STUDIES IN AUSTRALIAN ATHECATE HYDROIDS.

No. 1. Two New Species of the Genus *Myriothela*.

By

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(Plates xxxii-xxxiv and Figure 1.)

Introduction.

Athecate Hydroids are very poorly represented among the marine Hydroid Zoophytes of Eastern Australia. In the following pages two new species of this interesting but little known group, belonging to the Genus *Myriothela*, are described and figured from the coastal waters of New South Wales. In their morphology and histology they present many striking points of difference from other Australian Athecata, and represent a genus not previously recorded from these latitudes of the Southern Hemisphere. My specimens were obtained from a mass of rapidly-drying seaweeds that had been thrown up on the sandy beach of Maroubra Bay, near Sydney, New South Wales. The large solitary hydranths of very remarkable appearance first attracted my attention, but an exhaustive search failed to reveal the presence of further specimens beyond those I had already secured. The hydranths were attached to the lobes of the thallus of a large seaweed and, on closer examination, proved to be representatives of the curious genus *Myriothela*. Unfortunately the specimens already showed signs of maceration, but after fixation in 70% alcohol, are sufficiently well preserved to permit of a detailed description of the external characters and some of the more salient features of the histology. Subsequently, the late Professor Launcelot Harrison discovered a second species of *Myriothela* on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney. These specimens, fixed in sublimate-acetic and transferred to 70% alcohol, are in an excellent state of preservation for histological purposes. Both species have been studied by means of this fixed material. Serial sections of the hydranths with their attached blastostyles and gonophores were cut in a transverse direction, and afterwards stained with Ehrlich's hæmatoxylin followed by eosin. The sections were cut in thicknesses varying from 6 to 8 μ.

The genus *Myriothela* is represented in the Northern Hemisphere by six species, *M. cocksi*, *M. phrygia*, *M. gigantea*, *M. minuta*,

M. mitra and *M. verrucosa*. In his "Fauna Groendlandia," Otto Fabricius (1780) gave a very brief and inadequate description, under the name of *Lucernaria phrygia*, of the first northern species of *Myriothela* which, however, he duly recognised as a member of the Cœlenterata. De Blainville (1834) created a new genus, *Candelabrum*, for Fabricius' species, but failing to recognise its affinities classed it with the Vermes. In 1849 M. Sars[1] established the genus *Myriothela*, with *M. arctica* for its type, but this species has been shown to be identical with *M. phrygia* (Fabricius). Vigurs, in 1849, gave the name of *Arum Cocksii* to a species which several writers, following Hincks and Allman, considered identical with *M. phrygia* (Fabricius) and *M. arctica*, Sars. Both G. O. Sars (1873) and Bonnevie (1899) have shown that *M. cocksi* (Vigurs) must be regarded as a distinct species. The distinguishing characters which Bonnevie relied upon for the separation of these northern species have been accepted by Benoit (1925), whose work on the gametogenesis of *Myriothela* has been confined entirely to *M. cocksi*. Benoit's summary of the specific characters is as follows: "Chez *M. phrygia*, il y a absence de *claspers* pour maintenir les œufs libérés et l'animal est attaché au sol par des filaments tentaculiformes qui naissent à la base de l'hydranthe. Chez *M. Cocksi Vigurs* il y a des *claspers* et l'animal est fixé aux rochers, non seulement par quelques filaments, mais surtout par des expansions lamelliformes du périderme de *l'hydrorhize*." Bonnevie[2] has also described four new species from the Northern Hemisphere.

The first representative of the genus *Myriothela* to be recorded from the Southern Hemisphere was collected by the Swedish South Pole Expedition off Cumberland Bay, South Georgia, at a depth of 252 to 310 metres. This bizarre form was described by Jäderholm (1904) as a new species under the name of *Myriothela austro-georgiæ*. Later, specimens of *M. austro-georgiæ* were taken by the French Antarctic Expedition from Flanders Bay and Booth-Wandel Island, and by the German South Pole Expedition at Kerguelen Island. The Scottish National Antarctic Expedition also dredged several examples of this remarkable Hydroid in Scotia Bay, South Orkneys, while one specimen was found "on the surface of the water, in a hole which had been cut in the ice."

The discovery of two new species of *Myriothela* in the Southern Hemisphere is extremely interesting since the range of the genus must now be extended from the Antarctic circumpolar seas to include the more temperate waters of the coast of New South Wales. Moreover, by the addition of these new species to the list of gymnoblastic forms which have been definitely recorded from this region, the hitherto very limited number of Athecata has been increased from eleven to thirteen species.

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[1] Sars, M.—Zoolog. Reise in Lofoten og Finmarken, 14, 1849.
[2] Bonnevie.—Zeitschr. für Wiss. Zool., lxiii, 1898, pp. 465-495.

DESCRIPTIONS OF THE NEW SPECIES.

Family MYRIOTHELIDÆ.

Genus MYRIOTHELA, *Sars.*

MYRIOTHELA AUSTRALIS, *sp. nov.*

(Pl. xxxii, Pl. xxxiii, fig. 3; Pl. xxxiv, figs. 1-4.)

General description.—The individuals are solitary, growing quite independently of each other upon the surface of a seaweed. In the living condition, or at least before fixation, the general colour of the hydroid is a pale flesh-pink, but in the preserved state it is a pale straw colour.

The hydranth consists of an isolated, attached polyp, carrying near its proximal end the blastostyles, which give origin and support to the gonophores. The hydranth is perfectly naked and is highly contractile. There is no hydrocaulus. The proximal end of the hydranth is truncated and is attached to the substratum by a number of tentacle-like filaments which constitute the hydrorhiza. At the truncated end of each of these short rooting processes is a small, circular, chitinoid disc of a dark brown colour. There is no investment of chitinous perisarc around the proximal end of the hydranth as in *M. cocksi* and *M. harrisoni*.

The hydranth is elongated, cylindrical in form, and gradually tapers towards the apex. The mouth is a small aperture occupying the summit of a short conical hypostome, behind which the tentacles commence and thence extend over the rest of the body down to the blastostyle-bearing zone. The tentacles are capitate with stout cylindrical stems, each terminated by a large spherical capitulum which is well defined and distinct from the stem. These tentacles are very numerous, up to fifteen hundred may be counted on a single hydranth. They are set very close to one another and densely cover the hydranth as far as the blastostyle region where they decrease very much in size, but do not encroach upon this portion of the hydranth as they do in the case of *M. austro-georgiæ*, in which they are found between the blastostyles. The tentacle zone of the hydranth is exceedingly long, occupying about five-sixths of the entire length of the extended polyp.

The blastostyle-bearing portion of the hydranth, which is marked by a series of well-defined longitudinal furrows with finer transverse striations, is slightly narrower than the tentacle-zone immediately above it. The blastostyles are grouped at the base of the hydranth just above its point of attachment to the substratum. This zone occupies about one-sixth of the entire length of the extended hydranth. The blastostyles occur very close together in great abundance and completely obscure the proximal end of the hydranth. They surround the body on all sides, without any very definite.

arrangement. The blastostyles, which are unbranched, are elongated, cylindrical, clavate structures. The distal extremity of the blastostyle is swollen into a club-shaped head bearing a cluster of tentacles, which differ from those of the hydranth in their larger size and in the form of the capitulum, which is trumpet-shaped and borne upon a long, slender, cylindrical stem.

On the proximal side of this cluster of tentacles arise the gonophores, which are continued to within a short distance of the attached end. The mature gonophores are spherical in form, supported on narrow cylindrical peduncles, which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity.

The male and female gonophores have an apical opening representing the velar aperture, and are carried on separate individuals. In the female, the blastostyle bears terminally some eight to ten capitate tentacles, and there are usually three or four mature gonophores near the distal extremity and some six to eight immature ones on the proximal side of these. In the male, the swollen head of the blastostyle bears six to nine capitate tentacles. The gonophores are more numerous than in the female, up to fifteen occurring on a blastostyle, but they are slightly smaller than those of the female. In some of the male gonophores the distal pole is encircled by a ring of dark brown pigment granules.

The remarkable structures to which Allman[3] gave the name of "claspers" in his description of *M. cocksi* do not occur in this Australian species.

Locality.—The specimens were found growing on the lobes of the thallus of a seaweed thrown up on the sandy beach of Maroubra Bay, near Sydney, New South Wales. (Coll. E. A. Briggs). *M. australis* may prove eventually to be a shallow-water form.

Type.—The holotype (Reg. No. Y.610), and slides of serial sections have been deposited in the Australian Museum, Sydney.

Forty specimens of this species were obtained ranging from 4 mm. to 30 mm. in length. Further details of the structure of the various portions of the hydroid, together with some notes on the more salient features of the histology may now be given.

HYDRANTH.

Body-wall.—In the body-wall of the hydranth (Pl. xxxiv, fig. 4) the ectoderm is stratified, consisting of an outer part with cells rich in contents and nuclei and an inner lightly-staining hyaline portion.

[3] Allman—Philosophical Transactions, clxv, 1875, p. 550.

The supporting lamella is very strongly developed and gives off closely placed, thin, either simple or branched, secondary lamellæ which stretch out through the whole of the hyaline portion of the ectoderm. On each side of these secondary lamellæ, in the tentacle-bearing zone, there is attached a layer of well developed longitudinal muscle fibres. These, however, are very poorly developed in the blastostyle-bearing region.

The endoderm of the body-wall consists of large-celled tissue and on its inner side is beset with a series of folds which lie close together and elongated in the direction of the long axis of the body. These folds form thin, remarkably high villi which project into the body-cavity. Each of these endodermal villi, with the exception of the broader basal portion, consists throughout its length of two layers of cells which are separated from each other by a thin secondary lamellá given off from the supporting lamella. The villi cease at a point a short distance from the mouth opening. As a general rule they are quite separate from one another, but occasionally two may become closely adpressed near their apices. In the distal region of the tentacle-bearing zone, the villi are characterized by the presence of goblet cells. Each of these is flask-shaped, and consists of an expanded part, which stains lightly, followed by a narrow tail filled with deeply-staining granular cytoplasm. In the middle tentacular region the goblet cells disappear from the villi, which are then characterized by the presence of numerous gland cells. At the apex of each villus is a group of apical cells. In these the cytoplasm is abundant and stains deeply, thus offering a marked contrast to the other cells of the villus, which Hardy[4] refers to as the "vacuolate cells." These possess a large vacuole surrounded by scanty cytoplasm with only a single nucleus. Wedged between the outer margins of these vacuolate cells are other and smaller dark-staining cells which constitute the gland cells. These are very widely distributed throughout the endoderm, but they occur in greatest numbers on the sides of the villi. Occasionally, one or two of these gland cells may occur at the apex of a villus. In the blastostyle-bearing zone the endoderm is almost exclusively composed of vacuolate cells usually loaded with stored nutritive material in the form of nutritive spheres.

The body-wall of the hydranth is richly supplied with large oval nematocysts. Each contains a comparatively thick thread.

Tentacles.—The stalk of the tentacle (Pl. xxxiv, figs. 1 and 3) consists of a single layer of ectoderm and a large-celled endoderm which contains a narrow lumen. The supporting lamella is thin; on its outer side is attached a layer of fine longitudinal muscle fibres. In the capitulum of the tentacle (Pl. xxxiv, fig. 1) the supporting lamella increases greatly in thickness and gives rise to a series

[4] Hardy.—Quart. Journ. Micro. Science (n.s.), xxxii, 1891, p. 519.

of closely-packed fine threads which stretch out to the ectoderm and form the main mass of the apex of the tentacle. These threads or fibres are very distinctly marked off from the ectoderm, and Jäderholm, who has described a similar condition in *M. austro-georgiæ*, suggests that their function is probably to keep the apex of the tentacle in an expanded state even when the rest of the tentacle is contracted. According to Bonnevie's figures[5] the supporting lamella in the species from the Northern Hemisphere increases in thickness very considerably towards the distal end of the tentacle, where it forms a structureless, homogeneous layer somewhat broader than the ectoderm and endoderm taken together.

The endoderm in the apex of the tentacle consists of a single layer of cells which line the upper part of a circular cavity situated in the lower portion of the swollen capitulum. These cells assume a very different character to the endoderm cells of the stalk of the tentacle since they are smaller and very cytoplasmic with deeply-staining contents. The floor of this cavity communicates by a narrow aperture with the lumen in the axial part of the tentacle-stalk.

The capitulum of the tentacle is richly supplied with large oval nematocysts containing a comparatively thick thread. Scattered nematocysts also occur in the ectoderm of the stem and at the bases of the tentacles.

BLASTOSTYLES.

The fully-developed blastostyle has a narrow base of attachment to the proximal end of the hydranth, and a club-shaped extremity on which is borne a cluster of capitate tentacles. The blastostyle has no mouth, but contains an extensive cavity communicating with the general body cavity of the hydranth. In the female, the blastostyle bears terminally some eight to ten capitate tentacles, while in the male the swollen head is provided with six to nine tentacles.

Body-wall.—The body-wall of the blastostyle, like that of the hydranth, consists of a stratified ectoderm abundantly provided with large oval nematocysts (Pl. xxxiv, fig. 2). The supporting lamella is comparatively thin and gives off either simple or branched secondary lamellæ which stretch out through the hyaline portion of the ectoderm. The endoderm is composed almost exclusively of vacuolate cells with a few scattered gland cells in the proximal part of the blastostyle. The endoderm is produced into low conical villi of very characteristic appearance due to the cells being heavily charged with nutritive spheres.

Tentacles.—The stalk of the tentacle (Pl. xxxiv, fig. 2) consists of a single layer of ectoderm and a large-celled endoderm which

[5] Bonnevie.—Hydroida. Den Norske Nordhavs-Expedition, 1876-1878, xxvi, Zoologi, 1899.

contains a very narrow lumen. The supporting lamella is thin. In the capitulum, which is trumpet-shaped, the supporting lamella increases in thickness but still remains comparatively thin. From it arises a series of fine threads or fibres which stretch out to the ectoderm. The endoderm in the apex of the tentacle consists of a single layer of cells which line the upper part of a circular cavity situated in the lower portion of the trumpet-shaped capitulum. In the case of a tentacle from a blastostyle bearing female gonophores, these endoderm cells form an extremely tenuous layer and thus offer a very marked contrast to the endoderm cells occupying a similar position in the capitulum of a tentacle from the hydranth. A tentacle from a blastostyle bearing male gonophores has the upper part of the cavity lined by very cytoplasmic cells with deeply-staining contents. In both types of tentacle the floor of the cavity communicates by a narrow aperture with the lumen in the axial part of the tentacle-stalk. The large-celled endoderm of the stalk is completely cut off from the vacuolate cells (endoderm cells) of the blastostyle by a partition of supporting lamella.

The capitulum of the tentacle is richly supplied with nematocysts which are of two kinds. There are (1) oval to narrow, spindle-shaped nematocysts, and (2) shorter and broader nematocysts with comparatively thick threads. These two types are similar to those which Jäderholm[6] found in the tentacles of the hydranth of *M. austro-georgiæ*. Scattered nematocysts also occur in the ectoderm of the stalk and at the bases of the tentacles.

GONOPHORES.

In a recent publication Benoit[7] has traced in detail the development of the gonophores in *M. cocksi*. This species bears both male and female gonophores on the one individual and even on the same blastostyle. Benoit's material from Roscoff and L'Île Ti-sao-son clearly shows this peculiar arrangement of the gonophores to which he refers as follows: "Ordinairement, chez les *Hydraires*, un blastostyle porte des gonophores du même sexe, mâle ou femelle. La *Myriothèle* présente ce caractère exceptionel d'avoir des gonophores des deux sexes sur le même blastostyle, les gonophores mâles groupés ordinairement à l'extrémité du blastostyle, les gonophores femelles beaucoup plus nombreux, à la base."

In the case of *M. australis* all the gonophores on a blastostyle are of the same sex, and throughout any one individual the sex of the gonophores is uniform. The mature gonophores are spherical in form, supported on narrow cylindrical peduncles which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity. In

[6] Jäderholm.—Wiss. Ergebn. d. schwedischen Südpolar-expedition, 1901-1903, v, 8, 1905.

[7] Benoit.—Archiv. de Zool. Exper. et Gen., lxiv, 1925, pp. 85-326.

the female there are usually three or four mature gonophores near the distal end and some six to eight immature ones on the proximal side of these. In the male the gonophores are more numerous though slightly smaller than those in the female, up to fifteen occurring on a single blastostyle. In some of these male gonophores the distal pole is encircled by a ring of dark brown pigment granules.

Both the male and the female gonophores have an apical opening representing the velar aperture. This feature appears to be unique among the species of *Myriothela*, except *M. harrisoni* where a similar condition exists in both sexes. The remarkable structures to which Allman gave the name of "claspers" in his description of *M. cocksi* do not occur in either of the Australian species.

HYDRORHIZA.

The tentacle-like filaments by means of which the truncated base of the hydranth is attached to the lobes of the thallus of the seaweed are covered by a loose mass of débris-laden mucus which spreads out upon the substratum. At the apex of each of these short rooting processes is a small, circular, chitinoid disc of dark brown colour. The wall of the filament consists of a single layer of ectoderm, the cells of which reach their greatest height at the apex where, in all probability, they form gland cells. The supporting lamella is thin, and is devoid of the threads so characteristic of that layer in the body-wall and tentacles of the hydranth. The endoderm cells surround a narrow lumen running through the axis of the rooting process.

MYRIOTHELA HARRISONI, *sp. nov.*

(Pl. xxxiii, figs. 1-2; Pl. xxxiv, fig. 5; and Fig. 1.)

General description.—The individuals are solitary, growing quite independently of each other, hanging freely into the water on the under surface of rocks below the level of low spring tides. In the living state the general colour of the hydroid is pinkish-white, changing to brownish-white on preservation.

The hydranth consists of an isolated attached polyp, divisible into three distinct regions—(1) a slender cylindrical distal portion bearing the tentacles, (2) a swollen, conical middle region bearing the blastostyles, and (3) a proximal hydrorhiza invested by a clear chestnut brown perisarc. There is no hydrocaulus.

The distal portion of the hydranth has the shape of a slender cylinder of even diameter, twelve times as long as broad, tapering slightly towards its junction with the blastostyle-bearing region. It bears upwards of six hundred capitate tentacles, densely crowded and imbricating distally, but becoming sparser proximally, the proximal millimetre carrying only about a dozen small tentacles.

The head of the tentacle is spheroidal, the long axis continuous with that of the peduncle. The peduncle is, in the contracted condition after fixation, one and a half to twice times the length of the capitulum. The transverse diameter of the former is about half that of the latter. A few of the tentacles have confluent patches of pinkish-purple spots upon the distal portion of the capitulum. The base of the tentacle-bearing region, which is comparatively free from tentacles, is transversely wrinkled, with hardly discernible longitudinal striæ, the lines produced by muscular contraction being thus just the opposite of those described below for the blastostyle region. In the contracted condition the hypostome and mouth are not visible.

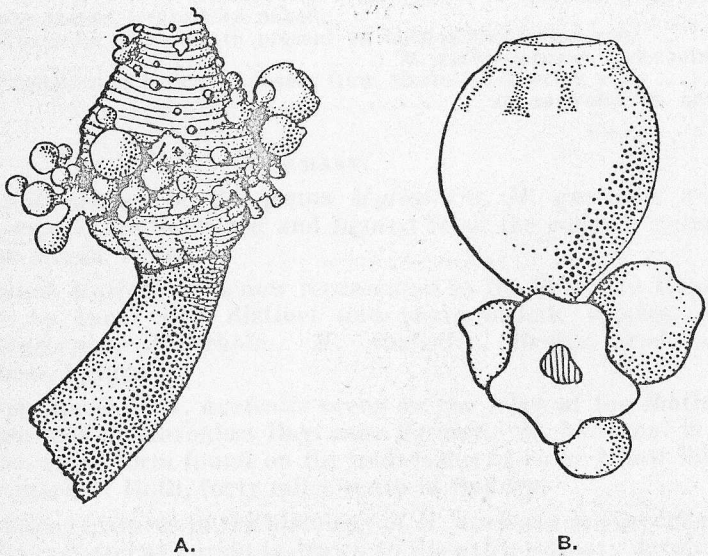

Fig. 1.—*Myriothela harrisoni*, sp. nov. A. Blastostyle-bearing region of hydranth. B. Blastostyle bearing gonophores in different stages of development.

The blastostyle-bearing zone is less than one-third as long as the tentacle-bearing region, but more than twice as wide, and is conical in shape. The blastostyles are borne on the middle zone in such numbers as to hide the surface. The base and apex are practically free from blastostyles, and are marked by fairly deep longitudinal furrows, with fine transverse striæ due to muscular contraction. Each blastostyle consists of an irregularly lobed base with a narrow, cylindrical, distal portion continued into a single terminal tentacle generally resembling those on the tentacle-bearing zone of the hydranth, but flatter distally and of larger size. The lobes of the base represent developing gonophores, the mature gonophores being

borne distally. The latter often appear terminal, having grown so large as to push the single tentacle to one side.

The mature gonophores are sub-spherical in shape, somewhat flattened distally, and are sessile or shortly pedunculate. They exhibit no definite arrangement on the blastostyle.

The male and female gonophores, with an apical opening representing the velar aperture (Pl. xxxiv, fig. 5), are borne upon separate individuals. In the male the blastostyle bears two or three ripe gonophores, and three or four in process of development. The only female individual was cut into sections before the diœcious habit was recognized, and entire blastostyles are not available for comparison. The ripe female gonophore has a diameter almost twice that of the male. Otherwise the female blastostyle has the same general appearance. Allman's "claspers" do not occur in this species.

The hydrorhiza is of variable form. Its main mass is in the form of a short cylinder, the axis of which is set transversely towards the main body of the hydranth, which arises towards one end. This cylindrical portion gives off slender rooting processes, expanded and truncated distally, for attachment to the sub-stratum. The whole of the hydrorhiza is covered by a translucent chestnut-brown perisarc, which is without pattern or any markings other than a few irregular superficial wrinklings.

The detailed discussion of the histology of this species has been reserved for the present and will form the subject of a later paper in this series of studies on the Australian Athecate Hydroids.

Locality.—*Myriothela harrisoni* is a shallow-water form, found on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney, New South Wales (Coll. L. Harrison).

Type.—The holotype (Reg. No. Y.611), and slides of serial sections have been deposited in the Australian Museum, Sydney.

Affinities of the New Species.

These large, solitary, attached hydranths have been referred to Sars' genus *Myriothela* on account of the elongated, cylindrical, distal portion bearing numerous capitate tentacles; the middle region carrying blastostyles which give origin and support to the gonophores; and the production of the proximal end into an adherent hydrorhiza. They are described as new species differing in several well-marked characters from the other representatives of the genus.

The southern forms, *M. austro-georgiæ*, *M. australis* and *M. harrisoni*, agree in being diœcious. *M. australis* is readily distinguished from *M. austro-georgiæ* by its small size, up to 30 mm. in height; the absence of tentacles from the blastostyle-bearing zone;

and the presence of an apical velar aperture in the male and female gonophores. *M. harrisoni* differs from the other southern species in the presence of a translucent perisarc investing the hydrorhiza, and in the form of the blastostyle, which consists of an irregularly lobed base with a narrow, cylindrical, distal portion continued into a single terminal tentacle. This species shows a certain relationship with the northern forms, *M. phrygia* and *M. cocksi*, in which the hydrorhiza is covered by a dense chitinous perisarc, but here the resemblance ends since *M. harrisoni* is diœcious and the gonophores, male and female, bear an apical opening representing a velar aperture.

Key to the Southern Species of the Genus *Myriothela*.

A. Perisarc present, forming an investment over the hydrorhiza ..... *M. harrisoni*, sp. nov.

A.A. Perisarc absent, hydrorhiza naked.

B. Tentacles of hydranth present on blastostyle-bearing zone ..... *M. austro-georgiæ*, Jäderholm.

B.B. Tentacles of hydranth absent from blastostyle-bearing zone ..... *M. australis*, sp. nov.

Summary.

1. Two new species of the genus *Myriothela*, *M. australis* and *M. harrisoni*, are described and figured from the coastal waters of New South Wales.

2. The genus *Myriothela* is now represented in the Southern Hemisphere by three very distinct and characteristic species, *M. austro-georgiæ*, Jäderholm, *M. australis*, Briggs, and *M. harrisoni*, Briggs.

3. The specimens of *M. australis* occur on the lobes of the thallus of a seaweed at Maroubra Bay, near Sydney. *M. harrisoni* is a shallow-water form found on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney.

4. The salient features in the histology of *M. australis* are described and figured, and attention is drawn to the extraordinary development of the supporting lamella in the capitulum of the tentacles from the tentacle-bearing zone of the hydranth.

5. Both the male and female gonophores of *M. australis* and *M. harrisoni* have an apical opening representing the velar aperture. This unique feature is recorded for the first time among the members of the genus *Myriothela*.