

ART. XXXIX.—On the Structure of *Hormosira billardieri*.

By T. A. MOLLET.

[Read before the Philosophical Institute of Canterbury, 4th November, 1880.]

Plates XIII. and XIV.

THE genus *Hormosira*, which belongs to one of the three sub-orders of the Algæ, the Fucaceæ, is described by Hooker in his "Handbook of the N.Z. Flora" as follows:—"Root discoid. Frond olive-brown, without distinct organs, dichotomously branched, moniliform, internodes inflated, fertile. Fruit dioecious. Conceptacles sunk in the periphery of the internodes, containing sessile narrow-pyriform spores and unbranched paranemata."

This genus, confined to Australian and New Zealand seas, has as its sole representative the species *billardieri*:—"Frond 6-18 inches long, very variable in size and robustness; internodes obconical, wingless." After thus describing it, Hooker mentions three varieties—*banksii*, *labillardieri*, and *sieberi*; but many of the features of these occur in the seaweed forming the subject of this paper. In fact, the shape of the internodes is far from being constant, and it must be admitted, as has been done by Harvey,* that the various forms described are most probably one and the same.

In "Phycologica Australica"† the different forms will be found figured, and, after describing them, the author concludes by supposing them all to be one species, varying slightly, due to the different conditions of growth, such as exposure, depth of water, etc.

The branching of this seaweed is generally dichotomous (commonly so-called), but is very often trichotomous, either irregular on the summit of the internode, or the three branches placed at equal intervals along the upper edge (Pl. XIV., fig. 1). It is not unusual to see as many as four branches springing from one internode (Pl. XIV., fig. 2), and in two or three cases I have noted six.

At times lateral branches are found (Pl. XIV., figs. 2 and 3). Internodes are also occasionally found united towards their base (Pl. XIV., figs. 4 and 5). This junction might at first sight appear to be a node, with two internodes springing from it; but the fact of its being hollow and in communication with their two cavities precludes the possibility of such an idea.

A most important point not mentioned in any of the works I have had access to (including the Australasian Floras in the Christchurch Public Library), is that the branching does not always take place from the inter-

* In the section Algæ, Hooker's "Flora of Tasmania," Vol. II., p. 285.

† "Phycologica Australica," Harvey, Vol. , pl. 135.

nodes, but frequently from the nodes themselves. It may be dichotomous (Pl. XIV., figs. 6 and 7), polychotomous (Pl. XIV., fig. 8), or take the form of a lateral shoot (Pl. XIV., fig. 9), in the same manner as the internode mentioned above.

The plants used in this investigation received no chemical preparation whatever; they were gathered in the living state, and left to dry for some days, after which time they were in a firmer and better condition for making thin sections than when freshly gathered. If kept, however, too long in a very dry atmosphere they showed a great tendency to brittleness, in which state they were very difficult to cut.

Before proceeding to the detailed structure of the plant, I would also mention that I have adhered to Hooker's nomenclature in regard to the terms node and internode. A node is generally looked upon as that part of the plant from which branches or leaves arise; but, in this case, the secondary stems generally branch out from the inflated internodes (see previous remarks on branching), which are therefore incorrectly named.

Nodes.—The nodes, which are solid throughout, consist externally of a single layer of thin polygonal cells (Pl. XIII., fig. 1), somewhat resembling the epidermis of the Phanerogamia, but unlike the latter are in a living state, many being found in the process of division. These cells, though very irregular in outline, are mostly hexagonal, and are so easily separated from the limiting tissue beneath, that in most of the sections made fragments of the tissue which they go to form were continually seen. This layer appears to be absent in the species of *Fuci* examined by Mr. F. O. Bower,* as he in no place mentions its existence.

The layer of tissue next beneath is composed of minute oblong cells, gradually increasing in size as they recede from the external tissue. Towards the surface these cells are oblong, but they become more oval-shaped towards the inner tissues. (Pl. XIII., figs. 2 and 3.) It is only in very thin sections that the shape of these cells—the granular contents of which are deeply coloured with chlorophyll—can be satisfactorily determined; in thicker ones they appear to be of much greater length than is really the case. This layer corresponds with the "limiting tissue" of F. O. Bower.

The tissue adjoining on the inner side, his cortical tissue, is an aggregation of irregularly-shaped cells, containing small quantities of chlorophyll, and having no clearly-defined division between the cell-walls (Pl. XIII., figs. 2 and 3). This layer graduates from the limiting tissue on the outside into a mass of parallel cells, forming the central part of the node (Pl. XIII., figs. 2 and 3).

* On the Development of the Conceptacle of the Fucaceæ. ("Quart. Journ. Micro. Science," January, 1880.)

These parallel cells contain a minute amount of chlorophyll, and are in shape cylindrical, their average length being about five times the diameter; but the boundary of the cell-wall, which could not be traced in the cortical tissue, is here occasionally clearly distinguishable in transverse section.

Internodes.—The internodes, which are in the early state semi-transparent, become olive-brown when mature; and the cavity which is invariably found in them contains a saline solution. This central cavity is to be detected in even the very young stages of their growth, when they are no more than .08 inch in diameter. The only exception to the above is the basal internode, which is solid throughout, but the one next above has a small hollow centre, and the third, and sometimes fourth, is furnished with a nearly full-sized cavity (Pl. XIV., fig. 6).

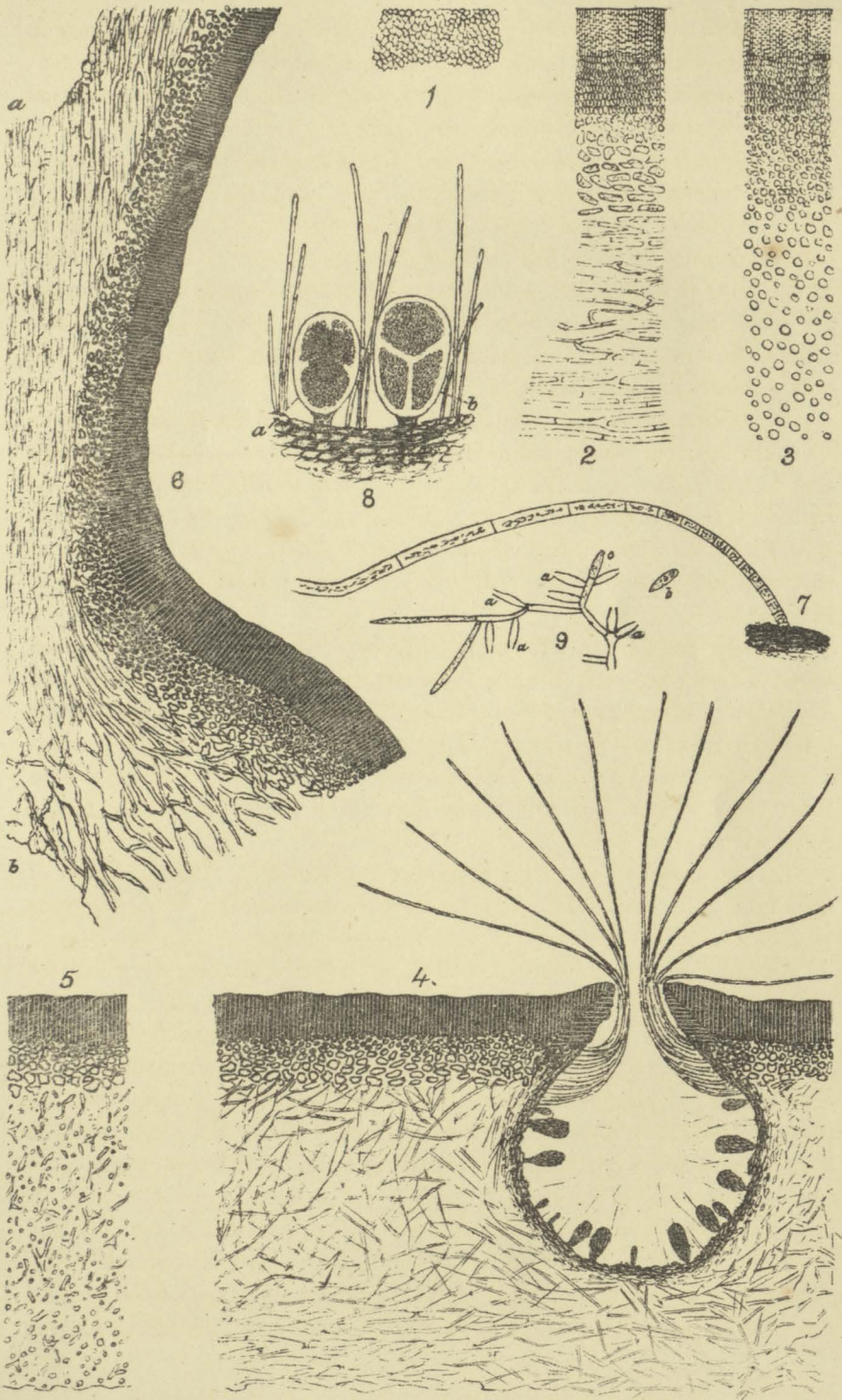
A few central threads, extending from the base to the top, may be seen by splitting open a fresh internode. Their structure somewhat resembles that of the nodes, the same thin layer of outer tissue being present, and within this also the minute oblong cells of the limiting tissue (Pl. XIII., figs. 4 and 5). The cortical tissue, however, differs slightly from that in the node, the cells being if anything more compact, though more irregular in outline.

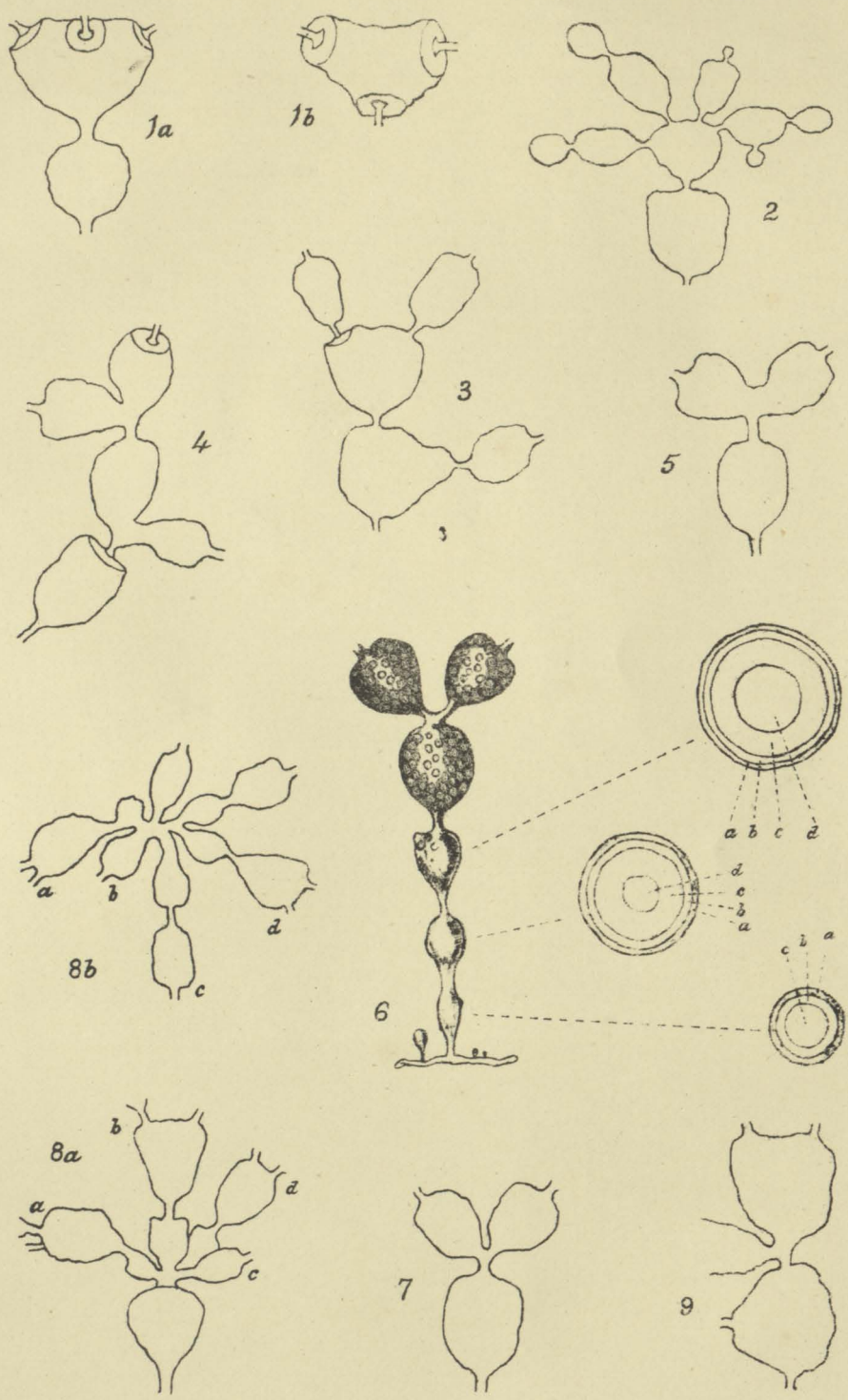
Between the cortical and innermost tissue lies a mass of cells joined together endwise, and forming long strings branching frequently, and without any apparent uniformity (Pl. XIII., figs. 4 and 5). These cells are tubular and mostly straight, but at times curved and bent at various angles. In some cases two adjacent rows of cells will be connected by a short tube, with a septum midway, reminding one most forcibly of the conjugation of *Spirogyra*.

The innermost tissue of the internode is a collection of parallel rows of cylindrical cells (Pl. XIII., figs. 4 and 5), somewhat akin to the previous layer, which in structure resembles this innermost tissue.

All these tissues, though described as different layers, must not be supposed to have a strong line of demarcation between them. On the contrary, they blend almost imperceptibly into each other, with the exception of the limiting tissue, which is moderately well-defined, and the outer single layer of polygonal cells. Owing to the thickness and gelatinous nature of the cell-walls in the cortical and inner tissues, the cells unite to form a transparent medium, the cavities in which are the only guide as to the size and shape of the original components of the structure.

As regards the connection between the different tissues in the node and internode, it may be remarked that the outer single layer is continuous, also the limiting and cortical tissues (Pl. XIII., fig. 6); but the layer of parallel cells divides into two equal parts (as seen in longitudinal section) on leaving





the proximal end of the node. At the distal end the central part of the tissue comes to an abrupt termination, leaving the surrounding mass only to pass on into the internode, where the parallel cells are comparatively few, being replaced by those of irregular shape.

Conceptacles.—The conceptacles, containing the sexual organs, are scattered over the surface of the internode, or, rather, in its outer tissues. The conceptacles are flask-shaped, and about $\cdot 03$ inch in diameter. The tissue lining them is of two distinct kinds; that of the mouth and about one-sixth of the depth of the cavity resembles, and is apparently a continuation of, the limiting tissue (Pl. XIII., fig. 4), but the remainder consists of cortical tissue. These facts would lead to the supposition that the origin of these conceptacles is the same as that of those in *Fucus serratus* ;* but on this point I am not prepared to give a definite opinion.

At some little distance within the mouth of the conceptacle (male and female), viz., from the termination of the limiting tissue, and extending to about an equal depth within the cavity, is to be found a collection of multicellular hairs, which protrude for some distance out of the mouth of the conceptacle. (Pl. XIII., fig. 4.) These hairs are quite distinct from, and have no resemblance to, the slender filaments hereafter mentioned. At the base the length of the cells, of which these hairs are composed, is equal to the diameter; but as we trace the cells on towards the free end, we find them gradually elongating till, at the extremity, their length is many times that of their diameter. (Pl. XIII., fig. 7.)

In the female conceptacle (Pl. XIII., fig. 4) the remaining surface is densely covered with slender filaments, most of them extending nearly to the centre of the cavity. The oogonia, irregularly scattered among these paranemata, contain in the primitive stage yellow granular matter, which slowly changes, as they increase in size, to a dark brown colour, and finally divides to form four oospheres. (Pl. XIII., figs. 4 and 8.)

In the conceptacle containing the male organs of reproduction, the slender filaments are wanting; but their place is occupied by thick clusters of branched hairs (Pl. XIII., fig. 9), upon which are formed the antheridia. The cell-walls of the latter are divided into two layers—an inner and an outer; the outer forming part of the branching hair. When the antheridium is mature it escapes slowly from this outer cell-wall, and is then seen to consist of the previously inner cell-wall filled with antherozoids. (Pl. XIII., fig. 9.)

Referring again to the oogonia, which I have not seen in a mature condition, it may be well to state that they appear, when young, cylindrical; at

* See F. O. Bower, *loc. cit.*

a later stage, pyriform; and when nearly ripe, obovoid. (Pl. XIII., figs. 4 and 8.)

I have had no opportunity of studying the fertilization of this seaweed, but am assured by Prof. Hutton that April is the best time of the year to witness it, and that it is over by June, being evidently confined to the autumn months. I have only to add that my thanks are due to the above-named gentleman, for the kind interest he has manifested in the subject throughout.

DESCRIPTION OF PLATES XIII. and XIV.

(All the figures natural size unless otherwise specified.)

Hormosira billardieri.

Plate XIII.

1. Epidermal tissue of polygonal cells ($\times$ about 180 diam.).
2. Longitudinal half-section of node, showing limiting, cortical, and parallel tissues ($\times$ about 120).
3. Transverse ditto ($\times$ about 120).
4. Longitudinal section of tissues of internode, showing limiting, cortical, irregular, and parallel tissues; also female conceptacle with multicellular hairs, paranemata, and oogonia ($\times$ about 60).
5. Transverse section of tissues of internode ($\times$ about 60).
6. Longitudinal half-section of node and ends of two internodes, showing stoppage of most of parallel cells at distal end *a*, and their division into two parts at proximal end *b* ($\times$ about 40).
7. Multicellular hairs of conceptacle, $\frac{1}{2}$ length, showing division into cells ($\times$ about 180).
8. Paranemata and oogonia, latter nearly mature ($\times$ about 180).
 - a.* oogonium with contents divided into four parts, one of these partly hidden by remaining three.
 - b.* oogonium with contents differently divided.
9. Branch bearing antheridia ($\times$ about 180).
 - a.* Empty antheridial cells (outer cell-wall of antheridium).
 - b.* Escaped antheridium (inner cell-wall enclosing antherozoids).
 - c.* antheridium, not fully mature.

Plate XIV.

- 1*a.* Portion of frond, showing trichotomous branching from upper internode.
Side view.
- 1*b.* The same branching internode. Top view.
2. End of branch showing quadrichotomous branching, and young internode springing from side of an older one.
3. Lateral branching from internode.
4. Union of two internodes near their base.
5. Ditto.

6. Dichotomous branching from node. Sections of basal internode and the next two above, as seen by the naked eye. (Three times nat. size.)
 - a. Limiting tissue.
 - b. Cortical tissue.
 - c. Inner tissues.
 - d. Cavity containing saline solution.
7. Dichotomous branching from node.
- 8a. Polychotomous branching from node. Front view.
 - a, b, etc., mark the same branches as in fig. 8b.
- 8b. Ditto. View from above.
 - a, b, etc., mark the same branches as in fig. 8a.
9. Lateral branching from node and internode.

ART. XL.—*A Visit to Stewart Island, with Notes on its Flora.*

By D. PETRIE, M.A.

[Read before the Otago Institute, 29th June, 1880.]

IN the month of January of this year Mr. G. M. Thomson and I made a short excursion to Stewart Island for the purpose of dredging in the inlets, and examining, as far as we could, the flora of that little-known part of New Zealand. Our examination of the flora was confined to the country around Paterson's Inlet, and that in the neighbourhood of Port Pegasus.

Paterson's Inlet is for the most part comparatively shallow, and extends more than half-way across the greatest breadth of the island. It is surrounded on nearly all sides by hills of moderate elevation, with rather steep slopes that are clothed with "bush" to the water's edge. At the head or north-western extremity of the inlet however, it is bordered by a low tract some three miles in width, which is difficult of access except near high water, in consequence of extensive shoals. From this part of the inlet there extends for a good many miles to the westward a flat swampy area, some three miles or less in average width, and raised but little above sea-level. It is drained by a forked creek, which is tidal in its northern branch for at least six miles. About six miles from the inlet this flat area is connected by a rather narrow, low, boggy valley bending to the south, with a similar area of low swampy land abutting on Mason Bay and the west coast of the island. The distance from sea to sea is probably about thirteen miles. Sand-hills occur at intervals throughout the flat areas at the head of the inlet and Mason Bay respectively, but they do not extend into the connecting valley. It is evident that at no remote date a strait here ran across Stewart Island, separating the high land in the north, of which Mount Anglem is the culmi-