COMMONWEALTH OF AUSTRALIA
Copyright Regulations 1969

WARNING

This material has been reproduced and communicated to you by or on behalf of The University of Adelaide pursuant to Part VB of the Copyright Act 1968 (the Act).

The material in this communication may be subject to copyright under the Act. Any further reproduction or communication of this material by you may be the subject of copyright protection under the Act.

Do not remove this notice.

External Copyright permission (if applicable)

Published in Nature 184 (4689): 828-9.

A FREE FLOATING MARINE RED ALGA.

On April 14th, 1959, during a research trip along the coast of Victoria, Australia, the beach at Bridgewater Bay, near Portland, was observed from a distance to show a deep red band at about high water mark, and the sea to be similarly coloured close inshore. The band on the beach was up to 25 feet broad and several hundred yards long, and consisted of enormous numbers of deep red algal balls, each about 1 cm. in diameter. The mass of balls was generally 1-2" deep, but in places reached 10". Amongst rocks at the end of the beach the balls were piled up 2-3 feet high, and large rock pools were completely filled with them. Other algae were virtually absent from this drift, but further eastwards along the beach fairly rich drift of other algae occurred. In no case were the red algal balls found attached to any other alga or marine angiosperm.

From the top of nearby cliffs, numerous red streaks were seen extending 200 to 300 yards out to sea beyond the ~~me~~ immediate beach waves; these streaks were probably several yards across, with clear water between them, and were orientated perpendicular to the beach. They were present throughout the morning of observation.

The alga concerned appears to be a species of *Antithamnion* which was growing actively as a free floating form offshore from the beach, with some being continually washed up on the beach.

The absence of any plants attached to other algae, and the structure of the balls described below, precludes the possibility that they had been detached in enormous numbers from some sublittoral substratum or host. The balls can be described as of the "aegagropilous" form, and of one hundred balls examined, 96 were tetrasporangial and 4 were apparently sterile. No sexual plants were seen.

The base of the plants consists of an axial cell, in general with no evidence of any attaching organs. In about 25% of the plants, however, 2 to a few multicellular rhizoidal filaments had developed from the end cell, but these showed no signs of having been attached to anything. The oldest parts of the thallus were situated near the center of the balls. Multiplication apparently occurred by fragmentation of the thallus, and axial cells from which branches had broken were frequently observed. In a few cases dead cells occurred in lower parts of the thallus, but fragmentation usually appeared to take place between two adjacent cells.

The thallus is dichotomously branched, with verticils of short pointed laterals at the upper end of each cell. The cells are 1-2 times as long as broad, varying from about 60 μ diameter near the apices to 180-250 μ diameter in the oldest parts. The short laterals occur in verticils of 4 except immediately above a branch axil, where the inner lateral is usually absent; in the latter case the outer lateral is usually larger than the other two. The laterals are not placed in line with those of adjacent cells. The laterals are up to 80 μ long, 25-35 μ broad at the cbase, consisting of 3-5cells, unbranched, tapering sharply to a blunt point, and often bearing hairs on a short stalk cell, most commonly on the upper side of the basal cell. The thallus is not mucilaginous. Epiphytic growth of diatoms, other microscopic algae and protozoans was considerable.

The tetrasporangia are sessile on the upper side of the basal cell of short laterals, 45-60 μ in diameter, and are cruciately divided, though often appearing tetrahedral when mature; the division however appeared to be successive in all cases, with the second and third divisions almost simultaneous and at right angles to each other. Sporangia are not frequent on most plants, and in some cases only one or two per plant were found.

The alga was maintained in culture for 2-3 weeks, but soon became overgrown with the numerous epiphytes originally present. Further development of the short laterals into longer shoots, themselves with very short laterals, was observed.

In the absence of sexual material the genus cannot be determined with certainty, though it is certainly close to Antithamnion and it appears to be distinct from any previously described Australian species. Revisional studies at present under way on Australian Crouanieae will include this alga.

The water in which this alga was growing is open-ocean water, within a wide bay, and is not subject to any pollution or dilution. The salinity is approximately 36‰ and the sea temperature about 16°C.

As far as we can ascertain, this is a unique case of a free floating member of the Rhodophyta in open water. The following additional information on its occurrence before and after our observations are from Mr. C. Beauglehole, a local algal collector. Local residents had observed a "red beach" for a few days before April 14th, but not on any previous occasion within recent years. On April 15th, a very high tide almost completely removed the beach drift, but great masses were visible out to sea, somewhat east of the original streaks. The floating masses, with some beach drift, were present on the 18th (forming a line about 20 yards wide and a mile or more long), but had disappeared at Mr. Beauglehole's next visit on April 26th, and have not been observed since. On April 18th, large breakers just off a reef were coloured red by the algae, which always appeared to maintain its position offshore. No trace of this alga was seen in nearby bays during the period of observations.

This occurrence is apparently more in the nature of a "bloom" during especially suitable conditions, though its' development under the normally fairly rough conditions of Bridgewater Bay is remarkable. On April 14th, waves near the beach were about a foot high and similar conditions had prevailed since a store 8-10 days previous.

The most striking free-floating marine alga is the _Sargassum_ of the Sargasso Sea[1]. "Loose-lying" forms of other marine algae are known from the Baltic[1], and such forms of Fucaceae in salt marshes are well known. Moore,[2,3] has recorded loose-lying forms of _Macrocystis pyrifera_ and _Hormosira banksii_ in New Zealand. These loose-lying forms all appear to be confined to calm, shallow bays, with dilution a prominent feature in the Baltic, and in most cases the algae concerned lie on the bottom. Such cases seem to be distinct from the _Antithamnion_ reported here. Also these loose-lying forms are invariably sterile, while nearly all of the _Antithamnion_ plants were tetrasporangial.

1. Fritsch, F.E. The structure and reproduction of the algae. Vol. II (1945).

2. Moore, L.B. _Trans. Roy. Soc. N. Zeal._ **72** (4):333-340 (1943).

3. Moore, L.B. _Trans. Roy. Soc. N. Zeal._ **78** (1): 48-53 (1950).

H.B.S. Womersley, Department of Botany,
University of Adelaide, South Australia

June 24th, 1959.

R.E. Norris, Department of Botany,
University of Minnesota, U.S.A.

Published in Nova Hedwidgia,
Dec. 1959.

SYMPODOPHYLLUM, A NEW GENUS OF DELESSERIACEAE (RHODOPHYTA) FROM SOUTH AUSTRALIA.

By E. Ann Shepley and H.B.S. Womersley,
Department of Botany, University of Adelaide.

The first material of this new and distinctive alga was collected by Miss C.A. Davey from Investigator Strait (south coast of Yorke Peninsula) in 1899. This sterile specimen (Davey, No. 272) was presumably sent to Reinbold (who described other collections made by Miss Davey) but was in turn sent by Reinbold to Falkenberg, who recognised the alga as undescribed and named it Sympodophyllum reinboldi on the specimen sheet. This name however has never been mentioned in the literature. The Davey specimen is in the Hamburg Herbarium and was brought to our attention by Prof. G.F. Papenfuss.

In April 1955, a few small plants of this alga were collected by us in the drift at Pondalowie Bay, on the south-west coast of Yorke Peninsula, growing on the basal rhizoidal parts of Dictypta radicans Harvey. One of these plants was tetrasporic, the others sterile. No other specimens of Sympodophyllum have been found.

The following description is based on the liquid-preserved Pondalowie Bay material, and Falkenberg's very appropriate manuscript name is adopted.

Structure of the Thallus.

The largest plant collected is about 4 cm/s. in height. The thallus is attached to rhizoids of *Dictyota radicans* by a small, cellular, holdfast, and consists of an upright central axis on which small, incurving, stem-clasping leaflets are arranged alternately in 2 ranks. The actual growing tip is completely hidden by the older curved leaflets (figs. 1 and 2). The leaflets are sympodially developed with the growing point of the upright axis arising as a lateral branch on the adaxial surface of the previous leaflet (fig. 2).

Growth is initiated by a hemispherical apical cell which segments posteriorly. Each of the segments so produced (primary cells) undergoes lateral division, cutting off the two lateral pericentral cells (figs. 3 and 4). Within the next few segments from the apical cell, divisions of the central cell occur producing abaxial and adaxial pericentral cells (fig. 3). The lateral pericentral cells undergo further lateral division forming chains of cells of the second order, each of which may act as an initial cutting off a short row of cells of the third order away from the apex of the blade. Close to the apex of young leaflets, the apical cells of the developing rows of the third order are markedly elongate and are visible as distinct lines across the blade (fig. 5). In older mature leaflets the end cells of these rows are isodiametric and mostly abut on the next posterior row of the second order, though several outer rows of the third order do reach the margin of the blade (fig. 6). Insome second order rows the older cells (nearest the central cell X) may cut off a single cell towards the apex of the leaflet (fig. 5).

In mature leaflets the cell rows of the second order enlarge and are conspicuous as microscopic lateral nerves, giving quite a distinctive appearance to the leaflets (fig. 2). These lateral nerves are similar to but not so prominent as those found in Apoglossum, but no intercalary divisions occur in cell rows of the second order.

Cortication of the midrib and lamina of the leaflets commences very early and only the youngest leaflets are uncorticate. Up to three layers of small corticating cells are formed over both surfaces of the leaflets and gradually extend from the midrib area to the margin of the leaflet.

The lower stem-like part of the thallus results from the loss of the wings and upper midrib (above the branch origin) pf lower leaflets, leaving only the basal midrib. Cortication of the lower midrib and stem is by cells of fairly uniform size; distinct rhizoids were not abserved.

New leaflets appear to arise endogenously on the upper surface on the deeply concave youngest leaflets. Occasionally more than one leaflet arises thus giving rise to occasional thallus branches (fig. 1).

Development of Tetrasporangia.

On one plant only, a few tetrasporangial leaflets were found. These leaflets were corticate, (1-3 layers of cells), but a young leaflet showed clearly that the tetrasporangia are cut off by the lateral pericentral cells and cells of the second order rows, the tetrasporangia nearest the central cell being the oldest (fig. 7). Each second order cell cuts off the tetrasporangium towards the apex of the leaflet, so that they lie in the central plane of the leaflet and form only a single layer in the thallus. Up to 6 sporangia were seen along one series of second order cells, mature ones being about 100 μ in diameter. In older leaflets this regular arrangement of the tetrasporangia is less conspicuous. The formation of cover cells could not be observed due to lack of adequate material.

Discussion.

Kylin (1956) distinguishes 8 groups in the Delesserieae, to which should be added the Botryocarpa group (Wagner 1954). Of these groups, the Sarcomenia group has been shown to be more closely allied to the Rhodomelaceae (Womersley and Shepley 1959).

The distinctions between the groups of the Delesserieae are based chiefly on the development of the blades, in particu on whether all cell rows of the third order reach the thallus margin or not, and on the presence of absence of intercalary divisions in cell rows of the second or higher orders. Thus on Kylin's scheme Sympodophyllum is most closely allied to the Membranoptera group, in which not all the cell rows of the third order reach the margin and intercalary cell divisions are absent. It differs from the Membranoptera group however in the method of branching, since in the latter group branching is from the margin (except in Holmesia where branching is from the margin or from the midrib and special small reproductive leaflets occur (Wagner 1954; 301)).

Sympodophyllum is further distinguished by the sympodial development of the thallus as a whole (similar to Hypoglossum revolutum) and by the presence of microscopic lateral veins, formed by cell rows of the second order.

The tetrasporangial arrangement sharply separates Sympodophyllum from other Delesserieae, except Caloglossa. In the Delesserieae in general, the tetrasporangia arise from cortical cells, and not primary cells, except in Claudea where both types of cells are involved, and Vanvoorstia where pericentral cells only are concerned (Papenfuss 1937). In Caloglossa a single layer of sporangia is formed from the lateral pericentral cells and from successive cells of cell rows of the sedond order apart from those nearest the margin of the blade. *Sympodophyllum* develops sporangia from the lateral pericentral cells and from successive cells of the rows of the second order in a similar manner. A further major difference between *Sympodophyllum* and *Caloglossa*, and other Delesserieae is that only one layer of sporangia is formed in the plane of the blade, whereas in all other Delesserieae two such layers of sporangia are formed. In *Caloglossa* all cell rows of the third order reach the thallus margin, in contrast to *Sympodophyllum* where they do not.

The thallus structure and distinctive tetrasporangium arrangement justify placing *Sympodophyllum* in a separate group, which is probably most closely related to the *Caloglossa* group.

Sympodophyllum Group.

Thallus of sympodial leaflets. Cell rows of third order not all reaching the thallus margin. Rows of cells of second order forming microscopic veins. Intercalary divisions absent. Sporangia produced anteriorly by lateral pericentral cells and successive cells of rows of second order, forming a single layer in the plane of the blade.

Thallus ex sympodialibus foliis fit. Series cellularum ordinis tertii non omnes marginem thalli attingunt. Series cellularum ordinis secundi sunt microscopicae laterales venae.

Divisiones cellularum intercalariae absunt. Sporangia ex lateralibus pericentralibusque cellulis et ex continuis seriebus cellularum secundi ordinis fiunt. Sporangia exposita in uno ordine in plano folii.

Sympodophyllum reinboldii gen. et. sp. nov.

Thallus erect, leafy, sympodial, becoming corticate. Leaflets alternate, concave adaxially, arising sympodially from the lower midrib of the preceding leaflet. Erect axis formed from lower midribs.

Not all cell rows of third order reaching the thallus margin. Cell rows of second order forming microscopic lateral veins: no intercalary divisions present.

Tetrasporangia produced on both sides of the midrib. Sporangia formed from lateral pericentral cells and successive cells of rows of the second order, in one layer.

Cystocarps and spermatangia unknown.

Thallus erectus, frondosus, sympodialis et tandem corticatus. Folia alternata, adaxiale concava, orientia sympodiale ex promimi folii costa inferiore. Axis erectus ex costis inferioribus fit.

Series cellularum ordinis tertii non omnes marginem thalli attingunt. Series cellularum ordinis secundi sunt microscopicae laterales venae. Divisiones cellularum intercalariae absunt.

Tetrasporangia in utroque latere costae adsunt. Sporangia ex lateralibus pericentralibusque cellulis et ex continuis seriebus cellularum secundi ordinis fiunt. Sporangia exposita in uno ordine. Cystocarpia et spermatia incognita.

Type: AD, A19,887. Pondalowie Bay, South Australia.
Drift, on rhizoids of Dictyota radicans Harvey. April 24, 1955. H.B.S. Womersley and E. Wollaston.

Other Locality: Investigator Strait, South Australia, May 5, 1899. Miss C.A. Davey, No. 272.

LEGENDS FOR FIGURES.

Fig. 1. Sketch of type specimen attached to rhizoids of *Dictyota radicans* (shown in black).

Fig. 2. Leaflets near the apex, showing midrib, lateral veins and development of young leaflets.

Fig. 3. Apex of a leaflet showing segmentation.

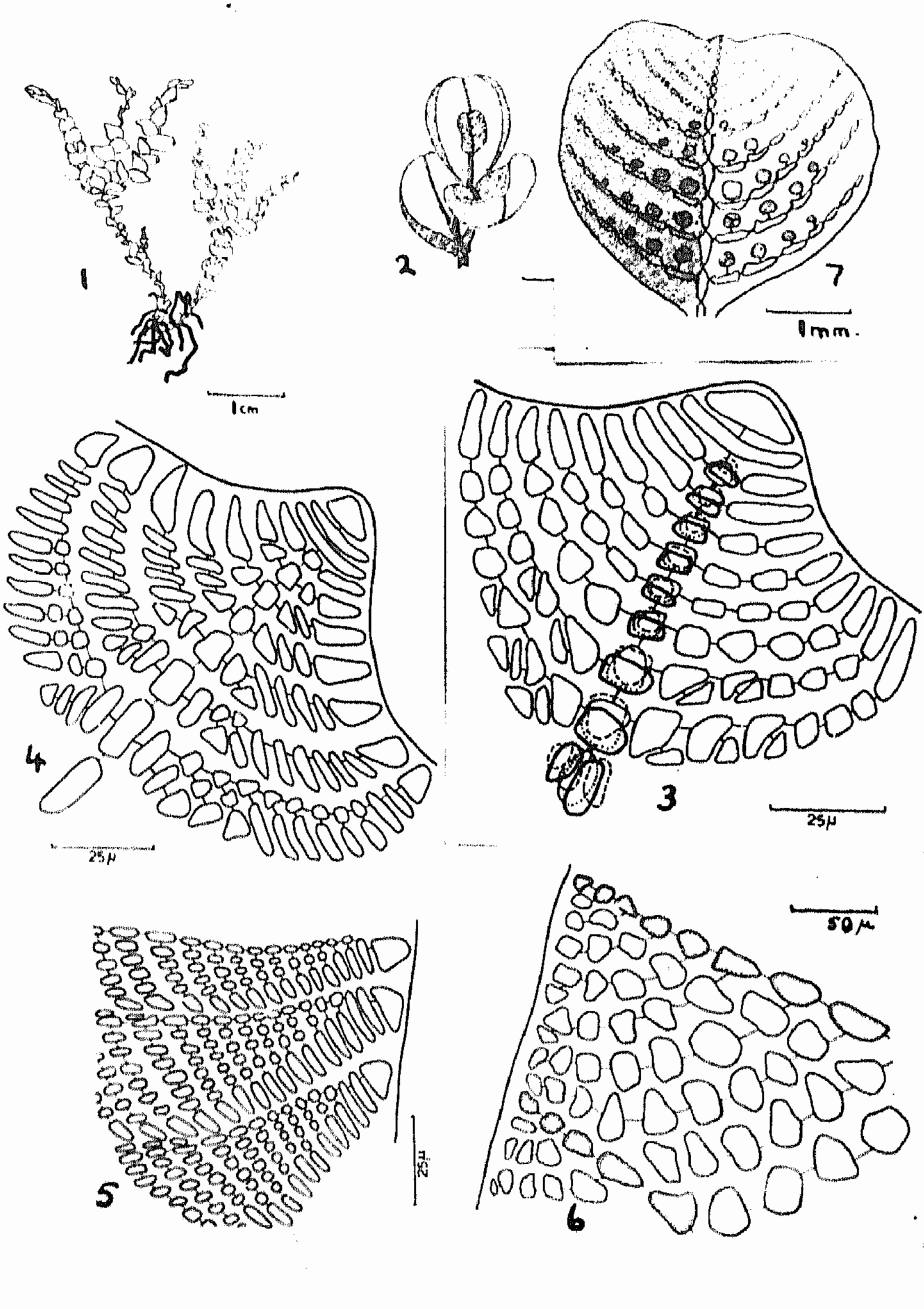
Fig. 4. Ditto, with transverse pericentral cells omitted, showing development of cell rows of the third order.

Fig. 5. Peart of a young leaflet, showing well developed but immature cell rows of the third order, with elongate terminal cells.

Fig. 6. Part of mature leaflet (cortication omitted) showing cell rows of the third order abutting a second order row (cells with double outline) except near the margin of the blade.

Fig. 7. Tetrasporangial leaflet, showing formation of tetraspores from the lateral pericentral cells and successive cells or rows of the second order. Cortication shown only on the left side.

c.c. = central cell; l.p.c. = lateral pericentral cell; t.p.c. = transverse pericentral cell; 2 = cell of second order; 3 = cell of third order.


1
1cm
2
7
1mm.
4
25µ
3
25µ
5
25µ
6
50µ