

Det Kgl. Danske Videnskabernes Selskab.

Biologiske Meddelelser. **V**, 3.

MARINE ALGÆ
FROM THE CANARY ISLANDS
ESPECIALLY FROM TENERIFFE AND GRAN CANARIA

I. CHLOROPHYCEÆ

BY

F. BØRGESEN



KØBENHAVN

HOVEDKOMMISSIONÆR: ANDR. FRED. HØST & SØN, KGL. HOF-BOGHANDEL
BIANCO LUNOS BOGTRYKKERI

1925

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Det Kgl. Danske Videnskabernes Selskab.

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The collection of Marine Algæ on which the present work is based originates from my journey to the Canary Islands in the winter of 1920—21.

I started from Copenhagen at the beginning of December and after I had stayed a few days in London, a Liverpool boat took me to the Canary Islands. The boat first called at Las Palmas. After a short stay there, it went on to Santa Cruz on Teneriffe, where I disembarked.

I first visited Orotava on the northern side of Teneriffe, where I remained till the end of January. From there I went to Santa Cruz, where I stayed till the end of February. Then I travelled over to Gran Canaria where, except for a short stay in the country, I lived at the sea-shore near Las Palmas until I left the Islands at the beginning of April.

During my stay at Orotava I examined the coast almost daily during low-tide, weather and sea permitting.

The shore consists mostly of old lava-streams. It is extremely uneven and broken up by numerous large and small depressions and fissures and on the whole provides a good place of growth for algæ.

I also tried to dredge here, but unfortunately without success. The sea was constantly very rough during the time I was here, which at the outset made dredging from

a small boat difficult. Besides that, the bottom was very uneven, and the depth increased very rapidly.

In Santa Cruz the harbour and the coast north and south of this were examined but without any particular result, the algal vegetation being rather poor.

The richest algal vegetation was undoubtedly to be found on Gran Canaria. The hotel at which I stayed was situated quite close to the sea on the eastern side of the island almost midway between Puerto de la Luz and Las Palmas. The situation of the hotel was thus the best possible. From here I examined partly the eastern stretch of coast north and south of Las Palmas, and partly the bay, Bahia del Confital, facing north-west between the main island and the Isleta.

At the bottom of this bay there is a long, narrow reef which gives protection against the mighty Atlantic waves ceaselessly rolling and breaking against the reef. Behind the reef there is a narrow lagoon-like stretch with shallow water reaching a depth of 3—4 fathoms. Here I frequently dredged with pretty good results. A few times I was on the reef itself. It was only possible to get there when the water was lowest at springtides, which at the Canary Islands unfortunately occurs at sunrise or sunset so that it was hardly properly light. The reef which, as I have said, is very much exposed, is covered by a carpet of algæ, among which calcareous algæ predominate.

I also examined the shore of the Isleta off Bahia del Confital with good results.

As regards our knowledge of the algal flora of the islands, it was to be expected that, in this particular domain, in course of time, various larger and smaller contributions would be made by many of the numerous scientific men

who have visited these interesting islands, although of course only a few of them have spared time to examine the algal flora or have been interested in doing so.

I shall briefly mention the larger and more important contributions. Later on in the text I refer to these again, as well as to the more scattered items of information that I have come across.

As the earliest should be mentioned here MONTAGNE'S list of algæ in WEBB and BERTHELOT'S great work on the natural history of the Canary Islands¹.

Through the great kindness of Professor MANGIN, Director of the botanical department of the Muséum d'Histoire Naturelle, Paris, and Dr. G. HAMEL, Paris, I have been able to see some of MONTAGNE'S original specimens where MONTAGNE'S determination is doubtful or incorrect.

The next work I shall refer to here is PICCONE'S valuable list of algæ in "Crociera del Corsaro alle Isole Madera e Canarie del Capitano ENRICO D'ALBERTIS", *Alge per ANTONIO PICCONE*, Genova 1884. As I was not able to find this book in Copenhagen, the lately deceased Professor G. B. DE-TONI of Modena shortly before his death kindly procured a copy of it for me. In this paper there is a very full list of algæ collected especially near Arecife on the island of Lanzarote and on the neighbouring little island of Graciosa. PICCONE'S list possesses special importance owing to its being based on the collections from these rarely visited islands.

PICCONE'S collection of algæ is owned by Dr. ACHILLE

¹ BARKER-WEBB, P. et SABIN BERTHELOT, *Histoire Naturelle des Iles Canaries*. Tome troisième, deuxième partie. *Phytographia Canariensis*. Sectio ultima. *Plantas cellulaires par Camille Montagne*. Paris 1840.

FORTI in Verona, and I owe special thanks to the latter for sending me several of PICCONE's original specimens.

A short list of algæ collected at Gran Canaria by C. BOLLE and Dr. LIEBETRUTH is added as an appendix to PICCONE's treatise.

In addition, PICCONE has published a short list of algæ (Pugillo di Alghe Canariensi in "Nuovo Giornale botanico Italiano", vol. XVIII, 1886, p. 119) based upon a small collection of algæ gathered by Dr. CHRIST at Puerto Orotava.

Next comes one of the most valuable contribution to our knowledge of the Canarian algæ, due to the late M^{lle} A. VICKERS. Its title is "Contribution à la flore algologique des Canaries" published in "Annales des Sciences Naturelles", 8^{ème} Série, Botanique, vol. 4, 1896.

M^{lle} VICKERS stayed at Las Palmas on Gran Canaria from November 1895 to March 1896 and from there examined the coasts of the island. Her list comprises 136 species, of which 33 had not been found on the islands before. M^{lle} VICKERS' determinations must certainly on the whole be considered trustworthy, as mentioned in the preface to her work she has consulted Dr. BORNET in doubtful cases. Most of M^{lle} VICKERS' collection of Canarian algæ is now incorporated in the collections of Jardin Botanique de l'État, Bruxelles, and I am very much obliged to Professor E. DE WILDEMAN, Director of the garden, for the permission to see some of M^{lle} VICKERS' specimens.

Finally Professor C. SAUVAGEAU, Bordeaux, in "A Propos des Cystoseira de Banyuls et de Guéthary" (Bulletin de la Station Biologique d'Arcachon, 14^{ème} Année, Bordeaux 1912, p. 48) has published a list of algæ found by him and not previously known on the islands, among which are several discoveries of special interest for instance the

West Indian *Ernodesmis verticillata* and *Nemoderma tingitana*, first known from Tangier in Morocco, where it was discovered by SCHOUSBOE.

Professor SAUVAGEAU stayed at Puerto Orotava on Teneriffe from 5. December to 12. February and examined the coast in that neighbourhood. Professor SAUVAGEAU has shown me the great kindness of lending me the whole of his large collection of specimens, both dried and in alcohol, which has been a great help to me, and for which I now render him my best thanks.

The following list of algæ from the Islands contains, in the first place, the species found in my own collection. But to make the list as complete as possible I have added all previously found species which I have met with in the literature, though at the same time, where old and doubtful determinations are concerned, I have tried as far as possible to decide what species we have to do with by examining of the original specimens.

Although I shall defer some more general observations on the algal flora of the islands until the whole list is complete, there is one fact of general interest which I should like to mention here.

By degrees, as the algal flora of the islands became known, it became evident that a comparatively large number of species are common to these islands and the West Indies. For the present I shall confine myself to the Chlorophyceæ, and among such species common to both groups of Islands, I shall call attention to the following interesting discoveries: of *Struvea ramosa* found by PICONE, *Siphonocladus tropicus* by M^{lle} VICKERS, *Ernodesmis*

verticillata and *Cladophora fascicularis* by Professor SAUVAGEAU and *Chaetomorpha media* by myself; and among earlier discoveries those of *Cymopolia barbata* (also known from Cadiz) and *Cladophoropsis membranacea*. And if we do not confine ourselves to the islands alone, but include species which are common to them and the Mediterranean, the following may be added: *Anadyomene stellata*, *Dasycladus clavæformis*, *Microdictyon Agardhianum*, *Bryopsis ramulosa* and *Caulerpa prolifera*.

As is clearly evident from this list, these are mostly very characteristic forms, and such as are moreover often in a marked degree characteristic of the West Indian algal flora.

This strong resemblance which, though less pronounced, is nevertheless noticeable also in the land-vegetation, makes one think of the old much-disputed theory of an ancient land-connection with America and of WEGENER'S theory of the shifting of the continents.

The drawings have been executed partly by Mr. OVE ROSTRUP, M. Sc., and partly by myself. The habit illustrations have for the most part been drawn by Mr. ROSTRUP, the figures of the details are generally mine.

Finally I must thank the Trustees of the Carlsberg Foundation for a grant towards the cost of the journey as well as for smaller grants especially for the production of the drawings, and I must also thank the Rask-Ørsted Foundation for a grant towards of translation into English.

CHLOROPHYCEÆ

I. Ulothricales.

Fam. 1. Ulotrichaceæ.

Ulothrix Kütz.

1. Ulothrix flacca (Dillw.) Thur.

THURET in LE JOLIS, Liste, p. 56. FOSLIE, Contributiones, I, p. 144, tab. 3, fig. 1—3; ROSENINGE, Grønlands Havalger, p. 935 WILLE, Studien über Chlorophyceen, I—VII, p. 18, tab. 1, fig. 54—57; tab. 2, fig. 58—63.

Conferva flacca Dillw., Brit. Confervæ, pl. 49.

A single filament only has been found, and I should not have mentioned it, had it not been quite in accordance with WILLE's detailed description and figures.

The base being preserved in the specimen, answered quite to WILLE's fig. 55. From the 5—6 lowermost cells in the filament subcuticular rhizoids grow downwards one issuing from each cell.

The cells in the filament had a breadth of about 20—22 μ , and the length of the cells was a little above half the diameter.

The cells contain a single well developed ribbon-shaped parietal chromatophore with a single or few pyrenoids.

Also the arrangement of the cells, as mentioned by WILLE, in groups of two or more cells, was present in the upper end of the filament.

Found among *Enteromorpha* upon rocks near high water mark.

Gran Canaria, Playa de Santa Catalina near Las Palmas.

Geogr. Distrib. Greenland, West coast of Europe, Atlantic and Pacific coast of North America.

Fam. 2. *Ulvaceæ*.

Enteromorpha Link.

1. *Enteromorpha plumosa* Kütz.

KÜTZING, *Phycologia generalis*, 1843, p. 300, tab. 20, fig. 1.

COLLINS, *Green Algae of N. America*, 1909, p. 198.

Enteromorpha Hopkirkii M'Calla in Harv., *Phycol. Brit.*, pl. 263.

VICKERS, *Alg. Can.*, p. 298; *Phycologia Barbada.*, 1908, pl. V.

The specimens found agree very well with the figure of M^{lle} VICKERS, l. c.

The plant was growing upon rocks in rather exposed places, forming low, dense, green coverings in which sand had often accumulated. Further it was a common epiphyte upon larger algæ especially upon *Cymopolia barbata*. M^{lle} VICKERS found the plant epiphytic upon *Spyridia*.

Teneriffe: Orotava. Gran Canaria: Playa de las Canteras, Playa de Santa Catalina near Castillo, where it was also found by M^{lle} VICKERS.

Geogr. Distrib. Atlantic coasts of Europe and America, Mediterranean Sea, West Indies, Malayan Archipelago etc.

2. *Enteromorpha clathrata* (Roth) Grev.

GREVILLE, *Alg. Britannicæ*, 1850, p. 181. J. AGARDH, *Till Algernes Systematik*, VI, p. 153.

Conferva clathrata Roth, *Catalecta*, III, p. 175.

The specimens are generally rather small, rarely much more than 5—6 cm high. They are abundantly ramified.

The cells are usually in all parts of the thallus arranged in longitudinal series.

Found near high water mark on rocks and stones in rather exposed places. Seems to be common, especially at the shores near Las Palmas.

Teneriffe: Orotava. Gran Canaria: Common along the shores north and south of Las Palmas, Bahia del Confital. MONTAGNE l. c. p. 182 writes: "In littoribus Canariensibus vulgaris".

Geogr. Distrib. Atlantic coasts of Europe and America. The Mediterranean Sea, West Indies, Tasmania, New Zealand etc.

3. *Enteromorpha erecta* (Lyngb.) J. Ag.

J. AGARDH, Till Algernes Systematik, VI, p. 152. COLLINS, Green Alg. of North America, p. 200.

Scytosiphon erectus Lyngb., Hydroph. Dan., p. 65, tab. 15, fig. C.

The specimens referred to this species are small, about 2 cm high, forming quite low, dense, moss-like coverings upon reefs. They are much ramified at the base, less so higher up.

The branches taper gradually upwards, often running out into rather long, thin filaments, composed of a few rows of nearly rectangular cells arranged in longitudinal and transverse rows.

The plant was found near high water mark or a little below it, in rather exposed places.

Gran Canaria: Upon reefs south of Las Palmas.

Geogr. Distrib. West coast of Europe, Mediterranean Sea, Atlantic coast of North America, West Indies.

4. *Enteromorpha ramulosa* (Engl. Bot.) Hook.

HOOKE, Brit. Flora, 1833, vol. II, p. 315. J. AGARDH, Till Algernes Systematik, VI, p. 154.

Ulva ramulosa Engl. Bot., pl., 2137.

The specimens are all much branched. Some of the specimens are more like the plant figured by KÜTZING in Tab. Phycol., vol. VI, pl. 32 fig. 2. Others are densely covered with short spine-like ramuli like KÜTZING's fig. 3 of the same plate = f. *spinescens* (Kütz.).

The plant was found upon rocks and as an epiphyte upon larger algæ f. i. upon *Galaxaura*, *Cladophora proliferata* etc. It occurred in rather exposed places near or somewhat below high water mark and seems to be rather common.

Teneriffe: Orotava (CHRIST,!), without locality (LIEBETRUTH). Gran Canaria: Las Palmas (VICKERS,!), Christoballo. Lanzarote: (PICCONE).

Geogr. Distrib. Atlantic coasts of Europe and America; The Mediterranean Sea, West Indies, Tasmania, New Zealand etc.

5. *Enteromorpha compressa* (L.) Grev.

GREVILLE, Alg. Britannicæ, p. 180, tab. 18. J. AGARDH, Till Algernes Systematik, p. 137.

Ulva compressa L., Flora Suec., 1755, p. 433, no. 1155.

The specimens I refer to this species agree very well with the description of COLLINS in "The Green Algae of North America", p. 201. The frond is more or less ramified being, like the branches, narrowed at the base, broader upwards. The cells are not arranged in rows, and are rather small, about 10—15 μ in diameter.

The plant was growing upon rocks near high water mark in rather exposed places.

Teneriffe: Orotava. Gran Canaria: Las Palmas, according to specimens found in the Botanical Museum, Copenhagen, collected by GELERT and determined by REINBOLD. Punta de Telde leg. DESPRÉAUX according to MONTAGNE; without locality (BOLLE). Isla Graciosa: (PICCONE).

Geogr. Distrib. Arctic Seas, Coasts of Europe and America, Mediterranean Sea, Pacific, Tasmania etc.

6. *Enteromorpha lingulata* J. Ag.

J. AGARDH, Till Algeries Systematik, VI, Ulvaceæ, p. 143.

Gran Canaria: Bahia del Confital (Vickers).

Geogr. Distrib. Atlantic shores of Europe and North America, West Indies, Mexico, Tasmania, New Zealand etc.

7. *Enteromorpha minima* Nägeli.

NÄGELI in Kützing, Spec. Alg., p. 482. KÜTZING, Tab. Phycol., vol. VI, tab. 43, fig. 3. J. AGARDH, Till Algeries Syst., VI, p. 135.

To this species I have referred a small form which occurred in large quantities as a dense low covering upon rocks and stones. The specimens are very small, mostly not reaching a cm. in length.

As a rule they were not ramified. The frond is compressed, spatulate of form. The cells are small about 5μ broad and arranged without order. The membrane is about 8μ thick.

The plant occurred near high water mark in rather exposed places.

Gran Canaria: Las Palmas. Teneriffe: Orotava.

Geogr. Distrib. Atlantic coast of Europe and North-America, Mediterranean Sea, Mexico, Pacific.

8. *Enteromorpha intestinalis* (L.) Grev.

GREVILLE, Alg. Britannicæ, p. 179.

This species has been found by SAUVAGEAU at Orotava. And in the Herbarium of the Botanical Museum, Copenhagen, some small specimens from Gr. Canaria are found. They were collected by GELERT and determined by REINBOLD, though with a? I have examined the specimens and

I am of the opinion that the determination is right. The cells occur without order; they are roundish, about 10—11 μ broad and have thick walls. MONTAGNE l. c. p. 181 says: "Typus ad littora Canariensiae vulgaris. Varietas *crispa* ad oras insulae Gomeræ à cl. DESPRÉAUX lecta est".

Teneriffe: Orotava (SAUVAGEAU). Gran Canaria: Las Palmas (GELERT). Gomera (DESPRÉAUX).

Geogr. Distrib. Widely distributed in colder and temperate seas.

? *Enteromorpha Linza* (L.) J. Ag.

This species is mentioned with a ? in the list of M^{lle} VICKERS. Major REINBOLD has seen the specimens and is of the opinion that they are perhaps referable to the forma *lanceolata* of this species.

Ulva L.

1. *Ulva Lactuca* L.

LINNÉ, Spec. plant., vol. II, 1753, p. 1163.

Most of the specimens are small, rarely more than 5—6 cm high, forming low tufts upon rocks.

Some of the specimens had a very crisp thallus, with now and then a few small, roundish holes. These specimens might perhaps be referred to the variety *cibrosa* J. AGARDH. According to BORNET, "Algues de P. K. A. Schousboe", p. 194, this form was found by HILLEBRAND in the Canary Islands.

On more or less exposed coasts south of Las Palmas a quite small form was found forming dense coatings upon rocks. The plants were not much higher than 1—2 cm. The thallus was much curved and irregularly shaped. The diameter of the thallus was about 30 μ . Seen from above

the cells were polygonal. I have compared this small plant with the *Ulva Californica* Wille (in *Phycotheca* Bor. Am., no. 611), but this is very different with its reniform thallus, long stipe and very small cells.

var. *rigida* Ag.

The specimens referred to this variety had a very thick thallus up to $235\ \mu$ thick. The cells are narrow but very high, about $600\ \mu$ long. Between the layers of cells rhizoids are present.

This species occurs near high water mark in exposed as well as in sheltered places. M^{lle} VICKERS writes about its occurrence: "Très commun sur la grève entre Las Palmas et le Castillo S. Christoballo, probablement parce que c'est le seul endroit où il y ait un peu de vase". I have visited this locality several times. The coast there is very flat, nearly horizontal with very little fall. The bottom is covered with larger and smaller stones and here and there low reefs run parallel along the shore sheltering it. The water is here much polluted from the town. This locality is an eldorado for green algæ; here *Ulvaceæ* (*Ulva*, *Enteromorpha*) and *Chætomorpha*, *Cladophora*, *Valonia* etc. grow abundantly, forming extensive associations. And here *Ulva Lactuca*, both the larger form and the small one mentioned above, occurs in great quantity.

Teneriffe: Orotava (SAUVAGEAU,!), Gran Canaria: Playa de Santa Catalina to Christoballo (VICKERS,!), Bahia del Confital. Regarding its occurrence at the Canary Islands MONTAGNE writes, l. c. p. 181. "Ad littora Canariensia frequens, imprimis in insulis Canariâ et Gomerâ lecta".

Geogr. Distrib. Extensive.

Fam. 3. *Chaetophoraceæ*.

Blastophysa Reinke.

1. **Blastophysa** spec.

In "A Propos des Cystoseira de Banyuls et de Guéthary", p. 50 SAUVAGEAU mentions "une Algue verte ressemblant au *Blastophysa*".

I have not seen this alga and am therefore not able to give any information about it.

Teneriffe: Orotava (SAUVAGEAU).

Endoderma Lagerh.

Endoderma viride (Reinke) Lagerh.

LAGERHEIM, G., Bidrag till Sveriges algflora, p. 75.

Entocladia viridis Reinke in Bot. Zeit., 1879, p. 476, tab. 6, figs. 6—9.

I have found this plant in *Valonia* and *Dictyota*. The form found was very like that I have mentioned in "The Marine Algæ of the Danish West Indies", vol. II, p. 417, fig. 398.

Teneriffe: Orotava. Gran Canaria: Playa de las Canteras.

Geogr. Distrib. Mediterranean Sea, Atlantic coasts of Europe and N. America, West Indies, Easter Island etc. Most probably widely spread.

Phæophila Hauck.

Phæophila Floridearum Hauck.

HAUCK, F., in Østerr. Bot. Zeitschr., 1876, p. 56—57; Meeresalgen, p. 464.

Found in *Codium elongatum*.

The cells were 15—25 μ broad and about 60 μ long.

Teneriffe: Puerto Orotava.

Geogr. Distrib. Mediterranean Sea, Atlantic coast of Europe, West Indies etc.

Gomontia Born. et Flah.

Gomontia polyrhiza (Lagerh.) Born. et Flah.

BORNET et FLAHAULT, Note sur deux nouv. genres d'algues perforantes (Journ. de Bot., vol. II, 1888, p. 163); Sur quelques plantes vivant dans le test calcaire des Mollusques (Bull. Soc. Bot. France, vol. 36, 1889, p. CLII, pl. VI—VIII).

Codiolum polyrhizum Lagerh., *Codiolum polyrhizum* nov. sp. (Öfvers. af k. Vet.-Akad. Forh., 1885, p. 21, tab. 28).

This species has been found a few times in shells. Is most probably common.

Gran Canaria: Bahia del Confital.

Geogr. Distrib. Mediterranean Sea, Atlantic coast of Europe and America, Greenland, Pacific coast of North America, etc.

II. Siphonocladiales.

On the basis of my rich material from the formerly Danish West Indian Islands I was able, when working out this highly interesting group, to widen our knowledge in several respects regarding the development and building up of the thallus of some of these forms and in consequence of this, as it seems to me, to arrive at a more natural classification of the genera and species.

Now I have also had the satisfaction of seeing my classification used, for instance in G. S. WEST'S excellent book on Algæ, 1916, and to some extent in the new edition of OLTMANN'S highly valuable and useful "Morphologie und Biologie der Algen", vol. I, 1922. Regarding this group OLTMANN'S has however, in some respects gone his own

way, which, as it seems to me, is not always quite the natural one. I therefore feel that a few words on the matter would be in place here.

When I tried, on the basis of my observations, to arrange the different forms belonging to this group in a natural way, I relied partly on the grouping found in the first edition of OLTMANN'S "Morphologie" and partly and more especially upon WILLE'S "Nachträge" to the *Chlorophyceæ* in ENGLER und PRANTL, "Die natürliche Pflanzenfamilien" (which had shortly before been edited) as WILLE was by then able to utilize the small papers I had already published on some of the forms belonging to this group.

In the new edition of the "Morphologie", OLTMANN'S refers the following four families to the isogamous group of the *Siphonocladiales*: *Cladophoraceæ*, *Siphonocladaceæ*, *Valoniaceæ* and the *Dasycladaceæ*.

While I quite agree with OLTMANN'S regarding the genera he refers to the *Cladophoraceæ* and *Dasycladaceæ*, I think it advisable in order to get a more natural delimitation of the other families, viz. the *Valoniaceæ* and the *Siphonocladaceæ*, to remove some of the genera referred by OLTMANN'S to these families, and refer them to two special families, viz. the *Boodleaceæ* and the *Anadyomenaceæ*.

As the family comprising the most primitive forms seems to me to be the *Valoniaceæ* I begin with it here, and refer to it the genera *Halicystis*, *Valonia* and *Dictyosphaeria*¹. They are all characterized by an amorphous thallus composed of one to many cells, mostly large and irregularly shaped, generally forming irregular clumps.

When OLTMANN'S still refers *Ernodesmis* to this family

¹ I confine myself here and in what follows to those genera only which I have been able to examine myself.

I cannot agree with him. This plant has a very characteristic and regularly built up thallus whose development originates from a large, cylindrical-clavate cell with annular constrictions at its base, this cell continuing to form the main stem of the plant during all its life. In this respect *Ernodesmis* is quite different from the genera belonging to the *Valoniaceæ*, and on the other hand is in correspondence with the genera which I refer to the *Siphonocladia-cæ*. I therefore consider that this plant cannot in a natural way be placed in the Fam. *Valoniaceæ*.

Next to the *Valoniaceæ* I place the Fam. *Boodleaceæ*. By the want of cross walls at the base of the branches, and by the often very long cells, and upon the whole the very irregular septation of the thallus, the representatives of this family mostly remind one of those of the Fam. *Valoniaceæ*.

Formerly I considered this group as a subfamily, but I now think it is most natural to regard it as forming a special family with the two genera *Cladophoropsis* and *Boodlea*. In their manner of growth they are rather like *Cladophora*, but differ from this genus by the want of walls at the bases of the branches, by the presence of numerous tenacula, and finally by having segregative cell-division.

From the Fam. *Boodleaceæ* the line of evolution has partly proceeded to the creation of such forms as are found in the Fam. *Anadyomenaceæ* and the Fam. *Cladophoraceæ* in which families the most highly developed and most regular septation is present, partly through *Struvea* (*Struvea anastomosans*) to the Fam. *Siphonocladia-cæ*.

Formerly I also considered the Fam. *Anadyomenaceæ* as a subfamily only. WILLE, too, has this subfamily, but

refers to it *Struvea* and *Boodlea* which I do not regard as a natural grouping. The genera I refer to this family, namely *Rhipidophyllon*, *Microdictyon* and *Anadyomene*, are all characterized by a flat leaf-like thallus, formed by the growing together of the richly ramified branch system, reminding one of that of *Cladophora* but with the branches all lying in the same plane. From the lowermost cells in this leaf-like part of the thallus numerous rhizoids are developed, clinging together and fixing the plant to the substratum. Finally we have here, at any rate partly, segregative cell division. *Rhipidophyllon* is the form most like *Cladophora*, having the most open thallus with the least coalescence of the filaments. Then follows *Microdictyon*, with a denser thallus and greater coalescence of the filaments, and finally *Anadyomene* with a quite dense thallus.

Regarding the limitation of the Fam. *Cladophoraceæ* I have nothing to add.

According to my view the Fam. *Siphonocladaceæ* comprises the genera *Ernodesmis*, *Siphonocladus*, *Struvea* and *Chamædoris*, since I do not include into this family, as OLTMANN'S does, either *Cladophoropsis* and *Boodlea*, or *Microdictyon* and *Anadyomene*.

The genera referred to this family according to my classification are all characterized by having their origin in a single, large, cylindric-clavate cell, with annular constrictions at the base, which continues to form the main stem during the further development of the plant. An exception is *Struvea anastomosans* which lacks the annular constrictions, and in which a well-developed stem is not always formed, this species forming a connecting link with the Fam. *Boodleaceæ*. Further segregative cell-division is

characteristic of the Fam. *Siphonocladaceæ* as I am almost inclined to suppose that this mode of cell-division also occurs in *Ernodesmis* (about this later on).

From this family with its marked main-stem there is in this respect a natural transition to the Fam. *Dasycladaceæ*, where likewise the single individual begins with a large cylindric-clavate cell, which is kept as the main stem during life. PIA¹ and SVEDELIUS² have given valuable information regarding the classification of the genera in this family.

Fam. 1. *Valoniaceæ*.

Halicystis Aresch.

1. *Halicystis ovalis* (Lyngb.) Aresch.

ARESCHOUG, *Phyceæ Scandin. Mar.*, 1850, p. 220. KUCKUCK, *Über den Bau und die Fortpflanzung von Halicystis Aresch. und Valonia Ginn.* (Bot. Zeit., 1907).

Gastridium ovale Lyngb., *Hydrophyt. Dan.*, p. 72, tab. 18 B.

Valonia ovalis (Lyngb.) Ag., *Spec. Alg.*, vol. I, p. 431. J. Ag., *Till Algernes Systematik*, VIII, p. 95.

This species has been found by SAUVAGEAU. In "A Propos des Cystoseira de Banyuls et de Guéthary" p. 50. SAUVAGEAU writes about it: "J'ai récolté le *V. ovalis* dans les mêmes conditions qu'à Cadiz et dans le golfe de Gascogne (1), sous les Lithothamniées ou dans leurs anfractuosités".

Teneriffe: Orotava (SAUVAGEAU).

Geogr. Distrib. West coast of Europe, Pacific coast of North America.

¹ PIA, JULIUS, *Die Siphoneae verticillatae vom Karbon bis zur Kreide* (Abhandl. d. Zool.-Botan. Gesellsch. in Wien, Bd. XI, Heft 2, 1920) and several other treatises on this matter.

² SVEDELIUS, N., *Zur Kenntnis der Gattung Neomeris* (Svensk Bot. Tidsskr., Bd. 17, H. 4, 1923).

Valonia Ginn:

1. *Valonia macrophysa* Kütz.

KÜTZING, *Phycologia generalis*, 1843, p. 307. *Species Algarum*, 1849, p. 507. J. AGARDH, *Till Algernes Systematik*, 5te Afdeln., 1886, VIII, p. 97. KUCKUCK, *Über den Bau und die Fortpflanzung von Halicystis Aresch. und Valonia Ginn.* (Bot. Zeit., 1907).

Some few specimens only in my collection are, I think, referable to this species.

They were growing upon rocks forming dense tufts in accordance with the description of KUCKUCK. The large cells in the tuft are of broadly pyriform shape, about 1 cm broad.

The plant PICCONE (l. c., p. 18) has referred to *Valonia ovalis* Ag. is most probably this species. PICCONE mentions that he has found two specimens of this plant, one upon *Zonaria variegata*, another upon *Vidalia volubilis*. Dr. ACHILLE FORTI, Verona, has allowed me to see the last mentioned specimen. It consists of a single plant. This is about 9 mm broad. It has a greyish colour except in the corner where the chromatophores are crowded together. The surface is shining and iridescent and it is evidently striated. According to this it seems to me that PICCONE's plant cannot be *Halicystis ovalis*, but must most probably be this species.

The specimens were found upon rocks in rather exposed places growing near low water mark or in pools.

Gran Canaria: Playa de Santa Catalina, and south of Las Palmas at Christoballo. Lanzarote: Arrecife (PICCONE).

Geogr. Distrib. Mediterranean Sea, West Indies.

2. *Valonia utricularis* (Roth) Ag.

C. AGARDH, *Spec. Alg.*, vol. I, p. 431. J. AGARDH, *Till Algernes Systematik*, VIII, p. 98. KUCKUCK, *Über den Bau und die Fortpflanzung von Halicystis Aresch. und Valonia Ginn.* (Bot. Zeit., 1907).

Conferva utricularis Roth, Catal. Bot., fasc. I, p. 160, tab. 1, fig. 1; fasc. II, p. 187.

Most of the specimens found are very like the figures 12 and 14 of KUCKUCK l. c. Large and small lentiform cells, the last mentioned with hapters, are abundantly present in the basal part of the vesicles.

Forma *crustacea* Kuck. was found in very exposed places.

Valonia utricularis grows in more or less exposed places mostly on vertical rocks in caves and crevices; where there is shade from projecting rocks, it is able to grow rather far up above low water mark. Also in pools it is rather common.

MONTAGNE in WEBB et BERTHELOT, T. III, p. 182, of *Valonia* forms mentions *Valonia Ægagropila* only. I have not referred any of the specimens I have seen to this species, but it is of course very probable that this form also occurs in the Canary Islands. When I have not taken it up as a separate species here, it is because MONTAGNE about his form remarks as follows: "Mes échantillons, dont les frondes ont plus d'une ligne de diamètre quand elles sont aplaties, paraissent tenir le milieu entre cette espèce et le *V. utricularis*".

Teneriffe: Puerto Orotava where it has also been found by SAUVAGEAU. Gran Canaria: In the environs of Las Palmas where M^{lle} VICKERS has also collected it, Bahia del Confital. Lanzarote: Arrecife (PICCONE).

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic, West Indies.

*Fam. 2. Boodleaceæ.***Cladophoropsis** Børgs.**Cladophoropsis membranacea** (Ag.) Børgs.

BØRGESEN, F., Contributions à la connaissance du genre *Siphonocladus* Schmitz (Oversigt kgl. danske Videnskab. Selsk. Forhandl., 1905, No. 3); *Marine Algæ*. D. W. I., vol. I, p. 47.

Conferva membranacea Ag., *Systema*, p. 120.

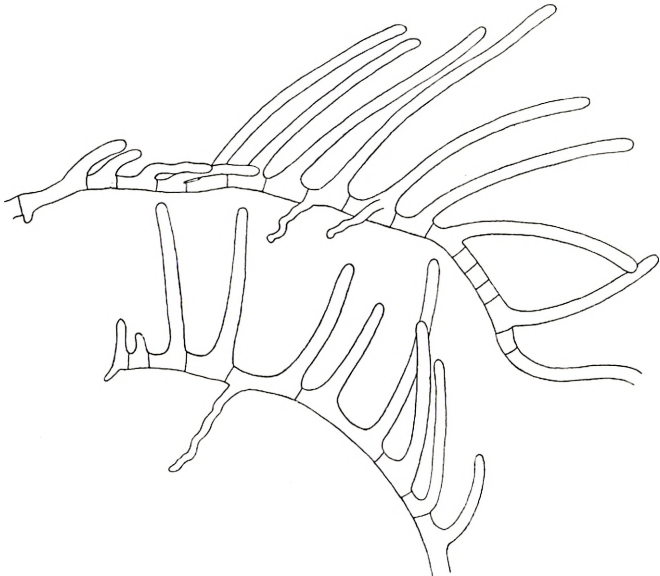


Fig. 1. *Cladophoropsis membranacea* (Ag.) Børgs. Two branches showing ramification. (About 12:1).

The Canarian specimens seem to agree very well with the West Indian plant.

In the accompanying figure 1 I have given an illustration of some filaments showing the characteristic unilateral ramification found so often in this species.

The diameter of the filaments was about 200 μ .

The plant grows in dense tufts upon rocks, or epiphytically upon other algæ; I have not found it like *Ægagro-*

pila-like clumps which were so very common in sheltered places at St. Croix.

At the shores of the islands it has previously been gathered by WEBB et BERTHELOT, the *Conferva enormis* Mont. (l. c. p. 186) being this species according to information most kindly given me by M. le Dr. G. HAMEL, Muséum d'Hist. Nat., Paris. M. HAMEL writes to me that, according to a note from his hand, BORNET has examined the plant and ascertained its identity with this species.

The *Cladophora enormis* Kütz. mentioned by PICCONE, l. c., p. 53 as collected at Gran Canaria by LIEBETRUTH is most probably referable to this species.

This seems also to be the case with the *Conferva membranacea* mentioned by MONTAGNE, l. c., p. 186. Regarding its occurrence at the Canary Islands MONTAGNE remarks: "Cette espèce, que ne fait pas partie de la collection de MM. WEBB et BERTHELOT, m'est tout-à-fait inconnue. Elle paraît avoir été trouvée à Ténériffe, par M. BORY, et communiquée à M. AGARDH, sous le nom de *C. cæspitosa*. C'est sur l'autorité de ce dernier que je la cite ici". According to kind information from Dr. HAMEL no specimens bearing this name are found in the Paris Museum.

Teneriffe: (BORY). Gran Canaria: (WEBB, LIEBETRUTH). Las Palmas near Castillo (!). Playa de las Canteras (VICKERS).
Geogr. Distrib., West Indies, Florida, Canary Islands.

Fam. 3. *Anadyomenaceæ*.

Anadyomene Lamouroux.

1. *Anadyomene stellata* (Wulf.) Ag.

C. AGARDH, Species Algarum, 1828, p. 400.

Ulva stellata Wulfen, Cryptogama aquat., p. 6. (RÖMER, Archiv für die Botanik, vol. 3, 1805).

Anadyomene flabellata Lamour., Hist. Polyp. corallig. flexibl., 1816, p. 365, pl. 14, fig. 3 a B.

The specimens found were growing on rocks in shallow water mostly laid dry during ebb-tide and in a rather exposed place. According to this habitat the plants have a rather small, robust thallus differing much from the thin, large West Indian form from deep water.

Fig. 2 shows part of the base of the plant. It is



Fig. 2. *Anadyomene stellata* (Wulf.) Ag. Base of a plant. (About 20 : 1).

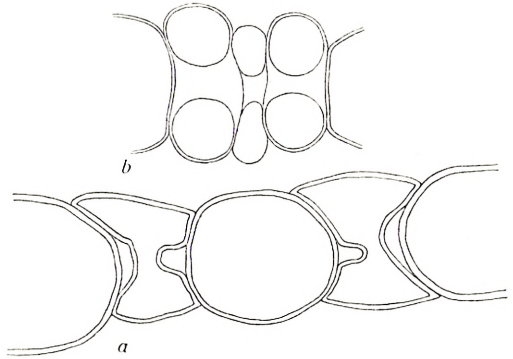


Fig. 3. *Anadyomene stellata* (Wulf.) Ag. Transverse sections of the thallus. (About 125 : 1).

seen that this is composed of numerous downward growing rhizoids developed from the large clavate cells in the thallus. These rhizoids are more or less, but rather loosely, woven together, forming a short stipe. When reaching the substratum they become divided at their base into several short branches, forming together larger or smaller irregularly lobed, coralliform discs. Transverse walls are present in the rhizoids.

A transverse section of the thallus shows that this is composed of a single layer of cells only (Fig. 3 *a*). In some parts of the thallus, to be sure, it may appear as if there were several layers (Fig. 3 *b*) but so far as I can see this is not actually so.

For the small cells filling out the intervals between the large cells in the thallus are lobed, and when the lobes are cut over by transverse sections they look like separate cells.

The cohesion of the small cells to the large ones is very firm and is strengthened by thick cuticular lists along their margin, far overlapping the margin of the large cells.

Gran Canaria: Playa de Santa Catalina near the old tower Castillo, where it has also been gathered by M^{lle} VICKERS, who found it, too, near Telde. According to MONTAGNE (l. c., p. 180) this species has also been collected at Gran Canaria by WEBB and DESPRÉAUX and according to PICCONE (l. c., p. 53) at the same island by LIEBETRUTH.

Geogr. Distrib. Mediterranean Sea, West Indies, Brazil.

Microdictyon Decsne.

1. *Microdictyon Agardhianum* Decsne.

DECAISNE, J., *Plantes de l'Arabie Heureuse* (Archives du Muséum, t. II, 1841, p. 115). COLLINS, FR., *The Green Algae of North America*, p. 366.

Hydrodictyon umbilicatum var. *tenuius* C. Agardh, *Systema* p. 85.

Microdictyon umbilicatum Zanard., *Iconographia Phycol. Adriat.*, vol. I, tab. 19.

Microdictyon umbilicatum Hauck, *De Toni et auct. proparte. non *Microdictyon umbilicatum* Velley.*

As pointed out some years ago by COLLINS l. c. p. 366, it is doubtful whether the commonly used specific name of this species, namely *Microdictyon umbilicatum*, is rightly

used for the European plant, as the question as to its identity with the Australian plant originally described by VELLEY, is open to doubt. VELLEY established his species upon a specimen from New South Wales (not from the Hawaiian Islands as commonly said, f. i. by J. AGARDH, DE-TONI and also by COLLINS) and gives a very good figure of the plant.

The best way to clear up this question would be to examine VELLEY's specimen. I therefore wrote to Mr. A. D. COTTON at Kew asking him if the original specimen of VELLEY was found in the Kew Herbarium. Mr. COTTON most kindly replied that the specimen of VELLEY was not at Kew, and he further informed me that he had written to Mr. GEPP of the British Museum about the matter, but VELLEY's specimen was not there either. Mr. COTTON enclosed an extract from Mr. GEPP's letter. As this is of much interest for the question, I quote some lines of it here. It runs: "As regards the type of *Conferva umbilicata* Velley, that was an epiphyte soaked off a large brown alga from New South Wales. My wife and I, when working at *Microdictyon* 20 years ago, wanted to see that type, but failed to trace it, and concluded that it has been lost. We have a specimen from Botany Bay collected by A. H. S. LUCAS; and that probably is conspecific with VELLEY's type. See also HARVEY's Australian Alg. Exsicc. No. 568 from Tasmania. — VELLEY's plate is so good that there is no reasonable doubt as to what his plant was".

According to this it must be supposed that the original specimen of VELLEY does not exist any longer. We are therefore obliged to restrict ourselves to the facts at hand.

I agree with Mr. GEPP that VELLEY's figure is a very good one. It shows a plant with stellate ramification, seven-

ral branches, often 5—6, issuing from the joints in the main veins. Compared with the above specimen mentioned by Mr. GEPP, of HARVEY'S Australian Alg. Exsiccatae, No. 568 from Tasmania, of which we have a fine specimen in the Botanical Museum, Copenhagen, it is easily found that its thallus is built up in exactly the same way as that of VELLEÏ'S plant.

On the basis of this observation and making a comparison with the Atlantic plant, it seems to me that it is wrong, as is now commonly done, (also by myself in my West Indian Algæ) to consider the Australian and European-West Indian plants as belonging to the same species, for the two plants differ essentially from each other.

In the Atlantic-Mediterranean plant, as figure 4 shows (comp. also the above-quoted figure of ZANARDINI), the ramification is as a rule cruciate, two opposite branches only issuing from each joint, while in that from the Australian waters, as mentioned above, several branches are given off from each joint. It is only in rare cases that secondary branches, as shown in fig. 4 *b*, are to be found in the Atlantic plant. And the two opposite branches are nearly always issued at right angles from the mother cells making the ramification almost regularly rectangular in the Atlantic plant, while this is not the case in the Australian form. Besides, several other minor differences are present, f. i. the main veins are not so markedly developed in the Atlantic plant, and the consistency of the thallus is more loosely built up in this form than in the Australian one.

But if the Atlantic-Mediterranean plant is thus well separated from the Australian plant, the question regarding the right naming of the Atlantic plant arises.

DECAISNE gave the name *M. Agardhianum* to a plant originating from Djedda in the Red Sea, and he supposes that his plant is the same as *Hydrodictyon umbilicatum*, var. *tenuius* C. Agardh, the name C. AGARDH gave the European plant.

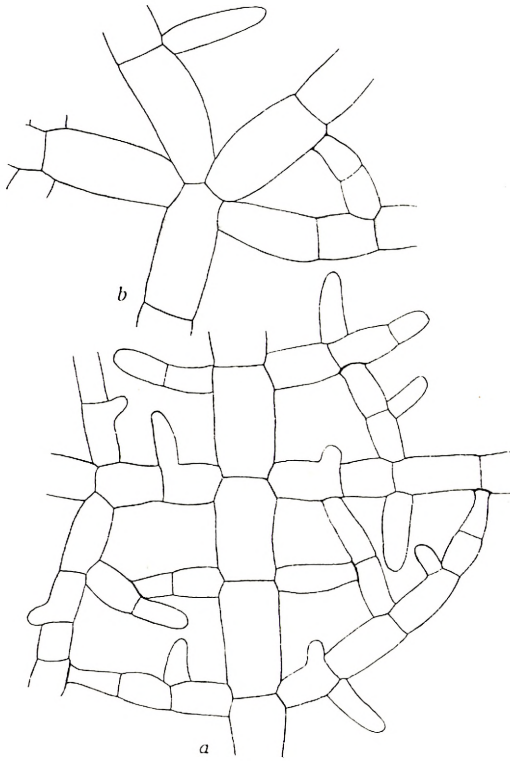


Fig. 4. *Microdictyon Agardhianum* Decsne. From St. Jan. Christiansfort, the formerly Danish West Indies. *a*, part of the thallus showing the common, cruciate ramification. *b*, more rare ramification of the main branch. (About 50:1).

If on examination of DECAISNE'S specimen this turned out to be the fact, the question was settled. When I applied to the Muséum d'Histoire Naturelle, Paris, asking if I might be allowed to see DECAISNE'S specimen, Dr. HAMEL

most kindly gave me the following information: "Dès que j'ai reçu votre lettre, j'ai recherché dans l'herbier du Muséum, dans l'herbier MONTAGNE, dans l'herbier THURET; je n'ai trouvé aucun échantillon de *Microdictyon* provenant de la mer rouge. Dans l'herbier THURET se trouve un échantillon des mers de Chine donné à THURET par DECAISNE; DECAISNE a marqué simplement: *Microdictyon* sans nom spécifique — mais BORNET a classé l'algue dans le *M. Agardhianum*«.

Such being the case, nothing more can be done at present. I prefer now to keep up the name DECAISNE gave the plant, taking it for granted, though not proved, that DECAISNE'S plant is like the European one.

If thus it is quite easy to keep the Atlantic-Mediterranean plant separated from *M. umbilicatum* Velley, it seems to be much more difficult to give the differences by which *M. umbilicatum* is separated from the other Canarian species *M. Calodictyon*, both these species being characterized by their well developed veins with stellate ramification. As differences I may point out that in *M. umbilicatum* generally fewer branches issue from the joints in the veins, and the branches are directed more to the side, the lowermost branches often downwards even, as is easily seen in VELLEY'S figure, while on the other hand we often in *M. Calodictyon* have 5—7 branches from each joint and these branches are more upward-directed, the plant reminding one a good deal of *Anadyomene* in consequence.

I have not found this plant myself but M^{lle} VICKERS dredged it in Puerto de la Luz, Gr. Canaria. And it has been gathered by PICCONE at Lanzarote: Arrecife; Dr. ACHILLE FORTI has most kindly sent me a fine specimen of PICCONE'S collection. And furthermore PICCONE (l. c., p. 53) mentions that it has been collected by LIEBETRUTH at Gran Canaria and by CHRIST at Orotava.

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean, West Indies, Red Sea, Canary Islands.

2. *Microdictyon Calodictyon* (Mont.) Decsne.

DECAISNE, I., *Plantes de l'Arabie heureuse* (Archives du Muséum d'Hist. Nat., vol. II, 1841, p. 115). KÜTZING, F., *Spec. Alg.*, p. 512. *Tabul. Phycolog.*, vol. VII, tab. 25, fig. II.

Anadyomene Calodictyon MONTAGNE in WEBB et BERTH., *Hist. Nat. Iles Canaries*, t. 3, p. 180, tab. 8, fig. 1.

When describing this species MONTAGNE referred it to the genus *Anadyomene*, and of the species of *Microdictyon*, the present one surely is that which comes nearest to this genus.

Firstly it resembles *Anadyomene* in having a rather firm thallus with much smaller and fewer openings than are found for instance in *M. Agardhianum*. And further the ramification reminds one rather of *Anadyomene* as 5—7 branches often issue from the upper end of the dividing main veins (Fig. 5). Also the cells in the veins carrying the branches are often markedly clavate like those in *Anadyomene*, but these cells are on the other hand much shorter, more like the other cells in the main veins.

The cells in the main veins are about $120\ \mu$ broad and 2—3, more rarely 1—4, times longer than their diameter.

By the way in which the cells are attached to the adjacent filaments in the net the plant is nearly related to *Microdictyon Agardhianum*; as is the case in this plant¹ the apices of the branches fix themselves to the adjacent filaments, strengthening the attachment by means of a ringlike thickening of cellulose (Fig. 6 a). But on the other hand this species is well separated from *M. Agardh-*

¹ BITTER, G., *Zur Morphologie und Physiologie von Microdictyon umbilicatum*. (Pringsh. Jahrb., Bd. 34, 1900, p. 199).

ianum by its ramification and much denser thallus. *Microdictyon Agardhianum* has not such marked main veins as found in this species, and the size of the cells is different, and further, in *Microdictyon Agardhianum*, rarely more than

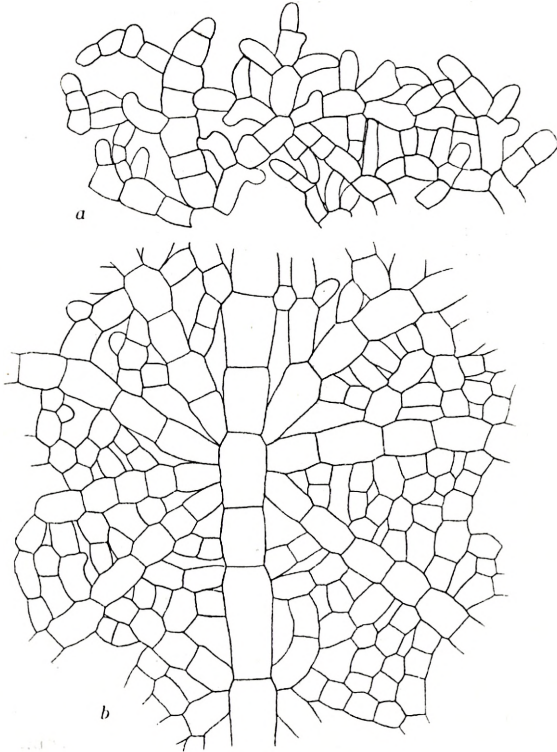


Fig. 5. *Microdictyon Catodictyon* (Mont.) Decsne. *a*, Part of the margin of the thallus. *b*, Part of the thallus showing ramification. (About 50 : 1).

two opposite branches issue from each joint of the main veins.

So far as I have been able to see on studying material preserved in spirits, the division of the cells is carried out in the following way. At the upper end of the cells, just below the transverse wall separating them from the cell above, a

small cupola-like outgrowth begins to be visible. This outgrowth becomes gradually larger, being steadily filled with the contents of the mother cell (protoplasm together with chromatophores, nuclei etc.) during the continued growth (Fig. 6 *a*). The outgrowth may reach a considerable size the contents

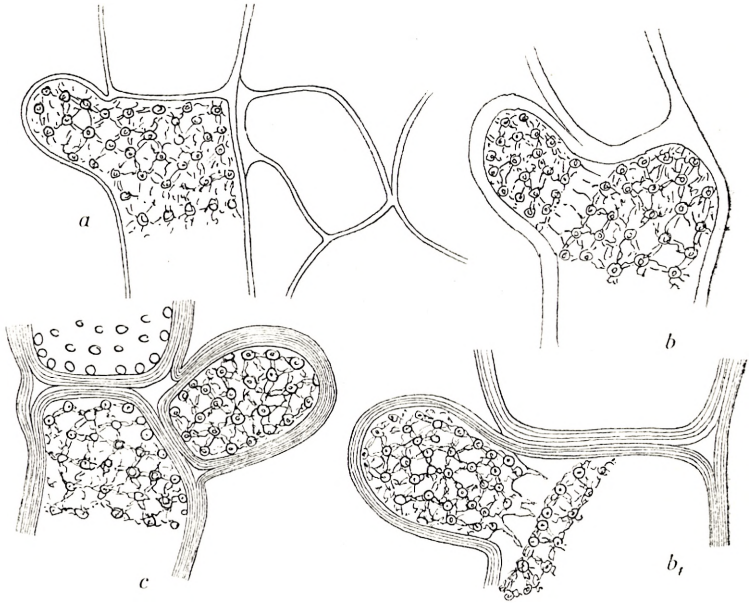


Fig. 6. *Microdictyon Calodictyon* (Mont.) Decsne. Division of cells. *a*, the young cell begins to grow out. *b* and *b*₁, showing the parting of the protoplasm. *c*, the new cell is fully developed. In *b*₁ and *c* the walls are drawn too thick to show the stratification of the wall. (About 265 : 1).

in the outgrowth and the mother cell steadily forming a coherent mass until suddenly the protoplasmic mass in the outgrowth becomes separated from that of the mother cell by a rather broad opening (Fig. 6 *b*, *b*₁). In cells where this separation has recently taken place fine connecting strings of protoplasm are often still seen between the two protoplasmic masses. Soon after a thin wall is formed, covering the rupture on both sides where the protoplasm

has parted. During the further growth the new walls gradually become thicker and approach each other and the division is performed (Fig. 6 c). Thus we have also in this plant segregative cell division.

The plant is strongly fastened to the substratum by means of rhizoids. These are developed from the basal end of the lowermost cells in the veins of the thallus. These rhizoids grow downwards along the walls of the cells below in the veins forming gradually a dense bundle of rhizoids by means of which the plant becomes attached.

Fig. 7 shows a basal part of a smaller plant. It is seen that the basal cells in the veins to which the rhizoids cling are very long in contradistinction

from the short cells in the veins higher up in the thallus. In this the young plants and the basal part of the older ones are quite like the thallus of *Rhipidiphyllon reticulatum*¹. *Rhipidiphyllon* may thus be considered a

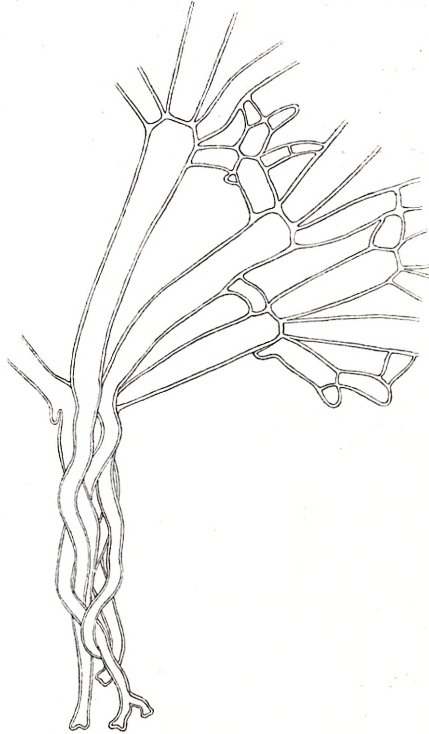


Fig. 7. *Microdictyon Calodictyon* (Mont.)
Deesne. Base of a young plant.
(About 50 : 1).

¹ Comp. my figures 3 and 4 in my paper: Marine Algæ from Easter Island (in SKOTTSBERG, The Natural History of Juan Fernandez and Easter Island, Vol. II).

form in which so to speak the juvenile stage of *Microdictyon* is kept throughout life. *Rhipidiphyllon* is certainly very closely related to *Microdictyon*, and how far this plant is really generically to be separated from *Microdictyon* is perhaps questionable, l. c., p. 253 I have pointed out the differences I have found.

To come back again to *Microdictyon* I may yet add that at the margin of the thallus the ends of the filaments



Fig. 8. *Microdictyon Calodictyon* (Mont.) Deesne. Part of the thallus, showing cells transformed into zoosporangia. (About 180:1).

are mutually free (Fig. 5 a). The growth takes place by acropetal division of the cells in the summit of the filaments. By this way of growing the margin gets a fringed appearance. Lower down the ends of the filaments gradually meet the adjacent filaments and become attached to them.

In some of the specimens the cells had in large parts of the network been transformed into zoosporangia (Fig. 8). A short conical outgrowth is formed on the wall of the cells and in the apices of these outgrowths a hole is for-

med through which the zoospores can escape; more rarely two holes are present in the same cell. The formation of the zoosporangia reminds one quite of that found e. g. in *Cladophoropsis*, *Boodlea*, *Ernodesmis* and *Siphonocladus*; compare my figures of the zoosporangia found in these genera in "The Marine Algæ of the D. W. I."

The plant may reach rather large dimensions; its diameter is often up to 7—8 cm. long.

The plant occurs about low water mark and lower down upon often rather exposed coast but it gets shelter from the tufts of larger algæ especially *Halopteris scoparia* upon which it is a common epiphyte.

When living its colour is darkgreen, when dried it becomes dark olive-green.

According to MONTAGNE, l. c., p. 80, WEBB has gathered this species at Orotava, Teneriffe, where SAUVAGEAU and I have likewise gathered it. M^{lle} VICKERS has collected it in several places at Las Palmas, Gr. Canaria. How far PICCONE has gathered this species at Lanzarote is open to doubt, the specimen of his which I have seen being *Microdictyon Agardhianum*.

Geogr. Distrib. Canary Island.

Fam. 4. *Cladophoraceæ*.

Chætomorpha Kütz.

1. *Chætomorpha media* (Ag.) Kütz.

KÜTZING, Species Alg., p. 380. HAUCK, Meeresalgen von Puerto-Rico (ENGLER'S Bot. Jahrb., vol. IX, 1888, p. 468). COLLINS, The green Algæ of North America, 2 Supplem., 1918, p. 79.

Conferva media Ag., Systema Alg., p. 100.

Chætomorpha antennina Auct. non *Conferva antennina* Bory.

I shall return later to my reasons for taking up the name used by HAUCK for this plant; I will first give a description of the Canarian specimens.

The plant forms dense, brushlike tufts which often reach a height of more than 12 cm. It is of a fresh green colour.

The tufts are fastened to the rocks by means of a vigorous system of rhizoids in accordance with my figures, l. c. p. 17. I have not found cross walls in the rhizoids. The rhizoids spread out more or less horizontally on the

rocks, and are very irregularly ramified, the branches often ending in small coralliform discs by means of which the plant is firmly attached to the rocks.



Fig. 9. *Chetomorpha media* (Ag.) Kütz. Base of a small tuft with young filaments growing up from the rhizoids. (About 25 : 1).

In my West Indian treatise I have mentioned (vol. I, p. 17) that upon the rhizoids swellings densely filled with starch were present, and that I presume that these are able to grow out into new plants. In the Canarian plants I have now found that these swellings gradually grow out into erect filaments (compare the Figs. 9—10) and that the tuft-like growth originates from

this. I have found these young specimens in all stages of development, from quite small ones to nearly full-grown filaments.

The young filaments are to begin with clavate without crosswalls, and they may reach a rather considerable length (often more than 1½ cm.) before crosswalls are formed.

The basal cells in the full-grown specimens are always

long, about 6—7 mm. long. In a well developed filament this cell is about $150\ \mu$ thick below and about $300\text{--}450\ \mu$ at the upper end. These cells are thus about 15 times longer than broad. The wall in the cell is stratified and thick, about $25\ \mu$; at their base the cells have annular constrictions (Fig.9,10).

The cells above the basal cells immediately become much shorter.

The cells in the filament are mostly about 1—3 times as long as they are broad, but shorter and longer ones occur. The filaments are about $400\ \mu$ thick but thinner and thicker ones are present; the thickest filament I have measured was $480\ \mu$ thick. While the cells in the lower part of the filaments are cylindrical with no constrictions at the crosswalls, those higher up in the filaments and especially the fructiferous ones are barrelshaped.

In the "Marine Algæ of Peru" (Mem. Torr. Bot. Club., vol. XV, p. 37), HOWE has pointed out that he has examined the type specimen of BORY's *Conferva antennina* from Réunion and has found that this plant differs essentially from the plant commonly called *Chætomorpha antennina* in the West Indies. Thus, the basal cell being up to 15 mm. long

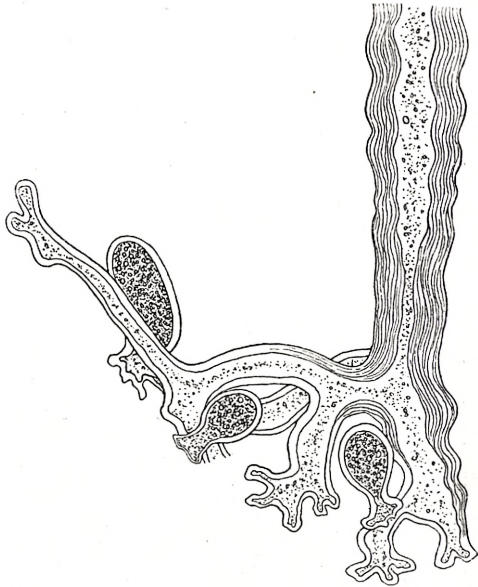


Fig. 10. *Chætomorpha media* (Ag.) Kütz.
Base of a plant with young plants on the
rhizoids. (About 60 : 1).

and uppermost with a breadth of 500—580 μ , is much longer and stouter than that commonly found in the West Indian plant. On the other hand the West Indian specimens have thicker filaments, and the cells in the filaments are relatively longer than those found in the Réunion-specimen.

Already HAUCK (l. c.) has referred specimens from Puerto Rico to *Chatomorpha media* after having compared his plants with an original specimen determined by C. AGARDH, and later on MØBIUS¹ tells us that HAUCK has determined specimens (from Brazil) to this species. In this paper MØBIUS gives the length of the basal cell of a specimen at 9 mm., thus somewhat longer than is commonly the case in the West Indian form. Now we have in the Botanical Museum, Copenhagen, several fine specimens from Brazil collected by GLAZIOU. These specimens MØBIUS has determined as *Ch. media*. Having examined these I have found that the basal cell is as a rule about 6 mm. long, thus in good accordance with the Canarian specimens as well as those from the West Indies, with which specimens the Brazilian ones upon the whole agree very well.

According to the description above, the Canarian specimens agree very well with those from the West Indies. I have examined these again and can add to my description, l. c. p. 16—17, that the length of the basal cell is mostly about 4—6 mm., being on an average about 15—16 times as long as broad in a well developed filament. The breadth of the cells in the filaments varies about 500 μ (the fructiferous about 660 μ) and their length from somewhat shorter than the breadth up to about 3—4 times longer, rarely more.

¹ MØBIUS, M., Bearbeitung der von H. SCHENCK in Brasilien gesammelten Algen. (Hedwigia, 28. Bd., 1889, p. 320—1).

Thus there seems to be good conformity between the forms gathered in different parts of the Atlantic Ocean, while on the other hand according to HOWE the plant from Réunion differs a good deal.

On the basis of these facts I therefore think it most appropriate to take up the old name of *C. AGARDH*.

In the same paper HOWE mentions that he has examined a specimen of KÜTZING'S *Chætomorpha pacifica* based partly upon a specimen collected by LIEBMANN at St. Augustin, Mexico. In the Botanical Museum, Copenhagen, we have a good deal of LIEBMANN'S specimens. They have once been determined by J. AGARDH as *Chætomorpha antennina*. The specimens are all rather small not much more than 4—5 cm. high. The cells are much collapsed. The basal cell is rather long about 9—10 mm. The breadth of the filaments about $450\ \mu$ and the length of the cells mostly about 1—3 times the breadth. Even if the Mexican plant thus approaches somewhat to that of Réunion I share Howe's view that it is impractical to try to distinguish it specifically from the Atlantic plant.

At the Canary Islands this plant was found in a very exposed locality, near or above high water mark, where it was constantly washed by the sea or the spray from it. Thus it grows here in a locality quite similar to that in which it occurs in the West Indies.

Teneriffe: Orotava.

Geogr. Distrib. West Indies, Atlantic and Pacific coasts of Mexico, Brazil, Canary Islands.

2. *Chætomorpha pachynema* Mont.

MONTAGNE in KÜTZING, *Species Alg.*, 1849, p. 379.

Conferva pachynema Mont. in WEBB et BERTHELOT, *Iles Canaries*, t. 3^{ième}, p. 180.

The plant grows gregariously in small tufts about 1—1½ cm. high or more.

The filaments have a longer basal cell (Fig. 11), about 2—3 mm. long or more; this cell is more or less clavate in shape, towards the bottom it is about 150 μ , at the upper often somewhat swelled end, as much as 500 μ broad. The wall of the cell is often very thick, from 20—50 μ , and stratified.

The basal cell (Fig. 12) is fastened by means of irregularly ramified rhizoids to the substratum. Here and there upon these rhizoids small swellings, at first nearly globular, are formed. These bodies at an early stage become divided from the rhizoids by a wall. They gradually increase

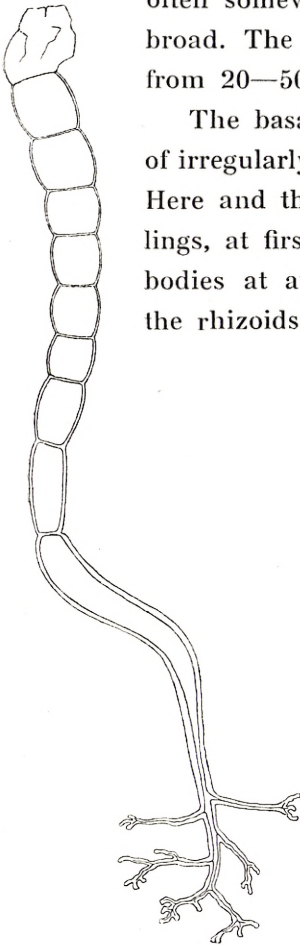


Fig. 11. *Chatomorpha pachynema* Mont. Habit of a plant. (About 10 : 1).

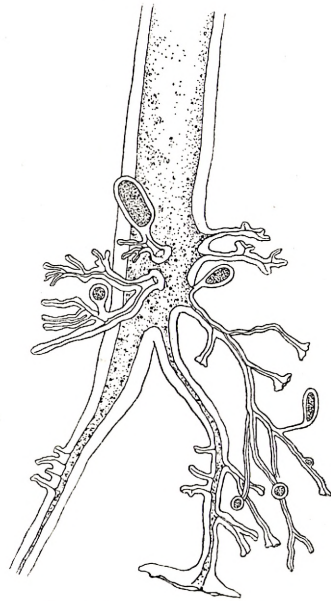


Fig. 12. *Chatomorpha pachynema* Mont. Base of a plant showing the origin of new plants in different stages of development. (About 25 : 1).

in length and grow out into new filaments. In this way the caespitose growth originates.

The cells in the filaments are short rather than long as a rule, but the length may be $1\frac{1}{2}$, or even longer than the breadth, before they are divided. The cells are barrel-shaped and their diameter may reach a length of $650\ \mu$.

The plant grows in very exposed places, where its small tufts are found in crevices in the rocks. It often grows high up above high water mark, where it is constantly wetted by the spray from the sea.

Teneriffe: Orotava, where it is also found by SAUVAGEAU
Gran Canaria: Las Palmas. MONTAGNE gives no special locality
Geogr. Distrib. Canary Islands.

3. *Chaetomorpha aerea* (Dillw.) Kütz.

KÜTZING, *Species Algarum*, 1849, p. 379. HAUCK, *Meeresalgen*, p. 438.

Conferva aerea Dillw., *Brit. Conf.*, pl. 80.

The basal cells in the specimens referred to this species are rather short, about $700\text{--}800\ \mu$ long; at their base the diameter reaches a length of about $120\ \mu$ at the upper end about $170\ \mu$. The wall of the basal cells is very thick and stratified.

In the filaments the length of the cells varies from about $\frac{3}{4}$ — $2\frac{1}{2}$ times their breadth. The diameter of the cells is about $250\text{--}300\ \mu$ long.

The plant forms large tufts, about 15 cm. high, near high water mark in exposed places.

Gran Canaria: Castillo (VICKERS!), Christoballo and other places near Las Palmas; DESPRÉAUX according to MONTAGNE.

Geogr. Distrib. Extensive.

4. *Chætomorpha Linum* (Fl. Dan.) Kütz.

KÜTZING, F., *Phycologia germ.*, p. 204; *Spec. Alg.*, p. 378; *Tab. Phycol.*, vol. 3, tab. 55, fig. 3. HAUCK, *Meeresalgen*, p. 439. DE-TONI, *Sylloge Alg.*, vol. I, p. 269.

Conferva Linum Müller in *Flora Danica*, tab. 771, fig. 2.

Rhizoclonium Linum Thur., cfr. BORNET, *Algues de Schousboe*, p. 204.

In my material I have not found any form which seems referable to this species.

On the other hand SAUVAGEAU collected some specimens at Orotava which he referred to it. SAUVAGEAU collected the plant in December and writes about it: "Je ne me rappelle pas l'avoir vu dans le dernier temps de mon séjour, disparaît probablement en Janvier". This perhaps explains why I have not seen it.

The form SAUVAGEAU has collected is a very thin one. The diameter of the filaments rarely exceeds $100\ \mu$ having generally an average length of $80\text{--}100\ \mu$. The length of the cells is about 1—2 times the breadth. The plant forms entangled masses upon other algæ.

It is a much more vigorous plant MONTAGNE refers to in his list of algæ, l. c. p. 184. I have been able to see two specimens of this plant, collected by WEBB at the Canary Islands and belonging to the Muséum d'Histoire Naturelle, Paris.

The cells of the filaments in this plant are about $200\text{--}300\ \mu$ thick, and their length in newly divided cells about half to twice as long as in older cells.

One of these specimens has been determined by J. AGARDH. In a note MONTAGNE remarks, (l. c. p. 184): "Notre plante, quoique vue par M. J. AGARDH, et annotée par lui comme variété de la présente espèce, me semble se

rapprocher davantage du *C. rigida*. Mais n'ayant pas de type de cette dernière, et conséquemment incertain de l'identité, je crois plus rationnel d'adopter la décision du savant phycologue suédois, en prévenant toutefois des légères différences que présente notre Conferve".

Teneriffe: Orotava, (SAUVAGEAU). Regarding the locality MONTAGNE writes: "Ad littora Canariensia haud rara".

Geogr. Distrib. Mediterranean Sea, Atlantic coast of Europe and America, Canary Islands, West Indies etc.

5. *Chaetomorpha capillare* (Kütz.).

Rhizoclonium capillare Kütz. in Bot. Zeit., 1847, p. 166. BORNET, Algues de Schousboe, p. 205.

Conferva tortuosa J. Ag., Alg. mediterran., p. 12.

Chaetomorpha tortuosa Kütz., Spec. Alg., p. 376; Tab. Phycol., vol. III, tab. 51, fig. II. HAUCK, Meeresalgen, p. 439.

non *Chaetomorpha tortuosa* (Dillw.) Kleen, Om Nordlandens hög्रे Hafsalger, p. 45.

I had at first referred this species to *Chaetomorpha tortuosa* (Dillw.) Kleen, but after examining of the specimen ARESCHOUG has distributed in Alg. Exsicc., Ser. nov., fasc. 1, no. 24 and comparing it with his description and figures of *Conferva tortuosa* Dillw. in Phyc. Scand. p. 207, tab. III G I have convinced myself that our plant, originating from warmer seas, is different from the northern form.

The plant from the Canary Islands forms large entangled

masses among other algæ. The filaments are about 60—70 μ thick. The basal cells are not much developed; they

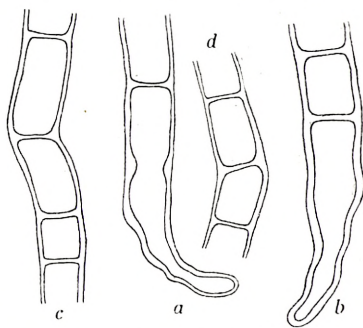


Fig. 13. *Chaetomorpha capillare* (Kütz.). *a*, *b*, bases of plants; *c* and *d* knee-like bent filaments. (About 100:1).

often become longer by through-growing of the cells above. They end in a rather short, not much developed rhizoid (Fig. 13 *a, b*).

The cells contain a large number of nuclei, about 30—50 according to the size of the cells.

BORNET (l. c.) refers this plant to *Rhizoclonium* and even if the Canarian plant wants lateral rhizoids nevertheless it shows some likeness to this plant by the knee-like bent filaments (Fig. 13 *c, d*). But having a large number of nuclei in each cells, it cannot be placed in that genus in which one or more rarely a few nuclei only are present in each cell.

The *Conferva implexa* mentioned in MONTAGNE'S list of algæ, p. 184, seems to me to belong to this species. I have been able to examine a specimen of it belonging to the Muséum National d'Histoire Naturelle, Paris. The filaments in this specimen have a breadth of about $60\ \mu$ and the length of the cells is about $1\frac{1}{2}$ —2 times as long.

Teneriffe: Puerto Orotava. Gran Canaria. Playa de Santa Catalina. Regarding the habitat MONTAGNE writes: "In oris Fortunatarum. In consortio *Valoniæ agagropilæ* cæspitulum hujusce *Confervæ* observavi".

Geogr. Distrib. Mediterranean Sea and adjacent part of the Atlantic ocean.

Urospora Aresch.

1. *Urospora læta* (Thur.).

Ulothrix læta Thur. in BORNET, Algues Schousboe, p. 202.

Conferva læta Schousb., Icon. inedite t. 59.

According to the description of THURET, l. c., the plant (Fig. 14) consists of a filament increasing slowly upwards in breadth the whole filament getting a clavate appearance.

Near the base the cells are cylindrical, about $10\ \mu$ thick and 4—6 times as long (Fig. 14 *a, b*). Upwards the filaments grow regularly thicker and at the same time the cells become more and more barrel-shaped. At the upper-

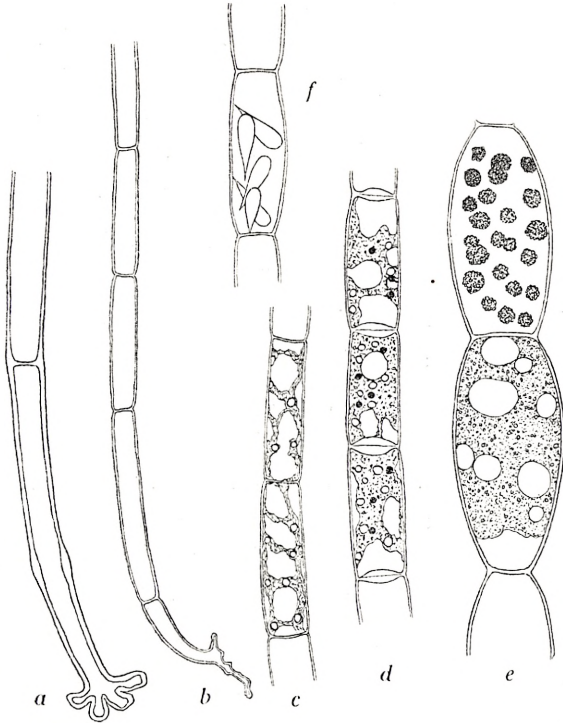


Fig. 14. *Urospora læta* (Thur.). *a* and *b*, bases of plants, in *a* with through-growing of the cell above the basal one; *c* and *d*, vegetative cells, *c* from the lower part, *d* higher up in the filament; *e*, the barrel-shaped fructiferous cells in the top of the filament; *f*, a cell with zoospores from a less vigorous filament. (About 350 : 1).

most end of the filaments where the cells are gradually transformed into zoosporangia, their diameter reaches a length of as much as $50\ \mu$ (Fig. 14 *e*).

The plant is attached to the substratum by means of a small irregular disc (Fig. 14 *a, b*). Several times as shown

in Fig. 14 *a*, I have seen the cell above the basal one grown downward through it as in my figure 100 *b* of *Urospora mirabilis* in "The Marine Algæ of the Færøes", p. 501.

The cells contain a parietal irregularly lobed and perforated but often nearly cylindrical chromatophore with numerous pyrenoids (Fig. 14 *c, d*). The nuclei are present to the number of 2 to 4, sometimes more, in each cell, but 4 seems to be the commonest number (Fig. 14 *d*).

With Iodine the pyrenoids stain dark violet while the many black granules in the chromatophores when treated with Iodine also indicate the presence of starch.

Treated with Chlor-Zinc-Iodine the cell-walls show no cellulose-reaction, acquiring a light yellow tinge as when treated with Iodine alone, in accordance with what is the case in *Rhizoclonium* and *Chaetomorpha*; compare my remarks in Mar. Alg. D. W. I., vol. II, p. 426—427.

The zoospores are formed in the uppermost cells of the filaments (Fig. 14 *e*). The shape of the zoospores seems to agree quite with that of *Urospora*; seen from the side they are obovate, in front broadly rounded, behind running out into a long point (Fig. 14 *f*). The four cilia I have not seen.

As it appears from this description this plant, having several nuclei in each cell, cannot be an *Ulothrix*. On the other hand it agrees very well with *Urospora*. Indeed it seems to be very closely related to the forma *elongata* Rosenv. of *Urospora mirabilis*. Nevertheless this form seems to be a little more robust, its cells reaching somewhat greater dimensions than are found in *Urospora leta*. Further the shape of the cells is somewhat different and the

wall of the cells seems to be a good deal thicker than is the case in *Urospora lata*.

The plant was an epiphyte upon *Galaxaura* on which it formed a dense, light green, soft covering.

The *Conferva villum* Agardh, Systema, p. 104, mentioned in MONTAGNE'S list of algæ, p. 185, is at any rate partly this species.

According to the descriptions of AGARDH and MONTAGNE¹ one cannot avoid the supposition that what they have considered to be this plant is nothing but the assimilating filaments of the host plant: *Galaxaura*. As well in the Latin diagnosis as also in the French description of MONTAGNE¹ the purple colour and the inflated bulbous basal part of the filaments suggest this very strongly.

I have been able to examine an original specimen of this plant belonging to the Muséum National d'Histoire Naturelle, Paris. Upon the envelope is written:

"*Conferva villum* Ag. Systema Alg., p. 104. Ex. spec. in coll. DELESSERT a cl. GAUDICHAUD deposito.

Ins. Canariens.

Ex dono D. Webb."

It is a specimen of *Galaxaura*, the densely-placed purple-coloured assimilating filaments of which are free in places, in others covered by a dense layer of epiphytes, mostly consisting of *Urospora lata*. As the green colour in this plant is exceedingly well preserved, it seems necessary to believe that it is the purple assimilating filaments of the *Galaxaura* which, together with the filaments of *Urospora*

¹ MONTAGNE describes the plant in the following way: "C. filis tenuissimis brevissimis, basi inflato-bulbosis, purpureis, simplicibus, rarò sub apice ramosiusculis, ramis tum divaricatis, articulis diametro duplò longioribus".

Hab. Ad *Galaxauram lapidescentem* Lamx. abundè crescit, quam undiquè villo brevissimo velatino purpureo obducit.

læta, form the "type" of the *Conferva villum*, the unbranched filaments in the *Galaxaura* becoming, by means of the epiphytes, "raro sub apice ramosiusculis" as said in the description.

I gathered the plant in rather exposed places near low water mark.

Gran Canaria: Bahia del Confital. Teneriffe (GAUDICHAUD).
Geogr. Distrib. Morocco, Canary Islands.

Rhizoclonium Kütz.

1. *Rhizoclonium Kernerii* Stockm.

STOCKMAYER, Ueber die Algengattung *Rhizoclonium* (Verhandl. d. zool.-bot. Gesellsch. in Wien, 40, 1890, p. 582). BØRGESEN, Marine Alg. D. W. I., vol. I, p. 20, fig. 8.

The specimens agree very well with plants from the West Indies. The filaments are about 12—16 μ thick and the length of the cells is about 80—100 μ .

The cells mostly contain 2 nuclei each, in the long ones 4 are often present.

Found intermingled among other algæ.

Gran Canaria: Las Palmas.
Geogr. Distrib. Europe, North America, West Indies.

Cladophora Kütz.

1. *Cladophora trichotoma* (Ag.) Kütz.

KÜTZING, Spec. Alg., p. 414; Tabul. Phycol., vol. IV, tab. 64, fig. 1.
HAUCK, Meeresalg., p. 448.

Conferva trichotoma Agardh, Syst. Alg., p. 121.

The specimens referred to this species form low, dense tufts, about 2—3 cm. high. The ramification is very irregular, generally secund, but often also alternate, and parts

of the filaments are often unbranched; opposite branches are found in places as shown in Fig. 15 *a* and in accordance with KÜTZING'S description and figure.

The diameter of the cells in the most vigorous filaments reaches a length of about 250μ , but the usual diameter is about 150μ . The cells are mostly about 6—8, rarely as much as 10—12 times as long as they are broad.

From the basal end of the cells, especially in the lower parts of the thallus, long rhizoids issue from nearly every cell (Fig. 16). The rhizoids have no crosswall at their point of origin and often no crosswalls at all. But in some of the rhizoids such are present. The rhizoids grow downwards, are generally unbranched,

more rarely divided in a few branches, and end in a small, lobed disc or a few short branchlets, by means of which the plant is fixed to the substratum or to other filaments in the tuft.

By the fact that opposite branches, which according to KÜTZING'S description must be considered as characteristic of this plant, are not so very common in my plant, this having more usually secund or irregular ramification, the

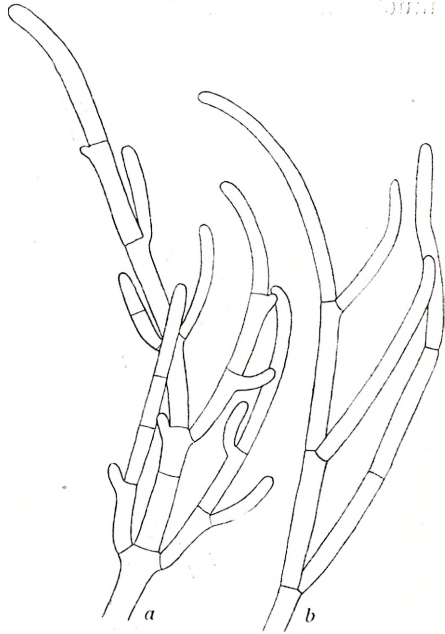


Fig. 15. *Cladophora trichotoma* (Ag.) Kütz. Parts of filaments from the upper part of the thallus. (About 15:1).

Canarian plant shows some likeness to *Cladophora repens* Harvey, and I have had some doubt whether my plant ought not be referred to this species. However, according to HARVEY'S description and figure in "Phycologia Britannica", pl. 236, the cells in this species are very long, much longer than those of my plant, and as HAUCK in

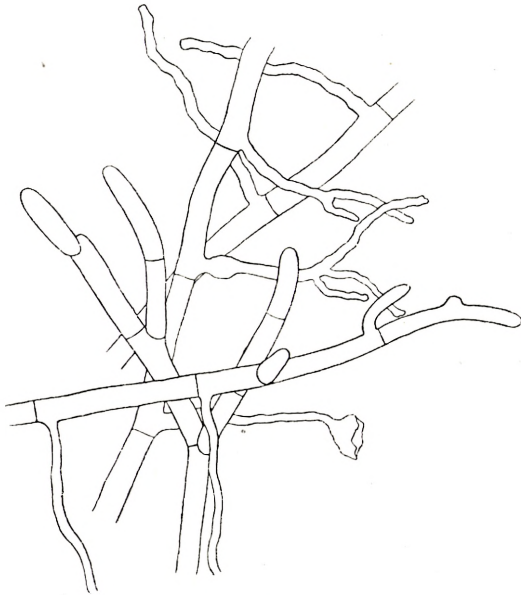


Fig. 16. *Cladophora trichotoma* (Ag.) Kütz. Parts of filaments from near the base with rhizoids. (About 15:1).

his description does not mention opposite branches, and yet opposite branches are present, even if not so very common, in my plant, I have no hesitation in referring this plant to the species of KÜTZING, to which SAUVAGEAU also has referred the specimens he collected at the Canary Islands.

M^{lle} VICKERS collected this species at Las Palmas, as the plant she calls *Cladophora enormis* is this species.

Dr. HAMEL in Paris has most kindly examined a specimen of M^{lle} VICKERS' collection in the Muséum d'Histoire Naturelle and affirmed its identity with this species. On the other hand the *Conferva enormis* Montagne l. c., p. 186 is *Cladophoropsis membranacea* according to kind information given by Dr. HAMEL, who writes to me that Dr. BORNET has identified it as this plant.

And further the *Conferva ægagropila* L. mentioned in MONTAGNE'S list of algæ, l. c., p. 186, is this species according to a specimen from the Paris Museum. Regarding its occurrence at the islands MONTAGNE writes, l. c., "Ad littora Canariensia haud rara".

The plant occurs upon stones and rocks somewhat above low water mark often in rather exposed places.

Teneriffe: Orotava (SAUVAGEAU,!). Gran Canaria: Bahía del Confital, Playa de Santa Catalina and south of Las Palmas near the old tower Christoballo (!), Las Palmas (VICKERS).

Geogr. Distrib. Mediterranean Sea, West coast of Europe, Pacific coast of North America.

2. *Cladophora inclusa* nov. spec.

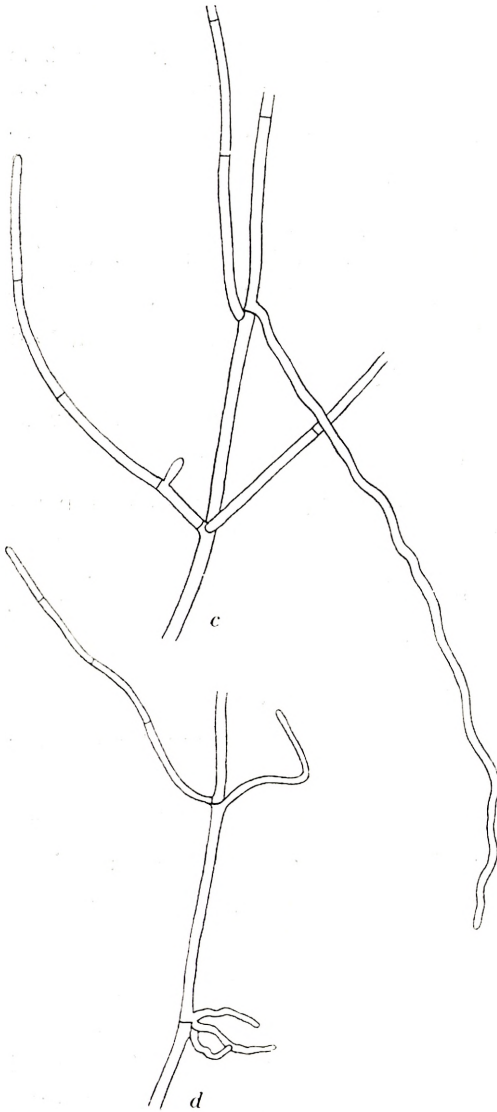
Thallus inter alias algas intricatus e filamentis ramosis compositus.

Filamenta in parte basali prostrata, rhizoidea crebra, decumbentia emittentia, in parte superiori plus minus erecta, sparse ramosa, ramis erectiusculis, sæpe brevibus, e cellulis 1—3 compositis.

Cellulis cylindricis, longis, inferne ca. 20—25 μ , superne ca. 15 μ latis, diametro 10—15—20 plo longioribus.

As the name indicates, this plant was found enclosed in tufts of other algæ. In the lower part of the thallus the filaments are more or less decumbent. From the basal end of nearly all the cells here issue long rhizoids (compare

Fig. 17 c). These have no wall at their point of origin neither have I found any cross walls in them. The rhizoids



grow downwards, attaching themselves to the substratum or to other algæ. From the upper end of the cells a branch generally issues. The branches grow out in all directions and are usually turned upwards. Later on yet another branch is often given off, owing to this it often looks as if the branches were opposite; but as a rule the angle between the two branches is less than 180.

In the lower part of the thallus the filaments have a diameter of about 20μ ; the thickest I have measured were 27μ . In the upper part of the thallus the diameter diminishes to about 15μ . The

Fig. 17. *Cladophora inclusa* nov. spec. Parts of filaments from the lower part of the thallus with rhizoids. (About 80:1).

length of the cells is from 10—15 up to 20 times greater than the breadth.

Compared with the thin thallus the wall of the filaments is rather thick, 1—2 μ ; it is clearly stratified.

The apex of the filaments is blunt. The cells are cylindrical throughout in the older part, though somewhat broadened out at their ends.

With Chlor-Zinc-Iodine the chromatophores stain black showing the presence of starch. On the other hand the walls of the cells which turn yellow do not show any cellulose-reaction.

The plant was found in a very exposed place where high breakers during high water constantly wash the rocks. These

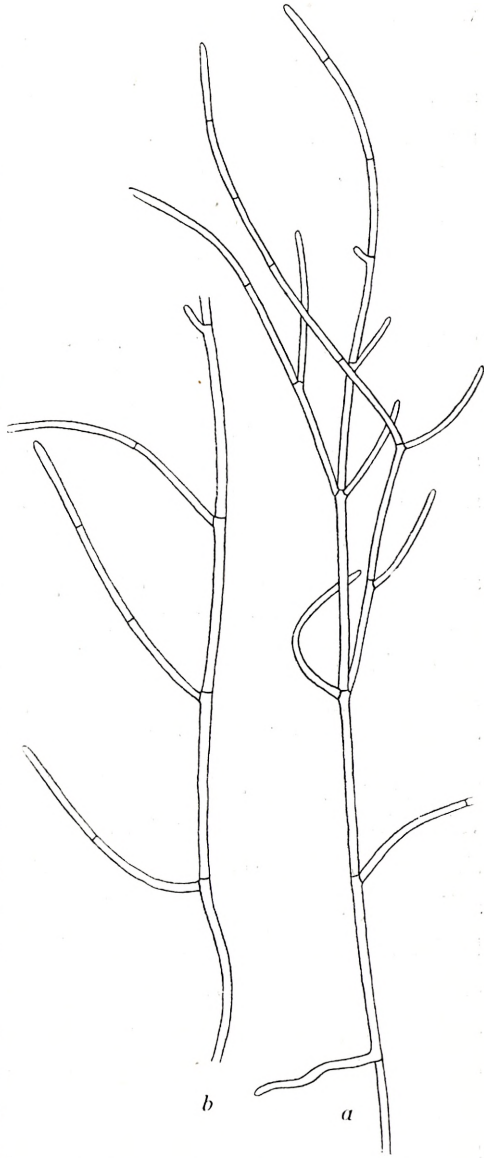


Fig. 18. *Cladophora inclusa* nov. spec. Parts of the thallus. In *a* a rhizoid. (*a*, about 60 : 1; *b*, about 80 : 1).

were in places covered with a crust about 1 cm. thick, composed of various algæ, of which the present species was one. At low tide the rocks were dry. The plant grows near high water mark.

Gran Canaria. Bahia del Confital.

3. *Cladophora boodleoides* nov. spec.

Cladophora pulvinato-cæspitosa, ad scopulos rhizoideis numerosis, perlongis adfixa, ca. 2 cm. alta, obscure viridis, ramosissima, ramificatione irregulari.

Rami nunc alterni, nunc secundi aut oppositi, sub angulo variabili egredientes, apicibus ramorum rhizoideis sæpe instructis et inter se per ea adhærentibus.

Cellulis in filamentis crassioribus 120 μ crassis, in ramis superioribus tenuioribus ca. 40 μ latis, diametro ca. 1—2, raro pæne 6 plo longioribus.

In "A Propos des *Cystoseira*", p. 51 SAUVAGEAU gives the following valuable information concerning this plant: "un autre *Cladophora* vivant en touffes adhérentes au rocher au sujet duquel M. BORNET, à qui je l'avais soumis, m'écrivait qu'il correspond au *Cl. Macallana* de LLOYD (*in Algues de l'Ouest*) et au *Cl. refracta* de CROUAN (*in DESMAZIÈRES, série 2, no. 469*), trouvés à l'état flottant et qui ne sont ni le *Cl. Macallana* Harv. ni le *Cl. refracta* Kütz., auxquels ces auteurs les ont rapportés; la plante des Canaries serait donc le type d'une espèce dont LLOYD et les frères CROUAN ont distribué la forme flottante et par conséquent modifiée".

According to this it is evident that our plant cannot keep any of the names mentioned above, and as it must be considered as the representative of a species not yet described, I propose to name it *boodleoides* on account of its great resemblance to the genus *Boodlea*, a name I gave

the plant provisionally before I received SAUVAGEAU'S collection of algæ by means of which I have been able to ascertain the identity of my plant with that of SAUVAGEAU.

The plant forms low, about 2 cm. high, darkgreen tufts upon rocks, more rarely it is found as an epiphyte upon larger algæ. When dried it turns a dark, brown-olive-

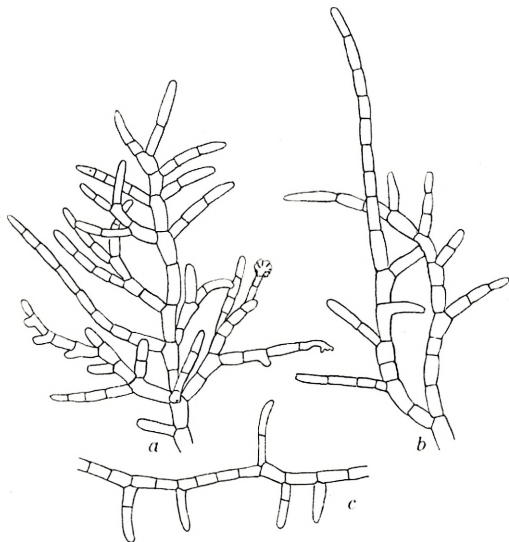


Fig. 19. *Cladophora boodleoides* nov. spec. *a* and *b*, Upper parts of filaments. *c*, part of a filament with short branchlets given off at right angles. (About 25 : 1).

green colour. It is fastened to the substratum by means of numerous rhizoids.

These rhizoids are of very variable shape and size. Some of them, and by far the most, are given off from the cells at the summit of the filaments (Fig. 19 *a*, 20), others from cells lower down in the tuft. The latter are mostly long, thin, irregularly bent with waved surface. Crosswalls are not always found in these rhizoids. These rhizoids mostly grow downwards serving to fix the

plant to the substratum, but they may also attach themselves to other filaments in the tuft. The rhizoids formed in the uppermost branches have another shape. The upper cells in these branches grow gradually thinner, shorter or longer and get a more or less well developed lobed disc at their end (Fig. 19 *a*, 20, 22 *a*). These rhizoids serve

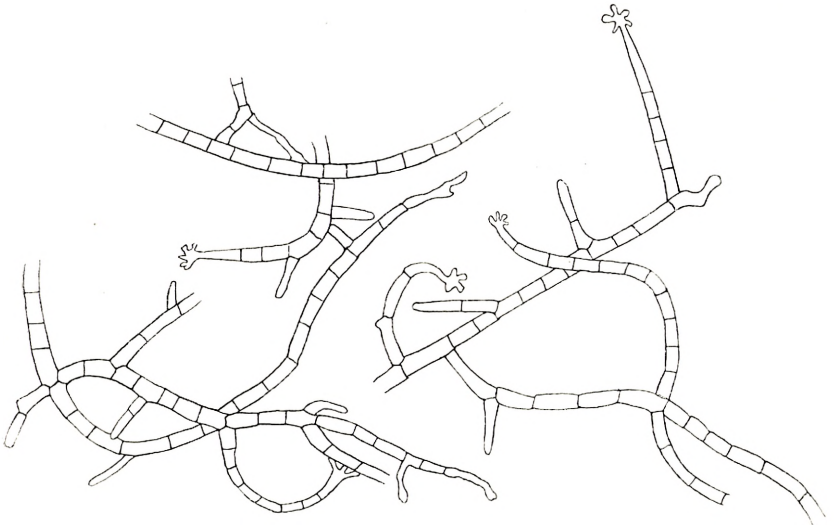


Fig. 20. *Cladophora boodleoides* nov. spec. Parts of filaments showing the very irregular ramification and the numerous rhizoids often attached to the neighbour filaments. (About 30 : 1).

not only to fix the plant to the substratum, but also, and for the most part, to keep the tuft together, the rhizoids attaching themselves to adjacent filaments. It is, however, not always that a coralliform disc terminates these rhizoids, often the branches fix themselves to the adjacent filaments in the way shown in Fig. 22 *c*. This reminds one very much of the kind of attachment found in *Microdictyon Agardhianum*, even if I have not seen any marked ring of cellulose here.

The cells in the plant are of rather variable size and shape. The diameter of the cells varies from a length of about $120\ \mu$ in the thickest branches to about $40\ \mu$ in the

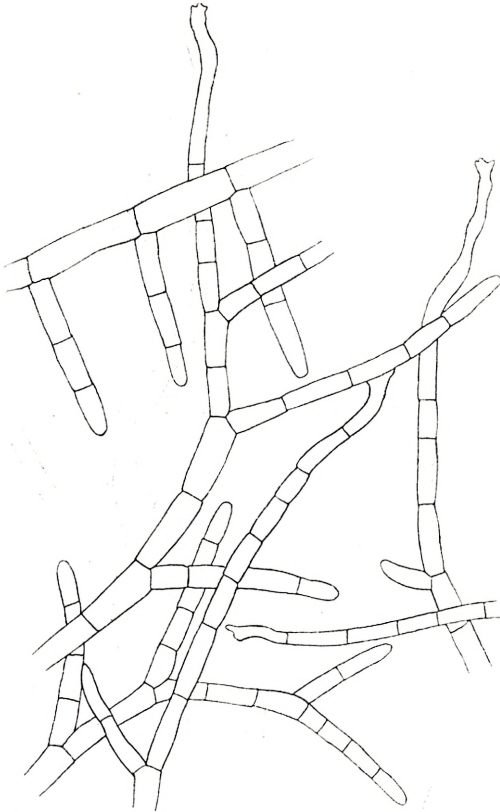


Fig. 21. *Cladophora boodleoides* nov. spec. Parts of filaments often terminating in rhizoids. (About 35:1).

upper parts of the thallus. And the length of the cells varies from not much more than the breadth up to about 7 times the breadth.

The ramification is, very variable too. In some parts of the thallus it is unilateral (compare the filaments above in Fig. 21, 19 c), in others alternate; now and then oppo-

site branches are given off (Fig. 19 *a*) or the ramification is more irregular. In some parts of the thallus a branch

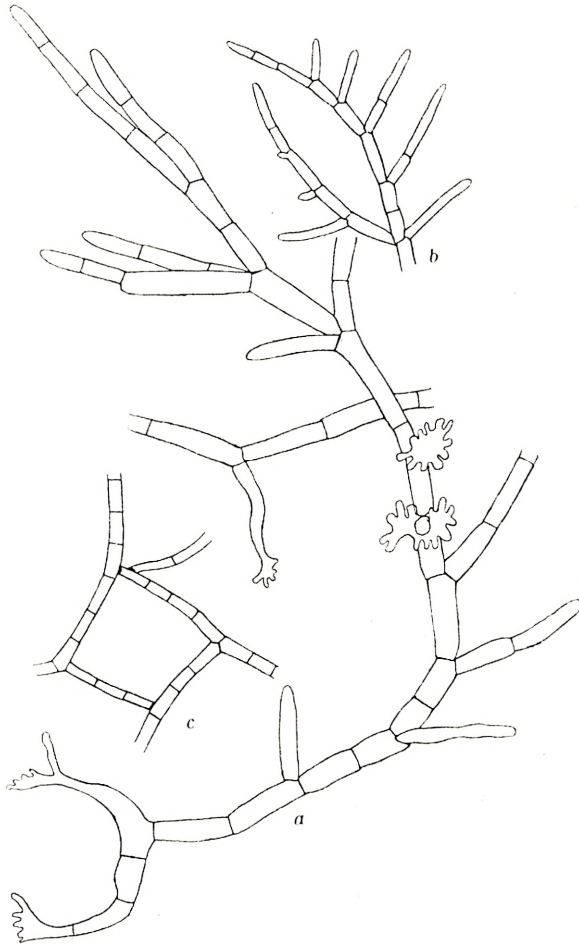


Fig. 22. *Cladophora bootoides* nov. spec. *a*, a single branchlet ending in rhizoids and with lateral rhizoids. *b*, summit of branch with second ramification. *c*, showing the growing together of the filaments.

(*a*, about 35:1; *b* and *c*, about 25:1).

issues from each cell, in others no branches occur. And what furthermore greatly contributes to the irregular

appearance is, that the branches are so very differently developed, some of them being short, formed only of a single cell, while others grow longer and become ramified.

The branches issue from the mother filament sometimes at acute angles, sometimes at right angles (Fig. 19 c).

By its ramification and whole way of growing our plant, as already mentioned, reminds one very much of *Boodlea*. But an essential difference is that *Boodlea* has true tenaculæ, while in our plant it is the summit of the branches which become rhizoidlike.

The plant occurs somewhat above low water mark in rather exposed places. SAUVAGEAU writes about its occurrence at Orotava: "basse mer, très commun, en petites boules sur les rochers, en bordure de l'eau".

Teneriffe: Orotava (SAUVAGEAU,!). Gran Canaria: Las Palmas, Bahia del Confital.

4. *Cladophora fascicularis* (Mont.) Kütz.

KÜTZING, Phycol. gener., p. 268; Species Alg., p. 393. COLLINS, The Green Algæ of North America, p. 345.

Conferva fascicularis Mertens in AGARDH, System., p. 114.

It is SAUVAGEAU who has made the interesting discovery at the Canary Islands of this alga which is so common in the West Indies. The specimen found is rather small, but well developed; it is about 7 cm. high.

Teneriffe: Orotava (SAUVAGEAU).

Geogr. Distrib. West Indies, Brazil.

5. *Cladophora prolifera* (Roth.) Kütz.

KÜTZING, Phycol. germ., p. 207; Species Alg., p. 390; Tabul. Phycol., vol. III, tab. 82, fig. 3. HAUCK, Meeresalgen, p. 450. BARNET, Algues de P. K. A. SCHOUSBOE, p. 207.

Conferva prolifera Roth, Catalecta, I, p. 182, tab. 3, fig. 2.

Several well-developed specimens of this plant have been found.

As described by BORNET, l. c. p. 207, and now by HAMEL in "Revue Algologique", vol. I, p. 174, the base of this plant is strengthened by means of numerous rhizoids issued from the basal ends of the lowermost branches. The rhizoids grow downwards along the stem of the plant, being firmly attached to it, and in this way the rhizoids form a fascicle of rhizoids round it (Compare HAMEL'S Fig. 3).

The wall of the rhizoids is thick and brown and provided with annular constrictions more or less along their whole length. When the rhizoids approach the substratum, they are often divided once or twice and get cross walls.

At the substratum the rhizoids become divided in many small irregularly ramified branches which are horizontally expanded and in this way form a broad disc by means of which the plant is firmly attached to the ground.

The plant occurs in rather exposed places somewhat above low water mark and in pools.

Gran Canaria. Along the shore from Puerto de la Luz to south of Las Palmas; Playa de Santa Catalina (VICKERS). Lanzarote: Isla Graciosa (PICCONE). Tenerife: (LIEBETRUTH), Orotava (SAUVAGEAU, !). "Ad rupes, saxa et conchas in littoribus Canariensibus haud rara", according to MONTAGNE in WEBB et BERTHELOT, l. c., p. 186.

Geogr. Distrib. Mediterranean Sea, Atlantic Ocean from the English to the Canary Islands, West Indies.

6. *Cladophora pellucida* (Huds.) Kütz.

KÜTZING, Phycol. Germ., p. 208; Spec. Alg., p. 390; Tab. Phycologicae, vol. III, tab. 83, fig. 2.

Conferva pellucida Huds., Flora Angl., p. 601. DILLWYN, Brit. Confervæ, 1809, plate 90.

The plant grows in dense tufts. These are formed by erect filaments now and then growing up from the basal much ramified rhizoids by means of which the plant is fastened to the substratum (Fig. 23). HAMEL in his detailed description of this species in "Revue Algologique", p. 171, has also pointed this out.

The very long basal cell, characteristic of this plant, is often about 2 cm. long and up to $600\ \mu$ thick. The plant is di-trichotomously ramified, in the upper part secund. Adventitious branches are often formed.

The base of the cells in the more vigorous branches are often somewhat subglobose swelled.

The plant occurs between tide-marks in rather exposed places and was found in well developed specimens up to 10 cm. high in the months of January and February.

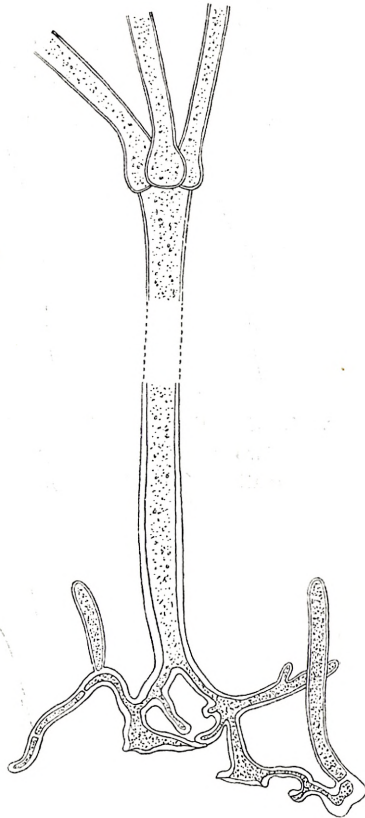


Fig. 23. *Cladophora pellucida* (Huds.) Kütz. Base of a plant showing young plants growing up from the rhizoids. (about 15:1).

Teneriffe: Orotava (SAUVAGEAU,!); Gran Canaria: Playa de Santa Catalina (VICKERS). This species has also been collected at both islands by LIEBETRUTH.

Geogr. Distrib. Mediterranean Sea, Atlantic Ocean from the English coast down to the Canary Islands.

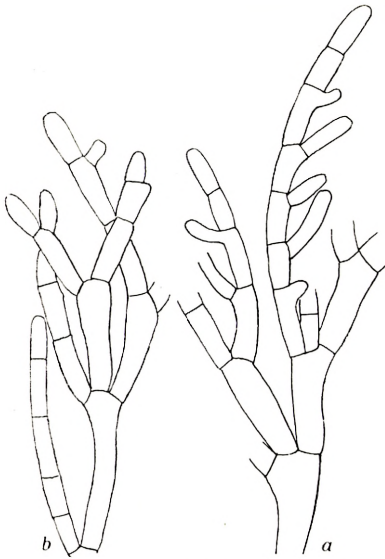


Fig. 24. *Cladophora Neesiorum* Kütz. Part of two branches showing ramification. (About 20:1).

7. *Cladophora Neesiorum* Kütz.

KÜTZING, Spec. Alg., p. 396;
Tab. Phycol. vol. IV, tab. 5.

HAUCK, Meeresalgen, p. 452.

I refer to this species some small plants forming low, dark-green tufts upon stones and rocks. It is a much ramified plant, mostly di-tri-polychotomously divided at each joint (Fig. 25 *b*).

In the main branches the breadth of the cells is about 150—180 μ and the length about 5, more rarely 6—7 times that of the breadth.

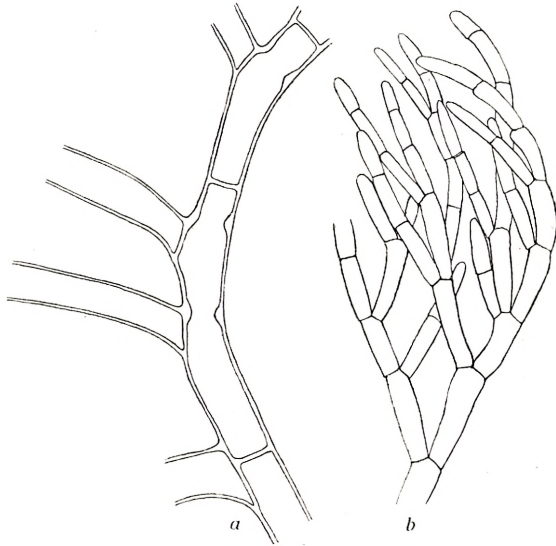


Fig. 25. *Cladophora Neesiorum* Kütz. *a*, part of a main filament near its base showing through-growing of cells. *b*, summit of filaments. (*a*, about 35:1; *b*, about 20:1).

The ramuli are about $100\ \mu$ thick and 3—4 times as long. In the upper part of the thallus the ramuli are generally secondly arranged (Fig. 24 a).

In the main branches the cells near the base often grow together with the mother branch at some length, and by through-growing of the cells the branches often seem to issue from the middle of the mother cell (Fig. 25 a).

The plant was found between tide marks in rather exposed places.

Gran Canaria: Playa de las Canteras in various places; Christoballo south of Las Palmas. M^{lle} VICKERS has found it at Las Palmas.

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean.

8. *Cladophora utriculosa* Kütz.

KÜTZING, F., Phycol. gen., p. 269. HAUCK, Meeresalgen, p. 454.

It is with much doubt that I refer to this species some few small specimens which show some likeness to the figures of KÜTZING quoted by HAUCK, l. c.

The specimens are about two cm. high only. They form small tufts, often intermingled with other algæ, upon rocks.

The diameter of the cells in the main stem was about $140\ \mu$, the length of the cells about two — four times as long. At the base several rhizoids are given off, by means of which the plant is fastened to the substratum (Fig. 26 a). The cells have here very thick and stratified walls.

The ramification is rather poor; in the basal part the filaments are destitute of branches for a long way; higher up, often with several joints between, a branch is given off; very rarely two from each joint. There are no marked main branches, the side-branches being as vigorous as the

mother filament. The branches are given off in all directions. In the upper part of the thallus on the other hand, the ramification becomes richer, a short branchlet composed of 1—3 cells issue unilaterally from nearly every joint (Fig. 26 *b*). The branchlets are about $100\ \mu$

thick, and the length of the cells varies from about $500\text{--}700\ \mu$. The branchlets are sometimes straight sometimes curved.

It occurred somewhat above low water mark in rather exposed places.

Gr. Canaria. Playa de Santa Catalina; Christoballo south of Las Palmas. Gran Canaria without locality (LIEBETRUTH).

Geogr. Distrib., Atlantic coast of Europe, West Indies, Brazil.

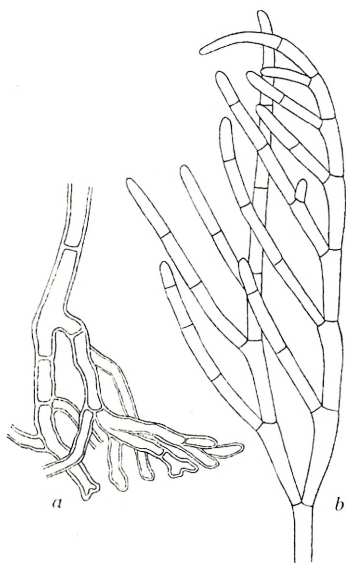


Fig. 26. *Cladophora utriculosa* Kütz. *a*, base of a plant; *b*, upper part of filaments showing ramification. (*a*, about 30 : 1; *b*, about 20 : 1).

9. *Cladophora flexuosa* (Griff.) Harv.

HARVEY, Phycol. Britannica, tab. 353.

HAUCK, Meeresalgen, p. 456.

Conferva flexuosa Griff. in WYATT, Alg. Danm., n. 227.

M^{lle} VICKERS refers to this species a small specimen she has found: "Sur les rochers de l'autre côté de Las Palmas; exemplaire unique".

Professor E. DE WILDEMAN has most kindly allowed me to see this specimen belonging to the collection of Jardin botanique de l'État, Bruxelles.

The specimen is small and not much ramified, the branches in the upper part of the specimen being long and

nearly destitute of branches. The cells in these filaments are somewhat barrelshaped (at any rate in the dried specimen) about $140\ \mu$ long and $45\ \mu$ broad.

HARVEY'S figure of this plant shows a much more ramified plant than is the case with the small specimen of M^{lle} VICKERS. On the other hand, when compared with the figure of *Cladophora sirocladia* Kütz. (Tab. Phycol., vol. 3, tab. 89, fig. 1) which HAUCK includes under this species, the Canarian specimen shows a somewhat greater likeness to this form by its longer, less ramified branches.

The specimen is surely too small and badly developed to make an exact determination possible.

Gran Canaria: Las Palmas (VICKERS).

Geogr. Distrib. Atlantic coasts of Europe and North America, Bermuda.

10. *Cladophora crystallina* (Roth) Kütz.

KÜTZING, Phycol. germ., p. 213; Spec. Alg., p. 401. HAUCK, Meeresalg., p. 459.

Conferva crystallina Roth, Catal. Bot., I, p. 196.

A single specimen only has been found. It is about 7 cm. high and is much ramified. The main filaments consist of cells which are, on an average, $140\ \mu$ broad and 6—7 times as long.

The branches are given off in all directions. In the upper part of the thallus the ramuli are unilaterally placed and one is given off from each cell. The ramuli are about $30\text{--}40\ \mu$ broad and about 6 times as long. They are mostly curved.

The specimen was gathered in a rather exposed place somewhat above low water mark.

MONTAGNE, l. c., p. 185, mentions *Conferva crystallina* Roth. I have been able to examine a specimen of this

plant belonging to the collections of the Muséum d'Histoire Naturelle, Paris, and take it to be this species.

Gr. Canaria: Christoballo south of Las Palmas. Regarding the habitat of this plant MONTAGNE writes: In fossis aqua marina repletis juxta Arguineguin insulæ Canariæ a cl. DESPREAUX lecta. According to PICCONE, l. c., p. 53 LIEBETRUTH has at Gran Canaria collected *Cladophora ceratina* Kütz., which is most probably this species.

Geogr. Distrib. Atlantic coast of Europe and North America, Mediterranean Sea, Canary Islands, West Indies.

11. *Cladophora expansa* (Mert.) Kütz.

KÜTZING, Tab. Phycol., vol. III, p. 27, tab. 99, fig. 1. HAUCK, Meeresalg., p. 462.

Conferva expansa Mertens in JÜRIG., Alg. Dec., no. 8.

This species has been found by M^{lle} VICKERS: "A basse mer sur *Cladophora prolifera*. Rochers en face de l'hôtel Métropole".

Through the kindness of Professor E. DE WILDEMAN I have been able to see a specimen of M^{lle} VICKERS's plant. The specimen is very small, about 1 cm. high, fixed to *Cladophora prolifera*. It is a much ramified plant, the cells in the ramuli are about 35 μ thick and about 180 μ long, in the main filament the diameter of the cells reaches a length of about 100 μ . In the size of its cells the plant comes near to the plant I refer to *Cl. crystallina*.

Gr. Canaria: Las Palmas (Vickers).

Geogr. Distrib. Atlantic coast of Europe and North America.

12. *Cladophora Liebetruithii* Grunow.

GRUNOW in PICCONE, Crociera del Corsaro etc.; p. 53.

This plant has been collected at Gran Canaria by Dr. LIEBETRUTH.

As PICCONE's paper is perhaps not so very easily

accessible, I give here the diagnosis of the plant: “Cl. filamenta irregulariter ramosa in globulum densum aggregata, ramis patentibus, saepe curvatis, alternantibus vel subsecundis, rariter oppositis vel subfasciculatis. Filamenta 0,05—0,1 mm. crassa. Articuli diametro plerumque sesquilingiores vel subaequales, rarius longiores. Color sordide fusco virescens”.

“Dal dott. Liebethuth fu raccolta anche nel Mare Jonio. — Differisce questa specie dalla *Cl. Braunii*, Harv., colla quale presenta moltissima affinità, per i rami più patenti e le articolazioni più brevi. Per gli stessi caratteri si discerne dalla *Cl. Meneghinii*, Ktz. Dalle varietà della *Cl. repens* differisce oltre a ciò per la mancanza di radichette discendenti” — GRUNOW *in lett.*

Gran Canaria. (Liebethuth).

13. *Cladophora Cymopolia* nov. spec.

Cladophora in *Cymopolia barbata* epiphytica, caespites densos parvos, altitudinem $\frac{1}{2}$ cm. raro superantes, formans.

Pars basalis rhizoidis brevibus plus minus in thallum incrustatum hospitis penetrantibus adfixa.

Filamenta a basi ramosa, di-trichotoma, in superiore parte unilateraliter ramosa, ramulis incurvatis.

Cellulae in filamentis crassioribus ca. 150μ crassae diametro 4—

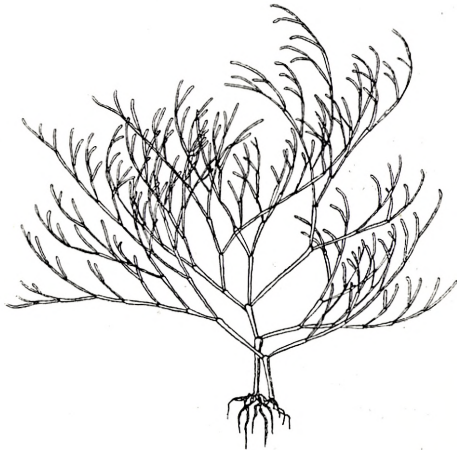


Fig. 27. *Cladophora Cymopolia* nov. spec.
Habit of the plant. (About 12:1).

6 plo longiores, in ramulis minoribus 30—40 μ crassæ et 300—350 μ longæ.

This small plant (Fig. 27) is a characteristic species among several plants which grow upon *Cymopolia barbata*. It forms roundish low tufts rarely higher than about $\frac{1}{2}$ cm. and often present so abundantly that they nearly quite cover the host. The colour is light green.

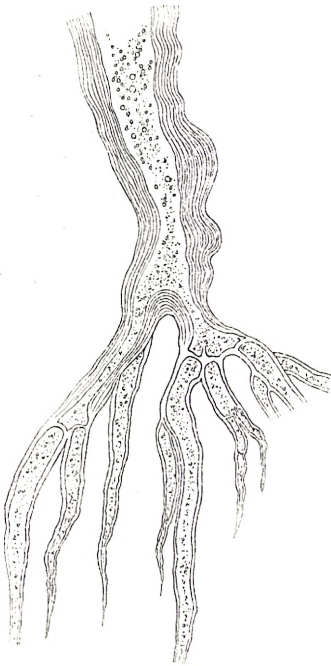


Fig. 28. *Cladophora Cymopolia*
nov. spec. Base of a plant.
(About 130 : 1).

The base consists of short decumbent filaments, composed of cells with thick stratified walls. These filaments square themselves over the surface of the host. From their lower end rhizoids like sinkers penetrate into the calcareous skeleton between the vesicles of the host, thus fixing the plant. The rhizoids are irregularly ramified with an uneven waved surface, growing thinner downwards (Fig. 28).

The erect filaments have in their basal part rather long cells; they measure, on an average, $500 \times 150 \mu$ (more rarely thicker) and their walls are thick and stratified (Fig. 29 a).

At their base the cells in the main branches often grow together with those of the mother filaments at some length and by the through-growing process we get the apparently remarkable mode of ramification shown in Fig. 29 a, which is often found in *Cladophora* and first described by ROSENVINGE.

At the basal end the cells mostly have a markedly spherical swelling arising from a constriction somewhat above their lowermost end Fig. 29 *a*. These swellings are present in the basal part of the thallus and pass gradually away upwards.

The ramification is rather irregular. Generally 2—3 branches issue from each joint, but adventitious branches

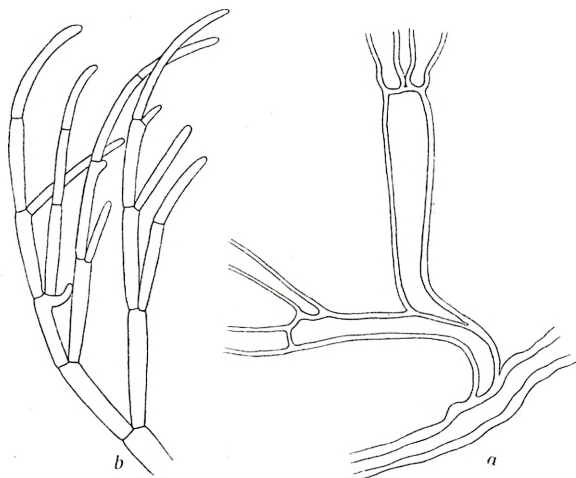


Fig. 29. *Cladophora Cymopolia* nov. spec. *a*, part of filaments from near the base showing through-growing of cells. *b*, upper part of filaments. (*a*, about 60:1; *b*, about 15:1).

ches are often found increasing the number of branches. Higher up the number of branches decreases and in the upper parts of the thallus usually a single branch only is formed from each joint (Fig. 29 *b*). Here the ramification is unilateral and the branches with the ramuli are all curved towards the middle of the thallus.

The cells in the ramuli are about 30—40 μ broad and 300—350 μ long. The apex of the cells is blunt.

This plant shows some likeness to *Cl. hamosa* (comp.

ROSENVINGE's description and figures¹⁾ but it differs from it by its basal part and its proportionally longer cells and by its small size.

COLLINS has described a *Cladophora constricta* characterized by an annular constriction just above the lower end of the cells in accordance with that found in the Canarian plant. But this constriction is much more developed in COLLINS' plant than in the Canarian plant from which the American is otherwise much different.

The plant is found in more sheltered places upon *Cymopolia*, which was growing near low water mark upon nearly horizontal rocks covered with shallow water during ebb-tide.

Gran Canaria: Playa de Santa Catalina at Las Palmas.

Fam. 5. *Siphonocladaceae*.

Struvea Sond.

1. *Struvea ramosa* Dickie.

DICKIE in Journal of the Linnean Society, Bot., vol. XIV, 1875, p. 316. MURRAY and BOODLE, System. account of the genus *Struvea* (Ann. of Bot., vol. II, p. 265, pl. XVI, fig. 3).

Struvea anastomosans (Harv.) var. *canariensis* Picc. et Grun, in PICCONE, Crociera del Corsaro alle Isole Madera e Canarie, Genova 1884, p. 20.

MURRAY & BOODLE have pointed out (l. c.) that the plant PICCONE has gathered at the Canary Islands and with GRUNOW referred to *Struvea anastomosans*, as a variety, belongs to this species, described upon specimens collected at Bermuda with the Challenger expedition. MURRAY and BOODLE have made a thorough comparison of specimens from both localities and ascertained their exact identity.

¹ ROSENVINGE, L. KOLDERUP, Om nogle Forgreningsforhold hos Slægterne *Cladophora* og *Chaetomorpha* (Botanisk Tidsskrift, Bd. 18, 1892, p. 36).

Dr. ACHILLE FORTI, Verona, has allowed me to see a specimen of PICCONE'S collection. This specimen is about $4\frac{1}{4}$ cm. high. The stipe alone is a little longer than 3 cm. At about $2\frac{1}{2}$ cm. above the base the stem is divided into two branches. The frond is incomplete, not quite 1 cm. broad.

Lanzarote: Arrecife (PICCONE).

Geogr. Distrib. West Indies, Canary Islands.

Siphonocladus (Schmitz) Børgs.

1. *Siphonocladus tropicus* (Crouan) J. Ag.

J. AGARDH, Till Algernes Systematik, 5te afd., p. 105. (Lunds Univ. Årsskr., 23, 1887). BØRGESEN, F., Contributions à la connaissance du genre *Siphonocladus* Schmitz (Overs. k. danske Vidensk. Selsk. Forhandl., 1905, p. 259); Marine Alg. D. W. I., vol. I, p. 61. HOWE, Phycological Studies, I. (Bull. Torr. Bot. Club, 32, 1905, p. 241).

Apjohnia tropica Crouan in MAZÉ et SCHRAMM, Alg. Guadel., p. 105.

I have found a few specimens of this peculiar alga. Regarding the development of the thallus the reader is referred to my papers quoted above.

The plant was found among other algæ in shallow water in the small, lagoon-like stretch of the sea behind the reef in Bahia del Confital, so in a locality reminding one very much of those in which it is found in the West Indies.

M^{lle} VICKERS made the interesting discovery of this plant at the islands.

Gran Canaria: Bahia del Confital (VICKERS,!).

Geogr. Distrib. West Indies, Canary Islands.

Ernodesmis Børgs.

1. *Ernodesmis verticillata* (Kütz.) Børgs.

BØRGESEN, F., Some Chlorophyceæ from the Danish West Indies, II (Botanisk Tidsskr., vol. 32, 1912, p. 259); Marine Alg. D. W. I., vol. I, p. 66.

Valonia verticillata Kütz., Spec. Alg., p. 508; Tabul. Phycol., vol. VI, tab. 88. J. AGARDH, Till Algernes Systematik, VIII, p. 100.

Professor SAUVAGEAU has made the interesting discovery of this alga at the Canary Islands; hitherto it was only known to exist in the West Indies and Brazil; several fine specimens are found in his collection.

In some of the Canarian plants the characteristic basal stipe with annular constrictions (comp. my fig. 53, *a*, l. c.) is present. It was especially owing to the presence of this stipe that I found it necessary to remove this plant from the genus *Valonia*, from which it also differs essentially in several other respects, e. g. by its lack of the lentiform cells so characteristic of *Valonia*, and by its regular ramification which *Valonia* lacks. Though OLTMANN'S, in the new edition of his "Morphologie und Biologie der Algen", vol. I, p. 362, keeps this plant in the family of the *Valoniaceæ* I can not, as already pointed out in the introductory remarks to this family, agree with him, as this plant comes near to e. g. *Siphonocladus*, *Struvea*, *Chamædoris*, which are all characterized by a stipe with annular constrictions, and together with these genera forms a natural family: The *Siphonocladaceæ*. There is certainly one point, the presence of which I have not been able to establish, namely, the division of the cells, which in the genera named is performed in the peculiar way which I have called segregative cell-division. But on re-examining some

preparations of this plant, I feel convinced that the walls occurring in the rhizoids of the basal part of the plant are due to segregative cell-division. And in this connection I should also like to draw attention to the figure of KÜTZING, quoted above, in which, in one of the branches (marked c), two balls are drawn which are quite suggestive of segregative cell-division.

The plant was collected near low water mark on rocks in exposed places.

Teneriffe: Orotava (SAUVAGEAU).

Geogr. Distrib. The West Indies, Brazil.

Fam. 6. *Dasycladaceæ*.

Subfam. 1. *Dasycladeæ*.

Dasycladus Ag.

1. *Dasycladus clavæformis* (Roth.) Ag.

ÅGARDH, C., Spec. Alg., II, p. 16. KÜTZING, Phycologia gener., p. 313, t. 40, fig. 1; Spec. Alg., p. 508; Tab. Phycol., vol. 6, tab. 91. CRAMER, Ueber die verticillirten Siphoneen, 1888, p. 37.

Conferva clavæformis Roth, Catal. bot., III, p. 315.

Compare DE-TONI, Syll. Alg., vol. I, p. 411 where more synonyms are found.

This species is very common in the environs of Las Palmas where it often forms large dense coverings upon nearly horizontal rocks. It grows in rather exposed places and also in more sheltered ones. The plant collects much sand and mud between the densely crowded thalli.

The specimens I gathered in the month of March were sterile.

Gr. Canaria: Playa de las Canteras; Playa de Santa Catalina (WEBB et BERTHELOT, M^{lle} VICKERS,!). Lanzarote: Arrecife (PICCONE).

While I have not seen this species at all at Teneriffe the plant was very common in the environs of Las Palmas at Gran Canaria as has also already been pointed out by MONTAGNE and later by M^{lle} VICKERS.

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean, Canary Islands, West Indies.

Subfam. 2. Neomereæ.

Cymopolia Lamour.

1. *Cymopolia barbata* (L.) Lamour.

LAMOUREUX, J. W., Hist. Polyp. flexib., 1816, p. 293. HARVEY, Nereis Bor. Am., Part III, p. 35, pl. 41 A. J. AGARDH, Till Algernes Systematik, 5te afdeln., VIII, p. 146. CRAMER, Verticill. Siphoneen, 1888, p. 16.

In the environs of Las Palmas this plant is very common.

Upon nearly horizontal rocks, covered during ebb-tide with shallow water or often laid nearly dry, it has its favourite growing place. Here its flexible, articulate, whitish green thallus, with the fine, light green hair-bushes at the end of the branches, is seen swaying to and fro in the swell.

Among older plants in such a locality I found some small specimens. They were growing upon a rock of a rather loose consistency, mostly composed of small pieces of stones and sand knitted together. In "Nuova Notarisia", ser. XXXVI, 1925, originally meant to be a jubilee number printed in honour of the twenty-fifth anniversary of the well known algological periodical, but changed at the sudden and very regrettable death of the editor, Prof. G. B. DE TONI in Modena, to a memorial number, I have published a note¹ based upon the finding of these small plants.

¹ BORGESSEN, F., Note on the development of the young thallus of *Cymopolia barbata* (L.) Lamour.

I have there given a description of these specimens together with some remarks regarding the development of the thallus of *Cymopolia*. The reader is referred to this note here.

Gran Canaria: Las Palmas where it is found by many investigators. Lanzarote: Arrecife (PICCONE).

Geogr. Distrib. West Indies, Cadiz, Canary Islands.

Subfam. 3. *Acetabulariæ*.

Acetabularia Lamouroux.

1. *Acetabularia mediterranea* Lamour.

LAMOUREUX, Polyp. coralligènes flexibles, 1816, p. 249. HAUCK, Meeresalgen, p. 484. SOLMS-LAUBACH, Monograph of the Acetabulariæ, p. 21.

I have not collected this species myself. But I have seen well developed specimens collected by PICCONE and most kindly sent to me by Dr. A. FORTI. Besides M^{lle} VICKERS has gathered this plant at the Islands.

Gr. Canaria: "A mi-marée sur les rochers de Confital et aussi à Antera" (M^{lle} VICKERS). Lanzarote: Arrecife (PICCONE).

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean.

III. Siphonales.

Fam. 1. *Codiaceæ*.

Subfam. 1. *Flabellarieæ*.

Pseudochlorodesmis nov. gen.

Frons cæspitosa in parte basali e filamentis decumbentibus, irregulariter moniliformibus, dichotome-subdichotome divisis et inter se intertextis, superne e filamentis liberis, erectis composita.

Fila erecta, cylindrica, parce ramosa, dichotome-subdichotome divisa.

Organa fructificationis ignota.

1. *Pseudochlorodesmis furcellata* (Zanard.).

Bryopsis furcellata Zanard, Saggio, p. 60; Icon. Phyc. Adriat., I, p. 135, tav. 32 A. KÜTZING, Tab. Phycol., vol. VI, tab. 71, fig. 2. HAUCK, Meeresalgen, p. 475.

Derbesia (?) *furcellata* Ardissonne, Phycol. Mediter., Parte II, 1886, p. 161.

Derbesia Penicillum Vickers?, l. c., p. 299.

This most probably incompletely known plant is surely most correctly placed in the family of the *Codiaceæ*, reminding one as it does of *Chlorodesmis*. But on the other hand it differs in several respects rather essentially from this genus, so I think it cannot in a natural way be placed in it.

If my supposition is right that my Canarian specimens are like or at any rate very nearly related to the *Bryopsis furcellata* Zanard., our plant has earlier been placed first in the genus *Bryopsis*, later in *Derbesia*, but the classing of it in any of these genera is at any rate not natural.

Regarding my reference of it to ZANARDINI'S species I may point out that I have had no opportunity to examine any original specimen of ZANARDINI and as his figures (l. c.) are very poor and his description in several respects differs essentially from my plant, it is very likely that I am wrong. Thus when ZANARDINI in his description says "plerumque ramulis in superiori parte distiche pinnatis vel undique imbricatis obsessi", this does not at all agree with my plant, and when he says concerning the contents of the ramuli "demum in zoosporas mutato", then this, too, does

not accord with my plant this being quite sterile. When nevertheless I have referred this plant to the species of ZANARDINI, it is because KÜTZING's above quoted figure looks like mine and furthermore because the descriptions of ARDISSONE and HAUCK in the works quoted above most probably refer to a plant that at any rate is much like mine.

And last not least, the reason is that I have been able to see a specimen from Sardinia of Herb. PICCONE which Dr. ACHILLE FORTI has most kindly sent me, and he informs me that the determination of this specimen has been controlled first by DE NOTARIS, later by PICCONE and most probably also by ZANARDINI. Having now examined this specimen I have in the first place been able to ascertain that it seems exactly to answer to a specimen I myself have collected in the Gulf of Ajaccio about 27 years ago and of which I have well preserved material in spirits. And furthermore that the Canarian plant seems much like the Mediterranean, though showing some minor differences, for which reason I think it most fitting to consider the Canarian plant as a new variety.

After these introductory remarks I shall now give a more detailed description of the Canarian plant.

The plant (Fig. 30) forms low, dense tufts, somewhat above $\frac{1}{2}$ cm. high, and grows upon rocks, calcareous algæ etc. The tufts are uncalcified.

The basal part (Fig. 31) is composed of a feltwork of torulose or moniliform, irregularly swollen and constricted filaments woven together. The filaments are subdichotomously branched.

This rhizome-like basal part is fastened to the substra-

tum by means of irregularly shaped rhizoids growing downwards from the lowermost filaments.

Upwards from the basal filaments proceed erect ones. In their lowermost part these filaments are much like

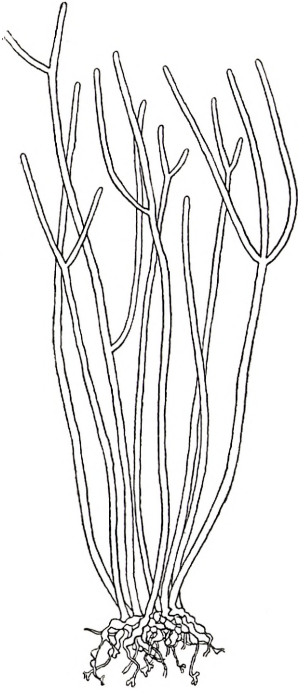


Fig. 30. *Pseudochlorodesmis furcellata* (Zanard.) Børgs.
var. *Canariensis* Børgs.
Habit of plant. A group of filaments prepared out of a tuft. (About 18:1).

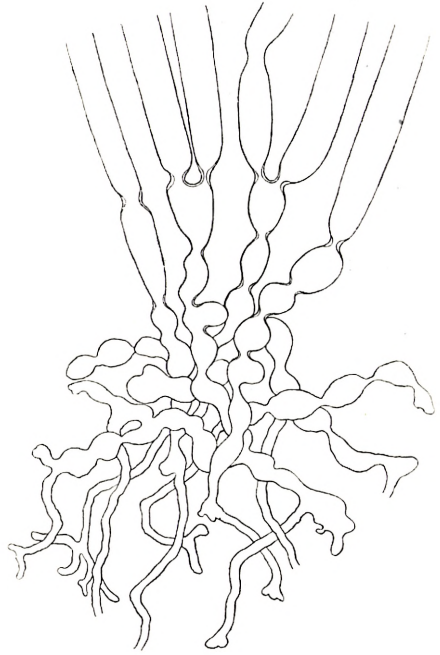


Fig. 31. *Pseudochlorodesmis furcellata* (Zanard.) Børgs.
var. *Canariensis* nov. var.
Basal part of a plant.
(About 60:1).

those in the basal part. They are irregularly constricted with a varying number of larger and smaller constrictions (Fig. 31). Often they have a single subdichotomical division here and above the ramification may be a single or few constrictions (Fig. 32). Then the filaments become cylindrical through their whole length, having no constrictions.

tion any more and keeping the same diameter to their summit. The filaments are about $70\ \mu$ thick.

Now and then they are divided into two, more rarely three branches. The ramification usually takes place in the upper end of the filaments. It is performed in such a way, that somewhat below the apex of the filament a swelling becomes visible (Fig. 33 *d*), this swelling grows gradually longer (Fig. 33 *e*) and is the beginning of the new branch which immediately gets as stout as the mother filament.

When a branch has been given off the end of the filament and the branch are generally unequally developed. In some cases the end of the filament continues the direction of the filament, becoming the most vigorous, while the branch is directed to the side (Fig. 33 *a*). But it also happens that the branch becomes the most vigorous, while the end of the filament stops growing. Sometimes the end of the filament and the branch get nearly equally vigorous and both at the same time diverge equally from the direction of the main filament. When, besides the end of the filament, two more branches are developed, it may happen, that the branches grow most vigorously while the end of the mother branch stops its growth.

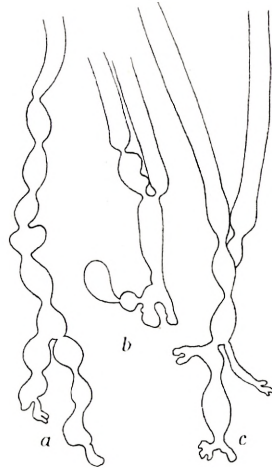


Fig. 32. *Pseudochlorodesmis furcellata* (Zanard.) Borgs. var. *Canariensis* nov. var. Basal parts of filaments. In *a* a single filament only is developed, *b* and *c*, dichotomously branched filaments, in *b* the left filament has one more constriction above that at the dichotomy; from the rhizoid-like part a young filament is developed.

(About 50 : 1).

From this it is clear that no true dichotomy is present in this plant, repeatedly dichotomial branching being otherwise the rule in the groups *Flabellariaceæ* and *Udoteaceæ* of the Fam. *Codiaceæ* according to A. and E. S. GEPP'S splendid monograph on this family.

The chromatophores are very small, oval-roundish of

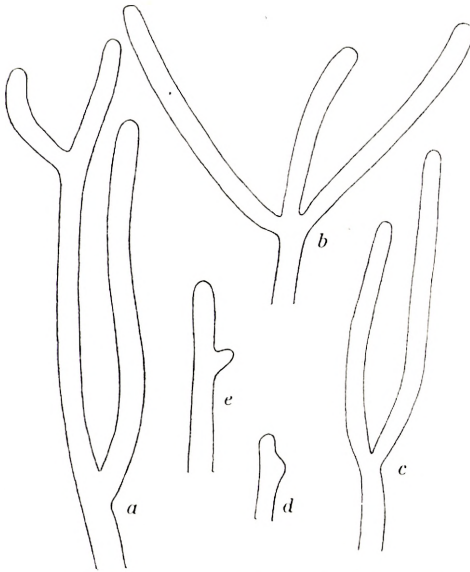


Fig. 33. *Pseudochlorodesmis furcellata* Børgs. var. *Canariensis* nov. var. *a, b, c* upper parts of filaments showing ramification. *d, e* the development of a branch.

(About 60:1).

shape, 2—3 μ long.

They are present in great number in the summit of the filaments, more scattered in the basal parts. The chromatophores are often arranged in long series. When treated with Iodine it is seen that they often contain much starch. No pyrenoids were visible.

Treated with Chlor-Zinc-Iodine the wall gets a light yellow colour.

As is evident from this description the basal part of this plant greatly reminds one of that of *Chlorodesmis* and the whole habit of our plant may also be said to come near to young stages of this genus; but it wants two characters of this genus, upon the whole characteristic of so many of the genera of the Fam. *Codiaceæ*, viz. the true dichotomial branching and the constrictions above the dichotomy in the erect filaments.

By the want of constrictions above the divisions our plant reminds one much of the ramification of *Udotea minima* which ERNST¹ found in plants when cultivated in solution of nutriment.

If now we compare our plant with that from the Mediterranean Sea, it is found that this plant (Fig. 34) in several respects differs somewhat from the Canarian one.

The Mediterranean plant is thus more robust than the Canarian; while in the latter the diameter of the thallus is usually about $70\ \mu$ long, rarely reaching $80\ \mu$, the Mediterranean plant has a thallus which is generally about 90 — $100\ \mu$ thick; HAUCK gives l. c. the dimensions as 60 — $120\ \mu$. Furthermore the Mediterranean form is much more ramified than the Canarian one, and the ramification seems to be more regularly dichotomous here as is also clearly seen in the figures of ZANARDINI (l. c.) and KÜTZING (l. c.). And finally traces of constrictions sometimes occur higher up in the Mediterranean

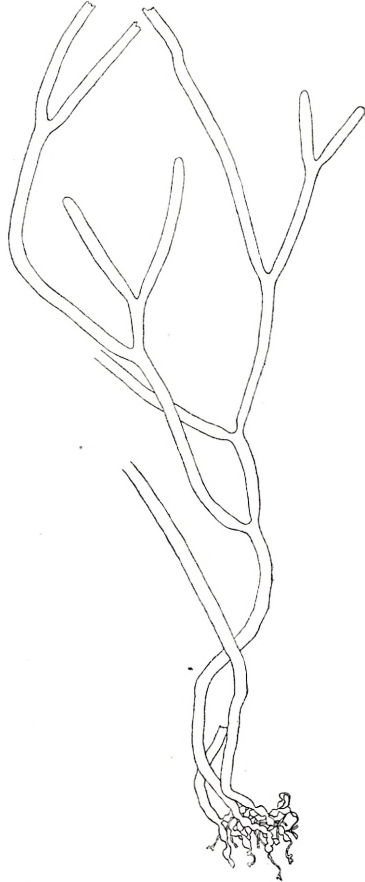


Fig. 34. *Pseudochlorodesmis furcellata* (Zanard.) Børgs. Part of a plant from Ajaccio, Corsica. (About 20 : 1).

¹ ERNST, A., Siphoneen-Studien, II (Beih. Bot. Centralbl., Bd. 16, Hefte 2, p. 199, tab. 2, figs. 25—26).

plant (comp. Fig. 34) while in the Canarian constrictions above the divisions are found only at the base of the filaments. In the upper part of the filaments the Mediterranean plant is quite like the Canarian, no constrictions at all being found here.

By its more regularly dichotomously branched thallus and by the presence at times of constrictions though not especially marked, above the dichotomy, the Mediterranean plant reminds one more of *Chlorodesmis* as well as of the young stages of *Udotea minima*.

But *Chlorodesmis*, on the other hand, has more regularly dichotomously ramified, erect filaments and furthermore, above the dichotomies always marked, though often uneven, constrictions. And in the fully developed plant a stipe is present.

And from the Mediterranean plant the young stages of *Udotea minima* differs in a similar way by the dichotomously ramified thallus with marked constrictions above the dichotomies.

As will be clear from these comparisons, the Canarian and Mediterranean plants differ rather from the nearest related representatives of the fam. *Codiaceæ*, viz. *Chlorodesmis* and forms of *Udotea minima*, for which reason I think it most natural to refer them to a new genus as done above.

And furthermore, as pointed out above, some minor differences are present, too, between the forms from the Canary Island and the Mediterranean, for which reason it seems most appropriate to me to consider the plant from the Canary Islands as the representative of a new variety, which may be characterized as follows:

var. *Canariensis* nov. var.

A forma *typica* differt crassitudine thalli minore, filis erectis in parte basali sæpe nudis, in superiori paulum ramosis, ramificatione subdichotoma.

The *Derbesia Penicillum* (*Bryopsis Meneghini*) of M^{lle} VICKERS found in the same locality as my plant, I have supposed to be this species, but I have searched in vain for a specimen of hers to compare with my plant. Neither in Jardin Botanique de l'État, Bruxelles, nor in Muséum National d'Histoire Naturelle, Paris, according to kind information respectively from Professor E. DE WILDEMAN and Dr. HAMEL, are any specimens to be found.

This plant was found in very exposed places growing upon rocks and calcareous algæ in crevices and pools somewhat above low water mark.

Gran Canaria: The Isleta at Bahia del Confital.

Geogr. Distrib. Mediterranean Sea; Canary Islands.

Avrainvillea Decsne.

I. *Avrainvillea canariensis* A. & E. S. Gepp.

A. and E. S. GEPP, The Codiaceae of the Siboga Expedition, p. 34, pl. XI, figs. 97, 98.

Udotea tomentosa Vickers, l. c. p. 300.

The interesting discovery of this species is due to the late M^{lle} VICKERS. Regarding the finding of the plant M^{lle} VICKERS tells us as follows (l. c. p. 295): "Sur le chemin de Telde, à 3 kilomètres de Las Palmas, il y a quelques rochers qui ne sont pas trop mauvais. Je suis arrivée là un jour au moment où l'on tirait la senne. Toute la population des environs y était assemblée, hommes, femmes et enfants. — Pour eux la pêche à été médiocre; moi, j'ai eu la chance de prendre possession de six beaux exem-

plaires d'*Udotea (Rhipilia) tomentosa*, ramenés par ces filets et laissés sur le sable par les pêcheurs”.

I went to the same place hoping to be just as successful. The fishermen were out drawing their nets, but no algæ appeared this time.

Mr. and Mrs. GEPPE described it as a new species: “We have seen two of her specimens (one is shown in fig. 97) and are unable to refer them to any known species, nor can we regard them as near allies of any other species. This is the only species of *Avrainvillea* which we have seen from near the West coast of Africa”.

Gran Canaria. Near Telde (Vickers).
Geogr. Distrib. Canary Islands.

Subfam. Udoteæ.

Udotea Lamouroux.

1. *Udotea petiolata* (Turra).

Ulva petiolata Turra, Florae Italicae Prodromus 1780, p. 68.

Flabellaria Desfontainii Lamour., Essai Thalass. p. 58, pl. 12, fig. 4.

Flabellaria petiolata Trevisan, Nomenclator Alg., 1845, p. 19 (not seen). A. and E. S. GEPPE, Codiaceae of the Siboga Expedition, p. 48.

Udotea Desfontainii Decsne, Essais sur une classification des Algues et des Polypiers calcifères. Mém. sur les Corallines. Thèses, Paris, 1842, p. 94.

Referring the reader for more synonyms of this polyonymous plant to the long list found in Mr. and Mrs. GEPPE's monograph of the *Codiaceae*, I shall only point out here, that in agreement with these authors I have taken up the old name of *Turra* for this plant, so well known under its earlier name *Udotea Desfontainii*. On the other hand, I have

not followed Mr. and Mrs. GEPP in removing it from the genus *Udotea*, especially because it is not calcified. It seems to me that OLTMANN'S is right when in his new edition of his handbook he points out (vol. I, p. 392): "Sie daraufhin generisch zu trennen, wie A. und E. S. GEPP das tun, scheint mir nicht zweckmässig. Die Verkalkung ist offenbar ein sekundäres Merkmal".

This plant was first gathered at the Canary Islands by HUMBOLDT, as stated by A. and E. S. GEPP, (l. c. p. 50), who have examined HUMBOLDT'S specimen in Paris. In "Plantes Équinoxiales", Tome II, 1809, p. 8, tab. 69 A, HUMBOLDT and BONPLAND call it *Fucus vitifolius* and give a very misleading figure of it. Referring the reader for more detail to GEPP'S monograph, I shall only mention here that LAMOUREUX refers it to *Caulerpa* and that in the very same work in which he describes *Flabellaria Desfontainii!*

Later PICCONE has gathered this plant. Dr. A. FORTI has most kindly sent me a specimen from PICCONE'S herbarium.

Lanzarote: Arrecife (PICCONE); between Isola Alegranza and Isola Clara north of Lanzarote at a depth of 32 fathoms (HUMBOLDT).

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean. Canary Islands. Cape de Verde Islands.

Halimeda Lamouroux.

1. *Halimeda Tuna* (Ellis et Sol.) Lamour.

LAMOUREUX, Classif. d. Polyp. corall. (Nouv. Bull. Soc. Philom., Tome III, 1812, p. 186); Hist. Polypiers corallig., 1816, p. 309, pl. 11, fig. 8 a, b.

BARTON, E., The Genus *Halimeda*, p. 11.

Corallina Tuna Ellis et Solander, Nat. Hist. Zoophytes, 1786, p. 111, tab. 20 fig. e.

forma *typica* Barton., l. c. p. 13.

Halimeda Tuna Lam., l. c.

I have not collected this plant myself but through the kindness of Dr. ACHILLE FORTI I have seen a typical specimen of it gathered by PICCONE.

forma *platydisca* (Deesne) Barton, l. c., p. 14.

Halimeda platydisca Deesne, Essais sur une classification des algues et des polypiers calcifères. Thèse, Paris 1842, p. 90.

It is from a specimen from the Canary Islands that DECAISNE has described his *Halimeda platydisca*.

Lanzarote: Arrecife (PICCONE); Canary Islands (d'ORBIGNY).
Geogr. Distrib. All warm seas.

Subfam. 3. Codieæ.

Codium Stackh.

Sectio I. Adhærentia De Toni.

Of forms belonging to this group I have found two on the shores of the Canary Islands. The one I refer to *Codium adhærens*, the other to *C. difforme*. These two species are regarded by various authors sometimes as well separated species, sometimes merely as forms of one species. Now SCHMIDT¹ with much emphasis points out that we have to do with two well separated species, *Codium adhærens* being easily distinguished from *Codium difforme* by means of 3 essential differences. These 3 characters are: 1) *Codium adhærens* has a firm, tough thallus as contrasted with the loose, spongy thallus of *Codium difforme*. Then 2) the utricles are much smaller in *Codium adhærens* than those in *Codium difforme*, and 3) the gametangia,

¹ OTTO CHR. SCHMIDT, Beiträge zur Kenntnis der Gattung *Codium* Stackh. (Bibliotheca Botanica, Heft 91, 1923).

too, are much smaller in *Codium adhærens* than those of *Codium difforme*.

As may be seen from the following descriptions of the two species, the Canary specimens do not quite answer to the typically developed forms as described by SCHMIDT, deviating from these especially in the size of the utricles. It seems to me a reasonable supposition that we may have to do with hybrids, as the two species are often found growing side by side in the same locality.

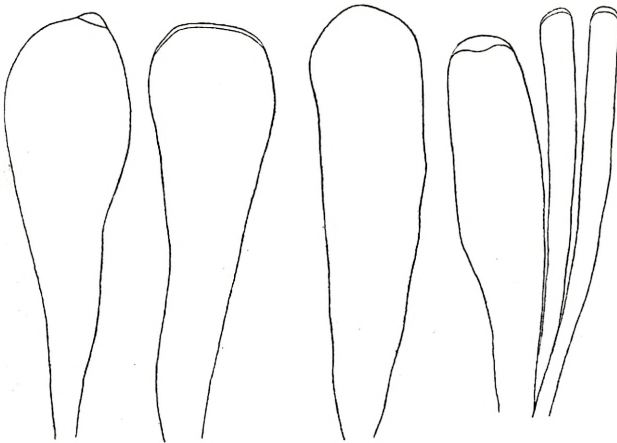


Fig. 35. *Codium adhærens* (Cabr.) Ag. f. *intermedia* n. f. Different forms and sizes of utricles from the same plant. (About: 80 : 1).

1. *Codium adhærens* (Cabr.) Ag.

AGARDH, C., Species Algarum, vol. 1, p. 457. OTTO C. SCHMIDT, l. c., p. 26.

Agardhia adhærens Cabrera, in Phys. Sällsk. Årsber. according to C. AGARDH, l. c.

All the specimens referred to this species have a markedly tough and firm consistency, and in this respect answer very well to the description of SCHMIDT.

Regarding the size of the utricles, on the other hand,

this was not quite the case. To be sure, most of the utricles answered well to the description and figures of SCHMIDT. Their diameter was about 60μ long; they were long, cylindrical, with a rounded apex often a little broadened out, and ending here in an usually very thick membrane. But in between

these utricles which were

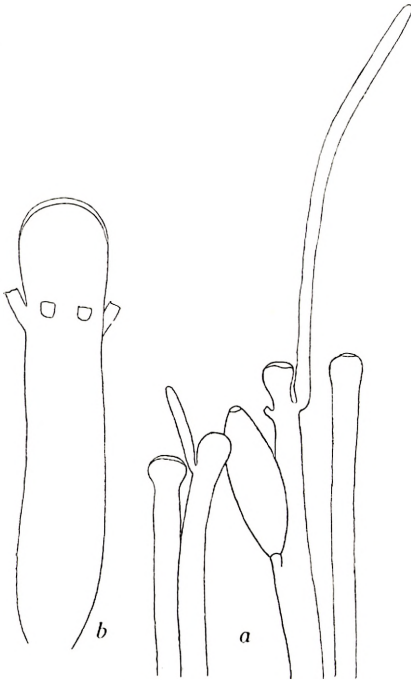


Fig. 36. *Codium adherens* (Cabr.) Ag. f. *intermedia* nov. f. *a*, utricles of normal size with a gametangium; *b*, a much larger utricle from the same plant. (About 60:1).

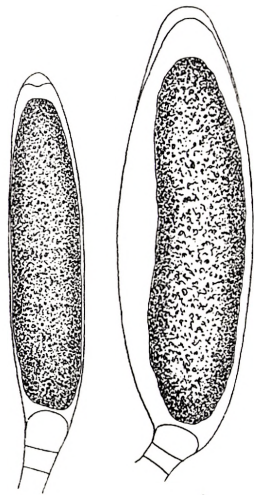


Fig. 37. *Codium adherens* (Cabr.) Ag. f. *intermedia* n. f. Two gametangia from the same plant. (About 120:1).

normal as to size, much thicker ones occurred, and often even rather abundantly (compare Figs. 35 and 36). I have measured utricles which had a diameter of 300μ , being thus like the thickest found in typical *C. difforme*. Such thick utricles were indeed more rare, but those from $100-150 \mu$ were common.

And in the only fructiferous specimen found the gametangia showed a similar variation. As figure 37 shows, the slender one which is $50\ \mu$ broad and $280\ \mu$ long, is quite typical, while, on the other hand, the larger one, which reaches the breadth of $85\ \mu$ and length of $312\ \mu$, has more the size of those of *C. difforme*.

On account of these differences I propose to call this form f. *intermedia*.

Hairs are common. They take their origin a little below the summit of the utricles, and these often carry several hairs. The diameter of the hairs is about $20\text{--}25\ \mu$; they are no doubt very perishable.

The sporangia always issue at a certain height upon the utricles, namely in such a way, that their upper ends are just a little below the summits of the utricles.

When this form occurs near *C. difforme*, it grows at a somewhat lower level than this species. And its appearance is also different, its surface being more uneven and folded.

The plant often forms extensive coverings upon rocks and stones, and occurs somewhat above low water mark, being laid dry during ebb-tide. It occurs in rather exposed places.

Teneriffe: Orotava (KRAUSE and ENGLER according to SCHMIDT,!)

Gran Canaria: Las Palmas, Bahia del Confital (VICKERS,!). Regarding its occurrence MONTAGNE writes, l. c., p. 183: "Ad littora Canariensia non rarum".

Geogr. Distrib. Atlantic coast of Europe from Great Britain southwards, West Africa, Brazil. West Indies, Cape, Japan, Australia, Hawaii etc.

2. *Codium difforme* Kütz.

KÜTZING, *Phycologia gener.*, p. 309. SCHMIDT, l. c., p. 31.

This species I have only collected in two places, the specimens from both localities not being quite typical.

The specimens have a very loose, soft and spongy consistency being in this respect quite typically developed.

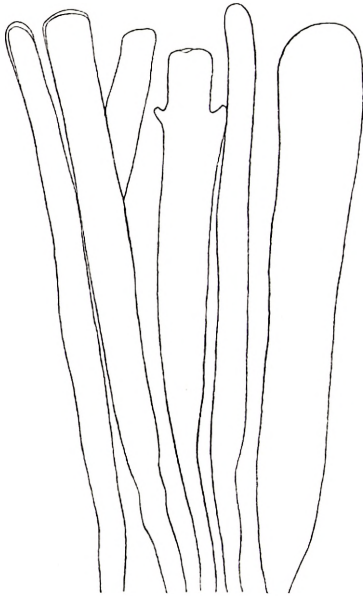


Fig. 38. *Codium difforme* Kütz.
Group of utricles from the same
plant. (About 200 : 1).

The utricles are much more easily separated than those of *C. adherens*. As to the shape of the utricles, these are in the present specimens from both localities long, cylindrical, generally about $60\ \mu$ thick, but in between these slender utricles, which are by far the most numerous, some thicker ones occur now and then whose diameter may reach a length of $140\ \mu$ (Fig. 38).

As this description shows, the utricles in both collections are in size and shape very like those of the typical *C. adherens*, being rarely thicker

than those found in typical specimens of this species according to the measurements given by SCHMIDT and not at all reaching the size of those found in normally developed specimens of *Codium difforme*.

The apices of the utricles are usually not thickened at all in the specimens found or at any rate very little.

In one of its places of growth, Playa de Santa Catalina at Las Palmas, it was found together with *C. adherens*.

Regarding its occurrence and appearance I have written in my diary: grows uppermost, has a rather smooth surface forming large, soft coverings upon the rocks; the colour of the thallus is light green, lighter than that of *C. adhaerens*.

This species occurs in exposed places about midway between high and low water mark.

Gran Canaria: Playa de Santa Catalina near Las Palmas; Bahía del Confital. It has not been found before in the islands.

Geogr. Distrib. Mediterranean Sea, West Indies, East Falkland, Kerguelen Islands etc.

Sectio II. Bursae De Toni.

3. *Codium Bursa* (L.) Ag.

AGARDH, Spec. Alg., vol. I, p. 457. SCHMIDT, l. c., p. 36.

Alcyonium Bursa L., Systema Naturæ, vol. I, pars II, p. 1295.

M^{lle} VICKERS found this species. As to its occurrence she writes: Trouvé dans une seule flaque profonde aux rochers de Confital". Further BORNET in "Les Algues de P.-K.-A. Schousboe", p. 215 mentions it as found at the shores of islands.

Gran Canaria: Bahía del Confital (M^{lle} VICKERS). Canary Islands (BOURGEAU).

Geogr. Distrib. West coast of Europe from Ireland southwards, Mediterranean Sea, Canary Islands.

Sectio III. Tomentosa De Toni.

4. *Codium tomentosum* (Huds.) Stackh.

STACKHOUSE, Nereis Britannica, 1795, p. 21, pl. VII.

OTTO CHR. SCHMIDT, Beitr. zur Kenntnis der Gattung *Codium*, Bibliotheca Botanica, Heft 91, 1923, p. 39.

Fucus tomentosus Huds., Flora Anglica, 1778, p. 584.

The specimens I have referred to this species are rather small; when dried they have all a light green colour in

contrast with the much darker colour of the specimens referred to *Codium elongatum*.

And further the thallus, which is about 2 mm. broad, is thus not only smaller, but also more slender than that of *Codium elongatum*, whose thallus in the narrow parts is about 4—5 mm. broad. Finally the specimens of this species are much more ramified than those of *Codium elongatum*.

The utricles were about 600—700 μ long and most commonly 120—160 μ broad; the thinnest utricles were about 70—100, the thickest up to 300 μ broad, thus agreeing with the dimensions given by SCHMIDT.

The plant occurred near low water mark in more sheltered places upon rocks. The specimens examined were sterile.

Gran Canaria: Playa de Santa Catalina, Bahía del Confital. Tenerife: Puerto Orotava (KRAUSE, ENGLER according to SCHMIDT who most kindly has sent me a specimen from this locality collected by ENGLER). MONTAGNE l. c. p. 182 writes about the occurrence of this species: "Ad littora Canariensia frequens, præsertim vero in portu Arrecifæ insulæ Lancerotæ cum coniocystio lectum." A preparation of MONTAGNE, belonging to the Muséum d'Histoire Naturelle, Paris, which I have been able to examine was *Codium elongatum*.

Geogr. Distrib. Seems to occur in most temperate and warm seas.

Sectio IV. *Elongata* De Toni.

5. *Codium elongatum* Ag.

C. AGARDH, Spec. Alg., vol. I, pars posterior, Lund 1822, p. 454.

Codium decortcatum (Woodw.) Howe, Phycological Studies V in Bull. Torr. Bot. Club, vol. 38, 1911, p. 494. OTTO CHR. SCHMIDT, Beitr. zur Kenntnis der Gattung *Codium* (Bibliot. Bot., Heft 91, p. 52).

Ulva decorticata Woodw.? Observations upon the Generic Character of *Ulva*, with Descriptions of some new Species (Transaction of the Linnean Society, vol. III, 1797, p. 55).

The specimens I have found of this species are all rather small; the largest are about 8—10 cm. high, but most of them are not much more than half this length.

They are all a good deal ramified, the ramification being irregularly subdichotomous or polytomous. The shape of the thallus is upon the whole rather variable; in most specimens it is compressed, in some more or less terete, but the characteristic broadened out, cuneate part of the thallus, found just below each ramification, is always compressed.

How the specimens differed in outer appearance from those of *Codium tomentosum* I have mentioned above in the description of this species.

Regarding the size of the utricles, these had a length of about 1000—1100 μ . Their breadth was mostly about 160—250 μ , but utricles reaching a breadth of about 460—500 μ were frequently interspersed; on the other hand quite slender ones reaching only a diameter of about 70 μ were also numerous (compare Fig. 39).

Thus the dimensions of the utricles did not reach nearly such high figures as those mentioned by SCHMIDT, but the utricles were on an average considerably larger than those found in the Canarian specimens of *C. tomentosum*.

Hairs were abundantly present in all specimens.

As the quotations above show, HOWE is of the opinion that this species is identical with WOODWARD's *Ulva decorticata* and he therefore uses this old name for the present species.

I shall willingly admit that much goes to show that WOODWARD's specimen really was this species; the comparison with *Himanthalia lorea* is not bad, and the fact that he points out in the diagnosis that the "rami", are

“ad dichotomiam compressi” suggests this species too, but otherwise his description is rather obscure and even differs from that of *Codium elongatum*. Thus the thallus is said to be “teres”, and it is stated that it is only ramified a few times;

and furthermore the apices of the branches are described as “attenuated”, which in this species is generally not the case, the ends of the branches, on the contrary, being often somewhat broader upwards; and finally the size of the plant is said to be “6 feet and 6 inches”.¹

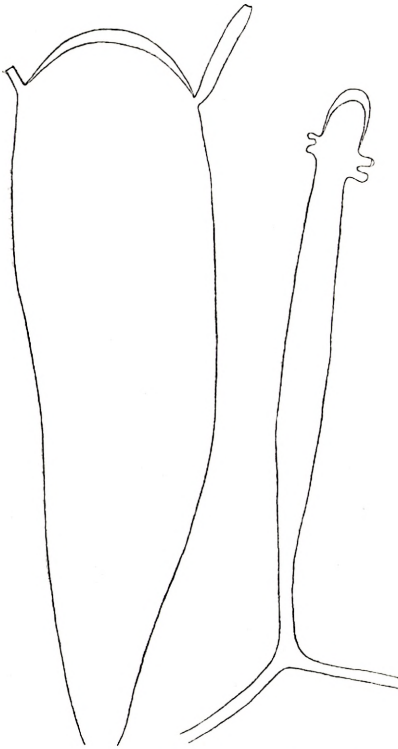


Fig. 39. *Codium elongatum* Ag.
Two utricles from the same plant.
(About : 1).

With the best intentions I cannot agree with HOWE in making use of WOODWARD'S name according to this description. In a case like this, when we have no original specimens to rely on, it seems to me that it must be required of a description, to enable us to restore an old name on the basis of it, that we really

may be sure that we have to do with the species in question. I do not think this is the case here.

And if WOODWARD'S plant really should be *C. elongatum*, a species which, as well known, reminds one so

¹ In SCHMIDT'S Monographie, p. 52, the plant is said to be “bis 60 cm. hoch”.

very much of *C. tomentosum* (Huds.), is it not strange that WOODWARD does not compare it with *Fucus tomentosus* Huds., a species he is well acquainted with, as, in a paper written by himself and GOODENOUGH in the same above quoted volume of "The Transactions of the Linnean Society", p. 195 he gives a description of this species? HOWE, too, has alluded to this peculiar fact.

It therefore seems to me that AGARDH was right when he proposed the new name *elongatum* for this species. That he quotes the doubtful species of WOODWARD is also quite correct; he ought only to have put a (?) after the quotation. When describing the "frons" as "compressa" AGARDH adds: "secundum WOODWARD cylindrica", thus pointing out one of the wrong characters in WOODWARD's description.

On account of this I therefore prefer to keep the name of AGARDH for this species.

Codium elongatum Ag. seems to be a rather common species on the shore of the islands. It occurs in somewhat sheltered places especially in pools about or somewhat above low water mark.

Teneriffe: Orotava. Gran Canaria: Las Palmas, Bahia del Confital, where it was also found by M^{lle} VICKERS.

When MONTAGNE in WEBB et BERTHELOT, l. c. p. 182, calls *Codium tomentosum* "frequens", one of his specimens is at any rate referable to *C. elongatum*. As mentioned above p. 94 I have been able to examine a preparation of MONTAGNE's the vesicles of which had the dimensions of *C. elongatum*.

Geogr. Distrib. Mediterranean, West Indies, Brazil.

Fam. 2. *Bryopsidaceæ*.

Bryopsis Lamouroux.

1. *Bryopsis plumosa* (Huds.) Ag.

C. AGARDH, Spec. Alg., vol. I, pars post., 1822, p. 448.

J. AGARDH, Till Algenes Systematik, VIII, Siphoneæ, p. 24.

A few specimens are found. They were growing epiphytically upon other algæ near low water mark in somewhat exposed places.

Teneriffe: Puerto Orotava, where fine specimens have also been gathered by SAUVAGEAU. Gran Canaria: Playa de Santa Catalina, here also found by Mlle VICKERS.

Geogr. Distrib. A widely spread plant in temperate and warm seas.

2. *Bryopsis cupressina* Lamour.

LAMOUREUX, Mém. sur trois nouv. genres de la fam. des Algues marines. (Extr. du Journ. de Bot., p. 23, tab. 1, fig. 3, a, b). BORNET, Algues de Schousboe, p. 214.

MONTAGNE in WEBB et BERTHELOT, l. c., p. 183, mentions this species as follows: "Unicum specimen e cæspitibus *Griffithsiæ arachnoideæ* extricavi". And regarding the locality of the last mentioned species it says p. 176: "In littore Canariæ insulæ invenit cl. DESPRÉAUX". Dr. HAMEL most kindly informs me that the specimen is not to be found any more in the collections of the Muséum d'Histoire Naturelle, Paris.

Geogr. Distrib. Mediterranean Sea.

3. *Bryopsis Balbisiana* Lamour.

LAMOUREUX, Essai ... Thalassiphytes, p. 66, pl. 13, fig. 2. BORNET, E., Algues de Schousboe, p. 213.

This species, of which LAMOUREUX (l. c.) only gives the name and a very bad figure, but no description, has been confused with *Derbesia Lamourouxii* (comp. f. i. J. AGARDH, Till Algernes Systematik, VIII, p. 21) and in DE-TONI, Sylloge Alg. vol. I, p. 424, is considered as nothing but a synonym of *Derbesia Lamourouxii*. In "Algues de Schousboe" BORNET on the other hand takes this

species up and quotes as synonym to this species *Bryopsis paniculata* Schousboe.

Of this plant we have in the Botanical Museum here a good many specimens in Herb. SCHOUSBOE, which I have now examined (comp. Fig. 40).

The plant forms large tufts which may reach a height of about 8 cm. From the basal part numerous vigorous erect branches arise. These are stem-like in the basal part, being here not ramified at all or very little. Higher up, usually rather near the upper end of the filaments, branches emerge. These are, like the mother branch, naked, that is, without ramuli in their basal part. Only near their summit are short ramuli developed, distichously arranged, and densely crowded, forming a small subpyramidal "leaf" at their top (Fig. 40).



Fig. 40. *Bryopsis Balbiana* Lamour. From a specimen collected by SCHOUSBOE at Marseille. (About 12:1).

The leaflike part is generally about 2—3 mm. long and about $1\frac{1}{2}$ mm. broad. The ramuli are directed upwards, longest a little above the base of the leaf, here about $1\frac{1}{2}$ mm. long and $40\ \mu$ broad.

The stem in the main branches is about $500\ \mu$ broad in dried specimens.

I have not myself collected this species but M^{lle} VICKERS mentions it in her list, p. 300. Concerning the specimens she has found she writes: "Les exemplaires peu développés que je rapporte à cette espèce ressemblent tout à fait à la forme qui est figurée dans les "Tabulæ phycologicae" (Vol. VI, tab. 78), de KÜTZING, sous le nom de *Br. penicillata*".

This figure (fig. *b*), showing the habit of the plant, also agrees very well with the specimens of SCHOUSBOE, but this is not the case with fig. *b'* in which the ramuli are given off round the rachis in all directions while in SCHOUSBOE's specimens the ramuli are arranged distichously as said above.

Perhaps a young, not very well developed, specimen of a *Bryopsis* collected by SAUVAGEAU at Orotava in January is referable to this species. The specimen has a vigorous main stem from which, somewhat above the middle, branches issue in all directions, bearing at their upper end short distichously arranged ramuli.

Gr. Canaria: "Dans les flaques à mi-maréé, Castillo.", (VICKERS). Teneriffe, Orotava (SAUVAGEAU). Without locality according to BORNET (HILLEBRAND).

Geogr. Distrib. Mediterranean Sea, Canary Islands.

4. *Bryopsis corymbosa* J. Ag.

J. AGARDH, Alg. mediterr., p. 21. CAMMERLOHER, Die Grünalgen der Adria, p. 50.

Bryopsis fastigiata Kütz., Phycologia germanica, p. 251; Spec. alg., p. 491; Tab Phycol., vol. VI, tab. 73. HAUCK, Meeresalgen, p. 473.

Bryopsis implexa De Notaris, Prosp. Fl. Ligustica, p. 73. BORNET, Algues de Schousboe, p. 213.

For more Synonyms see CAMMERLOHER.

The specimens found were growing in large, soft, dense tufts about 2 cm. high, upon vertical or somewhat sloping rocks, laid dry during ebb-tide.

The Canarian form seems to agree very well with the drawings of KÜTZING, vol. VI, tab. 73. The chief characteri-



Fig. 41. *Bryopsis corymbosa* J. Ag. Habit of a plant. (About 18:1).

istic of this species is the very irregular ramification (Fig. 41, 42), the ramuli in some places emerging rather densely and regularly distichously, in others much scattered, often with long intervals between them, and either unilaterally or all round the rachis.

From the basal end of the erect branches rhizoids are

commonly formed (Fig. 42), which grow downwards, becoming fastened to the rocks and at the same time giving rise to new erect shoots (Fig. 41). By this method of growth the tufts are steadily increased.

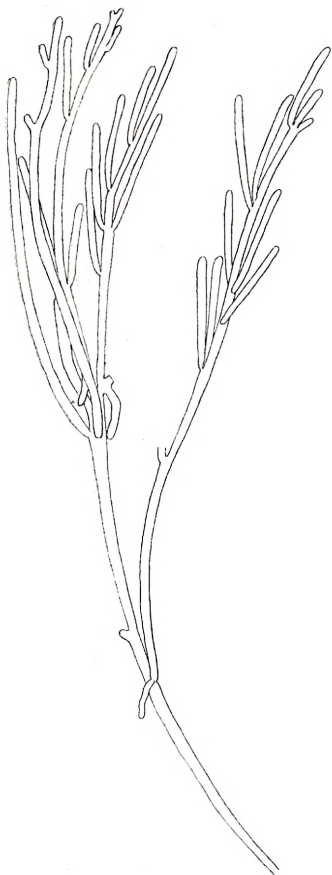


Fig. 42. *Bryopsis corymbosa* J. Ag. Erect filaments with rhizoids. (About 18:1).

The decumbent filaments and the more vigorous erect branches are about 125—250 μ thick, the ramuli about 50—90 μ .

The plant was found somewhat above low water mark generally in somewhat sheltered places.

Gran Canaria: South of Las Palmas.

Geogr. Distrib. Mediterranean Sea.

5. *Bryopsis ramulosa* Mont.

MONTAGNE in RAMON DE LA SAGRA, Hist. de Cuba, Paris 1838, p. 16, pl. III, fig. 2. KÜTZING, Spec. Alg., p. 491; Tab. Phycol., vol. VI, tab. 72, f. 2. J. AGARDH, Till Alpernes Systematik, VIII, p. 21.

Bryopsis plumosa var. *ramulosa* Harv., Nereis Bor.-Am. III, p. 31, tab. 45 A, fig. 4—6.

According to PICCONE (l. c., p. 53) this species has been col-

lected at the Islands by LIEBETRUTH.

Teneriffe (LIEBETRUTH).

Geogr. Distrib. West Indies, Florida, West coast of Africa.

6. *Bryopsis hypnoides* Lamouroux.

LAMOUREUX, I. V., Mémoire sur trois nouv. genres de la famille des Algues marines (Extr. du Journ. de Botanique, 1809, p. 33, tab. 1, fig. 2 a, b). J. AGARDH, Till Algernes Systematik, VIII, Siphoneæ, p. 27).

In my collection some few small, but well developed specimens are found epiphytic upon *Halopteris* and *Galaxaura*.

In the collection of SAUVAGEAU one dried specimen most probably belongs to this species. It had the pale green colour often found in *Bryopsis hypnoides* and the pinnules were also arranged all round the main axis.

The specimens occurred on rocks near low water mark in somewhat exposed places.

Teneriffe: Orotava (SAUVAGEAU); Gran Canaria: Playa de Santa Catalina and Bahia del Confital, where it also was collected by M^{lle} VICKERS.

Geogr. Distrib. Mediterranean Sea, Canary Islands, warmer Atlantic coasts of Europe and America, Pacific coast of America.

Pseudobryopsis Berth.

1. *Pseudobryopsis myura* (J. Ag.) Berth.

BERTHOLD in OLTMANN'S, Morphologie und Biologie der Algen, 1ster Bd., 1904, p. 303, fig. 190, 2.

Bryopsis myura J. Ag., Algæ Mediterr., 1842, p. 20; Till Algernes Systematik, VIII, Siphoneæ, p. 28.

Regarding this species BERTHOLD writes in his treatise "Über die Vertheilung der Algen im Golf von Neapel", p. 498: "Diese Pflanze ist durchaus verschieden von *Br. muscosa*, überhaupt ganz von *Bryopsis* zu trennen, da sie an der Basis ihrer Fiedern besondere seitliche Gametangien bildet, welche denen von *Codium* nahe stehen". In OLTMANN'S "Morphologie", as above quoted, BERTHOLD established the new genus *Pseudobryopsis* in accordance with this.

The plant was found abundantly near lowest water mark in low-lying depressions in the rocks which are filled with water during ebb-tide. It forms rather large, dense tufts. Like *Bryopsis* these tufts originate from rhizome-like creeping, irregularly ramified, basal filaments now and then sending up erect shoots, and downwards much ramified rhizoids. The erect shoots are clavate-cylindrical of shape and when they have reached a length of about 1—2 cm., the ramuli begin to be developed.

In the Canarian plant the largest specimens found were about 5 cm. high. The lowermost part about 1 cm. long is bare, else the erect shoots are densely covered by ramuli all round.

The ramuli are clavate-cylindrical. Their base is broadly rounded, the diameter of the ramulus may here reach a length of about 100 μ . Upwards the ramuli taper gradually to about 25—30 μ . Their summits are obtuse.

As pointed out by BERTHOLD the ramuli are separated by a wall from the central stem.

The gametangia are formed upon the ramuli, mostly only a few, 1—2, and on their upper side. But often more are formed, and they may then occur nearly all round the ramuli.

The gametangia are ovate of shape, the largest I have found were about 50 μ long and 30 μ broad.

The plant was growing in a somewhat exposed place.

Gran Canaria: On rocks at the shore between Puerto de la Luz and Las Palmas.

Geogr. Distrib. Mediterranean Sea.

Fam. 3. Derbesiaceæ.

Derbesia Solier.

1. Derbesia neglecta Berth.

BERTHOLD, G., Zur Kenntnis der Siphoneen und Bargiaceen
(Mitt. aus d. Zoologischen Station zu Neapel, II Bd., Heft 1, p. 77).

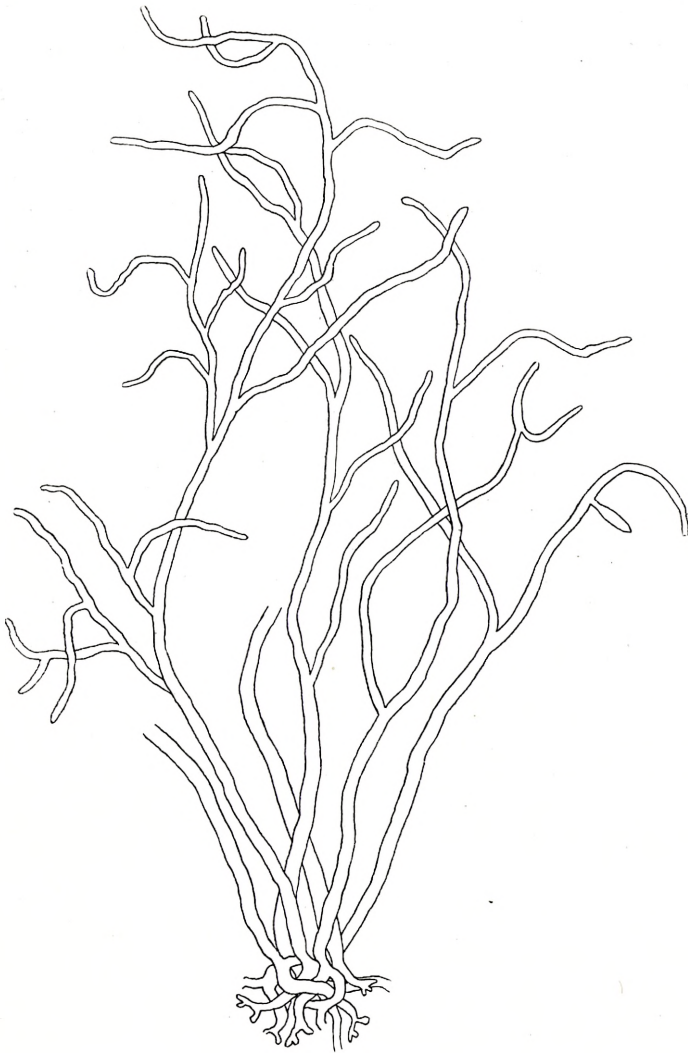


Fig. 43. *Derbesia neglecta* Berth. Small part of a tuft showing habit of plant. (About 25:1).

A small tuft is once found growing epiphytically upon *Hypnea musciformis*.

The base of the plant (Fig. 43) is composed of filaments irregularly narrowed and felted together from which rhizoids grow downwards and erect filaments upwards.

The erect filaments have thin walls; they are commonly about 40—50 μ thick, but thicker and thinner ones occur, just as the same filament is often thicker in one part and thinner in other. As a rule the filaments taper slowly upwards.

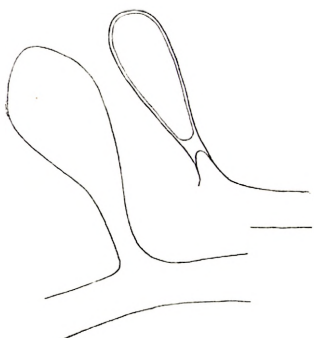


Fig. 44. *Derbesia neglecta* Berth. Two zoosporangia, the one yet in open connection with the mother filament. (About 125:1).

The ramification is very irregular, sometimes more or less dichotomous, but mostly scattered without any order. The uppermost ends of the filaments are recurved. These are only about 20 μ thick.

The end of the branches are obtuse.

At the ramifications the filaments are sometimes a little narrowed but mostly not. As a rule no walls are found in the thallus. The few walls I have seen occurred without any order and are surely to be referred to damage of the thallus. On the other hand the filaments have often narrowings by means of which the communication between the different parts of the filament is much restricted or quite closed.

In the specimen found a few not quite ripe sporangia were present.

As described by BERTHOLD the sporangia originate from short branchlets. These become pear-shaped. They are at first in open connection with the mother filament, later on

they are separated from it by means of a cellulose stopper in the neck-shaped base.

The sporangia are about $230\ \mu$ long and $80\ \mu$ broad (Fig. 44).

The plant was found in a very exposed place in a pool at low tide.

Teneriffe, Puerto Orotava.

Geogr. Distrib. Mediterranean Sea.

2. *Derbesia tenuissima* (De Not.) Crouan.

CROUAN, Florule du Finistère, p. 133. J. AGARDH, Till Algeries Systematik, VIII, p. 33.

Bryopsis tenuissima De-Not. in MORIS et DE-NOTARIS, Florula Caprariæ, 1840, p. 203, pl. 6, fig. 3, according to DE TONI.

Derbesia marina Solier in Ann. sc. nat., Bot., III sér., t. 7, p. 158, tab. 9, fig. 1—17, non LYNGBYE.

In his paper "*Derbesia marina* från Norges Nordkust" (Bihang till K. Svenska Vet.-Akad. Handlingar, Bd. 23, Afd. III, no. 5, Stockholm 1897), KJELLMAN has fully explained that SOLIER made a mistake in referring the present plant to LYNGBYE's *Vaucheria marina*, which had previously caused a good deal of confusion. KJELLMAN here points out the differences which are to be found between the species of LYNGBYE and the SOLIER's plant now referred to *D. tenuissima*. The ramification is different, *Derbesia marina* being a much more ramified plant, while in *Derbesia tenuissima* the ramification is not so much developed, many of the erect filaments being not at all ramified, while some are subdichotomously branched, or the ramification becomes more irregular as several branches are sometimes given off rather near each other. The ramification may take its rise from near the base of the filaments, but often it does not occur until higher up. Furthermore the cellulose-stop-

per found near the base of the branches of *D. marina* is not present in *D. tenuissima*. And finally according to KJELLMAN the number of zoospores is different in both spe-

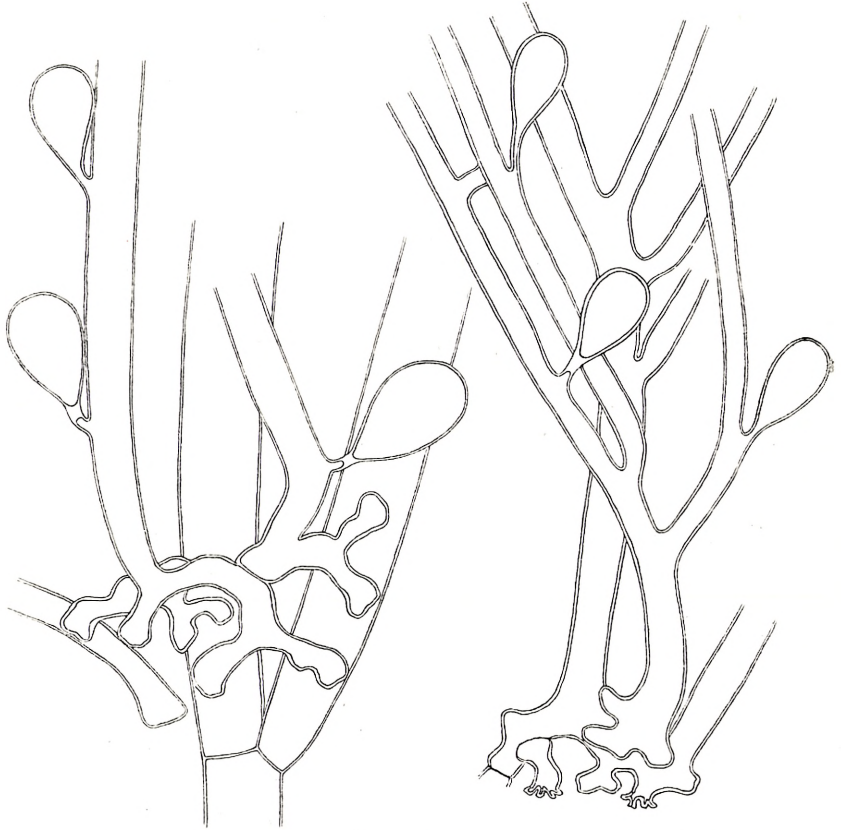


Fig. 45. *Derbesia tenuissima* (De Not.) Crouan. Basal part of two plants, with sporangia; a, growing upon *Cladophora*. (About 80:1).

cies. On the other hand it is not correct when KJELLMAN says that the zoosporangia in *D. tenuissima* should have no neck. In the Canarian plant at any rate the sporangia have rather a long neck, including the cellulose stopper, a length of about 35—50 μ .

The base of the plant (Fig. 45) consists of creeping

rhizomes, often arch-shaped, from which the erect filaments arise.

The diameter of the erect filaments is about $40\ \mu$. The chromatophores are spindle-shaped and contain a pyrenoid.

The sporangia are of variable shape, pear-shaped, obovate, often nearly globular. Their diameter is about $80\ \mu$ long, their length about $120\ \mu$.

In SAUVAGEAU'S collection several specimens are present. Most of them are epiphytic upon *Gelidium*, collected on the 24. Dec. and 4. Jan.: they are all sterile. Furthermore some specimens epiphytic upon *Cystosira* are found. Concerning the first mentioned, SAUVAGEAU has written upon the specimen: "n'est peut-être pas le même que celui qui vit sur le *Cystosira*, car il croît à un niveau inférieur". I have now examined these specimens and so far as I can see from the dried material, it seems to me to be *Derbesia tenuissima*.

This species was found as an epiphyte upon various algæ, for instance *Codium*, *Stypocaulon*, *Cladophora prolifera*, *Gelidium* etc.

It occurs in exposed and more sheltered places near or somewhat above low water mark.

Teneriffe: Orotava (SAUVAGEAU, l); Gran Canaria: Playa de Santa Catalina in various places.

Geogr. Distrib. Mediterranean Sea and adjacent parts of the Atlantic Ocean.

Fam. 4. Caulerpaceæ.

Caulerpa Lamouroux.

1. Caulerpa Webbiana Mont.

MONTAGNE, C., De l'organisation et du mode de reproduction des Caulerpes, et en particulier du *Caulerpa Webbiana*, espèce

nouvelle des îles Canaries. (Ann. des sciences nat., 2. ser., t. 9, bot., Paris 1838) et in Webb et Berthelot, Iles Canaries, t. 3, part. 2, sectio III, p. 178. WEBER VAN BOSSE, A., Monographie, p. 269.

This plant was originally described from material obtained in the Canary Islands.

It occurs in hollows in the rocks, which are filled with water during ebb-tide. In more exposed localities it may also grow somewhat above the level of the sea at low tide, in places where it is constantly watered by the spray.

The colour of the living plant is light green, somewhat phosphorescent.

It has a creeping rhizome from which numerous, thin, subdichotomously ramified rhizoids issue from the lower side; from the upper side the densely placed assimilators grow up.

Rhythmical growth occurred now and then, but it was not so markedly developed as in plants I found in the West Indies (l. c., p. 125, fig. 99).

Most of the specimens collected belong to the forma *typica*. But now and then, mixed in among the typical form with pinnules arranged verticillately, assimilators with distichously placed pinnules were found; pure growth of the last mentioned form (f. *disticha* Weber van Bosse) was not gathered.

Teneriffe: Orotava; where it was also collected by SAUVAGEAU. Gr. Canaria: Las Palmas, Bahia del Confital; found also by M^{lle} VICKERS in both places. LANZAROTE: Arrecife (WEBB).

Geogr. Distrib. Seems to occur in all warmer seas: West Indies, Pernambuco, Canary Islands, Red Sea, Japan, Friendly Islands etc.

2. *Caulerpa crassifolia* (Ag.) J. Ag.

J. AGARDH, Till Agernes Systematik I, p. 13.

HOWE, Phycological Studies II, p. 574. BØRGESEN, F., An ecological and systematic account of the Caulerpas of the Danish W. Indies, p. 362.

Caulerpa pinnata (L.) Weber van Bosse, Monographie, p. 289.

Forma *typica* (Weber van Bosse) Børgs.

The specimens I have collected of this species at the shores of the Canary Islands are all small (Fig. 46). In the largest specimens the assimilators are scarcely $1\frac{1}{2}$ cm. high.

The thallus is thick and firm in contrast to the very thin one of the West Indian plants.

On account of its small size, the assimilators have rarely more than 5—6 pairs of pinnules. These are proportionally broad and sometimes a little narrowed at their base. Thus reminding one of *f. mexicana*.

While in the West Indies it occurs in sheltered places, I have found this plant in the Canary Islands in the most exposed places where the Atlantic rollers constantly broke over the reefs, the small and robust thallus of the Canarian plant being merely an adaptation to its growing place. It creeps here immersed in the dense covering of *Melobesiaceæ* and other algæ upon the rocks.

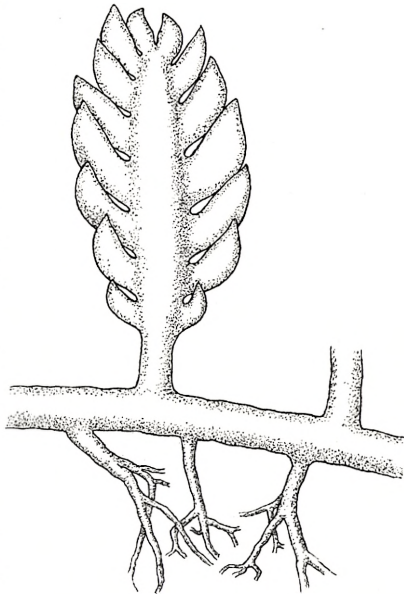


Fig. 46. *Caulerpa crassifolia* (Ag.)
J. Ag. Part of the thallus.
(About 4 : 1).

Gran Canaria: Bahia del Confital, where it is also found by M^{lle} VICKERS, who furthermore found it at Las Palmas and Castillo. LIEBETRUTH (without locality).

Geogr. Distrib. Seems to occur in most warm seas.

3. *Caulerpa prolifera* (Forsk.) Lamx.

LAMOUREUX, Mémoire sur les Caulerpes, p. 30. J. AGARDH, Till Algernes Systematik, I, p. 11. WEBER VON BOSSE, Monographie, p. 278.

Fucus prolifer Forsk., Fl. ægypt-arab., p. 193.

The specimens found belong to a proportionally narrow-leaved form reminding one somewhat of the forma *zosterifolia* I have described in my West Indian treatise (p. 27, fig. 101). The Canarian is distinguished from the West Indian form by having less interrupted leaves and not so many proliferations.

The leaves are about 8 cm. long and $\frac{1}{2}$ — $\frac{3}{4}$ cm. broad; the terete stem was usually longer than that in the West Indian form, often reaching a length of about 3 cm.

The plant occurred upon soft, muddy bottom in a sheltered bay behind a reef and was growing here in abundance together with seagrasses (*Cymodocea nodosa*) and masses of *Gracilaria* and *Spyridia*, thus the common association of algæ in similar localities.

Gran Canaria: Bahia del Confital where it was also found by M^{lle} VICKERS. LANZAROTE: Arrecife (PICCONE, MONTAGNE).

Geogr. Distrib. Mediterranean Sea and adjacent part of the Atlantic Ocean, Canary Islands, West Indies.

4. *Caulerpa peltata* Lamour.

LAMOUREUX in Journ. de Bot., 1809, p. 145, tab. 3, fig. 2 (Extrait, p. 33). Weber von Bosse, Monographie des Caulerpes, p. 373.

J. AGARDH, Till Alg. Systematik, I, Caulerpa, p. 37. SVEDELIUS, Ceylon species of Caulerpa, p. 131.

Caulerpa peltata forms dense tufts upon rocks; it prefers growing upon perpendicular walls, often more or less covered or shaded by projecting rocks. Its shining, phosphorating, rusty green to yellowish green thallus forms a

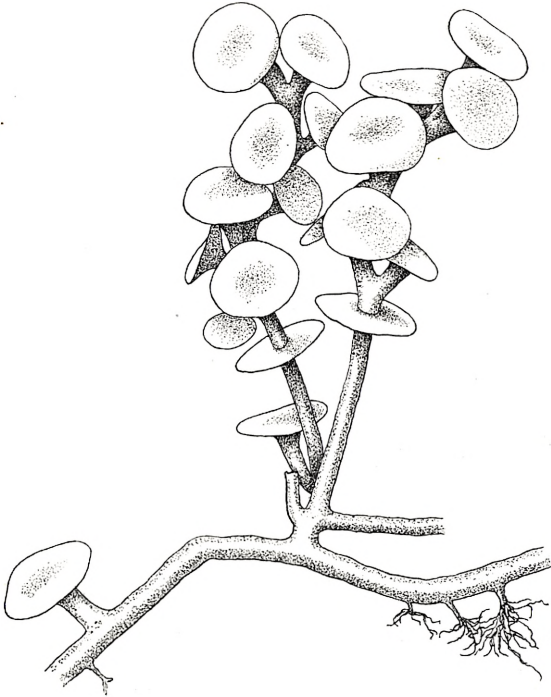


Fig. 47. *Caulerpa peltata* Lamour. Typical form. (About 4:1).

great contrast there to the otherwise mostly dark red-brown vegetation.

The shape of the thallus is highly variable.

Fig. 47 shows a part of a typical specimen. The disc-shaped branchlets are quite flat above. In most of the specimens their diameter is about 3 mm. but in vigorous plants it may reach a length of up to 5 mm. The branchlets are placed up along the main axis, turning the flat

discs obliquely upwards in all directions in accordance with SVEDELIUS' remarks, l. c. p. 131.

A peculiarity was present in the plant figured, namely that the two assimilators there shown have originated from perfoliation of branchlets, the original discs of these being found like a ring somewhat above their base.

In other specimens the shape of the branchlets was not so markedly peltate (compare Fig. 48 *a, b*). The upper

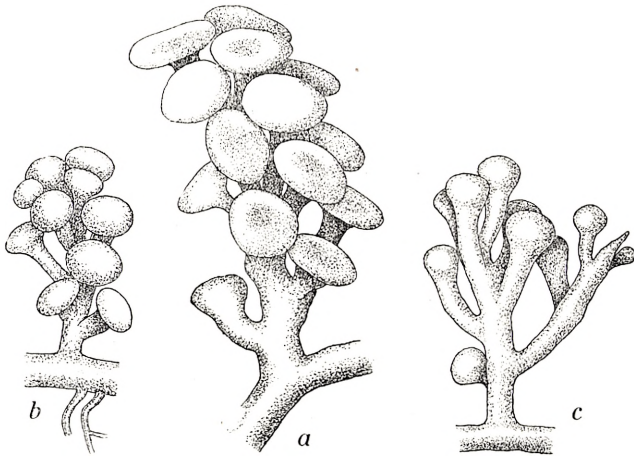


Fig. 48. *Caulerpa peltata* Lamour. Transitional forms to *Caulerpa racemosa*. (About 4:1).

surface of the branchlets in these plants was not flat but often somewhat convex and the stipe was broadly conical making a rather even transition to the disc. When this smaller development of the disc is carried further on, forms are found which approach very much such as belong to *Caulerpa racemosa*, especially the var. *Chemnitzia* (Fig. 48 *c*). If now a form like that figured in Fig. 48 *c* had occurred in pure growth, I would not have hesitated to refer it to *Caulerpa racemosa*. But all the tufts I have seen had branchlets of more or less varying shape making even

transitions from those of *Caulerpa racemosa* to var. *Chemnitzia* and further to *Caulerpa peltata*. Pure tufts were found only of the latter form, for which reason I refer the different forms found to this "species", this, in the Canary Islands, being, as it seems, the prevailing form of the highly varying, polymorph species: *Caulerpa racemosa*.

SVEDELIUS (l. c.) mentions and pictures similar transitional forms, compare f. i. his figures 29, 30 and 33 and M^d^{me} WEBER VAN BOSSE considers *Caulerpa peltata* as a "sous-espèce" only of *C. racemosa*.

On account of this great variability often found even in the same tuft I am inclined to mean that the *Caulerpa clavifera* mentioned by MONTAGNE, l. c., p. 178 is nothing but a form of this plant so variable in the Canary Islands.

And the same is the case with the plant which PICCONE, l. c., p. 19, calls *Caulerpa Chemnitzia*. Through the kindness of Dr. ACHILLE FORTI in Verona I have received a specimen of this plant. Having now examined this specimen I have arrived at the conclusion that it is very like my specimens; in PICCONE's specimen most of the branchlets rather approach in shape those of *Chemnitzia*, but several of the branchlets have such flat discs that they are like those of *peltata*.

At the shores of the Canary Islands this species grows somewhat below low water mark in not too exposed places or when it occurs at a higher level, it is found in pools filled with water during ebb-tide. In exposed localities on the other hand it is able to grow up to about high water mark. In such localities it grows felted in between other tuft-like algæ getting shelter in that way.

Gran Canaria: Upon reefs south of Las Palmas; Bahia del Confital; Playa de las Canteras (M^{lle} VICKERS), without locality (DESPRÉAUX according to WEBB et BERTHELOT, LIEBETRUTH). LANZA-

ROTE: Arrecife (PICCONE, WEBB et BERTHELOT according to MONTAGNE). Teneriffe, in promontorio Nuestra Senora de la Luz. (DESPRÉAUX).

Geogr. Distrib. Canary Islands, West Indies, Pacific and Indian Ocean.

Ostreobium Born. et Flah.

Ostreobium Queketti Bornet et Flahault.

BORNET, E. et CH. FLAHAULT, Sur quelques plantes vivant dans le test calcaire des Mollusques (Bull. Soc. Bot. Fr., vol. 36, 1889, p. CXLXI, pl. IX, fig. 5—8).

Found in shells. Is most probably common.

Gran Canaria. Bahia del Confital.

Geogr. Distrib. Europe, North America, West Indies, Easter Island etc. most likely cosmopolitan.

Just as the proofsheets in which *Microdictyon* is treated had come from the printer, I received from Professor SETCHELL a paper: "Notes on *Microdictyon*"¹ which touches on my remarks concerning representatives of this genus, and that is the reason why I wish to offer a few remarks here.

From this paper it is evident that the well-known American algologist is going to undertake the troublesome task of trying to put in order the confusion prevailing in this genus regarding the definition of species and synonymy. Prof. SETCHELL proposes several new species based partly upon forms which have been referred to the first described species *M. umbilicatum* (Velley) (compare my remarks above pp. 27—31), or have remained undescribed, or are wrongly referred to other species. Thus Prof. SETCHELL is also of opinion that the plant which I have found in the formerly Danish West Indies and referred to *Microdictyon umbilicatum* or, *Microdictyon Agardhianum*² as I call the plant

¹ SETCHELL, ALBERT WILLIAM, Notes on *Microdictyon* (University of California Publications in Botany, vol. 13, no. 3, issued Sept. 28, 1925).

² Prof. SETCHELL calls the plant from Cadiz *Microdictyon tenuius* (= *Hydrodictyon umbilicatum*, var. *tenuius* C. Ag.) the name DECAISNE

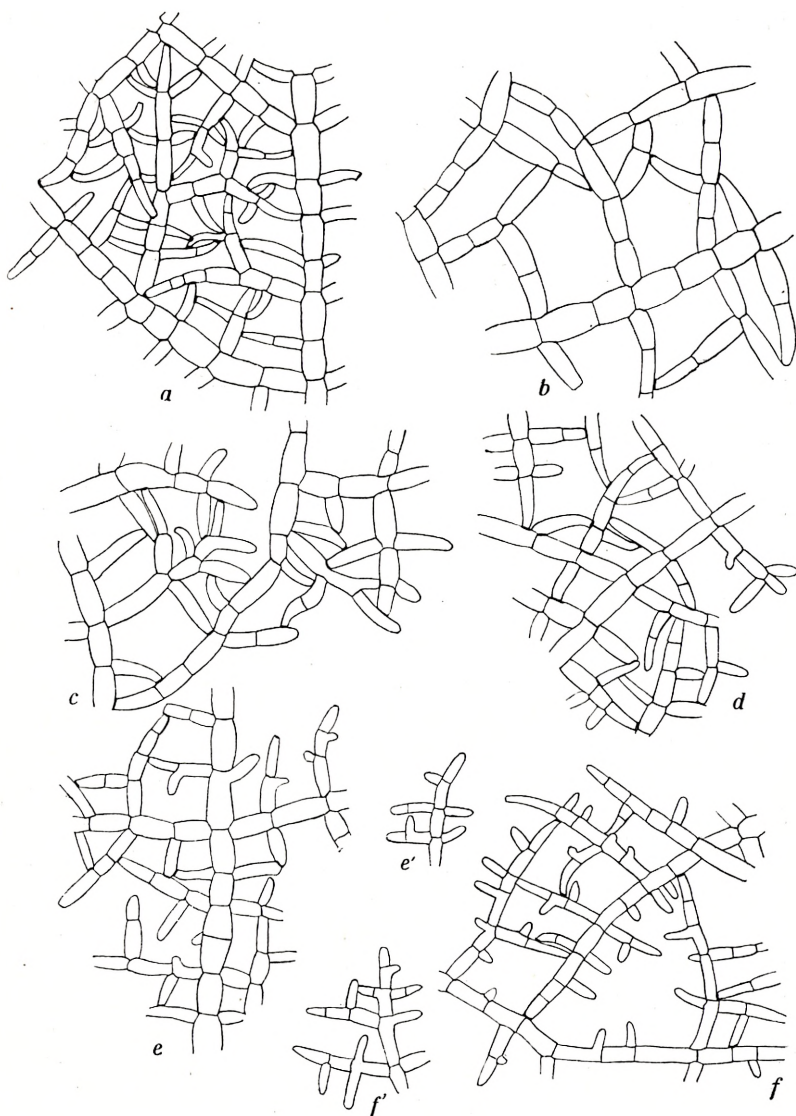


Fig. 49. *Microdictyon Agardhianum* Decsne. Parts of the thallus of forms from various localities. *a*, from St. Thomas gathered at a depth of about 20 fathoms. *b*, *c*, from Syrtis major at a depth of about 25 fathoms. *d*, from Lanzarote, Canary Islands. *e*, *e'* from the sound between St. Thomas and St. Jan off Christiansfort gathered at a depth of about 20 fathoms; *e'* part of the edge of the thallus. *f*, *f'* from Cadiz, growing in shallow water in a sheltered bay among seagrasses.

(All the figures about 20 : 1).

in this paper, cannot be considered as this plant but must be considered as the representative of a new species.

According to Prof. SETCHELL the West Indian plant "differs" (from the European-Mediterranean one) "particularly in less regular frond, finer mesh, uniformly shorter ultimate cells, and slightly broader primary filaments".

When I referred the West Indian plant to the European-Mediterranean form, I based my comparison chiefly upon material I had collected at Cadiz, and from this comparison I came to the result that even if some minor differences were present, it would be most correct not to separate specifically the European and the West Indian plants. In my paper ("Marine Alg. D. W. I.", vol. I, p. 26) I write: "both forms seem to agree very well, the Cadiz plants being somewhat more loosely and openly built (f. *tenuis*¹ of C. AGARDH l. c.), most probably due to the condition of life, growing as they did in a sheltered bay among sea-grasses, whilst the West Indian form, though found in deep water, was growing in localities where strong currents prevail".

Since then Prof. OSTENFELD has, during the Danish Oceanographical Expeditions 1908—10 to the Mediterranean and adjacent Seas², collected fine material in the Syrtis major which I have now compared with my material, and I have also been able to examine a specimen from the Canary Islands which Dr. ACHILLE FORTI has most kindly sent me. In the accompanying figure (Fig. 49) I have drawn parts of the thallus of plants from the West Indies, from Cadiz, Syrtis major and the Canary Islands.

The characters of distinction between the West Indian and the European plants pointed out by Professor SETCHELL are, first, that the frond is less regular and has finer meshes in the West Indian plant. In the material I have at my disposal I readily admit that the meshes of the European-Mediterranean plant are sometimes a little larger and more regularly rectangular than in the West Indian plant. This is due to the fact that in the old world

in "Plantes de l'Arabie Heureuse", p. 117, proposed for the plant in case his supposition regarding the identity of the plant from the Red Sea and of AGARDH's plant was not right.

¹ should be *tenuius*!

² Report on the Danish Oceanographical Expeditions 1908—1910 to the Mediterranean and adjacent Seas, vol. II K. 3 edited by JOHNS. SCHMIDT; Algæ by HENNING E. PETERSEN, 1918.

plant the branches issue at nearly right angles from the main filaments, while in the West Indian form the branches are often directed a little upwards. But deviations from this fact are found both in the material from the West Indies as well as in that from the European-Mediterranean Seas. Thus part of the thallus of a plant from St. Jan (Fig. 49 *e*), shows a very regular frond, while on the other hand part of a plant from the Syrtis major (Fig. 49 *c*) is quite as irregular as that drawn from a plant from St. Thomas (Fig. 49 *a*).

In the following characters mentioned by Prof. SETCHELL namely: "uniformly shorter ultimate cells, and slightly broader primary filaments" I cannot find any differences whatever. Fig. 49 *e'* and *f'* shows two pieces of the thallus from St. Jan and from Cadiz respectively and according to my view they quite agree.

And in the size of the primary filaments which according to the key in Prof. SETCHELL'S paper are said to come up to a breadth of about 200μ in the West Indian plant, while those in the European plant are said only to reach a diameter of 120μ , I have found no differences at all. In my West Indian material in specimens from St. Thomas I have found the thickest filaments to be up to 161μ only, and in those from St. Jan up to 172μ . On the other hand, in material as well from Cadiz as from Syrtis major, I have found cells in the veins reaching a breadth of 184μ . These characters therefore cannot be used, the differences found being no doubt referable to different external conditions of life (shallow water or deep sea, strong light or shadow, exposed places or sheltered ones etc.) which, as is well known, greatly influences the development of the thallus of algæ.

While both plants agree perfectly as to the characteristic cruciate ramification and size, there remains only the character of the slightly more regularly quadrangular meshes sometimes found in the European plant, a difference which is not always present however. Whether one finds it suitable to separate the two forms specifically on the basis of this character is a matter of taste, at any rate it is against my conception of species.

The small piece of a *Microdictyon* which I have found in Professor SKOTTSBERG'S collection of algæ from Easter Island¹

¹ The Natural History of Juan Fernandez and Easter Island edited by Dr. CARL SKOTTSBERG. Vol. II, 9, Marine Algæ from Easter Island by F. BØRGESEN. Upsala. Febr. 1924.

and called *M. umbilicatum* is most probably referable to VELLEJ'S plant, or at any rate nearly related to it. The plant has very small meshes, rather short cells, and the diameter of the cells in the veins mostly reaches a breadth of about $180\ \mu$. The material is too scanty to base any definite determination on and I regret that I have not left the plant unnamed.

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together with more essential synonyms, the last mentioned printed in Italics.

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