THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Anne Parker Fessenden final oral examination for the degree of Master of Science. We recommend that the degree of Master of Science be conferred upon the candidate.

Minneapolis, Minnesota

June 3 1920

Josephine E. Tilden
Chairman

E. J. Lund.

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THE UNIVERSITY OF MINNESOTA

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Report

of

Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Anna Parker Fessenden for the degree of Master of Science. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science.

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THESIS

OBSERVATIONS ON TWO RARE AUSTRALIAN ALGAE, MYRIOCLADIA SCIURUS, HARVEY AND BACTROPHORA IRREGULARIS, N. SP.

A Thesis submitted to the

Faculty of the Graduate School of the

University of Minnesota

by

Anna Parker Fessenden

In partial fulfillment of the requirement

for the degree of

MASTER OF SCIENCE

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MYRIOCLADIA SCIURUS, HARVEY

History.

The genus Myriocladia was established by J.G.Agardh[1] in 1841 with Myriocladia Lovenii as the type species.

Myriocladia. "Frons filiformis ramosa diorgana, filo primario tubuloso continuo, secundariis inferne articulis superne moniliformiter contractis undique vestito Sporidia ad apicis ramorum ramellis insidentia, filis involucrantibus stipata, illipsoidea, intra sacculum hyalinum granulosam materiam continentia." He described three members of the genus, M. Lovenii, M.Zosterae and M. Posidoniae. Agardh[2] in 1848 wrote a more extended description of the genus including a comparison of Myricladia with Mesogloia and concluding that "they err, in my opinion, who believe the plants of this genus are nothing if not forms or a young stage of Mesogloia." At that time he included three species in the genus, M. Lovenii Ag., M. Zosterae Ag. and M. Capensis Ag. M. Posidoniae after further examination of the structure and origin was excluded from the genus as it seemed to be a young form of another species.

The next new member of the genus was M. Sciurus, which was first described by Harvey[7] in 1853, as follows:

"Myriocladia Sciurus; frond solid, subsimple or alternately branched; branches worm-like, attenuate at base very long, simple; peripheric filaments elongate, branched at base, nearly cylindrical; articulations shorter than their breadth, slightly contracted at the joints."

Harvey collected the plant at Port Fairy, Victoria, and at Newcastle, New South Wales, Australia, during his voyage to the Australian colonies in October 1853. It was found "on stones; near low-water mark". Harvey described and pictured it in"Phycologia Australica". The specimens are in the herbarium at the University of Dublin. He placed it in Agardh's genus Myriocladia, giving the species name "Sciurus", Latin for squirrel, because of the resemblance of the frond to a squirrel's tail, "referring rather to the copious villosity than to the shape." He noted its resemblance to M.capensis J.Ag. (collected at the Cape of Good Hope and Port Natal) and wondered if it would be accepted by Agardh as a member of his genus. Later, Agardh[3] made longitudinal and cross sections of Harvey's dried specimens, added the descriptions of these to Harvey's first description, and included it in his genus Myriocladia in 1880. At this time there were six species, the new ones being M. Chorda and M.capensis.

Myriocladia Sciurus was collected the second time in Western Australia, at Dirk Hartog Island, and was described by Askenasy[4] in 1888. He states that "the genus Myriocladia Ag. can hardly be considered sufficiently established" since he found it to resemble Mesogloia in several points.

In 1893 Rosenvinge [12] described and pictured a new species, M.callitricha, collected on the shores of Greenland.

In 1907 Harold Kylin [10] collected and studied M.Lovenii, found on the west coast of Sweden. He transferred Mesogloia Ekmani to the genus Myriocladia (Myriocladia Ekmani (Aresch.)Kylin).

In the same year Dr.Howe[8] described another species, Myriocladia grandis, collected on a sand beach, Ancón, and at Isla Vieja, Independence Bay, Peru, South America. He states that the affinities of this species would appear to lie with Myriocladia

Sciurus differing only from the Australian species "in its distinctly complanate main axis and in its relatively and actually much shorter peripheral filaments."

The latest collection of Myriocladia known to me was of M. Sciurus made by Miss Josephine E. Tilden on September 24th, 1912, at Basin Bay, Kiami, New South Wales, Australia. This is the third time that Myriocladia Sciurus has been collected, all three collections having been made on the coast of Australia - twice on the East coast, at Port Fairy, Victoria, and Newcastle, New South Wales, by Harvey; at Kiami, New South Wales, By Miss Tilden; and once on the western coast at Dirk Hartog Island. It is remarkable that collections were made at two such widely separated points, when the plant has been found so rarely.

The plant body of Myriocladia Sciurus consists of cord-like fronds (Plate 1, fig. 1) arising from a small conical disc or holdfast which attaches it to rocks. The cylindrical cords are dark reddish-brown in color, slimy to the touch, not at all, slightly, or much branched, tapering towards the base. The tips of the frond are usually frayed out and ragged in appearance. The frond is composed of a colorless jelly-like axis, covered with brownish red hairs which are less numerous near the basal disc. Although others have found a conspicuous mucilaginous investment, none appears on the material examined by the author. The frond measures 30 cm. by 4-6 mm. Just above the holdfast it narrows to 2 mm. The branches vary from 2-3 mm. wide by 4-32 mm. long.

The Minute Structure of the Frond.

The axis of this plant seems to be solid, made up of colorless filaments running longitudinally and parallelly, so that when a cross section is made most of the threads appear to be cut transversely, and a few longitudinally and obliquely. These are separated by spaces greater than their diameters. These filaments are more numerous in the center of the frond (Plate I, fig.2) and fewer nearer the outside where the peripharal filaments are given off as branches from the outmost longitudinal threads of the axis. The axial filaments are also of different sizes, the larger ones being surrounded by the more numerous smaller ones. Both are larger than the cells of the peripheral filaments.

In a longitudinal section (Plate I, fig. 3) of the axis, most of the filaments appear running longitudinally through the center of the frond, branching off obliquely at the periphery to form the assimilatory filaments (Plate I, fig. 4). Both kinds of filaments are jointed. The cells of the broader filaments are 2-4 times as long as their diameter; those of the narrower ones are 4 - 8 times their diameter. The cells in the main axis(Plate I, fig. 5-9) contain very little coloring matter, thus giving to the central portion the colorless gelatinous appearance.

In a longitudinal section through the basal part of the frond and the holdfast,the axial filaments appear to be more numerous,more closely packed together and less definite in direction than those in the upper portion of the frond. They twist about each other filling all interstices so as to form a more solid mass. Except in the greater density of the filaments, the holdfast itself seems to have a structure not different from that of the upper portion of the frond.

A clearer idea of the structure of the frond is gained from a description of teased out material. Large colorless filaments run longitudinally through the center of the frond, sending out narrower branches which themselves branch (Plate I, fig.4) in two or often three directions and run up and down within the frond between the larger filaments. As Askenasy[4 p.23] says, the descending branches of these larger threads seem to be rhizoidal in character. Some of these branches are short and colorless and seem to have the function of weaving the axial filaments together. Others develop into assimilatory filaments when they reach the surface of the frond. The main large axial filaments after running through the frond turn obliquely and proceed towards the surface producing many assimilatory filaments. Thus, every axial filament ends in peripheral assimilatory filaments, so that the uppermost assimilatory filaments of the frond must be branches of axial filaments of tremendous length.

The peripheral assimilatory filaments (Plate II, fig.11) are both primary and secondary in origin. They are composed of cells which at the base are much wider than long, while those near the center are equally as long as wide, and the terminal cells (Plate I, fig. 10) are usually longer than their width. The assimilatory threads are much or little branched, there being apparently no regularity in the method of branching. They vary from 12-26 mic. in width and from 1 -1.5 mm. in length. The assimilatory filaments are made up of from 52 to 105 cells each. The branches are from 8 - 11 mic. in diameter, and are composed of from one to 40 cells. Some of the cells of the larger assimilatory filaments were covered with small colorless hairs (Plate II, fig. 13) from 4- 20 mic. in length. These were found to be minute blue-green algae. The assimilatory filaments contain spherical or ovoid phaeoplasts, golden brown in color, which are thickly crowded together.

A portion of an assimilatory filament displaying an unusual form of terminal cell is shown in Plate II, fig. 14.

Growth of the Frond.

Harvey said nothing about the growth of the frond nor of any of its parts. J.G.Agardh does not mention the method of growth. Askenasy speaks of the growth of the peripheral threads as intercalary, the growing point lying just outside the main axis of the frond, just above the region where the sporangia occur.

According to Askenasy[4], inner axial filaments grow straight up through the frond. The outer ones are "pressed to the side and take in their final turn an almost horizontal direction. The growth of Myriocladia Sciurus is therefore stamped as trichothallic."

Kjellman[6] states that growth in length of the frond of Myriocladia is not known. According to Dr.Howe[8] the mode of growth in Myriocladia grandis, which resembles M. Sciurus closely, is the same as for Chordaria divaricata as described by Reinke. Reinke[11] states that the growth in Chordaria divaricata is "intercalary and extends over the tip of the stem at the basal segments of the paraphyses which stud the tip."

From the writer's observations on this plant, growth of the frond appears to take place by means of the division of cells in all parts of the axial filaments. The peripheral assimilatory filaments have a special growing region at their base, just outside of the main axis. Growth also takes place at other points on the filaments, except near the apex.

The increase in the thickness of the frond evidently occurs by means of the increase in number of the axial filaments which arise as branches from the main axial filaments.

Reproduction.

The first description of reproduction in Myriocladia Sciurus is by

Askenasy[4]. He says: "Die (plurilocuIären) Sporangien stehen an den Enden seitlicher Auszweigungen am unteren Theile der freien Haare; man findet sie sowohl an älteren, wie an jüngeren Theilen des Thallus in grosser Zahl. Sie sind sitzend oder kurz gestielt, einzeln oder zu mehreren beisammen, indem die Trägerzellen eines Sporangiums Seitenzweige treiben, die wieder mit Sporangien enden. Diese selbst sind von cylindrischer Gestalt, in der Mitte oft etwas angeschwollen, in zahlreiche kleine Sporenmutterzellen getheilt; ihre Länge beträgt bis 90 μ, der Durchmesser bis 20 μ."

In the examination of the material the writer was unable to find organs of reproduction except what appear to be unilocular sporangia (Pl.II, figs. 15-18). The contents of these cells are divided into numerous gonidia (spores?). These sporangia are borne singly or in groups, at the base of the peripheral assimilatory filaments just outside the main axis of the frond and immediately below the main growing region. They vary in shape from claveate or oblong-obovate to oval, and in size from 12-80 mic. in width to 32 - 140 mic. in length. Frequently many small branches grow out from the cells in the vicinity of the sporangia (Plate II, fig.18), occasionally even from the same cell from which a sporangium arises (Plate II,fig.16). The sporangia usually arise obliquely from the upper portion of the main cells, or at least they soon turn upwards into an oblique position. Only once was a sporangium seen which was stalked (Plate II, fig. 19).

The contents of the sporangia when young seem to be homogeneous. Later they become divided up into many small brown rounded bodies, crowded very closely together within the colorless sporangium wall. The exact nature of the contents is difficult to to determine. In a few cases there were found empty sporangia with apical pores, containing a few small rounded or flask-shaped bodies (Plate II, fig. 20) which were probably animal forms. The opening of the sporangium occurs at the apex (Plate II, fig. 21). Many empty sporangia appear to be open at the tip and split down along the side (Plate II, fig. 19). A curious appearance is given when part of the contents of a sporangium is rounded into a sphere at the tip and pushed out beyond the opened sporangium wall (Plate II, fig. 22), in which case the sporangium forms a ball-shaped covering to the contents. The sporangium wall itself and its contents may also assume a spherical shape at the tip (Plate II, fig. 23). This occurs frequently. As for trichosporangia, described in many of the species of this genus, none have been found in _Myriocladia Sciurus_. The exact nature of the sporogenous material that does occur is not certain.

Classification.

The classification of the genus _Myriocladia_ is in a chaotic condition. J.G.Agardh, Harvey, Kjellman, and De Toni, all agree in placing _Myriocladia_ in the _Chordariaceae_. Askenasy[4], however, places _M.Sciurus_ in the _Mesogloiaceae_ and Dr. Howe[8] does the same with _M. grandis_. J.G.Agardh[3], in making his classification, bases it on the origin of the peripheral filaments: "Filis periphericis ab origine et una cum fronde sese evolvente provenientibus, extra gelatinam plus minus invicem liberis (demum quoad partem deciduis?)". The genera with these characteristics he places in the "Genera _Ectocarpoides_".

Kützing[9] includes _Myriocladia_ in the genus _Mesogloia_. Askenasy[4] says: "The genus _Myriocladia_ can hardly be considered sufficiently established. _M. Sciurus_ shows in referring to the sporangia several resemblances to *Mesogloia natalensis*. I have not changed the genus name, because the characteristics of the genus ~~compared with~~ those of *Mesogloia* are not as yet clearly laid down."

Kjellman[6] in his classification puts *Myriocladia* in the *Eudesmeae*. In giving the distinguishing characteristic he states: "The growth in length of the frond takes place by transverse division of the subterminal cells of the axial filament; the assimilatory filaments are secondary." This is confusing as in the description of the genus *Myriocladia* he says: "Sprossaufbau nicht bekannt." This seems to give him no reason for including *Myriocladia* in the *Eudesmeae* or anywhere in his classification, as it is based on the mode of growth. Dr. Howe[8] noticed this incongruity and from his observation of the growth of *M.grandis* says that *M. grandis* would be placed in the genus *Mesogloia*, according to Kjellman. He does not change the genus name, however, but keeps it in *Myriocladia* because of the close resemblance between *M.Sciurus* and *M.grandis*, and because it differs greatly from the type species of *Mesogloia*.

In placing this plant in *Myriocladia* the writer was unable to follow Agardh's classification entirely as it is based on the presence of enveloping gelatine. The material examined showed no gelatinous sheath. Kjellman's classification could not be followed as he separates *Myriocladia* from *Eudesme* on account of the difference in origin of the plurilocular sporangia, those of *Eudesme* and *Castagnea* arising from the upper part of the assimilatory filament, while those of *Myriocladia* arise from the middle part of the filaments. He also bases his classification on growth. No plurilocular sporangia have been found in the material studied, nor can the question of growth be disposed of without further study and further investigation with living material. It has, therefore, seemed best to identify the specimen as Myriocladia Sciurus from the description of the genus and species as given by J.G.Agardh, Askenasy and Harvey.

Summary and Conclusion.

1. The plant body of M.Sciurus consists of many branched cell-filaments running longitudinally transversely and obliquely, and terminated in long peripheral assimilatory filaments.

2. The holdfast or basal disc is composed of filaments more closely packed together than those in the upper part of the frond. Fewer and smaller empty spaces occur between the filaments.

3. The longitudinal filaments of the central axis of the frond are of different sizes, the larger ones giving rise to narrower ones, as branches. The narrower filaments grow both upward and downward seeking the spaces between the larger ones. The downward growing filaments appear rhizoidal in nature. In one case (Fig.9) anastomosing of axial filaments was observed. This, however, may be another instance of branching.

4. The peripheral assimilatory filaments are attenuated at the apex, and at the base where the sporangia occur, give rise to many branches. The growth of the peripheral filaments is generalized.

5. Unilocular sporangia have been observed containing gonidia (spores?). They open by an apical pore. There is no indication of the occurrance of plurilocular sporangia.

6. The questions of growth of the adult frond from the young plant, germination of the gonidia, and evidences of sexual reproduction require further investigation with living material in the field.

7. Myriocladia Sciurus belongs in the Chordariaceae because the older fronds are composed of many filaments running longitudinally, giving rise to branches that grow downward like rhizoids, and to peripheral assimilatory filaments.

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Bactrophora irregularis n.sp.

Bactrophora irregularis was collected September 24 1912, at Basin Bay, Kiami, New South Wales, Australia, by Miss Josephine E. Tilden. It consists of an irregularly branched frond (Plate III. fig.1) which arises from a small flat basal disc. The frond is light brown in color, soft and slimy to the touch, attenuated toward the base. In the largest frond examined, the width just above the hold-fast was .5 mm. and the greatest width was 2.5 mm., while the length was 13.5 cm. The branches arise from any point on the frond in no definite order. The largest branches measure 1 mm. in breadth and 5 cm. in length, and are slightly attenuated toward the tip. The lower younger branches are very short, slightly wider than the older ones, and blunt or rounded off at the tip. Upon closer examination the frond is found to be composed of a tubular colorless jelly-like axis, covered with very short brown "hairs", which are more abundant in certain portions thus giving to the frond varying shades of color.

Minute Structure of the Frond.

Examination of the interior of the frond shows it to be composed of colorless, elongated, slightly branched and anastomosing cell filaments (Plate III. figs.5,6) which take a longitudinal course through the frond. The center of the frond is practically hollow, the axial filaments forming a loosely connected layer surrounding the central cavity. From the exterior of this layer arise many stalked fascicles of peripheral assimilatory filaments(Plate III figs. 4,10,11) which grow out obliquely or at right angles to the longitudinal filaments. The axial cell filaments are of three sizes (Plate III,fig.5), the broadest and middle-sized ones giving rise to the narrowest as branches. The cells of the broadest filaments are from 32 - 64 mic. wide and from 120 - 260 mic. long. They are inflated at the middle and slightly contracted at the ends where they are frequently joined to much narrower cells, thus giving an attenuated appearance to the filaments. The middle-sized filaments are more numerous than the broad ones and in these anastomosis most frequently occurs (Plate III.fig.6). They are composed of cells 24 mic. wide and 120 mic. long. The smallest filaments are the most abundant. They arise as branches of the middle-sized filaments and also from the base of the stalk of the fascicles of perpheral assimilatory filaments (Plate III. figs.2,3,4), at their point of attachment to the longitudinal parellel filaments. It is these smallest branches that grow downward in the frond and appear rhizoidal in character. They often depart from the tubular layer of filaments and make their way into the cavity in the center of the frond. At the tip of the frond,or at the tip of a branch, these rhizoids are seen in various stages of development. Here they are 120 mic. and more in length. The cells that compose the small branches are 4-6 mic. wide and 100-115 mic. long. The cells of the axial filaments contain little protoplasm and practically no coloring matter is present except in the outermost filaments, from which the assimilatory threads arise.

In a transverse section through the frond (Plate III,fig.7), practically all of the axial filaments appear in cross section.Those near the periphery are seen running lengthwise and terminating in assimilatory threads. The hollow interior is bordered by a layer made up chiefly by the largest of the filaments. The same structure can be made out in the longitudinal section. The axial filaments all appear running longitudinally and parallel to each other, on either side of the central cavity. Toward the exterior of the frond they turn outwards and give rise to peripheral filaments.

From observation of the axial filaments it might seem that the middle-sized ones were the primary filaments. Possibly in increasing in size they develop into the largest and oldest filaments and in branching give rise to the smallest as well as to the peripheral filaments. This view is somewhat substantiated by an examination of the tips of fronds where there is a large central cavity bounded by a few longitudinal, parallel, middle-sized filaments which give rise to the peripheral fascicles and rhizoidal branches.

The peripheral assimilatory filaments are borne in stalked fascicles (Plate III. figs. 4,11) and it is these that give to the frond its slightly hairy appearance. The average length of these fascicles from the top of the stalk to the apices of the branches is 200 mic. The branches grow out at about the same point on the stalk, the same cell sometimes giving rise to more than one branch. The peripheral filaments are attenuated toward the base, swollen or thickened and moniliform at the apex and slightly incurved. They are composed of from 10 -- 25 cells. The apical cells are the broadest and are sometimes broader than their length (Plate III. fig. 9), measuring 20 mic. in diameter and 12 mic. in length. At other times they are longer than broad (Plate III.fig.11) and measure 12 by 16 mic. The middle cells of the filament are from 8 by 8 mic. up to 12 by 12 mic. , while the basal cells are more oblong in shape and measure 4 -6 mic. in diameter and about 8 mic. in length.

In addition to the peripheral assimilatory filaments a few long colorless hairs arise in the fascicles (Plate III.fig.4) and extend far out beyond the assimilatory threads. They are attenuated at the base and are composed of cells that vary from 4 by 4 mic. at the base to 8 by 32 mic. at the top, where they are usually broken off leaving blunt ends.

Growth of the Frond.

The growth in length of the frond takes place by the growth in length of the filaments composing it. The writer found no special region of growth in the axial filaments. However, at the apex of a teased out branch the presence of short cells in the axial filaments might seem to indicate that growth occurred at the apex or immediately below the apex of the filaments. No examination was made of the basal disc to determine if growth occurs there, as but one basal disc was found in the material at hand, and it was not deemed wise to mutilate the only perfect specimen in the collection.

The growth of the peripheral filaments does not seem to be restricted to any particular portion since both middle and apical cells were found in process of division. The rhizoidal filaments seem to grow from their bases, pushing downward in the frond. (This is indicated by the presence of short, recently-divided cells at the base of the rhizoidal filaments.) The paraphyses that occur among the peripheral assimilatory filaments grow in length by division of cells at the base.

Reproduction.

Two methods of reproduction have been observed in *Bactrophora irregularis* and these correspond essentially to methods known to occur in this genus. The terminal cells of the assimilatory filaments become transformed into plurilocular sporangia. Unilocular sporangia are developed at the base of the peripheral filaments. The two forms of reproductive organs do not occur on the same branch or fascicle, but there seems to be no special region of the frond set aside for either.

J.G.Agardh gives the name "trichosporangia" to the plurilocular sporangia. These sporangia are swollen and doubtless on this account give a more curved appearance to the filaments (Plate III.fig. 10,12). The sporangia are divided usually but once, longitudinally or transversely, On the outer side of the curved filaments the cells appear rounded out or are sometimes provided with a one-celled branch. The contents of the sporangia are apparently similar to the phaeoplasts in the other vegetative cells(Plate III.fig.9). The sporangia of Bactrophora irregularis resemble those described for B.vermicularis by Agardh[1]. They measure 12- 16 mic. in width by 2-3 mic. in length. The apical cell is usually slightly larger than the cells below it.

The unilocular sporangia (Plate III.fig.s. 4,10,12,13) are borne at the base of the peripheral assimilatory filaments, at the point where these arise from the stalk of the fascicle. The sporangia are sessile and are usually surrounded by peripheral filaments which curve about and partially enclose them. They are clavate to obovate in shape and the older ones are much swollen. They vary from 8- 40 mic. in width and from 32-104 in length. The contents are finely granular and loosely arranged within the hyaline sporangium wall. Occasionally the contents appear to be in the form of small spheres closely packed together. The few emptied sporangia seen (Plate III.fig. 14) were open at the apex.

Classification.

Bactrophora irregularis belongs in the family Chordariaceae, as described by J.G.Agardh[1], because the frond is composed of filaments which run in a longitudinal direction through it, giving off peripheral assimilatory threads as branches. At this point Agardh and Kjellman differ in their classification. Agardh baseshis on the relation of the peripheral threads to the confining gelatine. Kjellman bases it on growth. In the material studied it was impossible to determine whether or not gelatine was present. Now, In the absence of living material, does not the writer feel competent to state just how growth occurs. Kjellman states: "Sprossaufbau nicht bekannt." Omitting these two points, the plant corresponds in all other respects to the descriptions and keys leading to the genus *Bactrophora* in both classifications. A translation of Agardh's description of the genus is as follows: "Frond cylindrical, composed of a continuous axis and radiating peripheral threads within confining gelatine. Axis tubular within, composed of a few series of cells, a little distance apart, the interior ones wider, the exterior ones narrower; cells of the interior, cylindrical-oblong, joined in parallel longitudinal filaments, sparsely anastomosing, outer ones shorter. Peripheral threads confined in the common mucous, at the base many times forked and branched into fascicles, then elonagted, simple, thickened at the fertile apex, curved, bearing within the cells numerous swollen glomerules of sporidia."

Agardh includes three species in the genus: *Bactrophora filum*, *B. vermicularis*, and *B. nigrescens*. The plant in question differs from *B.filum* in the following respects: it has no distinct stipe; it has no cleft in the frond; it has many branches; the basal cells of the peripheral filaments do not have twin branches; the peripheral filaments are not as curved as those of *B.filum.* It differs from *B. vermicularis* chiefly in the method of branching and in the number and shape of the branches. It differs from *B.nigrescens* also in the method of branching and in the shape of the fertile peripheral filaments.

For the above reasons, the writer considers this plant a new species and gives to it the name, *Bactrophora irregularis*, because of the irregularity in the branching of the frond.

Baotrophora irregularis n.sp.

Fronde cylindracea, ramosa, ramis simplicibus, irregulariter egredientibus ex omni parte frondis; ramis longioribus parce attenuatis, brevioribus haud attenuatis, obtusis; filis axialibus majoribus 32-64 mic. diam., minoribus 4-6 mic. latis; filis periphericis ad 200 mic. longis; sporangiis plurilocularibus raris, cellulis 12-16 mic. diam., 2-3 mic. longis; sporangiis unilocularibus 8-40 mic. mic. diam., 32-104 mic. longis.

Hab. ad scopulos. Basin Bay, Kiami, New South Wales, Australia. September 1912. Tilden (7093 B).

Frond cylindrical, branched; branches simple, arising irregularly from any part of the frond, longer branches scarcely attenuated, shorter ones not at all attenuated, blunt at the apices; larger axial filaments 32-64 mic. in diameter, smaller ones 4-6 mic. in diameter; peripheral filaments up to 200 mic. in length; plurilocular sporangia rare, with cells 12-16 mic. in diameter, 2-3 mic. in length; unilocular sporangia 8-40 mic. in diameter, 32-104 mic. in length.

Summary

The frond of Bactrophora irregularis is cylindrical in shape and hollow. The main axis above the basal disc is about .5 mm. thick, broadened above to 2.5 mm. It bears numerous irregularly disposed simple branches, 1-1.5 mm. broad, 2mm. - 5 cm. long, of nearly uniform diameter.

The longitudinal filaments of the axis are of three sizes varying from 4-64 mic. in diameter. Occasionally they branch, the smallest branches in some cases being rhizoidal in character. Anastomosis occurs rarely. The cells of the rhizoids are 4-6 mic. in width, and 100-115 mic. in length.

The peripheral assimilatory filaments are usually about 200 mic. in length. They are in fascicles, borne on stalks which are branches of the longitudinal axial filaments. The terminal cells are distinctly moniliform and broadened. They may be even broader than long, 20 mic. in width by 12 mic. in length. The middle cells measure about 12 mic. in breadth and are usually as long as broad. The basal cells are longer than broad, 4 mic. in diameter, by 8 mic. in length. There are a few colorless hairs, or paraphyses, present, extending far beyond the assimilatory threads.

The terminal cells of the assimilatory filaments become transformed into plurilocular sporangia. The cells are usually divided once, either transversely or longitudinally.

The unilocular sporangia are clavate to ovate in form, 40-105 mi mic. long, by 8-32 mic. in breadth. They are usually solitary, and sessile. They are borne at the base of assimilatory filaments which curve around and enclose them.

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DESCRIPTION OF PLATES. I and II

Fig. 1. Myriocladia Sciurus. Natural size.

Fig. 2. Diagrammatic cross section of thallus, x 10.

Fig. 3. Longitudinal section of a portion of thallus, x 300.

Fig. 4. Axial filament of frond showing ascending and descending branches and peripheral assimilatory filaments, x 300.

Fig. 5. Axial cell filaments showing two sizes of filaments and branching, x 666.

Fig. 6. Ascending and descending rhizoidal-like branches of axial filaments, x 666.

Figs. 7-9. Axial cell filaments and branches, x 666.

Fig. 10. Apical cell.

Fig. 11. Peripheral assimilatory filaments, showing [redacted] method of branching, [redacted] x 666.

Fig. 12. Branches(of assimilatory filaments) on vegetative plant, x 415.

Fig. 13. Cells of assimilatory filament, showing cell contents and parasitic blue-green alga, x 850.

Fig. 14. An unusual formation of the apical cell of assimilatory filaments, x 1400.

Fig. 15. Five young sporangia at the base of an assimilatory filament, just below the principal region of growth. Numerous branches, x 625.

Fig. 16. Sporangia of various stages, x 500.

Fig. 17. Two sporangia, one [redacted] situated in axis of a branch, x 375.

Fig. 18. Largest sporangia observed, with numerous short branches arising near it, x 400.

Fig. 19. A group of emptied sporangia, one of which is pedi-celled, x 1600.

Fig. 20. An emptied sporangium with apical pore and contents, x 600.

Fig. 21. Two empty sporangia, x 1600.

Fig. 22. An abnormal sporangium, x 890.

Fig. 23. An abnormal sporangium, x 1600.

DESCRIPTION OF PLATE III.

Fig. 1. Frond of <u>Bactrophora irregularis.</u>

Fig. 2. Stalks of peripheral assimilatory filaments branching from axial filaments. Rhizoidal like branches growing down from the end of the stalk at the point from which the peripheral filaments arise.

Fig. 3. Detail of the rhizoidal branches shown in Fig. 2.

Fig. 4. A fascicle of assimilatory filaments with stalk and rhizoidal branch, and long colorless paraphyses.

Fig. 5. A group of axial filaments showing the variation in sizes.

Fig. 6. Anastomosing axial filaments.

Fig. 7. Part of a cross section through a small frond, showing a small empty region in the center, ~~xxxxxxxxx~~ longitudinal filaments and peripheral filaments.

Fig. 8. Longitudinal section through a small frond, showing empty region in the center, axial filaments running longitudinally and parallel and peripheral filaments arising obliquely.

Fig. 9. Apical cells of a peripheral assimilatory filament, showing contents.

Fig.10. A fascicle of fertile filaments showing longitudinal and transverse divisions of the apical cells.

Fig. 12. A small, much curved fertile filament.

Fig. 11. A fascicle of curved assimilatory filaments showing unilocular sporangia.

Fig. 13. Mature unilocular sporangia surrounded by short assimilatory filaments.

Fig. 14. Empty sporangia.

PLATE I

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PLATE II

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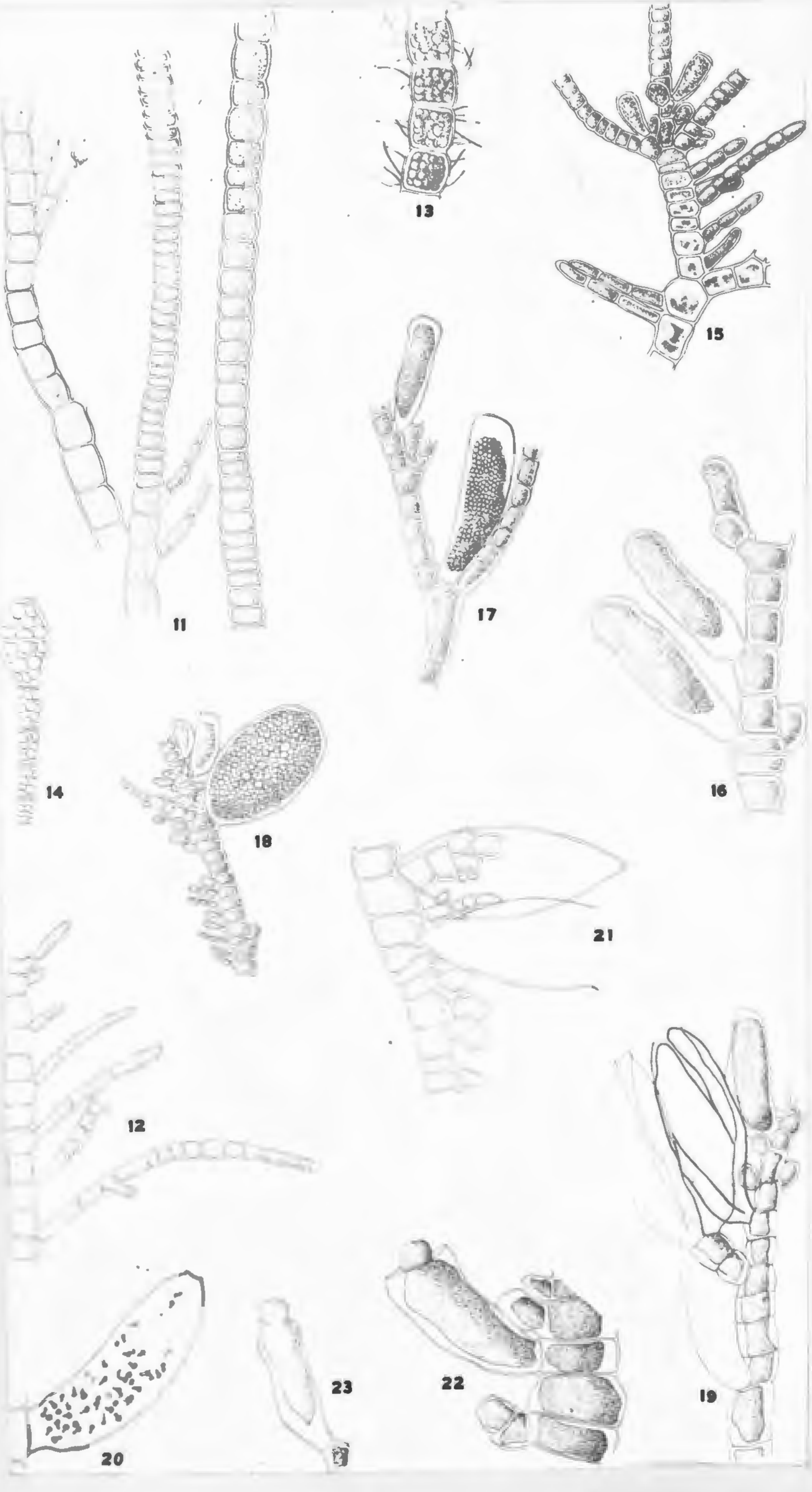

PLATE III

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