instead of *S. solidula*, the former name having priority.

Hartlaub also considers it probable that the *S. sieboldi* and *S. muelleri* of Kirchenpauer belong to the same species. It would be impossible to identify them from Kirchenpauer's account, but Hartlaub's descriptions and figures seem to me to support his opinion.

S. exigua, Thompson, is also ranked by Hartlaub as a synonym, on the strength of specimens marked *S. exigua* in the Kirchenpauer collection. *S. exigua*, however, has four-toothed hydrothecæ, consequently Kirchenpauer's specimen must be incorrectly referred to that species.

Inaba's Species 9, which Stechow refers to *S. indivisa*, is also a four-toothed form, and, therefore, its reference to *S. indivisa* is inadmissible.

The "Endeavour" specimens agree pretty closely with the typical *S. indivisa*, but are very thin and delicate. Most of them were growing on *S. adpressa*, Ritchie.

Locs.—Oyster Bay, Tasmania, 60 fathoms.

Forty miles west of Kingston, South Australia, 30 fathoms.

Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Twenty miles east of King Island, Bass Strait.

SERTULARELLA DIVARICATA, (*Busk*).

Sertularella divaricata, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 20, pl. ii., figs. 1-9 (synonymy). *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 291.

Locs.—Twenty miles east of King Island, Bass Strait.

Eight miles east of Sandon Bluff, Queensland, 35-40 fathoms.

Ten miles north of Circular Head, Tasmania.

Great Australian Bight.

Hunter Group, Bass Strait.

SERTULARELLA NEGLECTA, *Thompson*.

Sertularella neglecta, Thompson, Ann. Mag. Nat. Hist., (5), iii., 1879, p. 100, pl. xvi., fig. 1. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 110, pl. iii., fig. 3, pl. xix., figs. 22, 23. *Id.*, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 48. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 224. *Id.*, Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, pp. 69, 16, 20, 26, 56, 112, pl. ii., figs. 25, 53.

Sertularella Sonderi, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. —, pl. xvi., fig. 4.

? *Sertularella trimucronata*, Allman, Journ. Linn. Soc., Zool.. xix., 1885, p. 135, pl. x., figs. 1, 2. *Id.*, Hartlaub, Abh, Nat. Ver. Hamb., xvi., 1900, p. 48, fig. 24; *Id.*, Hartlaub, Zool. Jahrb., Suppl. vi., iii., 1905, p. 626, fig. Q^3.

I have added *S. trimucronata*, Allman, to the synonyms, as I cannot find in Allman's account anything to differentiate it from the present species.

Locs.—Forty miles west of Kingston, South Australia, 30 fathoms.

Off Murray mouth, South Australia, 20 fathoms.

Eleven miles 74° W. of Cape Martin, South Australia, 21 fathoms.

SERTULARELLA LATA, *Bale*.

Thuiaria lata, Bale, Journ. Micro. Soc. Vict., ii., 1881, pp. 26, 45, pl. xiii., fig. 2; *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 120, pl. vii., fig. 4; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 103, pl. iv., fig. 1; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 12. *Id.*, Kirkpatrick, Sci. Proc. R. Dublin Soc., (n.s.), vi., 1890, p. 604.

Sertularella lata, Levinsen, Vidensk. Medd. fra den naturh. Foren, 64, 1913, p. 312.

Not *Sertularella lata*, Billard, Arch. de Zool. exp. et gén., (4), vii., 1907, p. 346, fig. 4.

I have referred to this species in Part I under its original name of *Thuiaria lata*, but for the reasons already stated I now class it under the genus *Sertularella*.

With regard to its specific affinities much confusion exists. A number of hydroids have been referred to the species by different observers, some of which may possibly be rightly placed, while others have the gonangia so unlike those of *S. lata* in every particular that it is difficult to understand why they should have been associated with it. Apparently there are two species[1] (at least) closely resembling each other in the trophosome, but differing widely in the form of the gonangia. No fertile specimens of *S. lata* have been observed except a single one from Port Phillip, Victoria, collected by the late Mr. J. Bracebridge Wilson.

The following list includes the forms which have been regarded by other observers as specifically identical with *S. lata* :—

Sertularia tridentata, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 187.

Thuiaria diaphana, Busk, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 145, pl. xviii., figs. 1-3.

Thuiaria hyalina, Allman, Rep. Sci. Results " Challenger " Exped., Zool., xxiii., Hydroida, pt. II., 1888, p. 69, pl. xxxiii., fig. 2-2a.

Sertularella lata, Nutting, Amer. Hydr., II., Sertulariadæ, 1904, p. 85, pl. xviii., fig. 10 ; *Id.*, Nutting, Bull. U.S. Fish. Comm., 1905, p. 948.

Sertularella Torreyi, Nutting, Bull. U.S. Fish Comm., 1905, p. 949, pl. iv., fig. 4, pl. xi., figs. 2-3.

Sertularella lata, Billard, Arch. de Zool. exp. et gén., (4), vii., 1907, p. 346, fig. 4.

Sertularella speciosa, Congdon, Proc. Amer. Acad. of Arts and Sci., xlii., 1907, p. 476, figs. 24-28.

1. Another species having similar hydrothecæ is *Thecocladium flabellum*, Allman. Billard's figure of this species (Ann. Sci. Nat., Zool., (9), xi., 1910, p. 12) really more resembles *S. lata* than does his figure of " *Sertularella lata*." (Arch. de Zool. exp. et gén., (4), vii., 1907, p. 346), and would indeed serve admirably for *S. lata* except for the peculiarity of the pinnæ springing from hydrothecæ.

Sertularella tridentata, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 312; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 14.

Sertularella tridentata, Stechow, Abh. math.-phys. Klasse K. Bayer Akad. Wissensch., iii. Suppl.-Bd., 1913, p. 137, figs. 111-113; (*No.* 17 *Thuiaria sp.*, Inaba, Zool. Mag. Tokyo, 1890, figs. 46-48).

Of the foregoing, *Sertularella tridentata*, Lamouroux, is said by Billard, who has examined the type specimens, to be identical with the form described by him in 1907 as *S. lata*, hence he has since considered the latter a synonym of *S. tridentata*. Lamouroux' specimens, not including the gonangia, may be doubtful, but if really identical with Billard's species, they are not the true *S. lata*.

Nutting says that the specimens assigned by him to *S. lata* are the same as Allman's *Thuiaria hyalina*, types of which he has examined; the absence, however, in both cases of the gonangia renders the identification doubtful. It should be noted that Allman describes the hydranth of *T. hyalina* as only partially retractile, the upper portion, including the tentacular crown, being incapable of withdrawal into the hydrotheca, even when most fully retracted. In *S. lata*, on the contrary, the hydranths are found fully withdrawn into the hydrotheca, and occupying little more than the lower half of its cavity.

Inaba's species, which Stechow has referred to *S. tridentata*, is also without the gonangia. The figures resemble *S. lata*, but the aperture of the hydrotheca does not approximate so closely to the vertical position. It cannot be identified with *S. lata* with any certainty.

There remains Billard's *S. lata* or *S. tridentata*, with *T. diaphana*, Busk, *S. Torreyi*, Nutting, and *S. speciosa*, Congdon, and it is probable that these forms constitute a single species, the gonangia, as well as the hydrothecæ, being of the same type throughout. Billard's figure of the trophosome differs from *S. lata* in the hydrothecæ being more bent outward and having the apertures looking more upward. The most distinctive feature of this form, however, as of the others here associated with it, is the character of the gonangia. These are cylindrical in the upper half and gradually tapering below, not contracted at the summit, but even, according to Allman and Congdon, somewhat flaring. Surrounding the upper half are a number of longitudinal plications, between which the wall of the gonangium is convexly curved outwards. There is no trace of bilateral symmetry, and the form bears

a striking resemblance to that of the gonangium of *Orthopyxis wilsoni*, Bale.[1] Nutting also refers to this similarity to the gonangia of some of the Campanularians.

From this type the gonangia of *S. lata* differ in every character. In the first place the bilateral development is conspicuous, the gonangia having distinct dorsal and ventral aspects, the latter of which is directed inward. From a little above the middle the gonangium tapers gradually to the peduncle; it is also narrowed upwards, but in a less degree, and the narrowing at this part is mostly on the dorsal side, which is continued upward considerably higher than the ventral, and at the summit rounded over to the oblique concave termination, which is thus contracted at the dorsal border, but little or not at all in front. There is nothing in any way resembling the plicated condition found in the other species, but on the other hand there are regular transverse undulations (generally more pronounced than I have figured them), which are strongest at the dorsum, and become shallower towards the venter, where they are often not traceable. The gonangia are not erect on the pinnæ, but lie along them, with the venter almost appressed to them.

The pinnæ are usually long, attaining about three-quarters of an inch, and narrow at the point of origin. The distal internodes often bear only three hydrothecæ, but very rarely less. The hydrothecæ have four shallow emarginations; the intermediate points are usually distinct at the sides, but less pronounced above and below. The aperture is nearly vertical in typical specimens, in others somewhat less so. The terminal hydrotheca in each internode has the aperture directed slightly more upward than the others.

Locs.—Off St. Francis Island, Great Australian Bight, 30 fathoms.

Great Australian Bight, 80-120 fathoms and 130-190 fathoms.

SERTULARELLA ADPRESSA, *Ritchie.*

Sertularella adpressa, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 837, pl. lxxxv., fig. 5, pl. lxxxviii., figs. 1, 2, 9. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 291, pl. xxv., fig. 2.

This species has been fully described by Ritchie, and the present specimens, for the most part, answer perfectly to the

1. Bale—Proc. Roy. Soc. Vict., (n.s.), xxvii., pl. xii., fig. 5.

description. The gonothecæ, however, are narrower than those figured; here and there one is seen which in lateral view agrees with the figure, but this is exceptional; while the frontal aspect is far narrower, its width being usually just about the same as that of the pinna with its hydrothecæ, and the same width is maintained throughout, except just at the base.

The hydrothecæ are somewhat similar to those of *S. divaricata*, but are of narrower proportions, more regularly curved, and with the aperture smaller. In most cases regeneration has occurred repeatedly, and the later peristomes are generally decidedly smaller than the primary one, as well as slighter in texture.

There are no nodes, or very few, in the pinnæ; the hydrothecæ being in long uninterrupted series, such as were formerly considered characteristic of the genus *Thuiaria*.

Locs.—Oyster Bay, Tasmania, 60 fathoms.

Shoalhaven Bight, New South Wales, 15-45 fathoms.

Family PLUMULARIIDÆ.

This is by far the most important family represented in the collections, whether regarded in relation to the variety of the forms observed, or to the beauty and luxuriance of many of the species, or to the abundance of the colonies. Several species, both among the Statoplea and the Eleutheroplea, attain over a foot in height, and three or four reach two feet, possibly more. Out of thirty species the genera *Nemertesia*, *Kirchenpaueria*, and *Halicornopsis* are represented by one each; the rest, with one exception, are divided among the genera *Plumularia*, *Aglaophenia* (with *Thecocarpus*) and *Halicornaria*. The exception is a small form closely allied to *Cladocarpus*, for which a new genus is proposed under the name *Cladocarpella*.

Genus PLUMULARIA, *Lamarck*.

The genus *Plumularia*, as I have been used to regard it, would include a number of forms which, by Allman and others, were considered to be types of distinct genera. Such are *Antennella*, *Acanthella*, *Heteroplon*, and *Halopteris*. I have already referred to *Antennella*, which is a convenient division, but subject to the disadvantage that in studying a newly discovered specimen one cannot be certain whether it is a true *Antennella* or merely an unbranched form of some pinnate species.

Acanthella, like *Acanthocladium* among the Statoplea, is distinguished only by having its upper hydrocladia abortive, and terminating in, or replaced by, pointed spines.

Heteroplon is a synonym for those species of *Plumularia* in which the anterior mesial sarcothecæ are rigid instead of freely moveable, a condition which, as I pointed out long ago, is as common as the contrary. It may, of course, be held that this character is sufficient to found a genus upon (though the difference between the fixed and the moveable sarcotheca depends merely on the thickness of the basal part, and every intergradation occurs); no one, however, has adopted the genus since Allman, and it is only mentioned here since it appears in Stechow's recent list of the genera. Even Allman, when proposing the genus, at the same time described as a *Plumularia* (*P. laxa*) the common *P. campanula*, which has similar sarcothecæ to *H. pluma*. If Allman's figure of the latter species in front view[1] be compared with my front view of *P. campanula*,[2] it will be seen that the anterior sarcothecæ are as similar as if copied from the same individual. Allman also describes as *P. armata* a species which, according to Billard, has sarcothecæ of the same type, though differently represented in Allman's figure.

Of course the admission of the rigid sarcotheca as a good generic character would involve, for those who admit the genus *Antennella*, the creation of a new genus for those unbranched forms having moveable anterior sarcothecæ (the type form, *A. secundaria*, having them fixed), and similarly the genus *Monotheca* of Nutting would have to be subdivided, since of about eight forms known to me five have the anterior sarcothecæ moveable, while three have them in the form of stout rigid processes of the internode.

Halopteris is another type with fixed sarcothecæ, but its chief peculiarity was supposed to be the possession by the lateral sarcothecæ of a long tubular stem, adnate to the hydrotheca. In 1887 I suggested that this was probably only a peduncle, or process from the internode, differing only in its greater length from those found in *P. catharina*, *P. campanula*, and many other species. Nutting has confirmed this surmise in regard to Allman's species, and I have specimens of a nearly allied form—*P. balei*, Bartlett—which seems exactly similar to *H. carinata* so far as the lateral sarcothecæ are concerned, and in this the structures in question are also undoubtedly peduncles. *Antennella balei*,

1. Allman—Rep. Sci. Results "Challenger" Exped., Zool., vii., Hydroida, pt. I., 1883, pl. viii., fig. 2.
2. Bale—Proc. Linn. Soc. N.S. Wales, (2), III., 1888, pl. xx., fig. 2.

Billard, is another form with the same characteristic. I fully agree with Billard that these genera (except perhaps *Antennella*) are entirely superfluous.

The presence of an intrathecal ridge in *Plumularia* and its immediate allies is, though not nearly so frequent as in the Statoplea, by no means so exceptional as some observers have suggested, and it occurs on both the adcauline and the abcauline sides of the hydrotheca.[1] An abcauline ridge, of the same type as that of *Lytocarpus philippinus*, is found in *P. diaphragmata* and *P. jedani*, Billard, and the same form occurs in *P. balei*, Bartlett, as well as in *Kirchenpaueria mirabilis* and *K. producta*, which Billard includes in *Plumularia*. In all these cases the ridge is a distinct shelf extending across a large portion of the hydrothecal cavity. In the peculiar group which includes *P. asymmetrica* and *P. alata* we find these two species possessing an abcauline ridge less developed than that of the group last mentioned. In *P. habereri* var. *mediolineata*, Billard, occurs the first slight rudiment of the ridge which in the allied *P. asymmetrica* attains a fuller development. Among the species in which the ridge is adcauline is *P. filicaulis*; in one form it is rudimentary, in another it extends nearly half through the hydrotheca, and it may be noted that though on the adcauline side, it is not in that portion of the hydrotheca which is in contact with the internode, but in the free portion. *P. lucerna*, Mulder and Trebilcock, is said to have a similar ridge; I doubt, however, whether this species is distinct from *P. filicaulis*. In *P. goldsteini* the adcauline ridge is rudimentary. In the section *Monotheca* I have found only the adcauline ridge, which springs from a point close to the termination of the hydrocladium. In *P. obliqua* it is rudimentary; in the form which I have called var. *robusta* it is somewhat more developed. Again, in *P. compressa* it is very narrow, while in the closely allied *P. australis* it extends half through the hydrotheca, and in *P. spinulosa* it is still wider.

As a guide to the affinities of the species I cannot attach any importance to the presence of the intrathecal ridge, since we often find it present in one species while another, evidently very nearly allied, may have no trace of it. Such instances are *P. asymmetrica*, Bale, and *P. hertwigi*, Stechow, among the species with bilobed hydrothecæ; and *P. balei*, Bartlett,

1. I use the terms "adcauline" and "abcauline" instead of "posterior" and "anterior," as there are instances, both in the Statoplea and the Eleutheroplea, where the adcauline ridge cannot with propriety be described as posterior.

and *Halopteris carinata*, Allman, in the *Halopteris* group. For similar reasons, but little significance can be attached to the polysiphonic or monosiphonic condition of the hydrocaulus. The presence of "intermediate internodes" in the hydrocladia is not even of specific importance in such species as *P. campanula*, where these internodes may be distinctly defined in parts of the polypidom, while in other portions the nodes dividing them from the hydrothecal internodes may be obsolete. But the presence of intermediate internodes in *P. setacea* and its allies, and their absence in such species as *P. badia*, are more constant characters.

On the whole, I am disposed to think that the best primary sectional division of the genus (setting aside *Antennella* and *Monotheca*) would be into two groups, one containing those forms in which hydrothecæ are borne on the rachis as well as on the pinnæ, the other for all the species in which no hydrothecæ are borne on the rachis. This group, in which the genus reaches its highest development, includes the minor groups represented respectively by the well-known *P. setacea*, *P. badia* and the aberrant *P. asymmetrica*. The other main group, of which *P. catharina* and *P. campanula* are typical, I would distinguish by the sectional name THECOCAULUS. It is the more primitive type, being the next stage of development from the unbranched *Antennella*. I may here refer to a question of terminology, namely the use of the term "hydrocladium." Billard includes in the genus *Antennella* "les espèces de Plumulariidæ réduites aux hydroclades, se détachant de l'hydrorhize, ou même de la base d'un hydroclade primaire," while Jäderholm says that in *Antennella* there are no hydrocladia, but only hydrotheca-bearing stems. Billard's expression might be held to imply that *Antennella* is a degenerated form of *Plumularia*, while Jäderholm evidently regards it as a primitive form which has not developed branches. Of course it might be urged that any part of the polypary which bears hydrothecæ is a hydrocladium, but this would imply that in a pinnate specimen of *P. campanula*, for example, the pinnæ, the branches, and even the polysiphonic stem, were all hydrocladia, obviously a reductio ad absurdum. I think, therefore, that in this species the simple shoots, (*P. indivisa*) should be described as *stems*, while the lateral branches, whether scattered or regularly pinnate, are hydrocladia, which in their turn may bear secondary hydrocladia. According to Billard the true *Antennella* is a species which does not exist in the pinnate form, and I think that in the majority of species at least, it is a primitive, not a degenerated form. Nevertheless I am acquainted with three

Plumularians in which such degeneracy seems probable. These are *Plumularia filicaulis*, *Halicornaria humilis*, and another dwarf species of *Halicornaria*, belonging to the *ascidioides*-group. In all these instances a colony consists of a number of simple shoots, bearing hydrothecæ, with here and there a pinnate shoot. As in these species the rachis bears no hydrothecæ the simple shoots cannot, of course, be regarded as stems, but as hydrocladia springing directly from the hydrorhiza, and the species must be looked upon as degenerated forms, of which the *Halicornariæ* at least, which are both parasitic species, show abundant evidence in their irregular and depauperated aspect.

Of the few species of *Plumularia* represented in this collection *P. campanula*, *P. buski*, and *P. zygocladia* belong to the section *Thecocaulus*, and they agree also in possessing the character assigned by Allman to *Heteroplon*. *P. sulcata* is also a *Thecocaulus*, but is quite peculiar in its ramification, as well as in other particulars. *P. procumbens* belongs to what I have regarded as the typical *Plumulariæ*, and agrees with the *setacea*-group in having intermediate internodes on the hydrocladia.

P. asymmetrica belongs to a group in which there are no cauline hydrothecæ, but which differs considerably from the *setacea*-type, especially in having the margin of the hydrotheca bilobed. Its allies are *P. hertwigi*, Stechow, *P. habereri*, Stechow, and *P. alata*, Bale.

PLUMULARIA CAMPANULA, *Busk.*

Plumularia campanula, Busk, Voy. "Rattlesnake," i., 1852, p. 401. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 124, pl. x., fig. 5; *Id.*, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 776, pl. xx., figs. 1-6; *Id.*, Bale, Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 94; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 113; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), xxvi., 1913, p. 133. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v. 1890, p. 255. *Id.*, Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 466. *Id.*, Billard, C.R. Acad. Sci., cxlvii., 1908, p. 759.

Plumularia indivisa, Bale, Journ. Micro. Soc. Vict., ii., 1881, **pp. 39, 46, pl. xv., fig 1.**

Plumularia laxa, Allman, Rep. Sci. Results "Challenger" Exped., Zool., vii., Hydroida, pt. I., 1883, p. 19, pl. i., figs. 5-6.

Plumularia torresia, Von Lendenfeld, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 477, pl. xiii., figs. 13, 14, pl. xiv., fig. 16.

Plumularia rubra, Von Lendenfeld, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 476, pl. xiii., figs. 11, 12, pl. xiv., fig. 15.

Locs.—Twenty miles east of King Island, Bass Strait.

Oyster Bay, Tasmania, 60 fathoms.

Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

PLUMULARIA BUSKII, *Bale.*

Plumularia buskii, Bale, Biological Results, "Endeavour," ii., 1, 1914, p. 28 (synonymy). *Id.*, Billard, Les Hydr. de l'Exped. du Siboga, I., Plumularidæ, 1913, p. 21, fig. xi., pl. i., fig. 15. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 304.

Plumularia nuttingi, Billard, Arch. Zool. exp. et gén., (5), viii., 1911, p. lxvi., fig. 8.

Locs.—Forty miles west of Kingston, South Australia, 30 fathoms.

Sanders Bank, Kangaroo Island, 28 fathoms.

South Australian coast.

Off St. Francis Island, South Australia, 30 fathoms.

Twenty miles east of King Island, Bass Strait.

PLUMULARIA ZYGOCLADIA, *Bale.*

Plumularia zygocladia, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 171, pl. xxxvi., fig. 2.

Loc.—Thirty-eight miles north-east of North Reef Lighthouse, Capricorn Group, off Port Curtis, Queensland, 74 fathoms.

PLUMULARIA SULCATA, *Lamarck.*

Plumularia sulcata, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 172, pl. xxxv., figs. 6-7 (synonymy). *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 306, pl. xi., fig. 1.

Locs.—Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Bass Strait, 40 fathoms.

PLUMULARIA ASYMMETRICA, *Bale*.

Plumularia asymmetrica, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 29, pl. iv., figs. 2-3.

Locs.—Great Australian Bight, 130-190 fathoms, and 80-120 fathoms.

Great Australian Bight, Long. 126° 45¼′ E., 190-320 fathoms.

PLUMULARIA PROCUMBENS, *Spencer*.

Plumularia procumbens, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 29 (synonymy). *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 305, pl. x., fig. 1.

Besides specimens of the usual form, several were obtained which were more lax in habit, with sparser ramification, and the ultimate branchlets apparently more nearly pinnate in arrangement. The branches are not confined to one plane, but rather straggling, and there is nothing to indicate a procumbent habit.

Spencer mentions that the primary stem, which occupies the centre of the fascicle, is unjointed, having, as he surmises, lost its jointing after being enveloped by the supplementary tubes. In branches consisting of about a dozen tubes I find the jointing of the primary one generally distinct, but in a few instances it is obscure or wanting. The primary tube is exactly the same in structure as the small monosiphonic branchlets, any one of which may form the nucleus of a polysiphonic branch.

My former description of the ultimate branchlets as springing from all sides of the larger branches is not strictly accurate. Though really diverging in several directions they are, in their origin, confined to the two sides, where they are given off in pairs (a pair on each side alternately). As the two branchlets constituting a pair diverge widely from each other, they are in two planes on each side of the branch. This at least is the typical arrangement, but there is much irregularity, thus two pairs may follow on the same side, a single branchlet may be produced instead of a pair, or one may be abortive, while the amount of divergence also varies. The branchlets do not spring directly from the branch, but from the apophyses of the hydrocladia. These are stout and bracket-like, as in *P. badia* and *P. cornuta*, and when they give origin to a pair of branchlets one of the latter springs

from each side, so that the hydrocladium is situated between the two branchlets. I have not seen in any other species exactly the same form of ramification.

Locs.—Fifty miles south of St. Francis Island, South Australia, 30 fathoms.

Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Great Australian Bight, 80-120 fathoms, and 40-100 fathoms.

Genus NEMERTESIA, *Lamouroux.*

With Nutting, I regret that the old-established name *Antennularia* should be abandoned in favor of *Nemertesia*; some observers, however, have always adhered to the latter name, which was published by Lamouroux in 1812, and must, therefore, take priority of *Antennularia*, which dates from 1816.

The only species observed—*N. ciliata*—differs widely in habit from its congeners; the expanded hydrosoma, with its branches in one plane, and its numerous little pinnately-arranged branchlets with their scarcely-visible hydrocladia, giving it more the aspect of a *Plumularia*.

The species described by Billard as *Sibogella erecta*[1] is also provided with a multitude of little branchlets, but they differ from those of *N. ciliata* in being in several planes instead of pinnately arranged, and further in being given off from the primary tube, while those of *N. ciliata* spring from the supplementary tubes.

NEMERTESIA CILIATA, *Bale.*

Nemertesia ciliata, Bale, Biological Results " Endeavour," ii., 4, 1914, p. 170, pl. xxxvi., fig. 1. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 307, pl. x., fig. 3.

Hydrophyton reaching about a foot in height and four or five inches in width, compressed, profusely branched, polysiphonic, branches originating from the supplementary tubes; branchlets very numerous, mostly monosiphonic, biserial, from opposite to alternate, approximate, divided into distinct internodes of varying lengths, each of which, except the proximal one or two, supports from one to six or eight whorls of hydrocladia. Hydrocladia usually somewhat irregular on the proximal portions of the branches, on the other portions

1. Billard—Les Hydr. de l'Exped. du Siboga, I., Plumularidæ, 1913, p. 61.

arranged in regular whorls of three or four, those in each whorl alternating in position with those above and below; divided into hydrothecate long internodes and intermediate short ones bearing sarcothecæ only.

Hydrothecæ very small, cup-shaped, shallow, adnate up to the margin, which is smooth.

Sarcothecæ large, wineglass-shaped, bithalamic, canaliculate, moveable; one in front of each hydrotheca, two laterals above it, one on each intermediate internode, and two in the axil of each hydrocladium, usually one on the proximal internode of each branch and one or two on the apophysis. A conical open prominence on the apophysis of each hydrocladium.

Gonothecæ borne at the bases of the hydrocladia, campanulate, very thin and delicate.

Colour—Light brown.

The above description amends and supplements that in Part II in some minor points.

From such forms as *N. ramosa* the species is strongly differentiated by its habit, the pinnate arrangement of the branchlets being very characteristic. A main trunk with all its ramifications occupies a single plane, but where the stem divides into two or three such trunks near the base these may be each in a separate plane. The ultimate branchlets, which fringe each side of the larger branches at very short intervals, may reach an inch or more in length without further subdividing; when small they are monosiphonic, and most of them remain so, others become enveloped in the proximal portions by supplementary tubes derived from the parent branch, and so develop into polysiphonic branches giving origin to fresh branchlets.

A new branchlet commences with a stout apophysis given off by one of the supplementary tubes, then follows a short internode, or occasionally two, without hydrocladia. The first few hydrocladia are generally more or less irregular, those which represent the first whorl, or even the first four or five whorls, being placed unevenly instead of at a uniform height, and only gradually is the normal arrangement attained. The most usual condition is for all the whorls of a single branch to consist of either three or four hydrocladia, but while, as already mentioned, they may be in fours up to a certain point of a branch and in threes beyond it, I have seen no instance of whorls of three being succeeded distally by whorls of four.

The hydrothecæ are among the smallest known in the order; those of *Plumularia procumbens* and *P. badia* are the only ones which I have observed of so small a size.

The sarcothecæ have the border very slightly sinuated or cut down on one side, or they may be described as having the aperture somewhat oblique, the sinuation being so wide and shallow as to be scarcely distinguishable. The term "canaliculate," therefore, is scarcely applicable, but is used for want of a better, and to indicate the affinity between such sarcothecæ and those with a deep lateral sinus, to which the term more strictly applies. The lateral sinuation is more or less distinctly traceable in all species of *Plumularia* and *Nemertesia* observed by me.

The gonothecæ are small and excessively thin, so that few of them retain their original form. Those which were best preserved resembled the hydrothecæ of an *Obelia*, being widest at or close to the aperture, which is even, and not oblique. They are quite open, and do not appear to have possessed an operculum. Their length is only from 370 to 440 μ. *N. janini*, Lamouroux, possesses a small gonotheca of very similar form.

Locs.—Oyster Bay, Tasmania, 60 fathoms.

Thirty-five miles south-east of Bruni Island, Tasmania, 150-230 fathoms.

NEMERTESIA CILIATA, *Bale, var.* CRUCIATA, *var. nov.*

Similar to the type, except that the hydrocladia are mostly in pairs, each pair alternating in position with those above and below.

Excepting on the proximal portions of the branches the arrangement of the hydrocladia in alternate pairs is very general, though occasionally a branch bears them in sets of three, in which case there is often more or less irregularity among them. The branches seem to begin, more frequently than in the type, with two or three internodes devoid of hydrocladia, and, as in the type, the first few hydrocladia on a branch are irregular in position. A frequent arrangement is for two hydrocladia, nearly opposite, to begin the series, followed by three, all at different heights, the rest being in alternate pairs; many other variations, however, occur. No gonangia were seen.

The arrangement of the hydrocladia which characterizes the present variety is found also in *Antennularia cymodocea*

Busk,[1] *Heteropyxis tetrasticha*, (*Lowenia tetrasticha*, Meneghini)[2], and *N. decussata*, Kirchenpauer.[3] Of these *A. cymodocea* is distinguished from our species (and probably from all others) by the very peculiar structure of the hydrocladia, which, according to Kirkpatrick,[4] "are short, and composed of five or six joints, each bearing a cupped sarcotheca, and on the last joint a hydrotheca, adnate and dovetailed into the joint; a second hydrotheca is only exceptionally present." Kirkpatrick also mentions that the calycle is .1 mm. in length, which is about double that of *N. ciliata*. Further, *A. cymodocea* is said by Busk to be an unbranched species.

N. tetrasticha cannot be confused with *N. ciliata*, as its hydrocladia consist of hydrothecate internodes solely, and only one mesial sarcotheca occurs between every two hydrothecæ.

N. decussata has more affinity with the hydroid before us, its habit, however, is very different. It has thick polysiphonic stems from half an inch to an inch long, which divide quite irregularly one or more times into smaller polysiphonic branches, and these are continued, sometimes bifurcating, into long monosiphonic branchlets which may attain two or three inches in length without again subdividing. It is stated that each pair of hydrocladia occupies a separate internode of the branch, contrary to the condition in *N. ciliata*. According to Kirchenpauer's figures the hydrothecæ are larger than in most species, while in *N. ciliata* they are almost the minimum size for the family. The gonangia of *N. ciliata* contrast strongly with those of Kirchenpauer's species, which are of the lageniform type found in *Plumularia setacea*.

Locs.—Off South Cape, Tasmania, 75 fathoms.

Twenty-five miles north-east of Babel Island, Bass Strait, 70-100 fathoms.

Genus KIRCHENPAUERIA, *Jickeli*.

In Part I., under *Kirchenpaueria producta*, I have already discussed the validity of this genus. There are three ways of regarding it. First, it may be recognised as a distinct genus, to be known as *Kirchenpaueria*, unless the name *Diplocheilus* should prove to have priority—a question still unsettled.

1. Busk—Report British Association for 1850, (1851), pt. 2, p. 119.
2. Meneghini—Memor. dell' Instit. Venet., 1845, p. 183, pl. xiv., fig. 2.
3. Kirchenpauer—Abh. Nat. Ver. Hamburg, vi., 1876, pp. 52, 54, pls. ii., iii., and vii., fig. 24-24c.
4. Kirkpatrick—Sci. Proc. R. Dublin Soc. (n.s.), vi., 1890, p. 610.

Second, the species may all be included under *Plumularia*, which is the view adopted by Billard. Third, the species may be divided, those with an intrathecal ridge being placed under *Diplocheilus*, the others under *Kirchenpaueria*. This is the arrangement adopted by Stechow, in his general summary of the genera.

For the last division I can see no justification. As I have pointed out in a preceding page, the intrathecal ridge is a feature not at all uncommon in the genus *Plumularia*, and in several instances it precisely resembles that of *K. producta* and *K. mirabilis*. It is obviously of no greater physiological significance in those species than in *Plumularia*, *Lytocarpus*, *Aglaophenia*, *Halicornaria*, or *Sertularia*, from which genera no observer proposes to exclude a species on account of the presence or absence of an intrathecal ridge; and I cannot imagine any reason for applying a different rule to *Kirchenpaueria* alone among the hydroid genera.

For Billard's position there is, I think, more to be said; nevertheless, although the arrangement of the sarcothecæ in *Plumularia* is far less constant than in the Statoplea, the presence of at least one supracalycine pair is so nearly universal as to afford some justification for the separation of the species wanting that character, especially as those species are peculiar also in the possession of naked median sarcostyles. It is true that among the many *Plumulariæ* described by Billard in his "Report on the Siboga Expedition" there is one—*P. ventruosa*—which is without lateral sarcothecæ, while it is not stated whether any median sarcostyle is present; possibly this also should be referred to the present genus.

While the relationship between *Plumularia* and *Kirchenpaueria* is obvious, there is evident also a close affinity between the latter genus and *Halicornopsis*, indeed it is by the great difference in the general facies, dependent nevertheless on minor details, rather than by important structural characters, that the two genera are distinguished.

KIRCHENPAUERIA PRODUCTA, *Bale.*

Kirchenpaueria producta, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 59 (synonymy).

In the list of synonyms I have included a reference to Inaba's figure of "*Plumularia producta*" in the Tokyo Zoological Magazine for 1890; this must be deleted. As Stechow has pointed out in his revision of Inaba's species, the specimens examined by that observer belonged really to *K. mirabilis* (*Diplocheilus mirabilis*, Allman). This is

hydrocladia. Assuming that these are phylactocarps, they differ from those of *Cladocarpus* in not being limited to the proximal internode, and also in several being borne on the same hydrocladium. They originate on that part of the internode which is between the node and the base of the hydrotheca, and they may occur on two or three internodes in succession; I have not seen any on the proximal internodes. Only three were observed, but there were scars marking the positions where others had fallen. Each of the three consisted of one very short internode, unarmed, succeeded by two longer ones, clavate in form, consisting of a small closed receptacle, ventricose on one side, beyond which projected one or two lateral sarcothecæ. The aspect of the ends of these ramules was such as to indicate that their growth might have been continued.

It is impossible to be certain as to the exact relationship of these ramules to the gonosome, as no gonangia were present, nor any signs to indicate where they might have been detached. The internodes, with their lateral sarcothecæ projecting from one or both sides, are suggestive of atrophied hydrothecæ, but apart from their small size (about one-third the length of a hydrotheca), and their wholly different form, the little ventricose receptacles consist of the internodes themselves, and are not divided off from them as hydrothecæ would be. In view of the incomplete aspect of the ramules it seems just pos ible that the gonangia may have been borne terminally upon them.

CLADOCARPELLA MULTISEPTATA, *sp. nov.*

(Plate xlvii., figs. 1-5.)

Hydrocaulus about two inches in height, stem very slender, slightly fascicled at base, divided by long oblique nodes into internodes of very variable length; hydrocladia at unequal distances, biserial, alternate, both series borne on the front of the stem and directed forward; internodes long, nodes oblique.

Hydrothecæ very long, slender, gradually expanding from the middle to the aperture; hydropore in the base of the cell, next to the abcauline side, subtended by a small curved flap of perisarc; aperture at right angles, with a blunt anterior tooth, narrowed in the middle, the rest of the border with very minute irregular crenations, and adnate to the lateral sarcothecæ. Hydrothecal internode with about 9-14 septal ridges, transverse or nearly so, except the proximal one, which is very oblique.

Mesial sarcotheca a little below the hydrotheca, short, conical in lateral view, oblong in front view; terminal aperture a transverse slit crossing the end of the sarcotheca and slightly enlarged at the angles, inferior aperture rather large, with sub-tubular border; cauline and lateral sarcothecæ similar to the mesial, the cauline numerous, arranged in a single series along the whole front of the stem.

Gonangial (?) secondary ramules given off from some of the internodes of the hydrocladia, consisting of a short proximal internode and two (or more ?) longer ones, the latter ventricose, with one or two lateral sarcothecæ.

This species is closely allied to *Cladocarpus* (?) *bathyzonatus*, Ritchie, and I have had some doubt as to the propriety of separating it. It is so extremely slender and so readily tangled that it is not easy to isolate complete colonies, and I did not succeed in getting any perfect to the base. One only had on the lower portion a single supplementary tube, the rest, so far as they extended, were monosiphonic. The greatest disparity exists between the distances of the nodes, which are conspicuous and very oblique; measuring by the number of sarcothecæ, which are at nearly uniform distances along the stem, we find internodes bearing any number from one up to twelve or thirteen, and there are similar variations in the number of sarcothecæ which intervene between two hydrocladia. Some of the shorter internodes support sarcothecæ only. These irregularities are most marked in the lower portions of the stems; on the distal portions a comparatively regular sequence may prevail, the internodes there supporting usually a hydrocladium and nine to twelve sarcothecæ.

The two series of hydrocladia are both directed so strongly towards the front that, placed on a slide, they fall to one side, and their arrangement appears uniserial unless closely examined, when it is seen that they spring alternately from right and left of the median row of sarcothecæ.

The hydrothecal internodes are about .80 mm. long (the hydrothecæ themselves being about .60 mm.), and the hydrothecæ are like those of *C.* (?) *bathyzonatus* except that their proportionate length is greater, their abcauline wall not so narrowed in at the central part, and the anterior tooth different in form. The little perisarcal flap opposite the hydropore is as described by Ritchie. The sarcothecæ also agree with those of Ritchie's species, except that I did not observe so much diversity in the terminal orifices. In the lateral view a sarcotheca appears pointed, in the front view

The only species of which the generic position may be a matter of doubt are those of the last group. In Nutting's classification the corbula-bearing species are divided into two genera—*Aglaophenia*, comprising those forms in which the corbula is closed, composed of broad leaflets, and unprovided with hydrothecæ; and *Thecocarpus*, in which the corbula is open, composed of narrow rod- or sabre-shaped ribs, with a hydrotheca at the base of each rib. The species at present under consideration form an intermediate group, having the closed broad-leaved corbula characteristic of the restricted genus *Aglaophenia*, but bearing hydrothecæ as in *Thecocarpus*. In 1907, however, Billard described a species, *T. giardi*,[1] with similar corbulæ, and referred it to *Thecocarpus*, remarking that previously only species were known in which the ribs were free and the corbula open.[2]

According to Billard, then, the presence or absence of the hydrothecæ at the bases of the ribs is the sole criterion for dividing the species, and even this is not constant, as the same observer has described species in which the hydrothecæ are present in the female corbulæ only; while in the form which I have described under the name of *A. carinata*, and which Billard finds identical with *Plumularia brachiata*, Lamarck, the receptacles at the bases of the leaflets, which Billard considers hydrothecæ, but which seem to me to be sarcothecæ, are often replaced by two or several undoubted sarcothecæ, the structure, so far as those particular leaflets are concerned, being then the same as in the *crucialis* group.

Stechow admits the genus *Thecocarpus* in the same sense as Nutting, dividing the corbula-bearing species into three groups—(1) species with open corbulæ and a hydrotheca at the base of each rib=*Thecocarpus*, Nutting; (2) species with open corbulæ and no hydrothecæ=*A. whiteleggei*, and other species constituting the *divaricata* group; (3) species with closed corbulæ and no hydrothecæ=*Aglaophenia*. This grouping, however, is obviously incomplete, no provision being made for the fourth subdivision, namely, for the species with closed corbulæ but with hydrothecæ, such as those before us.

Evidently if the genus *Thecocarpus* is to be accepted at all it must be in the sense in which Billard adopted it, and Nutting's diagnosis should be modified accordingly.

1. Billard — Arch. de Zool. exp. et gén., (4), vi., Notes et Revue, p. lxxix.

2. This was an oversight, as I had in 1881 described *A. heterocarpa* (now known to be identical with *Plumularia brevirostris*, Busk), in which the corbula is similar to that of *A. pluma*, but with a well-developed hydrotheca on each leaflet.

Nutting has noticed that among the corbula-bearing species, when the proximal part of the gonocladium bears one hydrotheca only, that one is generally normal, but that where there are several hydrothecæ in that position they are usually more or less modified; also that in *Aglaophenia* the former type prevails, in *Thecocarpus* the latter. I find that the same rule applies generally (though not universally) to the Australian species. In *A. megalocarpa*, *A. armata*, and *A. tenuissima* there are below the corbula several hydrothecæ, which are modified to a greater or less extent; in *A. calycifera* the hydrothecæ themselves are little if at all altered, but the internodes supporting them differ from the normal hydrothecal internodes in being longer, and in the absence of septal ridges. In *A. brevirostris*, on the other hand, there is only a single hydrotheca, not distinctly modified, so that the condition is the same as in *Aglaophenia* proper; it is noteworthy, however, that in this species there are generally one or two modified hydrothecæ on the distal part of the gonocladium, which projects beyond the corbula.

In the *crucialis* group there are no hydrothecæ at all on the gonocladium, the proximal internodes supporting only a row of large sarcothecæ, like the proximal part of a branch, and the same condition is found in *A. phyllocarpa* and *A. brachiata*. None of the numerous American species comprised in Nutting's monograph exhibit this character, which appears to be confined to typical *Aglaopheniæ*, unless *A. brachiata* is an exception.

Species which are known to belong to the *divaricata* group are *A. divaricata* (Busk), *A. acanthocarpa*, Allman, *A. laxa*, Allman, *A. plumosa*, Bale, and *A. whiteleggei*, Bale. The same type prevails throughout all these species. The corbula-ribs are narrow, armed on each side with sarcothecæ, which are longer than those usually found in the other groups, the lowest two sarcothecæ on the distal side are without corresponding ones on the other side, and of these two sarcothecæ the first one is usually bifid or double, a feature which Allman accounts for by supposing it to represent the lateral pair of the suppressed hydrotheca. Of the species mentioned I have only observed the gonosome in *A. divaricata* (including *A. mccoyi*), *A. laxa*, and *A. plumosa*, but Allman's figure of *A. acanthocarpa* and Stechow's of *A. whiteleggei* show the same structure, and though Hilgendorf's figure of *A. laxa* does not exhibit similar regularity, I find it in the specimen which I have examined. The hiatus caused by the absence of the two lowest sarcothecæ on the proximal side corresponds to the gap which in the *crucialis* group and

other species is caused by the abrupt narrowing-in of the leaflets at the base, so that openings are left along the sides of the corbula. In the *crucialis* group and in *Thecocarpus* these openings are guarded by the lateral spurs, which project across them, and which support in the former a series of sarcothecæ, in the latter a hydrotheca.

It is observed by Nutting that the closed corbula is often erroneously described as having the distal edges only of the leaflets bordered by sarcothecæ, and he finds that in all cases where he has dissected the corbulæ the proximal edges also, though overlapped by the distal edges of the contiguous leaves, support a series of sarcothecæ, which project into the corbula. My experience (mainly of Australian species) is the contrary of this. I have not found the condition above described in any species, except very partially in *A. calycifera*. The general rule is that when the leaves are united the distal edge of one leaf overlaps the proximal edge of the next, and is fringed with sarcothecæ; frequently the overlapping portion is expanded into a free wing (often very large), which then bears the marginal sarcothecæ, and if the free extension rises above the corbula, so as to have both edges free, then both edges bear sarcothecæ. Similarly, if the leaflets become separate throughout, as in certain (presumably male) corbulæ of *A. parvula*, or separated at intervals only, wherever the edges are free sarcothecæ may be developed. On the other hand there are species—e.g., *A. megalocarpa*—which have the margins of the component leaves united smoothly, without any sarcothecæ whatever, while a row of sarcothecæ may run up the middle of the leaf instead, and a secondary leaf or crest may also spring from the same part. In some forms many sarcothecæ may be scattered irregularly over the surface.

The presence of a supernumerary leaf has often been noted, but in some species more than one such leaf may be present, and they may occur at the distal as well as the proximal extremity of the corbula. In the closed corbulæ of *A. parvula* the first leaflet on one side gives origin to a secondary free leaflet which runs along the side of the corbula parallel with the rachis. The corbulæ in general appear more prone to abnormal developments than the trophosomes, and irregularities of growth are, in some species, very common; for example, I have seen in more than one species a secondary corbula given off laterally from the middle of the primary one.

AGLAOPHENIA DIVARICATA (*Busk*).

Plumularia divaricata, Busk, Voy. "Rattlesnake," i., 1852, p. 398.

Aglaophenia divaricata, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, p. 26. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 162, pl. xv., fig. 8, pl. xvii., fig. 7; *Id.*, Bale, Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, pp. 97, 110; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 49. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 267. *Id.*, Billard, C. R. Acad. Sci., cxlviii., 1909, p. 368; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 54. *Id.*, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 866. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 315.

Plumularia ramosa, Busk, Voy. "Rattlesnake," i., 1852, p. 398.

Aglaophenia ramosa, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, p. 38, pls. i., ii., fig. 17. *Id.*, Hincks, Pop. Sci. Review, xiii., 1874, p. 235. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 164, pl. xviii., figs. 15, 16.

Lytocarpus ramosus, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 154, pl. xxv., figs. 1-3.

? *Aglaophenia brevicaulis*, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, p. 41, pl. i., fig. 20, pl. v., fig. 19.

Not *Aglaophenia ramosa*, Allman, Mem. Mus. Comp. Zool. Harv., v., 1877, p. 39, pl. xxiii., figs. 1-4.

Hydrophyton slender, polysiphonic, attaining four or five inches in height, much branched, branches widely divergent on all sides, more rarely in one plane, springing from the supplementary tubes. Hydrocladia alternate, one on each internode, both series directed towards the front, and rising at an angle of about 40-45 degrees; nodes slightly oblique.

Hydrothecæ cup-shaped, set at an angle of 40-45 degrees; a narrow intrathecal ridge about the middle of the adcauline side, with a slight fold from it partly surrounding the hydrotheca; hydropore very large; border with four teeth on each side, and a long incurved one in front, back adnate. Hydrothecal internode with a strong curved septal ridge in the middle.

Mesial sarcotheca variable in length, projecting at a wide angle, adnate to the hydrotheca as far as the margin and mainly rising from it, free part tapering in lateral view, tapering or not in front view, with distinct terminal and inferior apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ more or less conical, adnate up to the hydrotheca-margin, with a short free part directed forward;

those at the ends of the pinnæ generally much enlarged, lateral and terminal apertures distinct. Cauline sarcothecæ larger than the laterals, two on the rachis at the base of each hydrocladium.

Gonangial pinna replacing a hydrocladium, the first internode bearing a hydrotheca. Corbula open, with about 15-20 strongly arched pinnules on each side, each springing from a separate internode of the rachis and furnished with two lateral series of long slightly curved opposite tubular sarcothecæ; the two proximal ones on the distal side of each pinnule without corresponding ones on the other side, and the first one often bifid; nodes between the pairs of sarcothecæ usually indistinct or wanting; two sarcothecæ on the rachis at the base of each pinnule.

Colour.—Dark brown to black.

My suggestion of 1887 that *A. divaricata* and *A. ramosa* would probably prove identical is confirmed by Billard's examination of the type of *A. ramosa*, which he finds to agree exactly with the description of *A. divaricata*. Busk in separating them seems to have been mainly influenced by differences in the habit of his specimens, but much variation exists in this, as in other characters. Generally the ramification is quite irregular, but specimens occur with all the branches distinctly in one plane.

Small specimens, up to about half an inch, may be monosiphonic; the first supplementary tube is stouter than the primary one, which it partially envelops, and from it spring the branches, their first nine or ten internodes supporting no hydrocladia, but each bearing in front a large sarcotheca. The very dark colour which characterises the typical form is due to the remains of the soft parts, and is readily removed by liquor potassæ.

A very characteristic feature is the large size of the aperture between the hydrotheca and the internode, which extends from the base of the hydrotheca to the intrathecal ridge, and from side to side of the hydrotheca. Owing to the size of this aperture the intrathecal ridge, which borders it, is situated further from the base than usual, and when, as is commonly the case, the lateral sarcothecæ are long, their bases become coterminous with the ridge, hence, as Ritchie points out, the septal ridge which subtends the bases of the lateral sarcothecæ, and that which is opposite to the intrathecal ridge, are one and the same. The prolongation of the lateral sarcothecæ back to the intrathecal ridge is, however, not invariable; in

many cases there is a distinct interval between them. The intrathecal ridge is generally very narrow.

The mesial sarcotheca may be nearly straight, or slightly arched, and stands off at a wide angle from the hydrotheca, which it somewhat exceeds in length. The increase in size of the lateral sarcothecæ on the last internode or two of a hydrocladium is more marked than I have seen it in any other species, and it is not rare to find those on a terminal internode almost equalling in diameter the hydrotheca itself, while the next hydrocladium may be normal throughout.

The corbulæ are similar to those of *A. acanthocarpa*, Allman, but the bifid condition of the first unpaired sarcotheca on each pinnule is by no means invariable. These corbulæ resemble those of *A. plumosa*, Bale (a species not otherwise closely related to the present), but the pinnules in *A. plumosa* are less arched, the corbula being somewhat compressed.

Locs.—Oyster Bay, Tasmania, 60 fathoms.

Twenty miles east of King Island, Bass Strait.

Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Sanders Bank, Kangaroo Island, South Australia, 28 fathoms.

Forty miles west of Kingston, South Australia, 30 fathoms.

Hunter Group, Bass Strait.

AGLAOPHENIA DIVARICATA (Busk), *var.* MCCOYI, *Bale.*

Aglaophenia McCoyi, Bale, Journ. Micro. Soc. Vict., ii., 1881, pp. 36, 46, pl. xiv., fig. 2.

Aglaophenia divaricata, Bale, (in part), Cat. Austr. Hydr. Zooph., 1884, p. 162, pl. xv., fig. 7, pl. xviii., fig. 6.

Hydrophyton smaller than in the type; hydrothecæ with a wide intrathecal ridge, the anterior tooth furnished with a delicate erect crest; mesial sarcotheca with the distal portion erect and widened at the summit in a crescentic form.

Corbulæ as in the type.

In the " Catalogue " I united *A. mccoyi* with *A. divaricata*, as I found that certain specimens of the latter appeared to be transition forms. The specimens in question, however, though approximating to *A. mccoyi* in the broad mesial sarcothecæ, undoubtedly belonged to *A. divaricata*, and I have not so far met with other intermediate forms. There seems, therefore, sufficient ground to treat *A. mccoyi* as at least a distinct variety.

In other respects than those enumerated above the variety agrees with *A. divaricata*. It is a dwarf form, the largest specimen which I have met with measuring one and a half inches, but it is usually only about half that height. These small forms have generally not more than one accessory tube in the stem. The most characteristic feature is the form of the mesial sarcotheca, which follows the curve of the hydrotheca nearly to the margin and then curves upwards. The intrathecal ridge is a distinct partition extending half through the hydrotheca in an oblique direction, parallel with the border.

I can find no difference whatever in the corbulæ.

This variety does not occur among the "Endeavour" specimens.

AGLAOPHENIA DIVARICATA (*Busk*), *var.* ACANTHOCARPA, *Allman?*

? Aglaophenia acanthocarpa, Allman, Journ. Linn. Soc., Zool., xii., 1876, p. 274, pl. xxi., figs. 1-4.

Aglaophenia divaricata, var., Bale, Cat. Austr. Hydr. Zooph., 1884, p. 164.

Distinguished from the type by the presence of an oblique septal ridge in the internode, starting from the base of the lateral sarcothecæ, and by the smaller and more sharply triangular teeth of the hydrotheca-border.

The life-size figure given by Allman of *A. acanthocarpa* does not agree well with any specimen of this group which I have observed, still it recalls Busk's description of *A. ramosa*, which he says has the branches "rising in great numbers almost immediately from the mass of radical fibres." In other respects my specimen (from Port Jackson, New South Wales), agrees very fairly with Allman's account. As already mentioned, many specimens of *A. divaricata* occur in which the bases of the lateral sarcothecæ do not, as in typical forms, coincide with the base of the intrathecal ridge; the same condition prevails in the present form, but there is a strong septal ridge, in addition to the median one which alone exists in the type. The intrathecal ridge is an extremely narrow shelf, and gives origin to a fold in the hydrotheca-wall, very much as in the type.

In these specimens the lateral sarcothecæ towards the ends of the hydrocladia are not nearly so much enlarged as is usually the case with the typical *A. divaricata*.

Billard formerly suggested the identity of *A. acanthocarpa* with *A. divaricata*, and the present variety seems to bridge the difference which appeared to exist between them. I do not, however, concur in the reference of *A. laxa*, Allman, to the same species, nor do I think that *Thecocarpus laxus* of Billard's "Siboga" Report is the same as *A. laxa*. Hilgendorf[1] has described the corbula of a species which he considers to be *A. laxa*, and specimens of this species, which Mr. Briggs has kindly sent to me, come decidedly nearer to Allman's account than does *Thecocarpus laxus*. The corbula is of the same type exactly as that of *A. divaricata* and *A. acanthocarpa*, and bears no hydrothecæ. Where the specimens differ from Allman's account is in the septal ridges of the hydrothecal internodes, the one which Allman says is opposite the base of the hydrotheca being absent, while the front one is oblique; in short the condition is just as figured for *A. acanthocarpa*. In both *A. laxa* and *A. acanthocarpa*, as in *A. divaricata*, the intrathecal ridge, with its corresponding septal ridge, is set at or near the middle of the internode, instead of near the base of the hydrotheca, as in *T. laxus* and most other species. In *T. laxus* the third tooth on each side of the hydrotheca is widely everted, which is contrary to the condition in *A. laxa*. The latter has smaller and narrower hydrothecæ than *A. acanthocarpa*, and the front is somewhat incurved between the anterior tooth and the mesial sarcotheca, which does not extend to the aperture. In *var. acanthocarpa*, as in other forms of *A. divaricata*, the hydropore extends quite from side to side of the hydrotheca, so that in a lateral view the proximal half of its cavity appears completely continuous with that of the internode; this is not so noticeable in *A. laxa*, though here also the hydropore is very large, which accounts for the forward position of the intrathecal ridge. The latter is a mere fold in the hydrotheca-wall, the shelf-like portion on the adcauline side being even more rudimentary than in any of the varieties of *A. divaricata*. The anterior tooth of the hydrotheca has frequently an erect crest.

I have met with *var. acanthocarpa* (?) only in material from Port Jackson, New South Wales.

AGLAOPHENIA DIVARICATA (*Busk*), *var.* CYSTIFERA, *var. nov.*

Distinguished from the type by the great enlargement of the upper of the two cauline sarcothecæ which are borne by the hydrocladiate internodes of the rachis.

1. Hilgendorf—Trans. N.Z. Instit., xliii., 1911, p. 541, figs. 1-3.

This form, in its minute structure, does not differ greatly from the type, except in the peculiarity above mentioned. The upper sarcotheca is much enlarged, and forms an egg-shaped receptacle projecting laterally outwards; the series of median sarcothecæ which are borne on the proximal part of a branch (before the hydrocladia begin) are also very large.

I have seen a specimen with the top of the stem produced into a tendril-like stolon.

Loc.—South Australia.

AGLAOPHENIA DECUMBENS, *Bale.*

Aglaophenia decumbens, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 48, pl. iv., fig. 4, pl. vi., fig. 6. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 300; *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 315.

The height of specimens observed after the description was written is about a foot. The stem is very slender (only about half a millimetre), and nearly equal throughout most of its length. Only the lowest three inches were bare, the rest of the stem bearing numerous irregular branches about one half to one inch apart. Secondary and occasionally tertiary branches were observed.

The gonosome was not present, either in the "Endeavour" specimens or in those since recorded by Briggs from near Cape Pillar, Tasmania. There is a decided affinity between the species and *A. divaricata*; it may therefore be anticipated that the corbulæ will prove to be of the open type found in that species.

In Briggs' specimens, from two Tasmanian localities, the anterior teeth of the hydrothecæ are without the outward bend which I have figured; this feature therefore is probably exceptional.

Loc.—Oyster Bay, Tasmania, 60 fathoms (not Bass Strait, as stated in the original description).

AGLAOPHENIA MACROCARPA, *Bale.*

Aglaophenia macrocarpa, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 791, pl. xxi., figs. 3, 4; *Id.*, Bale, Biological Results "Endeavour," ii., 1, 1914, pp. 32, 36, 38-41, pl. iii., fig. 1, pl. vi., fig. 1, pl. i., figs. 1-2.

Aglaophenia crucialis, Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 864, pl. lxxxvi., fig. 1.

? *Aglaophenia crucialis*, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 169.

A. macrocarpa, which is not represented in the "Endeavour" collections, has been mentioned in Part I. for the purpose of discussing its relationship with the other members of the *crucialis*-group—*A. dannevigi*, *A. billardi*, *A. tasmanica*, and *A. crucialis*. I have since received some further material including, from Mr. Briggs, fragments of specimens considered to be *A. crucialis*, and others of *A. macrocarpa*, with drawings of the latter and notes on the Museum specimens; and from Dr. Ritchie, mounted specimens of the "Thetis" form figured by him as *A. crucialis*.

A specimen from Maroubra Bay, forwarded by Mr. Briggs, is a typical *A. macrocarpa*, agreeing with my former examples in all essentials; the gonosome is not present. I have figured in Part I. portion of a specimen in the Australian Museum, and Mr. Briggs has favoured me with drawings of another and much more perfect specimen, which is of precisely similar habit, the stem and branches being thick, and the latter curving upwards and even inwards towards the ends, while standing well out in front from the stem, towards which they face. Other specimens differ a good deal in habit, the hydrocaulus being more slender and the branches straighter; such a form is that figured by Ritchie, which, however, as Mr. Briggs informs me, has the branches facing back towards the stem or parent branch from which they spring, just as in the typical *A. macrocarpa*. The hydrothecæ differ from that form only in being slightly larger and in possessing the intrathecal tooth, which is sometimes strongly developed; its absolute inconstancy, however, in *A. billardi* and *A. tasmanica* shows it to be a negligeable character in distinguishing the species. The lateral lobes of the border are well developed, and in some cases they tend towards an angular form instead of being smoothly rounded as usual.

The affinity between *A. macrocarpa* and *A. tasmanica* is very close, and this is especially evident now that the male corbulæ of the two are known to be of similar type, (unlike those of *A. billardi*). Which of these forms (if either) is to be referred to *A. crucialis* is doubtful, since we are not informed which of them it resembles in habit, nor what is the character of its corbulæ.

AGLAOPHENIA BILLARDI, *Bale.*

Aglaophenia billardi, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 33, pl. iii., fig. 3, pl. vi., fig. 3.

Trifling differences in the habit of this species and *A. tasmanica*, referred to in the original descriptions, do not prove sufficiently constant to be of much value in determining the species. The most reliable distinction, so far as the trophosome is concerned, is in the longer and narrower hydrothecæ of *A. billardi*. It is now known that the male corbulæ differ in the two species (see *A. tasmanica*).

Locs.—Great Australian Bight, 40-100 fathoms, 130-190 fathoms, and 80-120 fathoms.

Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

AGLAOPHENIA TASMANICA, *Bale.*

Aglaophenia tasmanica, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 37, pl. iii., fig. 2, pl. vi., fig. 2. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 300, pl. xxvi; *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 316.

In some of the specimens a good deal of variation exists in regard to the length of the mesial sarcothecæ, which are sometimes not longer, proportionately to the hydrothecæ, than those of *A. billardi*. In specimens collected near Cape Pillar, Tasmania, Mr. Briggs has found the male corbulæ, of which he has obligingly forwarded me examples. Considering that *A. tasmanica* and *A. billardi* are such extremely close allies, and that their female corbulæ do not differ in any important particular, it would naturally be expected that a corresponding likeness would be found between the male corbulæ; such, however, is not the case. Those of *A. billardi* are cylindrical, closed throughout, and of equal diameter from end to end, while in *A. tasmanica* they are, as Mr. Briggs has pointed out, narrowed towards the end in consequence of the leaflets becoming gradually shortened, and also separate, just as in *A. dannevigi* and *A. macrocarpa*.

In the female corbulæ the lateral spurs, which spring outward and forward from the distal edges of the corbula-leaves attain a large size, and in some cases I have noticed that their distal portions, which are incurved towards the rachis, coming into contact with the proximal parts of the next spurs, attach themselves to them, so as to form a series of joined arches along each side of the gonocladium.

The male corbulæ have the last four or five leaflets on each side separate, broadly truncated, and progressively shorter and shorter, till the final pair are reduced close down to the lateral spurs, which are not shortened, but extend forward beyond the termination of the corbula-rachis.

Locs.—Oyster Bay, Tasmania, 20 fathoms.

North-east of Babel Island, Bass Strait, 100-170 fathoms.

East of Babel Island, Bass Strait, about 70 fathoms.

Twenty-one miles N. 65° E. of Babel Island, Bass Strait, 73 fathoms.

Off Babel Island, Bass Strait, 60 fathoms.

Twenty-five miles north-east of Babel Island, 70-100 fathoms.

Off Green Cape, 470 fathoms.

Eastern Slope, Bass Strait, 80-300 fathoms.

AGLAOPHENIA DANNEVIGI, *Bale.*

Aglaophenia dannevigi, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 41, pl. iii., fig. 4, pl. vi., fig. 4.

Locs.—Fifty miles south of Cape Wiles, South Australia, 75 fathoms.

Great Australian Bight, 130-300 fathoms.

AGLAOPHENIA CARINIFERA, *Bale.*

Aglaophenia carinifera, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 181, pl. xxxviii., figs. 1-2.

In the absence of the gonosome the reference of this species to the genus *Aglaophenia*, as restricted, is of course provisional. I have mentioned its resemblance to *A. brachiata* (Lamarck), which I regard as a typical *Aglaophenia*, while Billard considers it a *Thecocarpus*; the similarity, however, depends mainly on the presence of an anterior keel on the hydrotheca, a character found in several groups. In the form of the hydrotheca-margin it resembles the *crucialis*-group, and if the figure of the front view is compared with those of the members of that section it will be seen that little difference exists. The structure of the stem-fascicle also agrees with that of those species, not with that of *A. brachiata*.

Locs.—Great Australian Bight, 130-190 fathoms; 80-120 fathoms; and 100 fathoms.

Great Australian Bight, Long. 126° 45¼′ E., 190-320 fathoms.

AGLAOPHENIA CUPRESSINA, *Lamouroux.*

(Plate xlvii., figs. 6-8.)

Aglaophenia cupressina, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 169; *Id.*, Lamouroux, Encyc. Méth., ii., 1824, p. 16; *Id.*, Lamouroux in Quoy and Gaimard, 1824, p. 612, pl. 91, figs. 1-3. *Id.*, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, p. 27, pl. i., fig. 12. *Id.*, Billard, Ann. Sci. Nat., Zool., (9), v., 1907, p. 331, fig. 5; *Id.*, Billard, C. R. Acad. Sci., clxvii., 1908, p. 940; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), ix., 1909, p. 330; *Id.*, Billard, Ann. Sci. Nat., Zool., (9), xi., 1910, p. 56; *Id.*, Billard, Les Hydr. de l'Exped. du Siboga, I., Plumularidæ, 1913, p. 107, fig. xcvi., pl. vi. *Id.*, Stechow, Zool. Jahrb., xxxii., 1912, p. 372.

Plumularia bipinnata, Lamarck, Anim. sans Vert., 1816, p. 126.

Plumularia MacGillivrayi, Busk, Voy. "Rattlesnake," i., 1852, p. 400.

Aglaophenia MacGillivrayi, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, pp. 27, 35. *Id.*, Allman, Rep. Sci. Results "Challenger" Exped., Zool., vii., Hydroida, part I., 1883, p. 34, pls. x, xx, figs. 4-6. *Id.*, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 170, pl. xviii., figs. 12-14. *Id.*, Marktanner-Turneretscher, Ann. K. K. Hofmus. Wien, v., 1890, p. 268. *Id.*, Kirkpatrick, Sci. Proc. R. Dublin Soc., n.s., vi., 1890, p. 604; *Id.*, Kirkpatrick, Ann. Mag. Nat. Hist., (6), v., 1890, p. 12. *Id.*, Campenhausen, Abh. Senckenberg. naturf. Ges. Frankfurt-a-M., xxiii., 1897, p. 315. *Id.*, Weltner, Hydr. von Amb. u. Thursday Id., in Semon Zool. Forsch. in Austr. u. dem Malays. Arch., 1900, p. 587.

Aglaophenia spicata, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, p. 27, pl. i., fig. 11, pl. iv., fig. 11.

? *Aglaophenia bellis*, Thornely in Willey's Zool. Results, pt. iv., 1900, p. 456.

Anisocalyx (*Aglaophenia*) *cupressina*, Costa, Fauna del Regno di Napoli, Zoofiti, 1838, p. 19.

(Not *Aglaophenia spicata*, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 166).

Hydrophyton polysiphonic, about fifteen inches in height, stem and main branches thick, fringed with very numerous small pinnately-disposed opposite branchlets, in one plane, and facing one way, forming angles with the stem and large

branches of about 50°; each branch springing from an internode of the primary jointed stem, and replacing a hydrocladium. Hydrocladia short, alternate, one on each internode, both series directed towards the front and rising at an angle of about 50°; nodes transverse or very slightly oblique, often indistinct.

Hydrothecæ at an angle of about 30°, deep, very narrow between the median and lateral sarcothecæ; a slight fold or ridge directed obliquely forward near the base, and an extremely fine curved line starting from the top of the lateral sarcotheca and running to the base of the hydrotheca; border generally with the rudiment of an anterior tooth, sides with minute irregular crenations or sinuations, usually with one slightly larger tooth on each side near the front, back entire, adnate. Hydrothecal internode with very strong divergent septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ, often united by a longitudinal ridge at the back of the internode.

Mesial sarcotheca about as long as the hydrotheca, very thick, adnate up to the margin, divided into two loculi by an oblique nearly complete septum; aperture terminal, with a blunt rounded lobe on each side. Lateral sarcothecæ wide, reaching the border of the hydrotheca or slightly beyond it, terminal and lateral apertures united. Cauline sarcothecæ rather small, two at the base of each hydrocladium.

Gonangial pinna replacing a hydrocladium, the first internode bearing a hydrotheca. Corbula consisting of about seven or eight pairs of leaflets, springing from separate internodes of the rachis as narrow pinnules, but expanding above into wider leaflets, which unite to form a closed corbula; distal edge of each leaflet with a prominent series of closely-ranked sarcothecæ, the rows curved strongly forward; a short broad lateral process projecting from the distal edge of each leaflet just above its origin, bearing about three sarcothecæ, and overlapping the small openings between the bases of the leaflets, the latter marked with linear perisarcal thickenings.

This remarkable species, so distinct and characteristic alike in its habit and in its minute structure, is in certain points related to the *crucialis*-group. As in that group its branches and corbulæ take the place of hydrocladia, and there is the same tendency to the paired condition, less however in the corbulæ than in the branches. The branchlets usually take the place of two successive hydrocladia, so that they are as nearly as possible opposite. The sides of the hydrotheca-border are also very similar to those of *A. billardi* and *A.*

tasmanica, though less regular. The very short closely-ranked hydrocladia are very distinctive, no less than the peculiar form of the hydrothecæ and the median sarcothecæ, some of the descriptions of which have been by no means correct. This, as Allman pointed out, is the case with Kirchenpauer's statement that the mesial sarcotheca exceeded in width the hydrotheca itself. Allman's account of the hydrotheca-margin as being quite smooth is also erroneous, according to Billard, who has examined the original "Challenger" specimens. The oblique line which crosses the hydrotheca near the base, is the ordinary intrathecal fold found in a similar position in most species of *Aglaophenia*, but the longitudinal line is not, I think, found elsewhere. It runs from the top of the lateral sarcotheca to the base of the hydrotheca, and in a strict profile view it keeps parallel with the abcauline side of the hydrotheca, crossing the intrathecal fold. It is an extremely fine line, so delicate that it may easily be overlooked, except at its origin above the lateral sarcotheca, where it is slightly thicker; and in many of the hydrothecæ I failed to distinguish it.

There are commonly only two septal ridges in the internode, though in a few cases I have seen a third, which was almost coincident with the proximal node. In one of the rough sketches made by Mr. Busk an internode is seen with apparently four ridges; this results from the specimen being seen obliquely, so that the ridges on both sides of the internode are visible at once. The dorsal ridge, which unites the two transverse ones, is a very distinct feature in a back view of the hydrocladium when strongly marked; in some specimens, however, it is weak and obscure.

The lateral sarcothecæ are much like those of *A. billardi*, etc., except that they are considerably stouter in proportion to their length. The septum dividing the mesial sarcotheca has in side view, as Billard remarks, a sigmoid form; it has a narrow opening on the side next the hydrotheca. The terminal aperture, with its lateral lobes, is evidently formed, as in many other species, by two apertures cutting into each other.

The gonangial structures are really less exceptional in character than the trophosome, the series of large dish-shaped receptacles along the upper side of the corbula, shown in the "Challenger" Report, having no real existence. There are none of the large expanded free portions of the corbula-leaves, such as are found in most of the species described in these Reports; the distal edges, with their closely-ranged sarcothecæ, only projecting slightly outwards. The series of

sarcothecæ, after running obliquely up the sides of the corbula, when they reach the upper side curve strongly forward towards the distal end, those from the opposite sides meeting at a small angle. The narrowing of the leaflets, at their basal portion, leaves a series of openings, much smaller, however, than in some of the other species, and the lateral spurs which protect these openings are short and somewhat flabellate, usually with a sarcotheca about the middle of the front margin, and one, less advanced, at each side of it. The linear thickenings of the perisarc, which are shown in Allman's figure, are commonly very irregular, and often much less conspicuous and even wanting in part. The sex could not be determined, and it is possible that some difference may exist between the male and female corbulæ; in species where such differences are known, however, they depend on the open condition of the male corbulæ, or the more profuse development of the secondary appendages of the female; and differences of these sorts have apparently not been noticed so far in connection with the present species. According to Billard the gonocladium, on its proximal portion, supports one or two hydrothecæ, slightly or not modified; in my specimens I found a single one.

Loc.—Reef at North-west Island, off Port Curtis, Queensland.

AGLAOPHENIA (THECOCARPUS) ARMATA, *Bale.*

Aglaophenia armata, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 175, pl. xxxviii., figs. 3-4. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 314, pl. x., fig. 2.

On account of the indefinite character of the small receptacles on the corbula-leaves, I have expressed some doubt as to their hydrothecal nature. Corroborative evidence, however, that the species is properly placed is the presence on the proximal part of the gonocladium of several modified hydrothecæ, this being, according to Nutting, a character found in *Thecocarpus*, but not in typical species of *Aglaophenia*.

Locs.—Thirty-eight miles north-east of North Reef Lighthouse, Capricorn Group, off Port Curtis, Queensland, 74 fathoms.

Thirteen miles north-east of North Reef, 70-74 fathoms.

AGLAOPHENIA (THECOCARPUS) TENUISSIMA, *Bale.*

Aglaophenia tenuissima, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 179, pl. xxxvii., figs. 1-2. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 317, pl. xi., fig. 2.

Locs.—Great Australian Bight, Long. 126° 45¼′ E., 190-320 fathoms.

Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

Great Australian Bight, Long. 127° 20′ E., 180 fathoms.

Eastern Slope, Bass Strait, 80-300 fathoms.

Aglaophenia (Thecocarpus) calycifera, *Bale.*

Aglaophenia calycifera, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 178, pl. xxxvii., figs. 3-4.

The nodes of the hydrocladia are described as "transverse"; a more correct description, in the great majority of cases, would be "slightly oblique."

Locs.—Great Australian Bight, Long. 126° 45¼′ E., 190-320 fathoms.

Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

Aglaophenia (Thecocarpus) megalocarpa, *Bale.*

Aglaophenia megalocarpa, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 45, pl. iv., fig. 1, pl. vi., fig. 5.

The peculiar positions of the hydropore and the intrathecal ridge, along with the form of the lateral sarcothecæ, to which I have referred as so exceptional, are exactly paralleled in some of the forms which Billard, in his "Report on the Siboga Plumulariidæ," has ranked as varieties of *Thecocarpus myriophyllum*. From all those forms the hydrothecæ of *A. megalocarpa* differ in the denticulation of the border, and in the crest on the median tooth.

Loc.—Great Australian Bight, 80-120 fathoms.

Genus Halicornaria, *Busk.*

Of the species of *Halicornaria* comprised in the collection *H. superba* and *H. furcata var. intermedia* belong to the *ascidioides*-group, distinguished by the position of the abcauline intrathecal ridge; *H. urceolifera* and *var. scandens* belong to the *longirostris*-group, in which the intrathecal ridge is wanting; *H. vegæ* and *H. tubulifera* form a group, new to the Australian region, having no intrathecal ridge, and distinguished by the peculiar and characteristic ramification, which moreover is polysiphonic; and *H. birostrata* is distinct from all the others in the position of the intrathecal ridge, in the forked anterior sarcothecæ, and in other particulars.

All attempts to find a constant distinction between *Halicornaria* and the allied genera, dependent on the trophosome alone, have been failures. The monosiphonic habit is not constant, and it is found in some *Aglaopheniæ*. I formerly relied on the presence of sarcothecæ behind the axils of the hydrocladia, but I have recently found the same character in several species of *Aglaophenia* and *Thecocarpus*.

One character only is common to every *Halicornaria* which I have examined, and to no other genus, the presence namely of little perisarcal points on the margins of the hydropore, or on one margin only.

HALICORNARIA BIROSTRATA, *Bale*.

Halicornaria birostrata, Bale, Biological Results "Endeavour, ii., 1, 1914, p. 49, pl. iv., fig. 5, pl. vii., fig. 6.

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

HALICORNARIA VEGÆ, *Jäderholm*.

Halicornaria vegæ, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 185, pl. xxxvi., figs. 4-5 (synonymy).

Loc.—Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

HALICORNARIA TUBULIFERA, *Bale*.

Halicornaria tubulifera, Bale, Biological Results "Endeavour," ii., 4, 1914, p. 187, pl. xxxvi., fig. 3.

Loc.—Great Australian Bight, Long. 130° 40′ E., 160 fathoms.

HALICORNARIA SUPERBA, *Bale*.

Aglaophenia superba, Bale, Journ. Micro. Soc. Vict., ii., 1881, pp. 31, 45, pl. xiii., fig. 4-4b.

Halicornaria superba, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 175, pl. xiii., fig. 1, pl. xvi., fig. 4; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1893, p. 107; *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), xxvi., 1913, p. 145. *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 312.

A single specimen was observed, about nine inches in height, with two or three branches near the summit.

Locs.—Forty miles west of Kingston, South Australia, 30 fathoms.

Twenty miles east of King Island, Bass Strait.

HALICORNARIA FURCATA, *Bale, var.* INTERMEDIA, *Bale.*

Halicornaria intermedia, Bale, Biological Results "Endeavour," ii., 1, 1914, p. 53, pl. v., fig. 2, pl. vii., figs. 3-4. (Not *Halicornaria intermedia*, Billard, Les. Hydr. de l'Exped. du Siboga, I., Plumularidæ, 1913, p. 65, pl. iv., fig. 37).

Halicornaria furcata, Bale, var. *intermedia*, Bale, Biological Results "Endeavour," ii., 1, 1914, Addendum, p. 1. *Id.*, Briggs, Rec. Austr. Mus., x., 10, 1914, p. 298, pl. xxv., fig. 3; *Id.*, Briggs, Proc. Roy. Soc. N.S. Wales, xlviii., 1915, p. 310.

As mentioned in a supplementary slip inserted in Part I., it became necessary to cancel the specific name *intermedia* owing to Billard's having used the same name while my Report was awaiting publication; and in preference to proposing another specific name I ranked the form provisionally as a variety of *H. furcata*, pending further knowledge of the affinities of that species.

Among the later material received were a number of colonies, most of which agreed fully with the original description; but in one or two instances a variation occurred, in which each internode of the rachis bore a single hydrocladium only.

The variety is habitually associated with *Aglaophenia tasmanica*, and both hydroids are, up to the present, only recorded from the Tasmanian region. Each was obtained in eight dredgings, in seven of which they were growing together. In the collection from Cape Pillar, Tasmania, reported on by Mr. Briggs, as well as in a number of colonies from near Freycinet Peninsula, Tasmania, they were similarly associated, and Mr. Briggs considers that the *Halicornaria* always occurs as an epizoon on *A. tasmanica*.

Locs.—Oyster Bay, Tasmania, 20 fathoms.

North-east of Babel Island, Bass Strait, 100-170 fathoms.

East of Babel Island, about 70 fathoms.

Twenty-one miles N. 65° E. of Babel Island, 73 fathoms.

Off Babel Island, 60 fathoms.

Twenty-five miles north-east of Babel Island, 70-100 fathoms.

Off Green Cape, 470 fathoms.

Thirty-six miles S. 58° W. of Cape Wickham Lighthouse, 72 fathoms.

HALICORNARIA URCEOLIFERA (*Lamarck*).

Halicornaria urceolifera, Bale, Biological Results " Endeavour," ii., 4, 1914, p. 183, pl. xxxvii., figs. 5-6 (synonymy).

Loc.—Great Australian Bight, 80-120 fathoms.

HALICORNARIA URCEOLIFERA (*Lamarck*),

var. SCANDENS, *Bale.*

Halicornaria urceolifera (Lamarck), var. *scandens*, Bale, Biological Results " Endeavour," ii., 1, 1914, p. 51, pl. v., fig. 4, pl. vii., fig. 5; *Id.*, Bale, Biological Results " Endeavour," ii., 4, 1914, p. 184.

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

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NOTE.

Since the foregoing pages were in print I have received from Messrs. Mulder and Trebilcock their paper on "Victorian Hydroida, Part V.," from the "Geelong Naturalist," in which reference is made to some of the species mentioned in the present paper. One of the new forms described—*Sertularella annulaventricosa*—is almost certainly the same as *S. undulata* (*ante*, p. 284). *Plumularia setoceaformis*, n. sp. is evidently founded on a small specimen of *P. procumbens*, Spencer. A figure is given of "*Hebella scandans*," growing on *Sertularia unguiculata* as described herein (see *H. calcarata*, var. *contorta*). It is mentioned that hydrothecæ are borne on the primary stolon where it crosses the nodes of the *Sertularia*, a feature which I have not seen in my specimens.

I have also received from Dr. Fraser his paper on "Some Hydroids of the Vancouver Island Region, and Notes on some Alaskan Hydroids." *Halecium flexile*, Allman, and *H. parvulum*, Bale, which, following Billard, I have united, are recorded by the writer as distinct species.

ERRATA.

Part I. (Vol. ii., Pt. 1), page 16, sixth line from bottom, for "p. 459" read "p. 463."

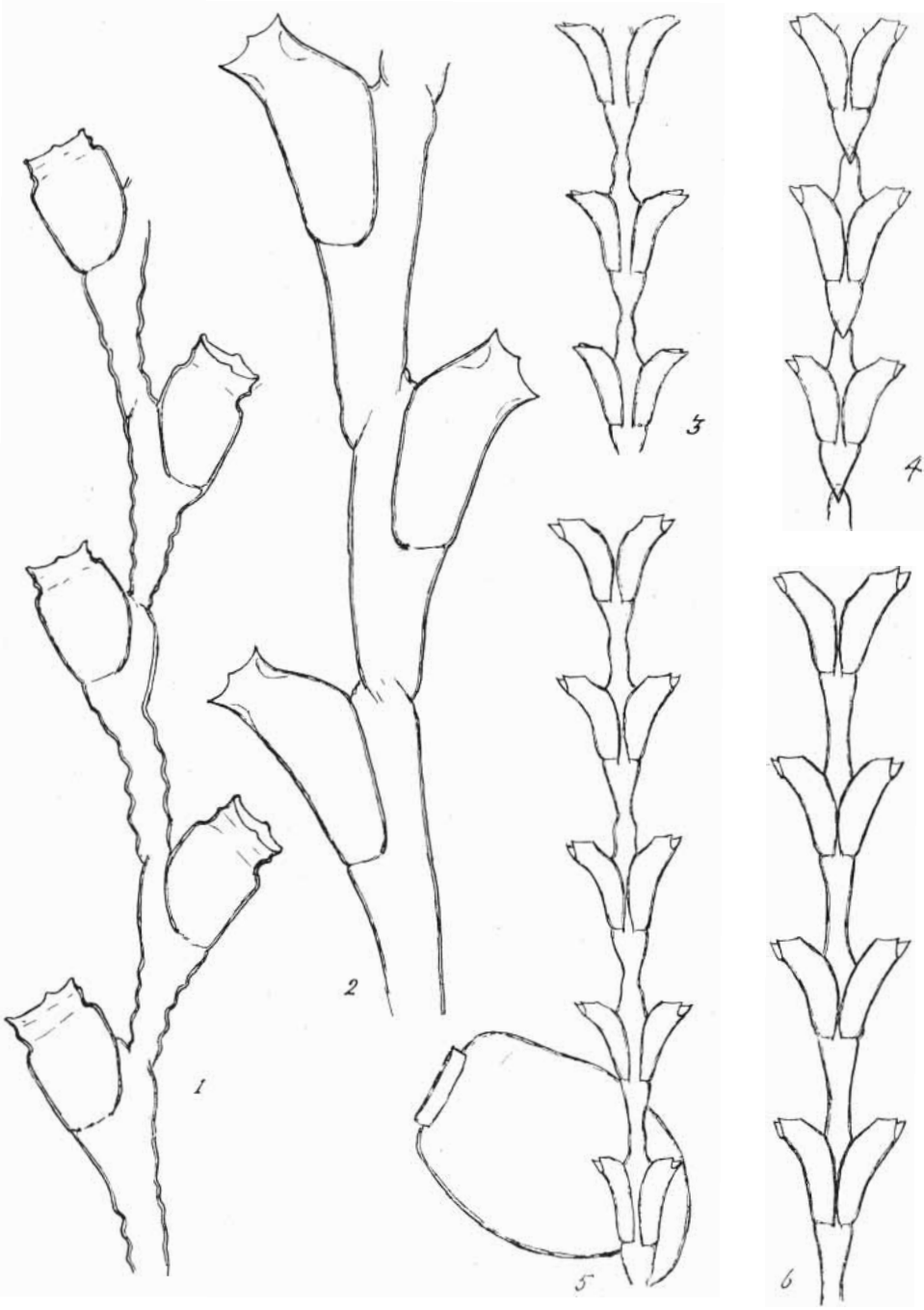
Part I. (Vol. ii., Pt. 1), page 53, line 25 from top, for "fig. 4" read "figs. 3-4."

Part II. (Vol. ii., Pt. 4), page 172, line 21, for "Proc. Roy. Soc. Edin." read "Proc. R. Phys. Soc. Edin."

EXPLANATION OF PLATE XLVI.

Fig. 1.—*Sertularella undulata*, sp. nov.
Fig. 2.—*Sertularella tasmanica*, sp. nov.
Fig. 3.—*Sertularia pusilla*, nom. nov.
Fig. 4.— ,, ,, ,, ,,
Fig. 5.— ,, ,, ,, ,,
Fig. 6.— ,, ,, ,, ,,

Figs. 1-6 × 40.



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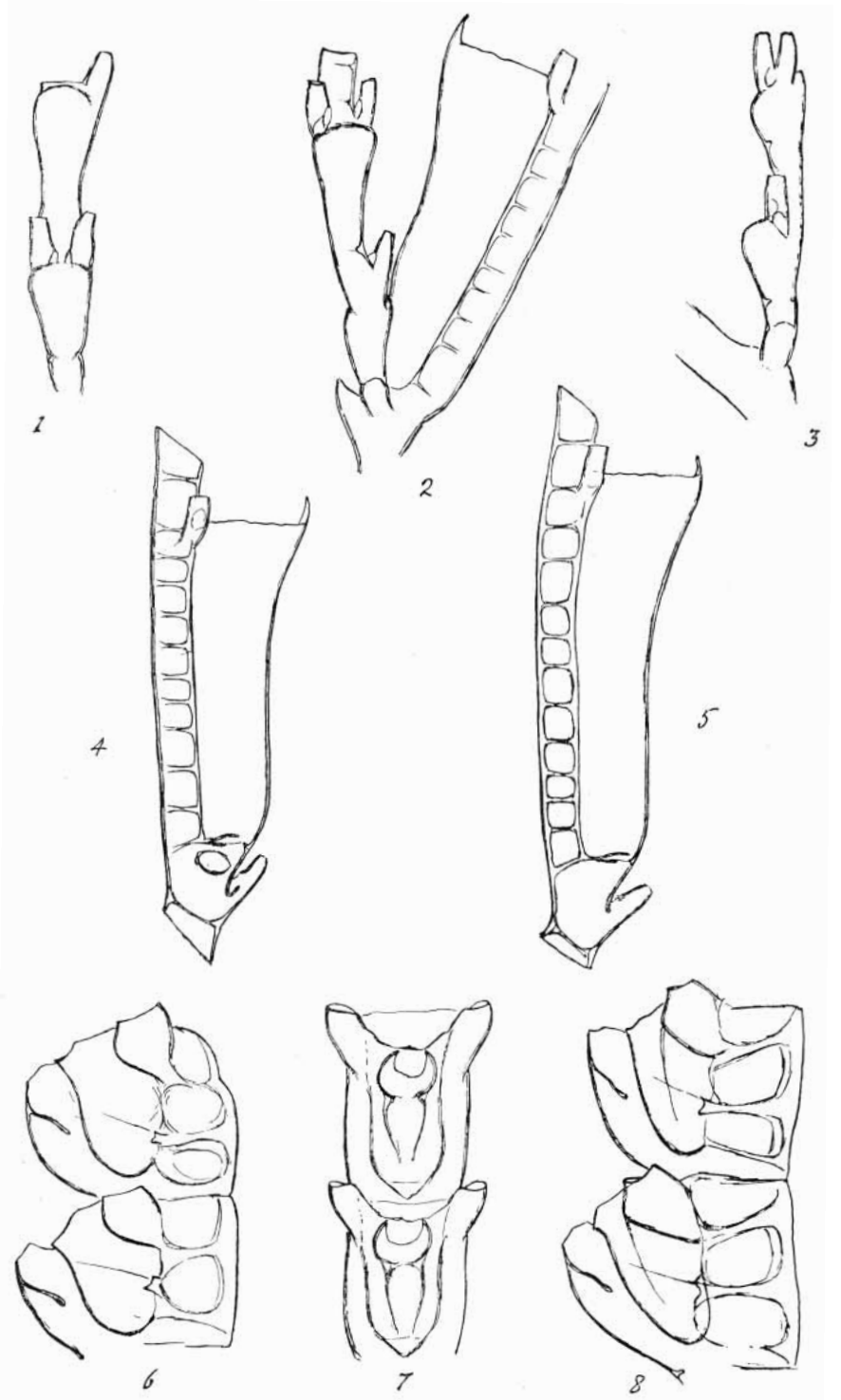

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