Det Kgl. Danske Videnskabernes Selskab.
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MARINE ALGÆ FROM THE CANARY ISLANDS

ESPECIALLY FROM TENERIFFE AND GRAN CANARIA

III. RHODOPHYCEÆ

PART III

CERAMIALES

BY

F. BØRGESEN

KØBENHAVN

HOVEDKOMMISSIONÆR: ANDR. FRED. HØST & SØN, KGL. HOF-BOGHANDEI

BIANCO LUNOS BOGTRYKKERI A/S

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The present paper, the last part of the Canarian Algæ which I intend to work out, since I hope a specialist will subsequently treat the *Cyanophyceæ*, comprises the last part of the *Rhodophyceæ*, viz. the *Ceramiales*.

In the introduction to the first part I have given a short account of my journey 1920—21 to the Canary Islands so I need not come back to it now.

There I have also mentioned the essential works which have contributed to increase our knowledge of the Canarian Algæ. Here I shall only add that a few species are mentioned in the work of BORY DE ST.-VINCENT, "Essais sur les Isles Fortunées", Paris an XI, 1803 and in a small note by L. GAIN et ROBERT MIRANDE, "Note sur les Algues recueuillies par M. L. GARRETA aux Îles Salvages et Canaries", published in "Bulletin du Muséum d'Histoire naturelle", 1912, no. 7.

In the previously published parts of this work I have several times pointed out the comparatively large and remarkable likeness between the algal flora of the Canary Islands and that of the West Indies. Of course this does not mean that the much more distant algal flora of the American side of the ocean and that of the Canary Islands should have more species in common than that of the Canary Islands and the European-African coasts. This is by no means the case.

Of the total number of Canarian Algæ mentioned in this work, altogether 326 species, 254 species (78 %) or a little more than three-fourths are also found at the shores of Europe and Africa or in the Mediterranean Sea, while 164 Canarian species (50 %) or only half the number also occur on the American side of the ocean. But even the fact that half of the Canarian Algæ are common to the algal flora of the far off American side of the ocean is in itself very important.

If we consider the separate main groups of marine Algæ of the Canary Islands, we find that the *Chlorophyceæ* are represented by 69 species of which 52 or 75 % are also found at the shores of the European-African side of the ocean and 48 or 70 % upon the American side. Of the 55 species of Canarian *Phæophyceæ* respectively 47 or 85 % are found at the African-European coasts, while 26 or 47 % are met with at the shores of America. And finally, of the 202 Canarian species of *Rhodophyceæ* 155 or 76 % are common to the algal flora of the European-African side of the ocean, while 90 species or 44 % are common to that of the American side. From this it will be seen that the *Chlorophyceæ* show the greatest likeness to the American flora, the *Rhodophyceæ* the least.

But whether or not this likeness may be called great at any rate a long series of species known from the West Indies are common too in the Canary Islands, and it is just the discovery of these species, which seem to have their eastern limit of distribution at the Canary Islands, that has given rise to my above-mentioned observation.

These West Indian species are the following: *Cladophoropsis membranacea, Chætomorpa media, Cladophora fascicularis, Struvea ramosa, Siphonocladus tropicus, Ernodesmis verticil-*

lata, Cymopolia barbata (found also at Cadiz), *Caulerpa Webbiana, Ectocarpus rhodochortonoides, Ectocarpus Rallsiæ, Sporochnus Bolleanus, Padina Vickersiæ, Aglaozonia canariensis, Sargassum Desfontainesii, Acrochætium crassipes, Acrochætium gracile, Acrochætium occidentale, Galaxaura flagelliformis* (found at Morocco), *Galaxaura cylindrica, Galaxaura obtusata* (found at Lisboa), *Lithophyllum accretum, Lithophyllum absimile, Lithophyllum cariboeum, Porolithon onkodes, Jania pumila, Phyllophora gelidioides, Rhabdonia decumbens, Wurdemannia setacea, Coelarthrum Albertisii, Cottoniella filamentosa, Spermothamnion speluncarum, Spermothamnion gorgoneum, Plumaria bipennata, Antithamnion Antillanum, Dipterosiphonia dendritica, Lophocladia trichoclados.*

As is evident from this list, these are all West Indian species, many of them even species characteristic of this region, and the occurrence at the Canary Islands of such a great number of West Indian species seems to be rather striking and, as already mentioned in the introduction to the *Chlorophyceæ*, 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.[1] Now it must of course not be left out of consideration that the algal flora of the very near-by African coast is very little

[1] As regards the land-vegetation, in which also a not inconsiderable American flora-element is present, ENGLER has not only with regard to the Canary Islands, but with respect to the whole flora of Africa, treated this question in an interesting paper: "Über floristische Verwandtschaft zwischen dem tropischen Afrika und Amerika, sowie über die Annahme eines versunkenen brasilianisch-äthiopischen Continents". (Sitzungsberichte der königl. preuss. Akademie der Wissenschaften, 1905, VI.). After having discussed the various contingencies of immigration ENGLER says at last: "Für mich kam es zunächst darauf an, zu zeigen, dass die neotropische und paläotropische Flora sich in Afrika und in Amerika trotz des jetz die beiden Erdtheile trennenden Oceans stark berühren".

known, or more correctly stated, quite unknown, and some of the species in question may possibly be found there. But even if this should be the case, and the boundaries of these species should be moved a short distance farther east, this does not interfere with the interesting fact that a number of characteristic West Indian species are also met with on the opposite side of the Atlantic Ocean. That any of these species might occur at the shores of the well-explored Mediterranean Sea does not seem very probable.

Finally I should like to point out that the present work must only be considered as a contribution to the knowledge of the algal flora of the Canary Islands. Personally I have only investigated some stretches of the coasts of Teneriffe and Gran Canaria, besides coasts which for the greater part have previously been examined by Professor SAUVAGEAU and the late M^lle^ VICKERS. But there is no doubt that a more thorough investigation of the western islands, especially Palma and Hiero, as well as the eastern Lanzarote and Fuertaventura, will considerably increase the number of species of the Islands, and on this account too I am of opinion that comparisons of the present material can only be considered temporary[1].

[1] After the above had already been prepared for the press I received from M^me^ LEMOINE an interesting note "Les Algues calcaires (Mélobésiées) des Canaries—Leurs affinités". (Assoc. franç. pour l'av. des sciences, 1928, p. 658—662, paru fin de Déc. 1929) about the geographical distribution of the Canarian *Melobesieæ* to which I direct attention. Here I only want to note the fact that M^me^ LEMOINE points out that to her list of 29 species of Canarian *Melobesieæ* published in the 4^th^ part of this work yet another species, namely *Archælithothamnium africanum* Fosl., which is mentioned in Professor SAUVAGEAU's list of Canarian Algæ, must be added. The complete number of *Melobesieæ* known from the Canary Islands thus amounts to 30 species.

Finally I wish to thank all who have in different ways helped me in the composition of this work.

To the Military Governor of the Canary Islands His Excellency General MONTE VERDE and to Colonel JESUS FERRER GIMENO I desire to express my sincerest thanks for the permission to explore the Isleta which is under the care of the military authorities and therefore closed to foreigners.

For great assistance in permitting me to examine specimens from the herbaria of earlier investigators I have first of all to thank Professor LOUIS MANGIN, Director of Muséum National d'Histoire Naturelle, Paris, and Dr. G. HAMEL, who with the greatest kindness undertook the work of looking out the specimens of MONTAGNE's herbarium and sending them to me. No less thanks are due to Dr. ACHILLE FORTI, Verona, the owner of PICCONE's most valuable herbarium, in which the collection of Capt. D'ALBERTIS from the Canary Islands is incorporated.

My warmest thanks are likewise due to Professor C. SAUVAGEAU, Bordeaux, who most kindly lent me his whole big collection of Canarian Algæ and permitted me to keep it here during the whole period of my work with the Canarian Algæ.

Furthermore I feel much indebted to Professor É. DE WILDEMAN, Musée botanique de l'État, Bruxelles, for having lent me specimens from the herbarium of M^lle^ VICKERS, and to many other algologists who have been of help to me by lending me material for comparison or in other ways, above all M^me^ PAUL LEMOINE, Paris, for the working out of the large group of *Melobesieæ* and Dr. HENNNING E. PETERSEN for the determination of the species of *Caramium*. I am also much indebted to Professor L. KOLDERUP ROSENVINGE, M^me^ Dr. A. WEBER VAN BOSSE, Eerbeek, Professor

N. Svedelius, Upsala, Professor H. Kylin, Lund, Dr. M. A. Howe, New York, Dr. Otto Chr. Schmidt, Berlin and Dr. A. Gepp, London for most valuable help in various directions.

Further I wish to address my sincerest thanks to Mr. Ove Rostrup, mag. sc. for his valuable help in producing the figures, and likewise to Mr. O. Hagerup, mag. sc. and Mr. G. Nygaard, cand. mag., who have also helped in this respect.

To the Trustees of the Carlsberg Foundation I am greatly indebted for grants, especially for the production of the drawings.

RHODOPHYCEÆ

V. Ceramiales.

Fam. 1. Ceramiaceæ.

Subfam. 1. Spermothamnieæ.

Trailliella Batt.

1. Trailliella intricata Batt.

Batters, E., Some new Brit. marine Algæ (Journ. of Bot., vol. 34, 1896, p. 10 and in Journ. of Bot., vol. 38, 1900, pl. 414, fig. 14). Kylin, H., Über Spermothamnion roseolum (Ag.) Pringsh. und Trailliella intricata Batters (Bot. Notiser, 1916. p. 87). Rosenvinge, L. Kolderup, Mar. Alg. Denmark, Part III, Rhodophyceæ III, 1923-24, p. 305.

Spermothamnion Turneri f. *intricata* Holmes et Batters, Annals of Bot., vol. 5, 1890, p. 86.

Spermothamnion roseolum Kylin in Arkiv for Botanik, Bd. 14, Stockholm 1915, p. 4.

According to Rosenvinge (l. c.) non *Ceramium intricatum* Ag., Syst., Alg., 1824, p. 132, and *Callithamnion intricatum* J. Ag., Spec. Alg., vol. II, pars I, p. 19 and Kützing, Tab. Phyc., vol. II, pl. 62.

This species was at first considered by Holmes and Batters as a var. *intricata* of *Spermothamnion Turneri*, but later, after having found specimens with tetraspores, Batters described it as the representative of a new genus in a vegetative state easily recognizable on account of the presence of numerous small gland cells, one of these being generally present near the upper end of each cell in the filaments.

Kylin has made a detailed examination of this plant

and its gland cells. In a paper: "Über die Blasenzellen einiger Florideen" etc., which appeared in "Arkiv för Botanik", Bd. 14, 1915, where the plant is called *Spermothamnion roseolum* (Ag.) Pringsh., Kylin mentions that the gland cells contain iodine. Shortly afterwards, in a reference to Kylin's paper, Kuckuck in "Zeitschrift f. Botanik" vol. 8, 1916 points out that the plant mentioned by Kylin is *Trailliella*, and here too he gives a summary of his own observations regarding the glands, which agree with those of Kylin.

In a later treatise: Über *Spermothamnion roseolum* (Ag.) Pringsh. und *Trailliella intricata* Batters" Kylin gives a detailed description of both plants. He gives a fine figure of *Trailliella*, describes the development of the glands and adds further observations regarding their contents of iodine.

And finally Rosenvinge, l. c., gives a very detailed description and fine figures of the plant and its formation of the tetraspores, the only known fructiferous organs of this plant.

As to the shape and size of the Canarian plant, its filaments seem to be somewhat smaller than those of the English specimens. While Batters found the breadth of the filaments up to 30—40 μ, the Canarian specimens rarely attain more than 24 μ. According to Kylin the Swedish specimens are from 24—32 μ broad in the lower parts of the filaments, down to 18—22 μ in the upper ends of these, thus agreeing better with the Canarian specimens. According to Rosenvinge the Danish specimens have a diameter of 25—38 μ.

All the Canarian specimens examined were sterile. The plant grows as an epiphyte upon larger algæ forming 1—3 cm. high, very intricate bushes. It was found in low-lying

rock pools on somewhat exposed shores. The specimens were collected in March.

Gran Canaria: Playa de Santa Catalina.

Geogr. Distrib. Kattegat, Skagerak, Limfjord, Heligoland, English coast, Mediterranean Sea, coast of Massachusetts, Friday Harbor, Wash.

Sphondylothamnion Nägl.

1. Sphondylothamnion multifidum (Huds.) Nägl.

Nägeli, Beiträge zur Morphol. und System. d. Ceramiaceen, p. 380. Bornet et Thuret, Notes algol., II, p. 181, tab. 47. Hauck, Meeresalgen, p. 49.

Conferva multifida Huds., Fl. Angl., p. 596. (For more synonyms compare de Toni ,Syll. Alg., vol. IV, Florideæ, p. 1258).

This species was gathered at the Islands by Mlle Vickers. Professor É. de Wildeman, Musée botanique de l'État, Bruxelles, has most kindly allowed me to see the small specimens found in the Herbarium of Mlle Vickers. The specimen I have examined was sterile. Mlle Vickers dredged the specimens in the Puerto de la Luz in March.

Gran Canaria. Puerto de la Luz (Mlle Vickers).

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

Spermothamnion Aresch.

1. Spermothamnion repens (Dillw.) K. Rosenvinge.

Rosenvinge, L. Kolderup, Mar. Alg. Denm., Part III, Rhodophyceæ III, p. 298, where literature concerning this species is quoted.

Conferva repens Dillwyn, Brit, Conferv., pl. 18.

Var. *Turneri* (Mertens).

Spermothamnion Turneri (Mertens) *α. Turneri* Aresch., Phyceæ Scand. Mar., 1850, p. 113.

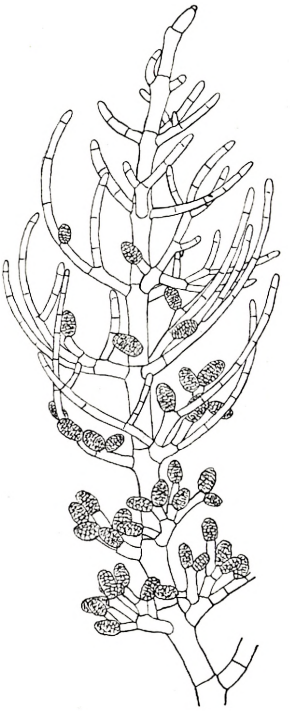

Fig. 1. *Spermothamnion repens* (Dillw.) K. Rosenv. Antheridial plant. (About 90:1).

Ceramium Turneri Mertens in ROTH, Catalecta botanica, III, 1806, p. 127, tab. V.

ROSENVINGE has given a most detailed description of this species to which I refer the reader.

The erect filaments are as a rule oppositely branched; in an antheridial plant verticillate ramification also occurred, as from a few cells in the main filament three branches were given off. Compare Fig. 1.

The almost spherical tetrasporangia (Fig. 2) are borne a few together on short branchlets. The antheridial bodies are oval in shape, sessile or placed on a short pedicel. The specimens were gathered at the end of March near low water mark in

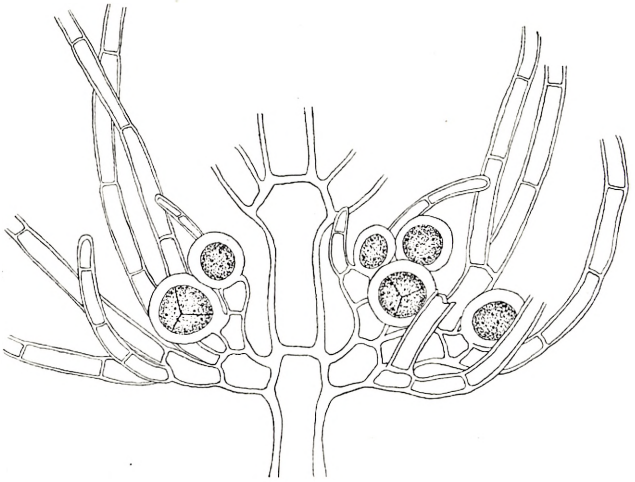

Fig. 2. *Spermothamnion repens* (Dillw.) K. Rosenv. Part of a plant with tetrasporangia. (About 200:1).

an exposed locality. This species has formerly been found at the Islands by Mlle VICKERS.

Gran Canaria: Puerto de la Luz (Mlle VICKERS), Bahia del Confital.

Geogr. Distrib. Along the coast of Europe southwards to the Canary Islands, Mediterranean Sea, coast of North America.

2. **Spermothamnion capitatum** (Schousb.) Bornet.

BORNET, Algues Schousb., p. 323, pl. III, figs. 6 and 7.
Ceramium capitatum Schousb., mscr.

The plant which I refer to this species was found as an epiphyte upon *Codium tomentosum* upon the vesicles of which the decumbent filaments creep, sending down between the vesicles short unicellular rhizoids swelled in the middle

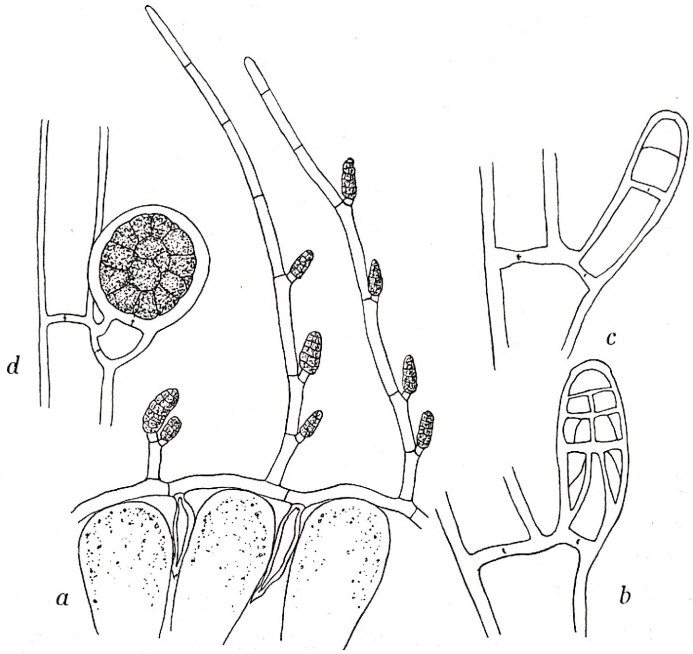

Fig. 3. *Spermothamnion capitatum* (Schousb.) Bornet. *a*, part of a plant creeping upon the vesicles of *Codium tomentosum*; *b*, *c*, development of antheridial bodies: *d*, a polysporangium. (*a*, about 75:1; *b*, *c*, about 400:1; *d*, about 225:1).

(Fig. 3 a). For instance one of the rhizoids was 27 μ broad at its origin from the mother cell and lower down at its broadest, 43 μ. The length of the rhizoids is about 150 μ. The basal creeping filaments are about 40—46 μ thick. The rhizoids are placed near the back end of the cells, while the erect filaments growing up from the creeping ones are placed near the foremost end of the cells.

The erect filaments consist of cylindrical cells about 28—40 μ thick and attaining a length of up to 5—6 times their breadth; the cells are thus a little larger than those in the plant from Morocco, according to Bornet.

Almost all the material I have seen was antheridial. The antheridial bodies (Fig. 3 a) are pedicellate, placed unilaterally up along the filaments; they are ovate-cylindrical of shape, about 100 μ long and 40 μ broad. As pointed out by Bornet, the antheridial bodies and upon the whole all the plant reminds one very much of *Spermothamnion flabellatum* from which *Spermothamnion capitatum* differs essentially by its polysporangia. Of these I have found only few. The polysporangia (Fig. 3 d) are pedicellate, nearly spherical about 80 μ long and 70 μ broad; the pedicel is about 40 μ long.

Gran Canaria: Bahia del Confital.
Geogr. Distrib. Mediterranean Sea, Canary Islands.

3. **Spermothamnion gorgoneum** (Mont.) Bornet.

Bornet in Vickers, Alg. Canaries, p. 305.
Callithamnion gorgoneum Mont. in Ann. Sc. nat., Bot., IV. sér., vol. 8, 1857, p. 289. Kützing, Tab. Phycol., vol. XII, pl. 1, tab. 2, figs. c, d.

I have not gathered this species myself, but in Sauvageau's collection fine specimens are present and the figures (Fig. 4) are drawn from a preparation of his. The plant has decumbent filaments creeping upon the upper

ends of the vesicles of *Codium*, sending down between these long pluricellular rhizoids (Fig. 4 *a*). The cells in these are

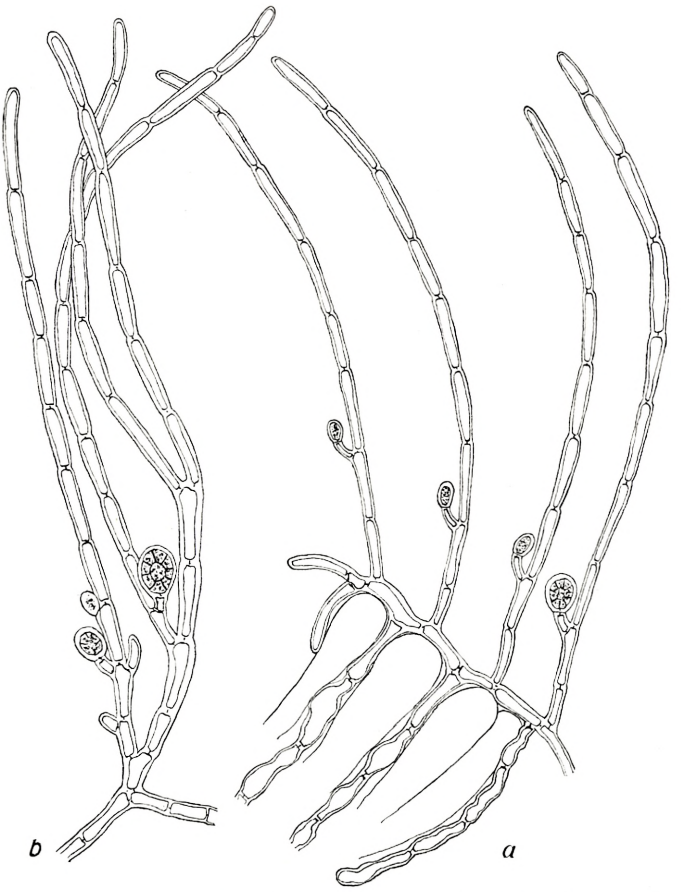

Fig. 4. *Spermothamnion gorgoneum* (Mont.) Bornet. (About 65:1).

more or less irregularly swelled in the middle. The rhizoids issue near the wall at the back end of the cells, one from each cell. The decumbent filaments are about 40 μ thick and have cells 3—4 times as long.

Upwards from the cells in the decumbent filaments the erect filaments grow up. These are as a rule not branched,

but the more vigorous ones are occasionally branched a few times in the basal part (Fig. 4 *b*). The erect filaments are about 35 μ thick with cells about 3—4 times as long. The cells are a little swelled near the upper end.

The pedicellate polysporangia (Fig. 4 *a*, *b*) are developed near the base of the erect filaments, as a rule a single one from each of the cells, but it happens that two and in that case oppositely placed sporangia issue from the same cell. As a rule each pedicel carries only one sporangium, but now and then a second one is developed at the side of the first one.

The sporangia are about 100 μ long and 80 μ broad and contain a large number of spores.

The plant grows on *Codium adhœrens*. It had sporangia in the end of December.

Teneriffe: Orotava (Sauvageau). Gran Canaria: Bahia del Confital (Mlle Vickers).

Geogr. Distrib. West Indies, Cape Verde Islands, Canary Islands.

4. Spermothamnion speluncarum (Collins and Hervey) Howe.

Howe, M. A.; in Britton & Millspaugh. The Bahama Flora, p. 578.

Rhodochorton specluncarum Collins and Herv., Algæ of Bermuda, p. 147.

I have had no original specimens of this plant to compare with mine, but according to the description by Collins and Hervey and especially that by Howe, there seems to be no doubt about the identity of the Canarian plant with that of the West Indies.

The Canarian plant was found upon rocks near low water mark where it formed a soft low velvety covering together with other small creeping algæ as *Plumaria Schousboei*, *Gelidium* etc. The base of the plant (Fig. 5 a)

consists of creeping filaments fixed to the substratum by means of shorter or longer rhizoids ending in a broader

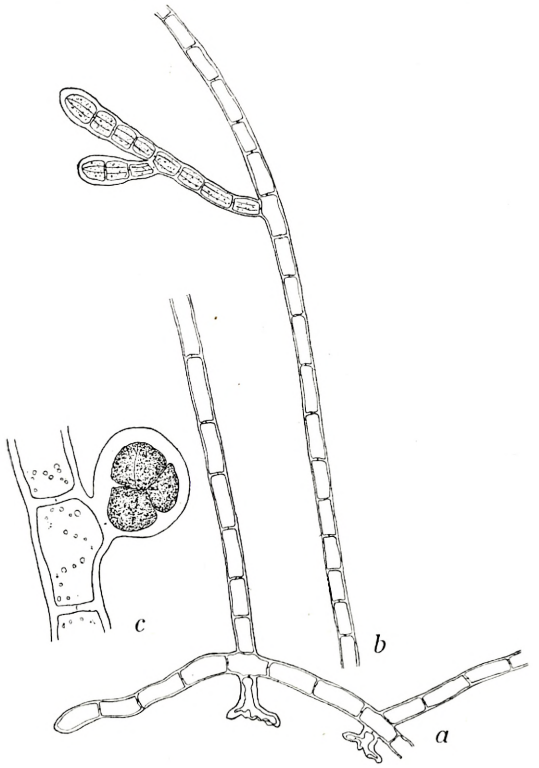

Fig. 5. *Spermothamnion speluncarum* (Collins and Herv.) Howe. *a*, basal part of a plant; *b*, upper end of an erect filament; *c*, a sporangium. (*a*, *b*, about 80 : 1; *c*, about 250 : 1).

disc. The rhizoids have no cross walls; once in a long one I saw a wall, but this is surely quite exceptional.

The prostrate filaments are more or less curved and composed of cells about 2—3 rarely 4 times as long as broad, their breadth reaching about 40 μ.

On the upper side of the creeping filaments erect ones arise; in their lower parts these are about 40 μ thick, tapering slowly upwards to about 27 μ. The cells in the erect filaments

are cylindrical $1^1/_2$—2 times as long as broad, rarely more. The filaments are irregularly ramified (Fig. 6), the branches

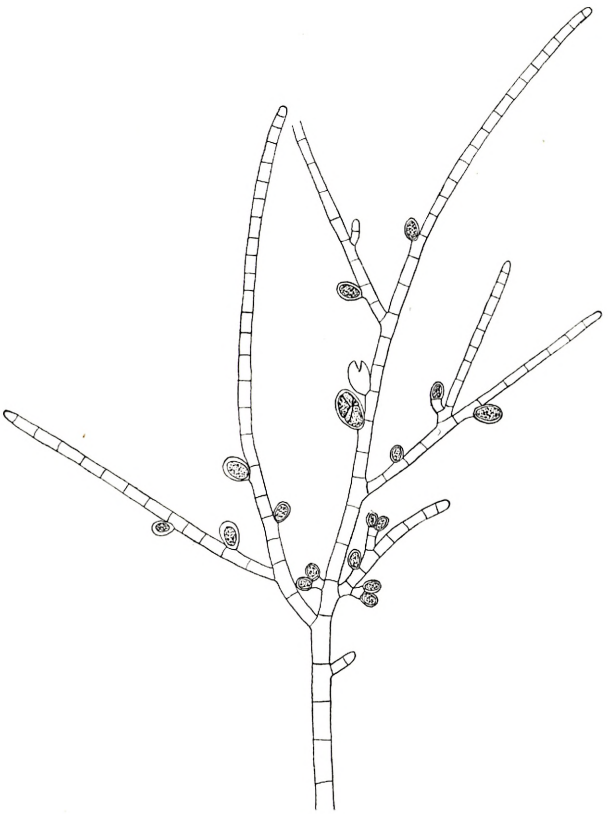

Fig. 6. *Spermothamnion speluncarum* (Coll. and Herv.) Howe. Part of the thallus with sporangia. (about 65 : 1).

issuing in all directions, sometimes in part secund or alternate and with longer or shorter intervals between them.

The wall of the plant is rather thick, from 3—6 μ in material preserved in spirit.

The sporangia (Fig. 5 *c*, Fig. 6) are commonly sessile, more rarely pedicellate. On the other hand, two sporangia are rather often placed upon a short cell or several sporangia

are found upon a short branch composed of a few cells. The sporangia are divided by irregularly placed walls in several spores. The sporangia are oblique-ovate, about 65 μ long and 55 μ broad.

As a peculiarity I wish to point out, too, that in many of the young shoots the diameter of the cells was a good deal longer than in the older part of the thallus. For instance the breadth of the uppermost cells reached 57 μ in the filaments shown in Fig. 5 *b*, while those farther down in the filaments had the normal size of about 40 μ.

The plant was growing upon rocks near low water mark in an exposed place. It had tetrasporangia in the month of March.

Teneriffe: Orotava.

Geogr. Distrib. Bermuda Islands, Bahama Islands, Canary Islands.

Ptilothamnion Thur.

1. **Ptilothamnion Pluma** (Dillw.) Thur.

THURET in LE JOLIS, Liste Alg. Cherb., p. 118. BORNET et THURET, Notes algol., p. XII and p. 179, plate 46. KYLIN, H., Entwicklungsgeschichtliche Florideenstudien, p. 77.

Conferva Pluma Dillw., Conf., Introd., No. 119, tab. F.

Callithamnion Pluma Ag., Spec. Alg., vol. II, p. 162. HARVEY, Phycol. Brit., pl. 296. KÜTZING, Tab. Phycol., vol. XI, tab. 82. HAUCK, Meeresalgen, p. 75.

This species is mentioned by MONTAGNE in »Iles Canaries«, p. 176 as found at the Islands. I have not seen any specimen. As to its occurrence MONTAGNE writes: »Super frondes *Gelidii coronopifolii*, cujus radices et imam caulis partem molli roseâque lanugine obducit, plura specimina observavi«. MONTAGNE does not mention any exact locality.

Geogr. Distrib. From the North Sea southwards to the Canary Islands.

2. Ptilothamnion micropterum (Mont.) Born.

Bornet in Sauvageau, Sur les Algues du Golfe de Gascogne, p. 18.

Callithamnion micropterum Mont. in Ann. Scienc. Nat., 2. sér., Bot., vol. XVIII, p. 261. Bornet, Algues de Schousboe, p. 331.

Callithamnion Pluma var. *micropterum* Mont., »Iles Canaries«, p. 177.

Ptilothamnion Pluma f. microptera (Mont.) Hauck, Meeresalgen, p. 76.

Montagne mentions this species in his list but he gives no locality. He only writes: »Ad frondes *Gelidii coronopifolii* in oris canariensibus ab amic. Webb lecti plura specimina inveni«.

Geogr. Distrib. Atlantic coast of France, Canary Islands.

Vickersia Karsakoff.

Vickersia baccata (J. Ag.) Karsakoff, emend. Børgs.

Vickersia? baccata Karsakoff in Ann. Sc. Natur., 8. Sér., Bot., 1897 (= the female plant).

Vickersia canariensis Karsakoff ibidem (= the tetrasporic plant).

Callithamnion baccatum J. Ag. in Öfvers. k. Vet.-Akad. Förhandl., 1870, p. 360, tab. II; Epicrisis, p. 27.

This genus has been described by M^lle^ Karsakoff from material gathered at the Canary Islands by M^lle^ Vickers. M^lle^ Karsakoff called this very elegant small algæ *Vickersia canariensis*. She based her description upon tetrasporic plants, the only fertile organs present in the specimens found by M^lle^ Vickers. In addition she referred, though with doubt, another species to this genus namely *Vickersia baccata* (J. Ag.) Karsak. = *Callithamnion baccatum* J. Ag. a species which J. Agardh based upon material from the Azores. The most essential differences between the two species is stated to be that in *Vickersia canariensis* the ramuli in the upper fertile part are clavate-ovate, turned upwards and composed as a rule of at least two cells, while in

Vickersia baccata the ramuli in the erect filaments of the plant are composed of a single nearly globose and horizontally placed vesicle.

When I examined my rather rich material from the Canary Islands it soon appeared to me that the *Callithamnion baccatum* J. Ag. represents the female plant and

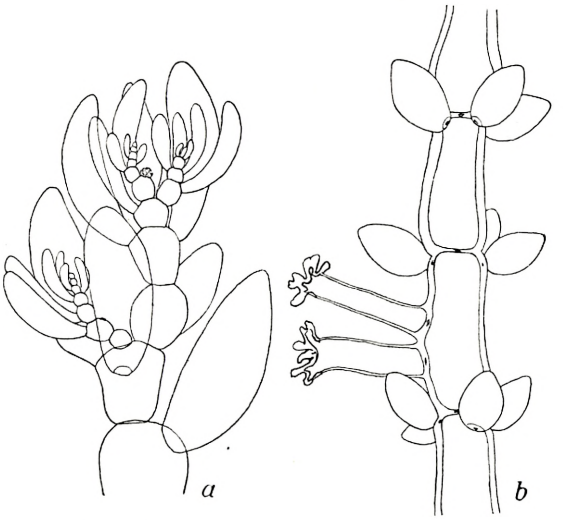

Fig. 7. *Vickersia baccata* (J. Ag.) Karsakoff. *a*, upper part of a female plant with small fertile branchlets. *b*, part of the thallus of a female plant with rhizoids. (*a*, about 80 : 1; *b*, about 30 : 1).

the *Vickersia canariensis* Karsak, the tetrasporic plant of the same species, the difference in the number of cells in the ramuli originating quite simply from the fact that in the female plant the ramuli in the fertile part are composed of only one often much inflated cell, while in the tetrasporic and male plants in the fertile part the ramuli are more elongated clavate and composed of two cells, these at their base having a small roundish cell which is the fertile one. With regard to the above statement compare Fig. 8 *b* showing the upper end of a male plant and Fig. 7 *b* in which a part

of a female plant is drawn; when the last mentioned figure is compared with that of J. Agardh of *Callithamnion bacca-*

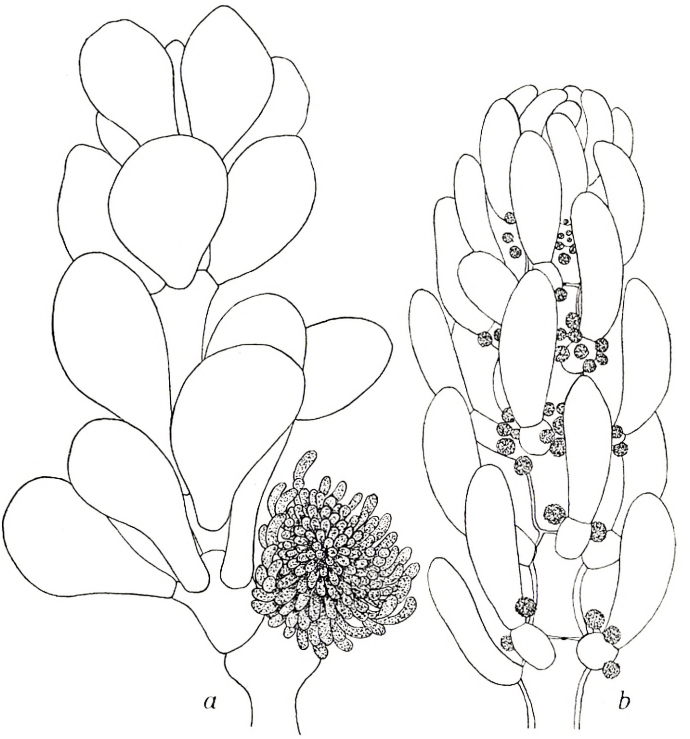

Fig. 8. *Vickersia baccata* (J. Ag.) Karsakoff. *a*, part of a plant with nearly ripe cystocarp. *b*, upper end of a male plant. (about 60 : 1).

tum it is evident that the two drawings originate from the same species.

Having arrived at this result it was of course of much interest to me to have it proved by comparison with the original material in J. Agardh's herbarium though it is true that his figure is not a very good one, having been drawn most probably after dried material. As nobody is allowed to borrow from J. Agardh's herbarium Professor H. Kylin, Lund, upon my request most kindly undertook the trouble

to compare a preparation of mine containing a female plant with the original plant of J. AGARDH's herbarium and found that the plant from the Canary Islands and that from the Azores are the same. Accordingly the species must have the name given to it by J. AGARDH.

As described by M^lle^ KARSAKOFF *Vickersia* has creeping decumbent filaments from which erect ones, a few cm high here and there grow up. The creeping filaments are fixed to the substratum, rocks or other algæ, by rhizoids ending as a rule in a small disc. (Compare M^lle^ KARSAKOFF's beautiful figures).

Any marked difference between the creeping and the erect filaments is not present, the erect filaments being able when near to suitable substratum to fix themselves by rhizoids. The main stem in the filaments is composed of cylindrical or barrel-shaped cells reaching a breadth of about 250—350 μ in the basal part of the plant, tapering slowly upwards in the erect filaments. No cortical layer is present. The decumbent filaments as well as the erect ones are provided with ramuli of very varying size and shape. In the decumbent filaments the ramuli are often composed of several, 3—4 or even more, cells; compare M^lle^ KARSAKOFF's figure 4. In the erect filaments, on the other hand, the ramuli in the vegetative plant consist only of a single cell; this is throughout the case in the female plant (Fig. 7), whereas in the fertile part of the tetrasporic and the male plant (Fig. 8 *b*) the ramuli are composed of two cells. The shape of the ramuli is rather varying. In the lower part of the erect filaments they are nearly cylindrical or, when the cells of which they are composed are swelled in their middle, moniliform, about 80—100 μ thick, while higher up they gradually get broader, especially in the female plant,

where the ramuli are about 400 μ broad and 500 μ long. The ramuli are verticillate at the upper end of each cell, as a rule 4 are present, sometimes only 3 in each whirl and they are more or less decussately arranged.

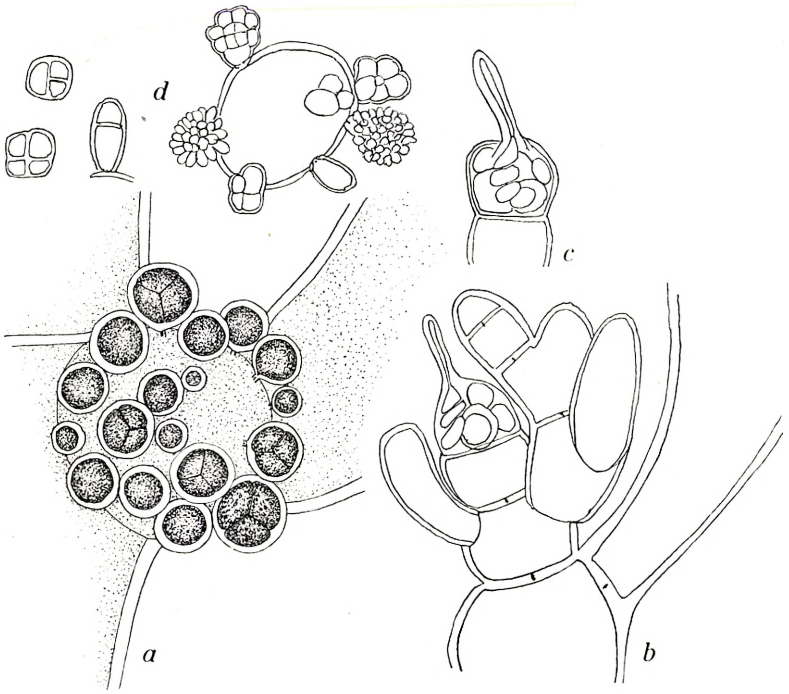

Fig. 9. *Vickersia baccata* (J. Ag.) Karsakoff. *a*, the basal cell of the ramulus with tetrasporangia; *b*, upper end of branchlet with a procarp; *c*, another procarp; *d*, basal cell of a ramulus with young androphores in various stages of development, and some more young androphores. (*a*, about 200 : 1; *b*, *c*, about 350 : 1; *d*, about 250 : 1).

M^{lle} KARSAKOFF has found only tetrasporic plants. In my material I have been fortunate enough to find also antheridial and cystocarpic plants.

As described by M^{lle} KARSAKOFF a short cell is developed at the lower end of the ramuli in the fertile part of the tetrasporic plant and upon this cell the tetrasporangia are

formed round about its surface and in such a number that they often cover the cell densely (Fig. 9 a). The sporangia are globular, about 60 μ broad, sessile, naked without any involucre. They are tetrahedrally divided. The number of

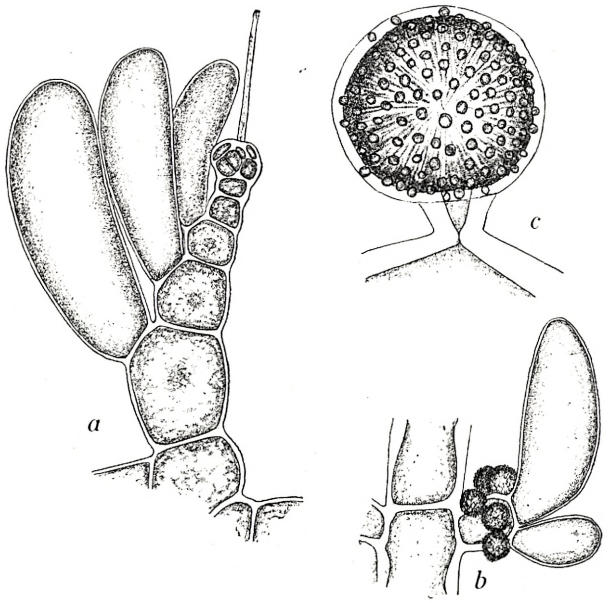

Fig. 10. *Vickersia baccata* (J. Ag.) Karsakoff. *a*, branchlet with procarp; *b*, a ramulus with antheridial bodies showing a rare case with two cells issuing from the basal cell; *c*, antheridial body. (*a*, about 200 : 1; *b*, about 100 : 1; *c*, about 500 : 1).

sporangia upon each fertile cell may be up to 50 or even more.

In the male plant (Fig. 8 *b*) the antheridial bodies are formed upon similar small cells at the base of the ramuli as found in the tetrasporic plant. The antheridial bodies (Fig. 10 *b*, *c*) are globular, about 50 μ broad, sessile and like the tetrasporangia naked without any involucre at all. They are gradually developed in great number upon the small fertile cell and cover its surface more or less densely. In a

few cases I have seen a single antheridial body upon the larger cell above. The development of the antheridial bodies (Fig. 9 *d*) takes place by an obovate small cell being developed from the surface of the basal cell. This small cell is divided by transverse and longitudinal walls and later on by walls in all directions; the result being the globular antheridial bodies. The peripheral cells in these are the antheridia in which the spermatia are formed.

While the material of tetrasporic and male plants was rather abundant, that of female plants was very scarce and most of it was sterile. The appearance of the female plant is described above. The development of the procarp takes place from one of the cells in some short dwarfish branchlets issued from the upper end of the big cells in the main stem (Fig. 7 a). These small branchlets are composed of 4—5 or more cells; sometimes two procarps are present in the same shoot. The procarps seem most frequently to be developed from one of the lower cells in the branchlets, but I have also found them originating from the upper cells (Fig. 10 *a*). The fertile cell issued from one of the cells in the branchlet is divided by a horizontal wall into two cells the lowermost of which remains undivided. I have not succeeded in finding quite young procarps; the youngest stages I have seen are drawn in fig. 9 *b c* showing procarps nearly ready for fertilization. In structure the procarp seems to show much likeness to those of *Spermothamnion* and *Ptilothamnion* as these are described and drawn by Kylin[1].

[1] Kylin, H., Studien über die Entwicklungsgeschichte der Florideen (K. Svenska Vetenskapsak. Handl., Bd. 63, 1923, p. 54). Kylin, H., Entwicklungsgeschichtliche Florideenstudien (Lunds Universitets Årsskr., N. F., Avd. 2, Bd. 24, 1928, no. 4, p. 78).

There seem to be formed 3 cells from the midmost of which 3 pericentral cells are cut off, one of these being the fertile cell from which the carpogonial branch is developed. This is composed of 3 cells and the carpogone with the trichogyne, which when fully developed is long and slender. No material by means of which the further development after the fertilization could be followed, was available.

The cystocarp (Fig. 8 *a*) of which I have succeeded in finding a single one only, consists of a roundish cluster of sporogenous filaments with carpospores surrounded by an open involucre composed of long unicellular somewhat curved cells.

A few years ago FUNK[1] made the interesting discovery of this plant in the Mediterranean Sea in the Gulf of Naples, this species being hitherto known only from some of the Macaronesian Islands. FUNK considers his plant as a special variety which he called var. *mediterranea*. According to FUNK this variety differs from the Canarian plant in two respects, namely by more slender and longer ramuli and by the fact that only 2—5 tetrasporangia are developed upon the fruiting cell. As to the first mentioned character, the shape and size of the ramuli, it varies much as we have alredy described above, as not only those of the female plants are much broader than those found in the tetrasporic and male specimens, but according to my observations the shape of the ramuli, too, alters much according to the different habitats and the external conditions prevailing there. And regarding the number of tetrasporangia upon each of the fruiting cells, I have in my material found that this varies very much. In some cases I have counted

[1] FUNK, G., Über einige Ceramiaceen aus dem Golf von Neapel. Beihefte z. Bot. Centralbl., Bd. 39, Abt. II, 1922.

more than 30 on the upward-turned side of the fertile cell, thus many more than 15, which according to Funk should be the highest number of tetrasporangia found in the typical form. Most probably the different number of tetrasporangia developed upon each fruiting cell is due to the stage of vigour present in the plant. It therefore seems most probable to me that the plant found by Funk is only to be considered as a local form.

Vickersia baccata seems locally to be rather abundant at the Canary Islands but by reason of its small size and because it generally grows intermingled among other algæ, it may easily escape observation.

The female plants were gathered in the month of January, antheridial plants in March and tetrasporic in the beginning of April.

The plant occurs even in much exposed places but also in more sheltered ones; at Gran Canaria I found it near Las Palmas in places where the water was very much polluted from the town. It grows somewhat above low water mark and is thus uncovered for some hours. It is found as an epiphyte upon *Corallina* or growing upon rocks in crevices or more or less dark places where it forms a characteristic association together with other small creeping algæ, for instance *Griffithsia tenuis, Tœnioma perpusillum, Herposiphonia tenella, Dipterosiphonia dendritica, Polysiphonia, Valonia, Caulerpa Webbiana* etc.

Teneriffe: Orotava where Sauvageau also found it.

Gran Canaria: Christoballo and at the shore near Las Palmas, Castillo (M^lle^ Vickers), Bahia del Confital (M^lle^ Vickers,!).

Geogr. Distrib. Canary Islands, Azores, Mediterranean Sea (Gulf of Naples).

Subfam. 2. Griffithsieæ.

Griffithsia. Ag.

1. Griffithsia arachnoidea Ag.

AGARDH, C., Spec. Alg., II, p. 131. MONTAGNE, Iles Canaries, p. 175.

Griffithsia furcellata J. Ag., Alg. Mediterr., p. 75; Epicrisis, p. 70. KÜTZING, Spec. Alg., p. 601; Tab. phycol., vol. XII, tab. 30, f. e-g. DE-TONI Syll. Alg., vol. IV, p. 1276. FUNK, G. Ueber einige Ceramiaceen aus dem Golf von Neapel in Beih. Bot. Centralblatt., Bd. 39, Abt. 2, 1922, p. 226, tab. V, fig. 3.

As it seems to me that *Griffithsia furcellata* J. Ag. is without doubt identical with *Griffithsia arachnoidea* Ag. I agree with DE-TONI in this respect. And as the name *arachnoidea* Ag. is the oldest name for this species it seems necessary to take this up instead of the newer name *furcellata* of J. AGARDH now generally used.

The plant has prostrate creeping filaments from which the erect ones arise. The basal filaments are about 250 μ thick or more and composed of cells about 1.2 mm long. The filaments are fastened to the substratum by means of rhizoids.

The erect fastigiate filaments are repeatedly subdichotomously ramified, getting gradually thinner upwards. In the middle of the tuft the cells are about 50 μ thick and 10—12 times as long; the upper ends of the filaments are often less than 20 μ thick.

The plant forms dense tufts of a fine carmin-red colour about 6—7 cm high or more. All the specimens I have examined of this plant were sterile, and upon the whole fructifying specimens have been searched for in vain until, a few years ago, FUNK succeeded in finding specimens with tetraspores in the Gulf of Naples. These are placed singly

upon a short pedicel in the upper parts of the thallus, thus deviating very much from the way in which these organs as a rule occur in the genus *Griffithsia*. According to Funk the plant seems to be able to propagate vegetatively to a great extent. It appeared suddenly in the winter of 1913—14 in great masses in the Gulf of Naples where it had not been observed for a long time. In the beginning all the specimens examined were sterile but easily propagated vegetatively, it was not until the month of May that tetrasporic specimens occurred, but the number of tetraspores was small.

At the Canary Islands the plant grows near low water mark in a rather exposed locality, and as M^lle^ Vickers mentions, it forms rather extensive tufts upon the rocks.

Gran Canaria. Playa de Santa Catalina north of Las Palmas, Bahia del Confital (M^lle^ Vickers). Without locality Despreaux according to Montagne, »Iles Canaries«, p. 175.

Geogr. Distrib. Mediterranean Sea, Canary Islands.

2. Griffithsia setacea (Ellis) Ag.

Agardh, C., Synop. Alg. Scand., p. 28; Spec. Alg., II, p. 129. Hauck, Meeresalgen, p. 93. De-Toni, Syll. Alg., vol. IV, p. 1274, where more litterature is quoted.

Conferva setacea Ellis in Philos. Transact., vol. 59, t. 18, fig. e.

This species is mentioned by Montagne, l. c., p. 175 as occurring at the Islands. According to kind information from Dr. Hamel no specimens of this species are to be found in Herb. Montagne in Muséum National d'Histoire Naturelle in Paris. As to its occurrence at the Islands Montagne writes: »In rupibus maritimis Canariæ, sed sterilis, lecta«.

Bornet in »Algues de Schousboe«, p. 324 mentions var. *sphærica* as found at the Islands.

Geogr. Distrib. From the English coast down to the Canary Islands, Mediterranean Sea.

3. Griffithsia tenuis Ag.

C. AGARDH, Spec. Alg., vol. II, p. 131. J. AGARDH, Spec. Alg., vol. II, p. 84; Epicrisis, p. 70. COLLINS and HERVEY, Alg. Bermuda, p. 135, pl. VI, figs. 38—39. BØRGESEN, F., Mar. Alg. D. W. I., p. 426, fig. 423.

Griffithsia thyrsigera Askenasy, Forschungsreise »Gazelle«, Algen, p. 36, pl. IX, figs. 1 and 4.

Callithamnion tenue Harv., Nereis Bor.-Am., part III, p. 130.

On the whole the Canarian plant agrees quite well with the West Indian ones with the exception that the thallus as a rule is much more slender. In most of the specimens the filaments had a diameter not very much surpassing 100 μ. A few specimens, however, had a thicker thallus up to about 160 μ broad, and SAUVAGEAU has collected some specimens at Orotava in which the filaments were often more than 200 μ thick, that is of similar breadth to the West Indian ones. The whirls of hairs at the upper end of the cells in the young part of the filaments were often rather poorly developed; in some collections they were even quite missing.

Also the whirls of the pedicellate tetrasporangia were less vigorously developed, the number of the tetrasporangia being as a rule small. In the West Indian plant 15 sporangia are often present in each whirl (compare my above quoted figure), while in the Canarian plant I have found only up to about 10, which agrees with the number ASKENASY found in his plant. The sporangia were about 50 μ broad.

The plant occurs near or somewhat above low water mark in sheltered places protected against the sun as well as in more exposed ones.

Tenerife: Orotava (Sauvageau,!);

Gran Canaria: Along the shore from Puerto de Luz and Las Palmas, Castillo (M^lle^ Vickers); Bahia del Confital.

Geogr. Distrib. Mediterranean Sea, West Indies, New Guinea. Ceylon, West Australia, Tonga Tabu.

4. Griffithsia barbata (Sm.) Ag.

C. Agardh, Spec. Alg., vol. II, p. 132. J. Agardh, Spec. Alg., vol. II, p. 80; Epicrisis, p. 64. Harvey, Phycol. Brit., tab. 281. Kützing, Spec. Alg., p. 660; Tab. Phycol., vol. XII, tab. 24. Børgesen, F., Mar. Alg. D. W. I., vol. II, p. 464.

Conferva barbata Smith, Engl. Bot., tab. 1814.

Of this species I have found tetrasporic as well as antheridial and female plants. The tetrasporic and female plants are figured by Harvey, l. c. and Kützing, l. c. and I have also (l. c., fig. 428) given an illustration of a procarp and cystocarp of this species. Of the antheridial plant, on the other hand, we have as far as I know only a rather poor illustration from Buffham[1].

As seen from my figure (Fig. 11) the antheridial bodies, like the tetrasporangia, are formed in the summit of the basal joint (according to the description of Thuret et Bornet in Études Phycol., p. 72, two basal joints are sometimes present) of the dichotomously ramified ramuli placed in whirls up along the main filaments. The innermost of the branches of the ramuli are transformed into the antheridial bodies, while the outermost placed at the periphery remain sterile, serving together with the remaining ramuli in the whirl as a kind of protective involucrum for the antheridial bodies. But the sterile parts of the ramuli are very perishable and soon drop off.

[1] Buffham, T. H., On the reproductive Organs, especially the Antheridia, of some of the Florideæ (Journ. Quekett Microscopical Club, vol. IV, ser. 2, 1891, p. 247, pl. XV, figs. 1—2.).

The fertile branch of the ramulus becomes divided into a row of oval-oblong cells (about 5—6), growing smaller

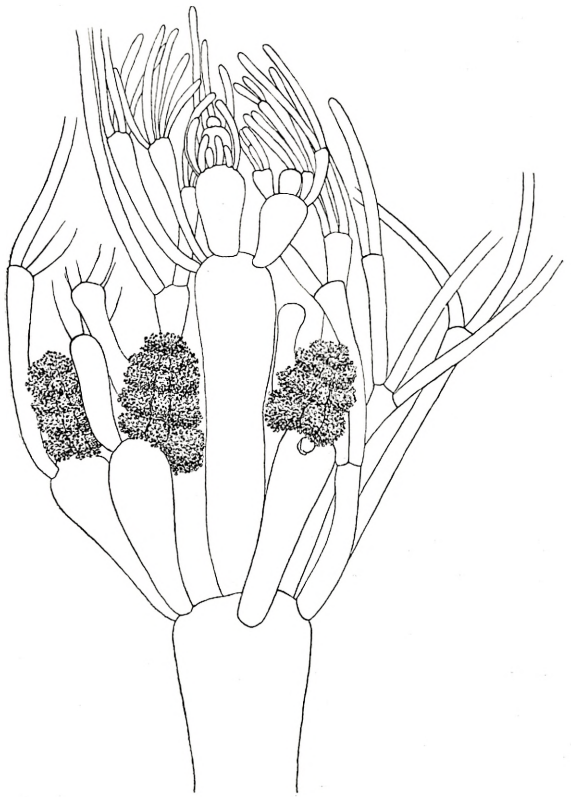

Fig. 11. *Griffithsia barbata* (Sm.) Ag. Summit of a male plant with antheridial bodies. (about 200 : 1).

upwards, and round the surface of these cells the repeatedly divided antheridial bodies are given off.

The antheridial plant I found was complete but small, about $1^1/_2$ cm high including its base. It was antheridial throughout, having no female organs at all. I mention this because not only BUFFHAM but also BORNET (l. c. p. 73) says that androphores and cystocarps always occur in the same plant.

I gathered this species at the end of March. It was growing upon *Cymodocea nodosa* in a sheltered locality.

Gran. Canaria: Puerto de la Luz at Las Palmas (Mlle Vickers), Bahia del Confital.

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea, West Indies.

5. **Griffithsia capitata** nov. spec.

Griffithsia phyllamphora Kütz., Tab. Phycolog., vol. XII, tab. 29?

Frons cæspitosa erectiuscula, ca. 2—3 cm alta et ultra, subdichotome ramosa, ex cellulis in parte inferiori ramorum subcylindricis, ca. 150—250 μ latis, in superiore parte 300 μ et ultra latis composita.

Tetrasporangia circa apicem cellularum fertilium verticillata, nuda, sine involucro.

Antheridia in summis cellulis terminalibus pyriformibus oriuntur discum rotundatum formantia.

The plant I am going to describe here as a new species seems to agree very well with the above quoted figure of Kützing's. This figure J. Agardh in "Epicrisis" p. 67 mentions with a? as belonging to *Griffithsia phyllamphora* while Hauck in "Meeresalgen", p. 93 says with regard to *Gr. phyllamphora*: "non Kütz., Tab. phycolog., XII, tab. 29". And De-Toni makes the same statement in "Sylloge Algarum", vol. IV, p. 1281. But it is not said to which species Kützing's plant is to be referred. On the other hand Funk in "Die Algenvegetation des Golfes von Neapel", p. 464, refers Kützing's figure without reservation to *Griffithsia phyllamphora*.

The specimens I have found form small tufts 2—3 cm high. The cells differ much in shape (compare Fig. 12); some are oval to cylindrical, others clavate or swelled in the lower part, tapering upwards. In the lower part of the

thallus the cells are often nearly cylindrical about 150—250 μ broad and up to ten times as long, in the upper part the cells become much broader up to about 370 μ; this applies

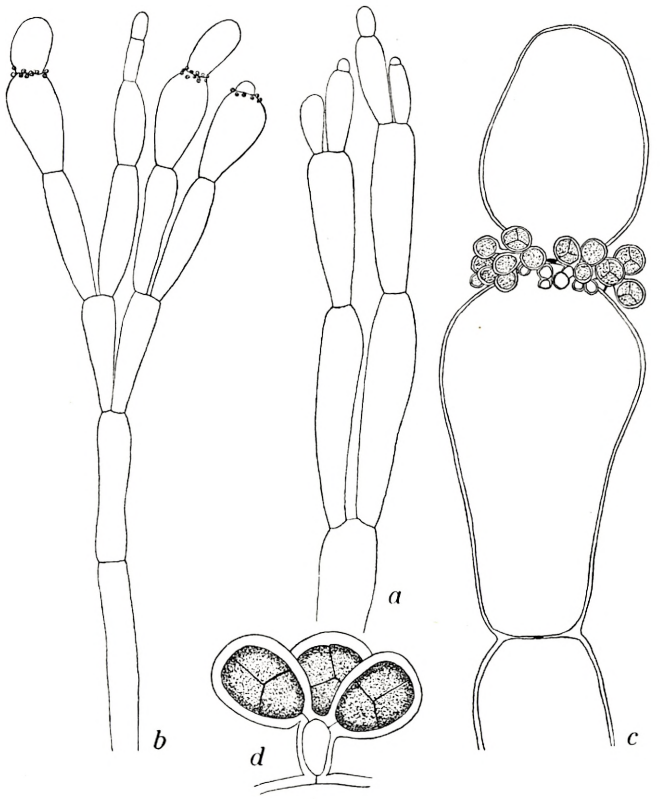

Fig. 12. *Griffithsia capitata* Børgs. *a*, *b*, parts of the thallus; *c*, upper end of a filament with tetrasporangia; *d*, a pedicel with sporangia. (*a*, *b*, about 25 : 1; *c*, about 80 : 1; *d*, about 250 : 1).

especially to the fertile ones. The plant is rather regularly subdichotomously ramified. I have never found hairs or dwarf shoots in this plant.

As at first I had found only tetrasporic plants and these did not seem to be referable to any known species, I called the plant *Griffithsia* spec. only. But as I have later found

also an antheridial plant which beyond doubt belongs to this species, I have given it the above mentioned name, referring to the characteristic antheridial bodies (Fig. 13).

In the tetrasporic plant the fertile cells are formed near

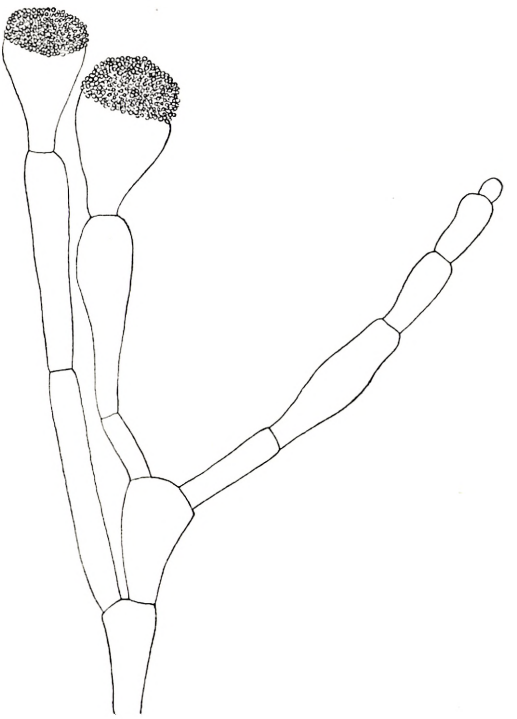

Fig. 13. *Griffithsia capitata* Børgs. Part of a male plant with antheridial bodies. (about 25 : 1).

the upper end of the branches one or two cells below the apex of the filaments (Fig. 12 *b, c*); the fertile cells are thicker than the other cells in the filaments, often pear-shaped, broadest at their upper end. The tetrasporangia are placed annularly round the upper end of the fertile cells, two or three together upon a short pear-shaped pedicel (Fig. 12 *d*). The ring of tetrasporangia is naked without involucral cells (Fig. 12 *c*).

In the male plant the vegetative cells have exactly the same shape as those in the tetrasporic plant. The uppermost cells in the filaments are the fructiferous ones; these become pear-shaped with broadly rounded apices (Fig. 13). They are about 570 μ long and 420 μ broad. The antheridial bodies are developed upon the upper end of these cells, forming here a roundish well defined disc about 330 μ broad.

By the occurrence of the antheridial bodies at the summit of the filaments this plant reminds one much of the West Indian *Griffithsia globifera* (Harv.) J. Ag. where likewise the antheridial bodies occur at the upper end of the uppermost cells in the filaments; but in this species the antheridial bodies are of more irregular shape and often cover more than half of the cells. Then the vegetative cells in *Gr. globifera* are shorter, thicker and as a rule more or less globular, and finally we find in this species both hairs and dwarf shoots of which I have seen no trace in the Canarian species. And it cannot be referred to *Gr. phyllamphora* because of the want of an involucrum round the tetrasporangia and because it lacks the short unilaterally placed branches found in this species; compare HAUCK's description in "Meeresalgen", p. 92. And *Griffithsia Schousboei* differs from this species by its much thicker and differently shaped thallus and by a deviating arrangement of the fertile organs. From *Griffithsia opuntioides* it differs by the want of the unicellular pear-shaped fertile branchlets characteristic of this species. And finally it is easily discernible from *Griffithsia Corallina* by its different shape of cells and, as already mentioned above, by the want of hairs and dwarfish shoots found in this species and by the fact that the involucral

cells are developed from the pedicels of the tetrasporangia in this species[1].

This plant was found near low-water mark in dark places, for instance in crevices of rocks, and near low water mark in somewhat exposed places or more sheltered ones. It was found with tetrasporangia and antheridia in the month of March.

Gran Canaria: Playa de Santa Catalina, Castillo.

6. Griffithsia phyllamphora J. Ag.

Agardh, J., Alg. Mediter., p. 77; Spec. Alg., vol. II, p. 81; Epicrisis, p. 67; Florideernes Morphologie, tab. I, fig. 8. Hauck, Meeresalgen, p. 92.

Non *Griffithsia phyllamphora* Kütz., Tab. Phycol., vol. XII, tab. 29.

I have only once found some tetrasporic specimens which I think are referable to this species (Fig. 14). In the lower part of the thallus the cells are more cylindrical to clavate 170—300 μ thick. Higher up the cells become thicker, oval or pear-shaped; the fertile cells reach a breadth of 450 μ or more. The tetrasporangia occur at the upper end of the fertile cells found near the summit of the filaments. They are encircled by a ring of somewhat inwardly curved vesicle-like cells about 120 μ broad and 250 μ long. These cells are developed directly from the main cells and not from the pedicells of the tetrasporangia as in *Griffithsia Corallina* according to Kylin's description of this plant.

In referring this plant to *Griffithsia phyllamphora* I must point out that I have not had any fertile material of this species with which to compare it.

[1] Kylin, H. Die Entwicklungsgeschichte von *Griffithsia corallina* (Lightf.) Ag. (Zeitschr. f. Bot., Jahrg. 1916, p. 116).

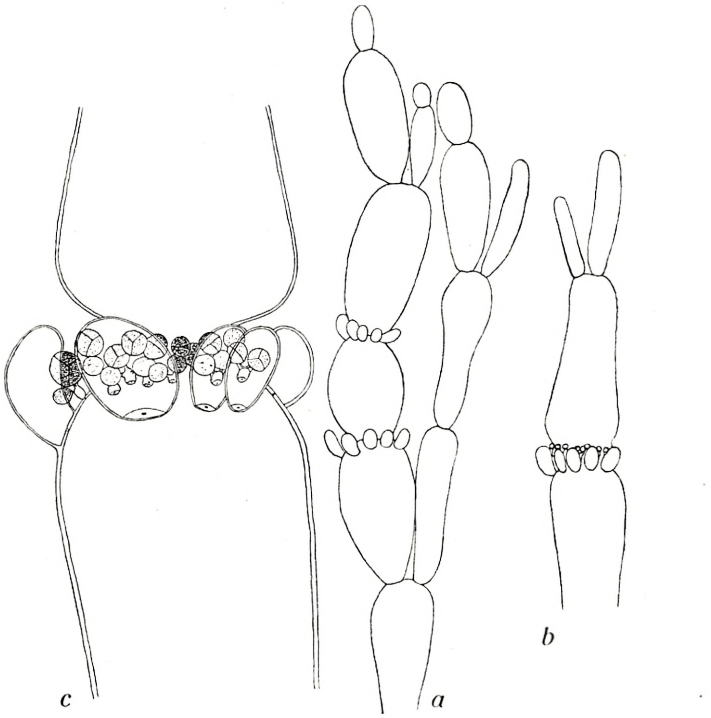

Fig. 14. *Griffithsia phyllamphora* J. Ag. *a*, upper end of a filament; *b*, *c*, parts of filaments with tetrasporangia. (*a*, *b*, about 25 : 1; *c*, about 80 : 1).

Bornet in "Algues de Schousboe", p. 324 mentions it as occurring at the Canary Islands and M^lle^ Vickers has it in her list too.

Gran Canaria: Playa de Santa Catalina (M^lle^ Vickers).
Geogr. Distrib.: Mediterranean Sea, Morocco, Canary Islands.

7. Griffithsia Schousboei Mont.

Montagne, in Webb, Otia Hispanica, p. 11, tab. 10, fig. p—q; Iles Canaries, p. 175. Agardh, J., Spec. Alg., vol. II, p. 78; Epicr., p. 66. Hauck, Meeresalgen., p. 92.

I have not found this species myself, but it is mentioned from the Islands by various investigators. In Herb. Mon-

TAGNE in Museum National d'Hist. Nat., Paris, two small Canarian specimens are present. One of them (from Gr. Canaria) has oblong cells reaching a breadth of about 500—600 μ, the other specimen (gathered by WEBB, "Canaries") has narrower cells, but some of them have nevertheless a breadth of up to 600 μ. As both specimens are sterile, the determination is not certain. I am indebted to Dr. HAMEL, Paris for the permission to see the specimens.

M^{lle} VICKERS mentions this species in her list p. 305, but I have not seen her specimens.

At Orotava Prof. SAUVAGEAU has found a small sterile plant which he refers though with a ? either to *Gr. Schousboei* or to *Gr. opuntioides*. Finally it must be pointed out that BORNET in "Algues Schousboe", p. 323 mentions this species as occurring at the Islands.

Regarding the locality M^{lle} VICKERS writes, l. c. p. 305: "A marée très basse, devant l'hôtel Métropole. Assez commun. De décembre à mars".

Gran Canaria: Playa de Santa Catalina (M^{lle} VICKERS), without locality (WEBB). Teneriffe: Orotava (SAUVAGEAU).

Geogr. Distrib. Mediterranean Sea. From the golf de Gascogne southwards to the Canary Islands, West Indies.

8. Griffithsia opuntioides J. Ag.

J. AGARDH, Alg. medit., p. 76; Spec. Alg., vol. II, p. 82; Epicrisis, p. 68; Florideernes Morphologie, Tab. 1, fig. 9. KÜTZING, Spec. Alg., p. 664. HAUCK, Meeresalgen., p. 94. ZANARDINI, Icon. phyc. adr., vol. II, p. 97, tab. 64, B.

I have only once found a specimen of this species. It was a male plant. The antheridial bodies (Fig. 15) are developed at the summit of the swelled pear-shaped unilaterally placed branchlets characteristic of this species. This branch is said to be composed of a single cell, but

in the male plant at any rate, besides the involucral cells surrounding the upper end of the big cell, a smaller nearly spherical cell was present at its summit. The antheridial bodies are developed from small globular cells found at the upper end of the big cell and consist as usual of a cluster of very ramified filaments. They are placed densely in great numbers round the upper end of the big cell surrounding the small apical cell and encircled by a ring of involucral cells.

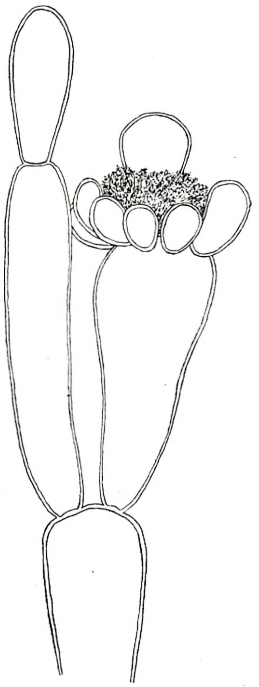

Fig. 15. *Griffithsia opuntiodes* J. Ag. Upper end of a filament with a branchlet carrying antheridial bodies. (about 35 : 1).

BORNET in "Algues Schousboe" mentions this species as occurring at the Canary Islands and M^lle^ VICKERS also has it in her list p. 305: "A basse mère, sur toute la grève depuis Castillo iusqu' à la jetée de Las Palmas. Assez commun. Novembre à mars".

Gran Canaria: Playa de Santa Catalina (M^lle^ VICKERS,!).

Geogr. Distrib. Mediterranean Sea, Canary Islands.

Griffithsia corallina (Lightf.) Ag. is mentioned by MONTAGNE, "Iles Canaries", p. 175; he writes about it "In conchis marinis ad littora Canariensia, sterilis verò, ut prior, lecta". According to kind information from Dr. HAMEL, Paris, no specimens are found in Herb. MONTAGNE, and as the determination is based upon sterile specimens it is surely not reliable.

Subfam. 3. Monosporeæ.

Monospora Solier.

1. Monospora pedicellata (Sm.) Solier.

Solier in Castagne, L., Catalogue des plantes qui croissent naturellement aux environs de Marseille, p. 242, tab. 7 et Suppl., p. 119 (non vidi). Zanardini, Icon. Adriat., vol. II, p. 107, tab. 67. Bornet et Thuret, Notes algol., p. 21, pl. 7. Hauck, Meeresalgen. p. 47.

Conferva pedicellata Smith., Engl. Bot., tab. 1817. For more synonyms etc. compare De-Toni, Sylloge Alg., vol. IV, Florideæ, p. 1298.

M^lle^ Vickers mentions this species in her list of Algæ from the Islands, p. 305. She found a single specimen only. I have not seen the specimen.

Gran Canaria. Playa de las Canteras where it was found in March (M^lle^ Vickers).

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

Subfam. 4. Callithamnieæ.

Callithamnion Lyngb.

1. Callithamnion byssoides Arn.

Arnott in Hooker, English Flora, vol. II, part 1, 1833, p. 342. Harvey, Manual, 1849, p. 178; Phycol. Brit., pl. 262. Børgesen, F., Some new or little known West Indian Florideæ (Bot. Tidsskrift, vol. 30, 1909, p. 11); Mar. Alg. D. W. I., vol. II, p. 218. Cfr. Schmitz, Fr. in Berichte d. deutsch. bot. Ges., Bd. XI, 1893, p. 280.

Leaving out of consideration some minor differences the Canarian specimens seem to be in good accordance with the West Indian form as described by me. The existing differences may no doubt be ascribed to the different environment in which the Canarian and the West Indian plants were found. The West Indian plant was growing

in the calm stagnant water in the lagoon of Christianssted, while the Canarian plant was found in the open sea in a rather exposed locality.

As such differences, which may be due to the influence of different external conditions, I may point out that the cells in the main stems of the Canarian plant were somewhat shorter than those in the West Indian one and that the walls of the cells in the former were thicker than those of the latter. And the more numerous and more vigorously developed descending filaments growing out from the base of the branches at the lowermost ends of the main stems must no doubt be ascribed to the more exposed locality of the Canarian plant. These filaments seem in most cases to be free, becoming rhizoid-like at their basal end and helping to fix the plant to the substratum. In the West Indian plants only very few and feeble descending filaments are present. Furthermore the more open ramification and in this connection the more lengthened joints in the branches of the West Indian plant in contrast to the more robust shape of the Canarian one must also be referred to the different localities.

The sessile, oblique-ovate to subpyriform sporangia are placed on the inner, upward-turned side of the branches. In the West Indian plant the sporangia are placed at the upper end of the joint near the corner, where the side-branches are given off. In the Canarian plant, on the other hand, the sporangia are not always given off at the upper end of the joint. Often they are formed lower down upon the joints, and furthermore now and then a new sporangium is developed or sometimes even two successively in descending succession upon the same joint (Fig. 16). This I have never seen in the West Indian plant. It has already

been described by NÆGELI in "Beiträge zur Morphologie und Systematik der Ceramiaceæ", p. 308 and ROSENVINGE mentions and figures something similar in *Callithamnion tetragonum* (l. c., p. 323, fig. 236 A) and other species. As to the shape and size of the sporangia those in the Canarian plant are somewhat more oblong, about 40 μ broad and 55 μ long, than those in the West Indian plant which are more spherical, a well developed sporangium here measuring 42 μ in breadth and 50 μ in length. The sporangia are tetrahedrally divided, hardly ever more irregularly.

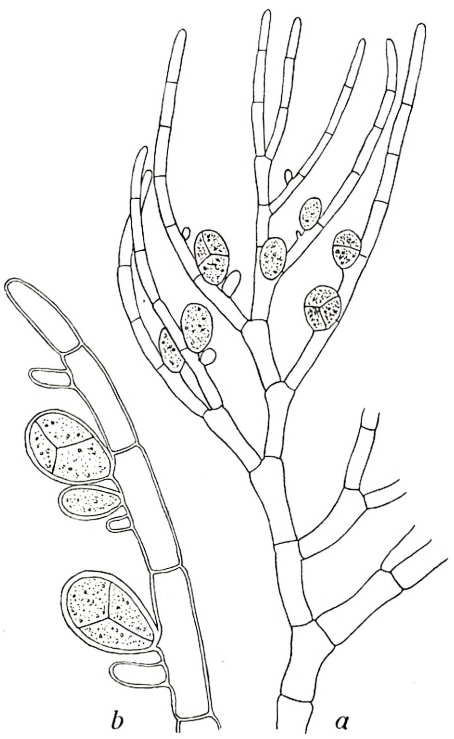

Fig. 16. *Callithamnion byssoides* Arn. Parts of the thallus with tetrasporangia. (*a*, about 250 : 1, *b*, about 100 : 1).

The antheridial bodies occur in the same place as the tetrasporangia and are built up quite like those in the West Indian plant, forming dense cushions on the inner upward-turned side of the joint. Also the female plant agreed very well with the West Indian plant, the cystocarps forming irregular more or less lobed bodies.

The plant was gathered in shallow water near the shore in a moderately exposed place. It had tetrasporangia and antheridia in the month of March.

Gran Canaria: Playa de Santa Catalina, Puerto de la Luz (M^lle^ VICKERS, "var. *arachnoidea*").

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

2. **Callithamnion corymbosum** (Engl. Bot.) Lyngb.

LYNGBYE, Hydrophyt. Dan., p. 125. J. AGARDH, Spec. Alg., vol. II, p. 41. THURET, Études Phycol., p. 67, pl. 33—35. ROSENVINGE, L. KOLDERUP, Mar. Alg. Denm., Part III, Rhodophyceae III, p. 325 (where more litterature is quoted).

Conferva corymbosa Engl. Bot., pl. 2352.

This species is described and beautifully pictured by THURET et BORNET in "Études phycologiques" and in "The Marine Algæ of Denmark" ROSENVINGE has later on given supplementary remarks with references to the literature to which I here refer the reader.

Specimens with tetraspores, antheridia and cystocarps were gathered in the months of March and April. It was found near low water mark and was growing in more open as well as in sheltered localities.

Gran Canaria: Tour Christoballo, Playa de las Canteras, Castillo, Puerto de la Luz (M^lle^ VICKERS).

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

3. **Callithamnion gallicum** Nägeli.

NÄGELI, Beitr. z. Morphologie und Systematik der Ceramiaceæ (Sitzungsber. d. k. bayer. Akademie d. Wiss., 1861, p. 371).

Prof. SAUVAGEAU has gathered a few small specimens which he has referred to this species. As pointed out by NÄGELI, compare also SAUVAGEAU, "Sur les Algues marines du Golfe de Gascogne", p. 63, this species has as a type the plant published by the brothers CROUAN in "Algues marines du Finistère", vol. II, no. 154 and there called *Callithamnion Brodiæi*.

Also M^lle^ Vickers collected a plant which she, though with a?, referred to this species.

Teneriffe: Orotava (Sauvageau). Gran Canaria: Playa de Santa Catalina (M^lle^ Vickers).

Geogr. Distrib. Atlantic coast of France, Canary Islands.

4. Callithamnion ellipticum Mont.

Montagne, Algues Canaries, p. 177. Kützing, Spec. Alg., p. 658. J. Agardh, Spec. Alg,. vol. II, p. 68.

Phlebothamnion ellipticum Kütz., Tab. Phycol., vol. XII, tab. 12.

This species is described by Montagne, l. c., p. 177; Dr. Hamel, Paris, has most kindly allowed me to see an original specimen. It is a very small one scarcely one centimeter high; it is laid upon mica, but the upper part of it is in rather a bad condition.

The main stem is thick, about 200 μ broad and composed of short cells about 110—150 μ long. It is densely covered with rhizoids from which short branchlets are developed. At the base the plant is fixed by numerous rhizoids. The branches issue to all sides. The uppermost cells in the branches are about 12 μ thick. The specimen I have seen was sterile.

Kützing's figure gives quite a good representation of the plant.

Gran Canaria: No locality is mentioned by Montagne.

Geogr. Distrib. Canary Islands.

5. Callithamnion tetragonum (With.) Ag.

C. Agardh, Spec. Alg., vol. II, p. 176. J. Agardh, Spec. Alg., vol. II, p. 53. Rosenvinge, Mar. Alg. Denm., p. 317 (where more literature is quoted).

Conferva tetragona Withering, Arrangement of British Plants, vol. IV, 1796, p. 405.

Callithamnion brachiatum Bonnem., Harvey, Phyc. Brit., pl. 137.

SAUVAGEAU has gathered a few small specimens which he in his list of species from the Canary Islands ("A propos des Cystoseira", p. 52) refers with a? to *Callithamnion brachiatum* Harv., (HARVEY, Phycol. Britannica, tab. 137). I am of the same opinion as ROSENVINGE, who has made a thorough examination of *Callithamnion tetragonum* and related forms, and earlier investigators like AGARDH, HAUCK and GRAN, in considering *Callithamnion brachiatum* as a form of *Callithamnion tetragonum*.

The specimens I have gathered of this species reach a height of about 4—6 cm. The rather entangled branches and branchlets give the plant a spongy appearance.

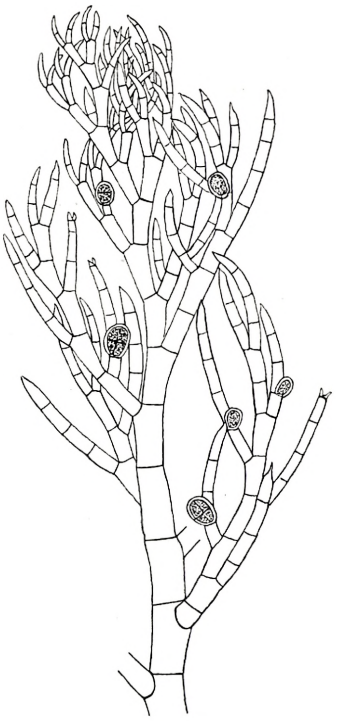

Fig. 17. *Callithamnion tetragonum* (With.) Ag. Upper end of shoot with tetrasporangia. (about 80 : 1).

My specimens, like SAUVAGEAU's, are referable to the forma *brachiata*. The pinnulæ of this form in contrast to the var. *typica* (HARVEY, l. c., pl. 136) are thickest at the base, tapering gradually upwards (Fig. 17); at their base the pinnules are about 30—40 μ thick. The main filaments are about 250 μ thick and densely covered by a cortical layer, from the cells of which short adventitious filaments grow out in great number. As to the branching of this plant I refer the reader to ROSENVINGE's detailed examination of var. *fruticulosa* J. AGARDH. The branches of the main

axis are placed spirally upon it with a divergence of about 1/4.

I have found only tetrasporic plants. The tetrasporangia are spherical, about 40 μ long and broad. They are tetrahedrally divided but often the division is rather irregular so the sporangia seem to be cruciately divided.

Teneriffe: Orotava (Sauvageau,!). Gran Canaria: Castillo near Las Palmas.

Geogr. Distrib. Atlantic coast of Europe southwards to the Canary Islands, Mediterranean Sea.

Subfam. 5. Compsothamnieæ.

Compsothamnion Näg.

1. Compsothamnion thuyoides (Sm.) Näg.

Nägeli, Ceramiaceæ, p. 344.

Conferva thuyoides Smith in English Botany, tab. 2205.

Callithamnion thuyoides Ag., Spec. Alg., vol. II, p. 172. J. Agardh, Spec. Alg., vol. II, p. 44. Hauck, Meeresalgen, p. 78.

This species (forma *breviarticulata*) is mentioned in Piccone's list, p. 55 as found at Gran Canaria by Liebetruth; I have not seen the specimen.

Geogr. Distrib. The Atlantic coast of England and France, Mediterranean Sea.

Subfam. 6. Ptiloteæ.

Plumaria (Stackh.) Schmitz.

1. Plumaria Schousboei (Born.) Schmitz.

Schmitz, Fr., Kleinere Beitr. z. Kenntn. d. Florideen, VI, p. 7. (La Nuova Notarisia 1896). Bornet, Alg. de Schousboe, p. 330.

Callithamnion elegans Schousboe in C. Agardh, Spec. Alg., vol. II, p. 162. Bornet et Thuret, Notes algolog, p. 32, tab. X. Hauck, Meeresalgen, p. 76.

Gymnothamnion elegans J. Ag., Analecta Algologica, 1892, p. 27 et p. 178, tab. 1, fig. 11—14.

Ptilota Schousboei Bornet in BORNET et THURET, Notes algolog., p. 34.

As the Canarian specimens I have gathered are sterile with the exception of a few tetrasporangia I have to rely upon the vegetative parts only. But the specimens seem to agree very well with BORNET's and THURET's description and fine figures.

As regards the vegetative thallus the very similar *Ptilothamnion Pluma* differs from *Plumaria Schousboei* by its shorter segments and the broader insertion of the branches, as they are often placed so close as to almost touch each other; compare BORNET's remarks in "Algues de Schousboe", p. 331.

The basal creeping filaments are about 30 μ thick and fixed to the substratum by means of unicellular rhizoids ending in a coralliform disc. In the erect filaments the oppositely placed undivided branchlets are about 16 μ thick at the base, tapering upwards to about 10 μ; they are composed of up to about 12 cells or more. The main axis is about 24—30 μ thick.

Nearly all the specimens examined were sterile, only a few sporangia were found. These occur at the summit of the branchlets and are about 60 μ long and 50 μ broad.

The plant was found near low water mark upon rocks in an exposed locality where it creeps upon the walls and roofs of small caverns, forming together with other small creeping algæ, for instance *Spermothamnion speluncarum*, a low soft covering upon the substratum. It was gathered with tetrasporangia in the month of March.

Teneriffe: Orotava.

Geogr. Distrib. Mediterranean Sea, Morocco.

2. Plumaria bipinnatum (Collins & Hervey) De-Toni.

De-Toni, Sylloge Alg., Vol. VI, Florideae, p. 488.

Gymnothamnion bipinnatum Collins and Hervey, Algæ of Bermuda, p. 139.

Ptilothamnion bipinnatum (Collins & Hervey) Howe in Britton, Flora of Bermuda, p. 525.

One of Sauvageau's preparations contains a few fragments of a small *Plumaria*-like plant (Fig. 18) which seems

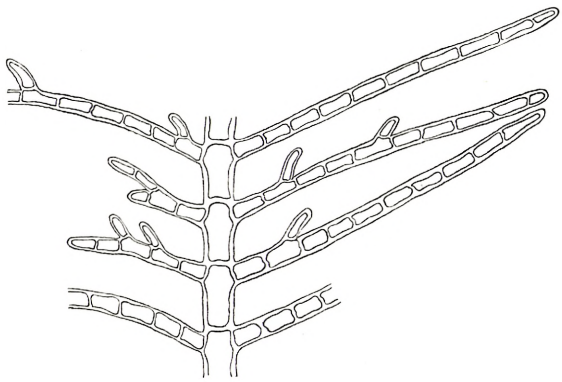

Fig. 18. *Plumaria bipinnata* (Collins & Herv.) De Toni. Part of the thallus. (about 250 : 1).

to agree with this species described from the Bermuda Islands. As the specimens are sterile, the determination is of course not quite certain, but the shape and size of the plant seem to agree very well with the Bermuda plant. Thus the creeping filaments had a breadth of about 20—22 μ, the erect ones at the base the same breadth, tapering upwards to about 12 μ; the length of the cells is from about 33 μ down to 22 μ. The branchlets are about 11 μ broad and 9—10 μ at the upper end.

As the plant very much resembles *Plumaria Schousboei* by its shape I refer it to this genus in agreement with De-Toni.

Sauvageau has found the plant upon *Zonaria variegata*.

Teneriffe: Orotava (SAUVAGEAU).
Geogr. Distrib. Bermuda, Canary Islands.

Ptilota plumosa Ag. is mentioned in MONTAGNE's list ("Iles Canaries", p. 162). But MONTAGNE says: "Nous ne citons cette espèce, qui ne se trouve pas dans notre collection, que d'après l'autorité de M. BORY qui l'énumère parmi les Thalassiophytes des Canaries". As *Spyridia aculeata* may show some likeness to this species, and as this species occurs at the Islands, the statement is perhaps due to a confusion of the two plants.

Subfam. 7. Crouanieæ.

Antithamnion Näg.

1. Antithamnion antillanum Børgs.

BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 226, figs. 213—216.

When I described this species I based it upon very little material, pointing out that it was no doubt very closely related to *A. cruciatum*, but that on some points it differed essentially from that plant.

I have now found this species in my Canarian collection, and as the Canarian specimens are well developed, I am able to give a supplementary description of the plant.

The decumbent creeping filaments are fastened to the substratum by means of vigorous hapters. The stem in these is of variable length and composed of thick-walled cells more or less doleiformis. The hapters end in a vigorous disc or are sometimes divided into several branches (comp. fig. 213, l. c.).

From the creeping filaments erect ones grow up. They are oppositely ramified (Fig. 19) and the pairs of pinnæ are decussately arranged. The main filaments are about

50—60 μ thick. A few of the pinnæ may grow out now and then as main branches, but most of them remain short with definite growth.

The pinnæ are as a rule alternately ramified, the pinnules being placed distichously up along the rachis; in the more vigorous pinnæ, however, a single or a few oppositely placed and more vigorously developed pinnules are present at their base (Fig. 20 *a*, *b*).

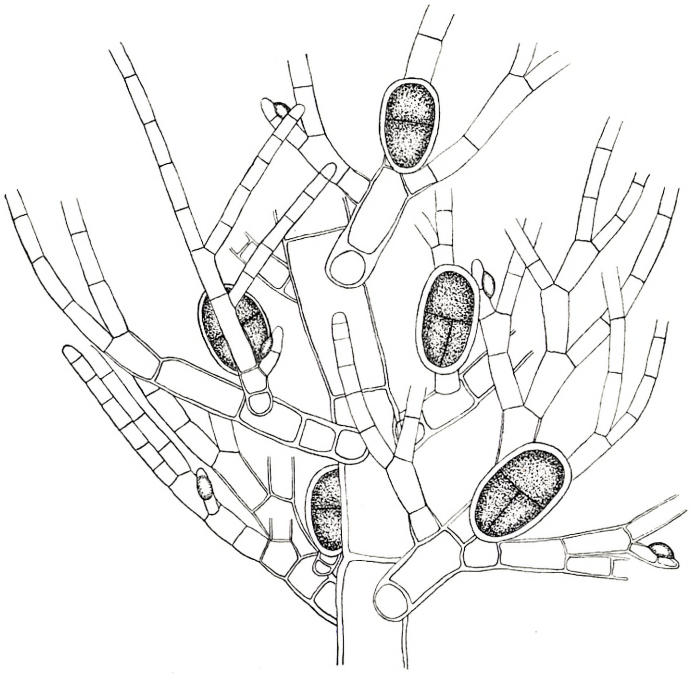

Fig. 19. *Antithamnion antillanum* Børgs. Part of the thallus with tetrasporangia. (about 200 : 1).

As with the West Indian plant so also in the Canarian the lowermost pinnules are ramified, giving off some pinnules of secondary order, while the uppermost are simple. These secondary pinnules as a rule issue unilaterally from the outer distal side of the main axis. The lowermost of

these secondary pinnules which is usually given off from the second basal cell of the rachis is quite small. It nearly

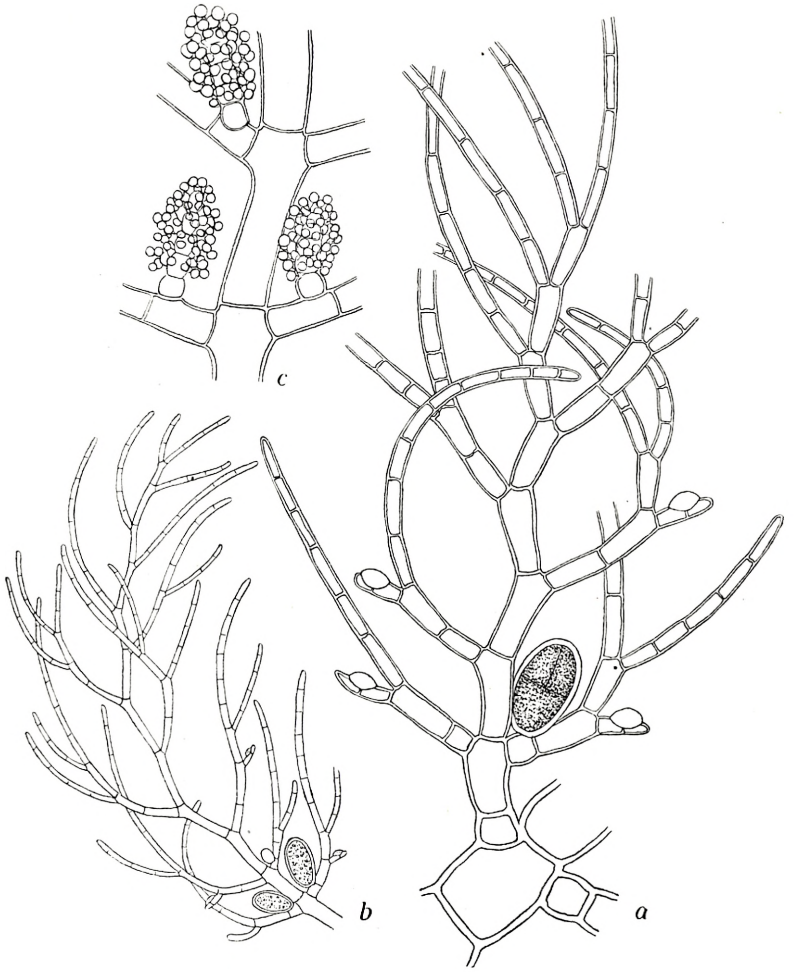

Fig. 20. *Antithamnion antillanum* Börgs. *a* and *b*, pinnæ with tetrasporangia. *c*, antheridial bodies. (*a*, about 200 : 1, *b*, about 75 : 1, *c*, about 350 : 1).

always consists of two cells, only rarely of more, and on the upper side carries a gland cell about 20 μ long and

15 μ broad (Fig. 20 *a*). Regarding the development of the glands I refer the reader to my description of the West Indian plant, this agreeing well with Nestler's[1] description of *Antithamnion cruciatum*. However, while in *A. cruciatum* the gland cells are in contact with 3—4 cells, in *A. antillanum* the gland cells rest only on half of the two cells of which the pinnules in this species are composed.

Tetrasporangia, of which I have seen only very few in the West Indian plant, were found in great number in the Canarian material. The sporangia are placed on the upper side of the rachis in the pinnules near its base. They seem always to be sessile, and rarely more than one is developed in each pinnule. As to their size and shape they quite agreed with my figure and description, having the characteristic, sub-cylindrical appearance with broadly rounded apex and base. The sporangia are about 80—100 μ long and 40—50 μ broad.

Of plants with sexual organs I have found only male plants. The antheridial bodies (Fig. 20 *c*) have a similar position to that of the tetrasporangia, being placed on the upper side of the lowermost cells in the pinnules and, as is the case with the tetrasporangia, only one or as a rule two antheridial clusters are developed in each pinnule. They are provided with a short unicellular stalk, their shape is ovate-pyramidal and they are up to about 40 μ high and 25—30 μ broad.

As said above, the plant is no doubt nearly related to *Antithamnion cruciatum*. Nevertheless it is easily recognizable from *A. cruciatum*, for instance by means of the two-celled

[1] Nestler, A., Die Blasenzellen von Antithamnion Plumula (Ellis) Thur. und Antithamnion cruciatum (AG.) Nägl. (Wissensch. Meeresuntersuchungen, III. Bd. I, 1899).

pinnules carrying the gland cells and by means of the sessile and differently shaped tetrasporangia.

The plant was gathered in somewhat sheltered places. It had tetrasporangia in the month of March. It was found as an epiphyte upon *Zonaria variegata*.

Gran Canaria: Bahia del Confital.
Geogr. Distrib. West Indies, Canary Islands.

2. Antithamnion cruciatum (Ag.) Näg.

NÄGELI, Neuern Algensysteme, p. 200, tab. VI, fig. 1—6, ROSENVINGE, Mar. Alg. Denm., III, p. 359 (where more literature is to be found).

Callithamnion cruciatum C. Ag., in Flora 1827, II, p. 637. HARVEY, Phycol. Brit., pl. 164. J. AGARDH, Spec. Alg., vol. II, p. 27.

Of this species I have found a few small specimens. The erect branches bear opposite branchlets placed decussately upon the main branches and the pinnules are placed oppositely on the rachis of the branchlets with the exception of the uppermost ones which are alternating. The gland cells are found upon small pinnules consisting as a rule of 3 cells, more rarely of two only. The specimens were all sterile. It was found in rather exposed places somewhat above, or when sheltered by rocks, near low water mark.

Teneriffe: Orotava (SAUVAGEAU). Gran Canaria: Playa de Santa Catalina; Castillo.

Geogr. Distrib. Along the North Atlantic coast of Europe and North America, Morocco, Canary Islands, Mediterranean Sea.

3. Antithamnion pteroton (Schousb.) Bornet.

BORNET, E., Algues de Schousboe, p. 331, pl. III, figs. 8 and 9.

Callithamnion pteroton Schousb., Icon. ined., t. 389; Descript., p. 319; Alg. Schousb. no. 247.

BORNET, l. c., p. 332 mentions that this fine plant occurs at the Canary Islands. He writes: "Dans l'herbier MON-

TAGNE, sous le nom de *Callithamnion micropterum*, et venant aussi des Canaries, se trouve un très petit échantillon, fixé sur un fragment de Coralline, qui appartient à l'*Antithamnion pteroton*".

Geogr. Distrib. Tanger, Canary Islands.

4. Antithamnion elegans Berth.

BERTHOLD, G., Über die Vertheilung der Algen im Golf von Neapel, p. 516. FUNK, G., Über einige Ceramiaceen aus dem Golf von Neapel (Beih. z. Bot. Centralbl., Bd. 39, Abt. II, 1922, p. 241, tab. V, fig. 17.).

BERTHOLD's description of this species is poor. It is said to differ essentially from *Antithamnion cruciatum* on account of its having a more delicate thallus and three pinnæ in each of the whorls. As Funk has pointed out, the last character is of no value as *Antithamnion cruciatum* often has three pinnæ only in each whirl, and I can add that in the Canarian specimens of *Antithamnion elegans* I have as a rule found four pinnæ in each whorl. But FUNK who has had an opportunity to examine the original plant of BERTHOLD has found a character by means of which *Antithamnion elegans* seems easy to diagnosticate, namely the disposition of the gland cells. The material of this species which I first examined, and upon which the following description is especially based, had very few gland cells, but later on I found another gathering in which the gland cells were more numerous and disposed similarly to those seen in FUNK's figure, so I do not hesitate to refer the Canarian plant to BERTHOLD's species.

The plant (Figs. 21, 22) upon which the following description is based, was found as an epiphyte upon *Gelidium corneum* upon the thallus of which the decumbent creeping

filaments are fixed. The erect filaments issuing from these reach a height of about 2 mm, rarely more.

The creeping filaments are fixed to the host by means of vigorous hapters (Fig. 21 *a*); these are as a rule short

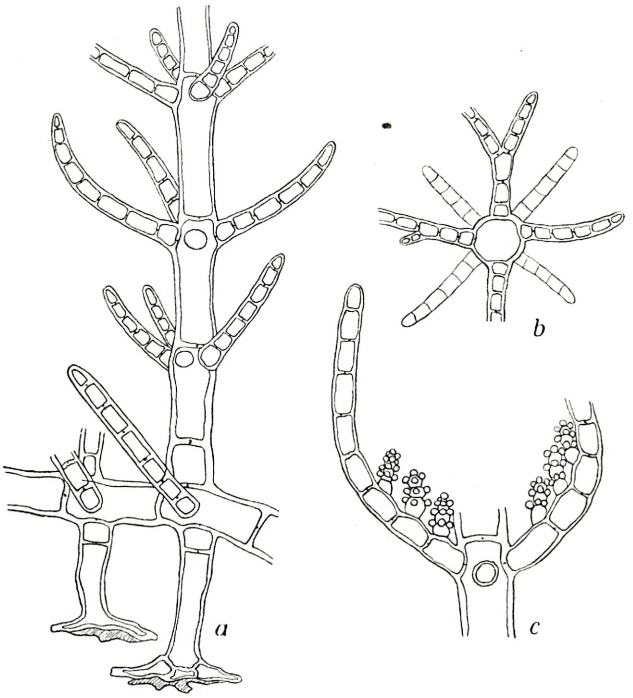

Fig. 21. *Antithamnion elegans* Berth. *a*, part of creeping filament; *b*, transverse section of the thallus showing the decussate arrangement of the pinnæ; *c*, part of a male plant. (*a* and *b*, about 200 : 1, *c*, about 350 : 1).

and composed of a short cell at their outgrowth and a single one in the stalk, and end in a broad disk. The creeping filaments are composed of cells about 80 μ long and 28—40 μ broad, their wall is about 4 μ thick. From each joint in the filament as a rule four pinnæ arranged in a whirl are given off; of these the lowermost pinnæ are transformed into the above-mentioned hapters, while

those placed oppositely to these on the upper side of the filaments generally develop into erect shoots; the pinnæ on both sides in most cases remain dwarfish, undeveloped, or more rarely they get indefinite growth, becoming creeping filaments or, when bending upwards, erect ones.

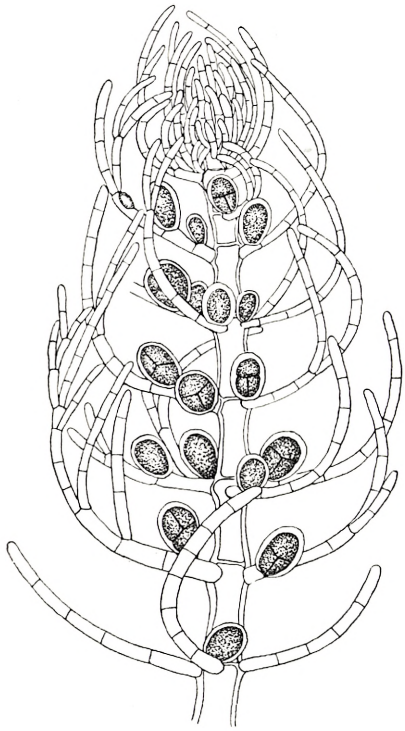

Fig. 22. *Antithamnion elegans* Berth. Part of a tetrasporic shoot. (about 225 : 1).

The erect filaments issuing from the decumbent filaments have cells about 62—160 μ long and 25—40 μ broad. At the upper end of each joint four pinnæ arranged in a whirl with right angles between them are given off. The pinnæ reach a length of about 150 μ when vigorously developed. They are composed of cells about 10—13 μ broad at their base and about 7—8 at their summits, the cells reaching a length of about $1^1/_2$—2 times their breadth. The pinnæ are as a rule placed alternating in whorls in 8 rows, each whorl of pinnæ being placed above the interstice between the pinnæ in the whorl below (Fig. 21 *b*) but not always quite regularly. In the lower part of the branches the pinnules are as a rule unbranched, higher up ramified, the pinnules being alternate or, in the upper part, unilateral. The distance between the

whorls is rather varying depending on the length of the cells. As in the decumbent filaments every pinna can be transformed into a shoot with indefinite growth, but this seems very rarely to take place in the erect filaments of this plant.

The gland cells (Fig. 23) are rather large, oblong, about 16—20 μ long and 8—12 μ broad. They rest on a single cell, having almost the same length as this. As a rule they occur near the middle of the pinnæ (Fig. 22, 23 *a*); so far as I have seen in this gathering the gland and the cell upon which it rests are always formed where a branch is given off. In this gathering as a rule only one gland cell occurs in each pinna, two are rarely present. The gland cells are most richly developed in the sterile plants; in the tetrasporic and antheridial ones they were rare (Fig. 22).

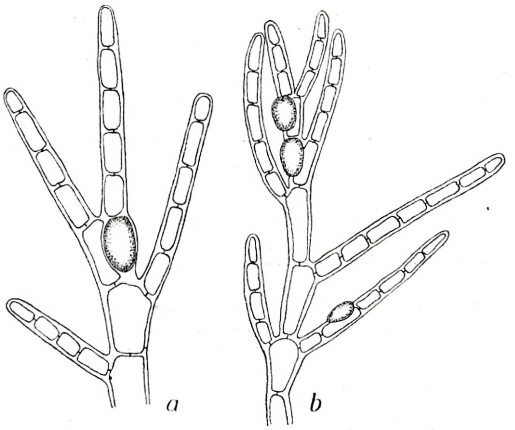

Fig. 23. *Antithamnion elegans* Berth. Pinnæ with gland cells. (about 200 : 1).

I have found only tetrasporic and antheridial specimens.

The tetrasporangia (Fig. 22) are developed near the base of the pinnæ, rarely more than one or two from each pinna. The tetrasporangia are placed on the upper side of the branches, they are cruciately divided, sessile, ovate-oblong of shape, about 40 μ long and 28 μ broad.

The antheridial bodies (Fig. 21 *c*) like the tetrasporangia are developed on the pinnæ, upon the cells in the lower

part of these and on their upper side. The antheridial bodies can be compared with a diminutive main shoot, the main stem in these being composed of short cells (4—5) each carrying a whorl of four cells from which the antheridia are developed.

In another collection more vigorously developed specimens occurred. The plant was growing upon *Corallina* together with various other algæ e. g. *Polysiphonia breviarticulata*, *Dipterosiphonia dendritica*, *Ceramium* etc. and still it was sterile. But the pinnæ were larger, more richly ramified, and this plant also differed from the above described one by the fact that the erect filaments were much branched, giving out several shoots with indefinite growth. The gland cells were present in greater number, often 3—5 or even more in each pinna (Fig. 23 *b*) occurred, not only in the same place a described above, but also in accordance with Funk's figure, upon the cells higher up in the pinnules. In other respects the two plants seem to agree quite well, so I consider the differences pointed out to be due to the more vigorous development of our plant.

Both gatherings were found in exposed places near low water mark. Plants with tetraspores and antheridia were found in the month of March.

Gran Canaria: Christoballo, Playa de las Canteras.

Geogr. Distrib. Hitherto found only in the Gulf of Naples.

Crouania J. Ag.

1. Crouania attenuata (Bonnem.) J. Ag.

Agardh, J., Alg. mediterr., p. 83. Harvey, Nereis Bor.-Am., p. 226, pl. 31 D. Børgesen, F., Mar. Alg. D. W. I., vol. II, p. 230—233, figs. 219—221.

Batrachospermum attenuatum Bonnem. in Herb. Ag.; comp. J. Agardh, Spec. Alg., vol. II, p. 105.

(For more synonyms compare DE-TONI, Sylloge. Alg., vol. IV, Florideae, p. 1417).

This species has been found several times intermingled among other algæ for instance *Callithamnion tetragonum*, *Lomentaria articulata*, *Chætomorpha* etc. The specimens were sterile. It was gathered in exposed localities near low water mark.

It has not previously been found at the Canary Islands.

Teneriffe: Orotava. Gran Canaria, Christoballo.

Geogr. Distrib. Mediterranean Sea, from the English coast southwards to the Canary Islands, West Indies.

Subfam. 8. Spyridieæ.

Spyridia Harv.

1. Spyridia filamentosa (Wulf.) Harv.

HARVEY, W. H., in HOOKER, Brit. Flora, vol. II, 1833, p. 337; Manual Brit. Alg., 1841., p. 101; Phycologia Brit., pl. 46. AGARDH, J., Spec. Alg., vol. II, p. 340; Epicrisis, p. 268. FARLOW, W. G., Mar. Alg. of New England, p. 140, pl. X, fig. 1 and pl. XII, fig. 2. BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 233, figs. 222—226. DE-TONI, Sylloge Alg., vol. IV, sect. III, p. 1427 (where more litterature is quoted).

Fucus filamentosus Wulfen, Cryptogama aquatica in ROEMER's Archiv f. d. Bot., III, 1803—5, p. 64.

In my West Indian algal flora I have pointed out that this plant is very plastic, varying much according to the different localities and external conditions prevailing there. This I have had confirmed, too, when examining the Canarian specimens. Thus the specimens from more open shores were robust with short ramuli, like my Fig. 224 l. c., while the plants I gathered in stagnant calm water in the uppermost part of Bahia del Confital behind the Isleta were flabby with long thin ramuli.

Specimens with tetrasporangia are found in the month of March. The plant prefers rather or quite sheltered places. It grows in shallow water somewhat below low-water mark and is furthermore common in rock pools in which the water is retained during ebbtide. In such places it has a yellow brown colour.

This species is no doubt common at the Islands and is mentioned by most investigators as found there. Montagne writes about it: "Ad rupes maritimas anfractuosas in portu *S. Cruz* cl. Bory, in orâ australi Teneriffæ circà *Guimar* clarr. Webb. et Berthelot, in promontorio tandem *Punta de Melenera* dicto cl. Despréaux hancce Algam legerunt".

Geogr. Distrib. West Indies, warmer parts of the Atlantic Ocean, Mediterranean Sea, Red Sea, Indian Ocean.

2. **Spyridia aculeata** (Schimp.) Kütz.

Kützing, Phycologia generalis, 1843, p. 377; Spec. Alg., 1849, p. 668; Tabulæ phycologicæ, vol. XII, tab. 51, figs. a, b. Agardh, J., Spec. Alg., vol. II, pars II, p. 342; Epicrisis, p. 271. Harvey, W. H., Nereis Bor.-Am., 1853, part II, p. 205. Børgesen, F., Mar. Alg. D. W. I., vol. II, p. 237.

Spyridia armata Kütz., Tab. phycologicæ, vol. XII, pl. 50, figs. c, d.

Spyridia Berkeleyana Mont. in Exploration scient. de l'Algerie, p. 141, pl. 15, fig. 6.

Ceramium aculeatum Schimper in Unio itin., n. 966 (non vidi).

Var. *typica* Børgs., l. c. p. 238, fig. 228.

Var. *disticha* Børgs., l. c. p. 238, fig. 229.

The Canarian specimens are in good accordance with the West Indian plant; at their base the ramuli had a breadth of up to 80 μ, tapering gradually upwards. While tendrils were common in the West Indian plants, I have not found any in my Canarian specimens.

Of the var. *disticha* I only once found a small specimen.

Specimens with tetrasporangia are found in the month of January.

The plant occurs in exposed localities somewhat above low water mark.

Teneriffe: Orotava (SAUVAGEAU,!), without locality (LIEBETRUTH). Gran Canaria: Playa de las Canteras.

Geogr. Distrib. West Indies, Southern shores of Europe, Morocco, Mediterranean Sea, Red Sea.

Subfam. 9. Ceramieæ.

Ceramium Lyngb.

1. Ceramium rubrum (Huds.) Ag[1].

AGARDH, C., Synopsis Alg., p. 60; Spec. Alg., vol. II, p. 146 J. AGARDH, Spec. Alg., vol. II, part 1, p. 127.

Conferva rubra Huds., Fl. Anglica, p. 600.

Of this species only very little material is present in my collection. It is found in the littoral zone in not too much exposed localities.

Gran Canaria: Christoballo, Playa de Santa Catalina. MONTAGNE l. c., p. 173 does not give any exact locality, he only writes: "In littore insulæ Canariæ rarissimum".

Geogr. Distrib. Wide-spread.

2. Ceramium diaphanum (Lightf.) Roth.

ROTH, Catal. botan., vol. III, p. 154. HARVEY, Phycologia brit., tab. 193. J. AGARDH, Spec. alg., vol. II, pars 1, p. 125; Epicrisis, p. 98.

Conferva diaphana Lightf., Flora scotica, p. 996.

[1] Dr. HENNING E. PETERSEN has most kindly determined my material of the genus *Ceramium*.

This species has been gathered several times in the littoral zone in more or less exposed localities where it often forms felted coverings upon stones together with other small algæ. Specimens found in March had tetrasporangia.

Gran Canaria: Christoballo, Playa de Santa Catalina, Bahia del Confital. Montagne l. c., p. 173 does not give any exact locality: "In conchis marinis *Griffithsiæ arachnoideæ* immixtum; in Canariâ à cl. Despréaux lectum".

Geogr. Distrib. European and American coasts, Morocco, Mediterranean Sea, Cape etc.

3. Ceramium strictum Grev. et Harv.

Harvey, Phycol. brit., pl. 334. J. Agardh, Spec. alg., vol. II, pars 1, p. 123; Epicrisis, p. 97.

This species has only once been found growing together with other small algæ upon stones in the littoral zone.

Gran Canaria: Las Palmas.

Geogr. Distrib. Warmer parts of the Atlantic Ocean, Mediterranean Sea.

4. Ceramium transversale Collins and Hervey.

Collins and Hervey, Alg. of Bermuda, p. 145, pl. V, fig. 29—31. Børgesen, Mar. Alg. D. W. I., vol. II, p. 243, fig. 233. H. E. Petersen, Algæ in Report on the Danish Oceanogr. Expedit. 1908—10, vol. II K 3, p. 14, figs. 5—7.

This fine little plant was at first described from the Bermudas and was shortly after found in collections of algæ from the Mediterranean Sea by H. E. Petersen. At the Canary Islands I have found it several times. It creeps upon larger Algæ, for instance *Laurencia*, near low water mark or somewhat below in more or less exposed places.

Gran Canaria: Christoballo, Bahia del Confital.

Geogr. Distrib.: West Indies, Mediterranean Sea, Canary Islands.

5. Ceramium ciliatum (Ellis) Ducl.

Ducluzeau, Essai sur l'Hist. Nat. des Conferves des environs de Montpellier, 1805, p. 64. Harvey, Phyc. Brit., pl. 139. J. Agardh, Spec. Alg., vol. II, pars 1, p. 133; Epicrisis, p. 103.

Conferva ciliata Ellis in Philos. Transact., 57, p. 425.

Besides typical specimens a peculiar form with very low belts is found (Fig. 24).

This species has been found in the littoral zone in exposed as well as sheltered places and seems to be common at the Islands. It has been found with tetrasporangia in the months of January and March.

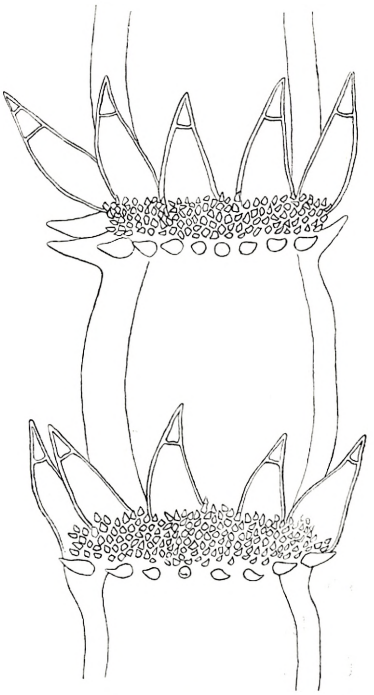

Fig. 24. *Ceramium ciliatum* (Ellis) Ducl. Peculiar form with very low belts. (about 200:1).

Teneriffe: Orotava, St. Andres, Santa Cruz (according to Montagne, l. c. p. 174). Gran Canaria: Bahia del Confital; without locality Liebetruth according to Piccone, Punta de Telde (Despréaux).

Geogr. Distrib. From the Færöes southwards to the Canary Islands, Mediterranean Sea.

6. Ceramium flabelligerum J. Ag.

J. Agardh, In systemata alg. hodierna adversaria, 1844, p. 27; Spec. Alg., vol. II, pars. 1., p. 134. Epicrisis, p. 103. Harvey, Phycologia Brit., pl. 114.

In some specimens gathered by Professor Sauvageau at Orotava numerous short spinulæ were found scattered over the surface of the thallus (Fig. 25).

This species seems to be common at the Islands where I have found it in the littoral zone even in very exposed localities. It had tetrasporangia in the month of January.

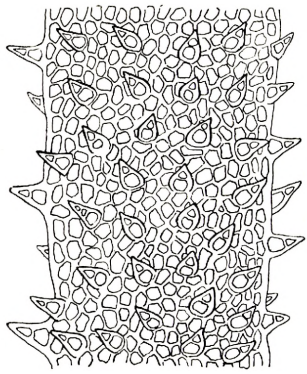

Fig. 25. *Ceramium flabelligerum*. Older part of the thallus with short spinulæ scattered over the surface. (about 200 : 1).

Teneriffe: Orotava (Sauvageau). Gran Canaria: Castillo, Playa de Santa Catalina, Christoballo.

Geogr. Distrib. From the English coast southwards to the Canary Islands.

7. Ceramium echionotum J. Ag.

J. Agardh, In systemata alg. hodierna adversaria, 1844, p. 27; Spec. Alg., vol. II, p. 1, p. 131; Epicrisis, p. 102. Harvey, Phycol. Brit., pl. 191.

Found in the littoral zone in more or less exposed localities. It had tetrasporangia in March.

Gran Canaria: Cristoballo, Bahia del Confital (M^lle^ Vickers,!).

Geogr. Distrib. From the English coast southwards to the Canary Islands; Mediterranean Sea.

In "A Propos des *Cystoseira* de Banyuls et de Guéthary" (Bull. de la Station Biologique d'Arcachon, 14^ième^ Anneé, 1911—12) p. 53 Sauvageau mentions *Ceramium acanthonotum* Carm. as found at the Canary Islands. Dr. H. E. Petersen has examined the specimens of Sauvageau and has found that these contain partly *Ceramiun ciliatum* and partly *Ceramium flabelligerum*.

Centroceras Kütz.

1. Centroceras clavulatum (Ag.) Mont.

Montagne, C., Exploration scientifique de l'Algérie, Algues, Tome I, 1846, p. 140. J. Agardh, Spec. Alg., vol. II, p. 148; Epicrisis, p. 108. Harvey, Nereis Bor.-Am., part II, p. 211, tab. 33 C.

Ceramium clavulatum Ag. in Kunth, Synopsis Plantarum, vol. II, 1822, p. 2.

This plant is found in more or less sheltered localities near low water mark or somewhat below, growing together with other small tufted Algæ, for instance *Corallina*.

It was common in the environs of Las Palmas where M^lle^ VICKERS has also collected it; on the other hand I have not found it at Teneriffe.

Geogr. Distrib.: Seems to occur in all warmer seas.

Fam. 2. ***Rhodomelaceæ.***

Subfam. 1. Laurencieæ.

Laurencia Lamx.

My material of this genus is very scarce and consists for the most part of poorly developed specimens. On the other hand the collection of Prof. SAUVAGEAU contains several good specimens.

1. **Laurencia obtusa** (Huds.) Lamour.

LAMOUROUX, J., Essai Thalassioph., p. 42. J. AGARDH, Spec. Alg., vol. II, pars 3, p. 750; Epicrisis, p. 653. HARVEY, Phycologia Brit., pl. 148.

Fucus obtusus Huds., Fl. Angl., p. 586. TURNER, Fuci, vol. I, tab. 21.

Of this species I have found a form which agrees very well with the one I have found in the West Indies and referred to var. *gelatinosa* (Mar. Alg. D. W. I., vol. II, p. 249, figs. 238—9). The main stems bear short branches on all sides, placed more or less vertically.

The specimens were tetrasporic. *Ricardia Montagnei* Derb. and Sol. was found upon them.

This species is mentioned from the Islands by most investigators and is most probably common there.

Geogr. Distrib. Warmer parts of the Atlantic Ocean, Mediterranean Sea, West Indies, Indian Ocean etc.

In "Crociera", p. 44, Piccone mentions that "un solo e meschinissimo esemplare" of *Laurencia papillosa* (Forsk.) Grev. has been found at the island *Graciosa* by Capt. d'Albertis. Dr. Achille Forti has most kindly allowed me to see the small fragment. It was so small that I did not feel inclined to make an anatomical examination of it, but according to its appearance and colour, more reddish than *L. papillosa*, it can most probably be referred to *Laurencia obtusa*.

2. Laurencia hybrida (DC.) Lenorm.

Lenormand in Duby, Botanicon Gallicum, 1830, pars 2. p. 951. Kützing, Spec. Alg., p. 856; Tab. Phycol., vol. XV, pl. 65, b, c. J. Agardh, Spec. Alg., vol. II, p. 76. Le Jolis, Alg. Mar. Cherbourg, p. 148. De-Toni, Sylloge Alg., vol. IV, 3, p. 796. Cotton, Clare Island Survey — Marine Algæ (Proceed. Roy. Irish Acad., vol. 31, 1912, p. 136).

Fucus hybridus De Candolle, Flore Française, tome II, 1805, p. 30.

Laurencia cæspitosa Lamx., Essai Thalassioph., 1813, p. 43. Montagne, Iles Canaries, p. 154. Bornet, E., Alg. Schousboe, p. 300.

Laurencia canariensis Mont. in litt., Kützing, Spec. Alg., p. 854 et 856.

Cotton has very clearly shown (l. c.) that the name to be used for this species is *Laurencia hybrida* (DC.) Lenorm. as *Fucus hybridus* DC. is the oldest name (1805) while Lamouroux' name *L. cæspitosa* is from the year 1813 and a nomen nudum only. As Cotton points out, it was not until 1840 that Montagne took up the name *Laurencia cæspitosa* Lamx. for a Canarian plant in his work on the

Canarian algæ, and this name has subsequently been used very much. But later MONTAGNE changed his former determination and gave this plant the new name *Laurencia canariensis* (in KÜTZING, Species Alg. p. 854)[1].

This species is mentioned at the Islands by most investigators and is most probably common there.

Geogr. Distrib. From the English coast southwards to the Canary Islands.

3. Laurencia pinnatifida (Gmel.) Lamour.

LAMOUROUX, I., Essai, p. 42; J. AGARDH, Spec. Alg., vol. II, p. 764; Epicrisis, p. 656.

Fucus pinnatifidus Gmelin, Syst. Nat., vol. II, p. 1385. TURNER, Fuci, tab. 20.

SAUVAGEAU has gathered fine specimens of this species at Orotava and I myself have found a small specimen near Las Palmas.

From MONTAGNE's herbarium I have seen a small fragment gathered by WEBB. *Laurencia pinnatifida* is also mentioned by PICCONE, l. c., p. 46.

This species is surely not common at the Islands. MONTAGNE writes p. 154: "In oris Canariensibus, si autem ex unico specimine lecto conjicere licet, rara".

Teneriffe: Orotava (SAUVAGEAU). Gran Canaria: Christoballo, withouth locality (WEBB). Isola Graciosa (d'ALBERTIS).

Geogr. Distrib. From the Færöes southwards to the Canary Islands, Mediterranean Sea.

4. Laurencia perforata (Bory) Mont.

MONTAGNE, "Iles Canaries", p. 155. KÜTZING, Spec. Alg., p. 853; Tab. Phycolog., vol. XV, tab. 49, figs. e—g. J. AGARDH, Spec. Alg., p. 748; Epicrisis, p. 648.

[1] On page 856 in the same work KÜTZING mentions another *Laurencia canariensis* with a somewhat different diagnosis. But as *Laurencia cæspitosa* Mont., p. 154 is quoted in both places as a synonym, it is most probably the same plant we have to do with.

Fucus perforatus Bory, Essai sur les îles Fortunées, p. 305, pl. 5, fig. 1. B. C. (non vidi).

This species has been described by MONTAGNE upon specimens from the Canary Islands, where I too have found it several times. My specimens seem to agree very well with an original specimen from Herb. MONTAGNE which Dr. HAMEL has most kindly allowed me to see.

This species is no doubt nearly related to *Laurencia papillosa* (Forsk.) Grev. When compared with my figure 236, p. 247 in vol. II of "The Mar. Alg. of the D. W. I." showing a transverse section of *Laurencia papillosa*, a similar section of the thallus of this species shows that here also the epidermal cells are narrow, pallissade-like (Fig. 26); sometimes, perhaps especially lower down in the thallus, some of the epidermal cells may be somewhat broader.

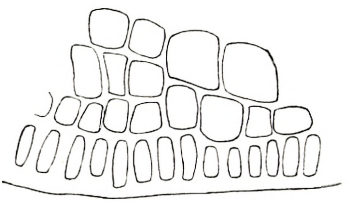

Fig. 26. *Laurencia perforata* Mont. Transverse section of the thallus. (about 175 : 1).

The Japanese algologist Dr. YUKIO YAMADA, who is working out a monograph of the troublesome genus *Laurencia*, had, during his stay in Paris, made a transverse section of the thallus of *L. perforata* Mont., and during his visit to Copenhagen he allowed me to compare his preparation with those of my specimens and I have thus also been able to establish the anatomical identity of my specimens with that of MONTAGNE.

As to the ramification, the branchlets, when compared with the very short ones in *Laurencia papillosa*, are considerably longer, especially the lower ones upon the bran-

ches; the branchlets are more or less secundly arranged and often curved.

The specimens were found upon a very exposed coast near low water mark. Upon one of the specimens *Ricardia* was rather common.

Gran Canaria: Playa de Santa Catalina, Playa de las Canteras. Teneriffe: Orotava. MONTAGNE, l. c. p. 155 does not give any exact locality, he writes: "In rupibus ad littora Canariensia vulgaris". Palma: (LIEBETRUTH).

Geogr. Distrib. Canary Islands, Madeira. Reported from the Bermudas, but the determination seems to be wrong. Compare M. A. HOWE, Algæ in BRITTON, Flora of Bermuda, p. 519.

Janczewskia Solms.

1. Janczewskia verrucæformis Solms.

SOLMS-LAUBACH, H., Note sur le JANCZEWSKIA in Mém. Soc. Nat. Sc. Natur. Cherbourg, T. XXI, 1877, p. 209, pl. 3. HAUCK, Meeresalgen, p. 524. FALKENBERG, P., Rhodomelaceen, p. 259, pl. 24, figs., 16—17. SETCHELL, W. A., Parasitic Florideæ, I, in University of California Public. in Bot., vol. 6, no. 1, p. 8.

Upon a small tuft of *Laurencia obtusa* I have once found a few specimens of this plant. As described by SOLMS it forms small roundish bodies upon the thallus of the host plant; the female plant when fully developed has the surface covered by the projecting roundish cystocarps, while the tetrasporic and the male specimens have a less warty surface. When living the parasite had a pale orange-yellow colour. At the place where the parasite is fixed to the host plant the thallus of the latter forms a sharp bend. The parasite sends filaments composed of longer or shorter cells into the thallus of the *Laurencia*. Fig. 27 *a* shows a transverse section of the thallus of *Janczewskia* and a part of the thallus of the *Laurencia* infected by the parasite.

Referring the reader to Solms's and Falkenberg's descriptions I shall restrict myself to giving a short description

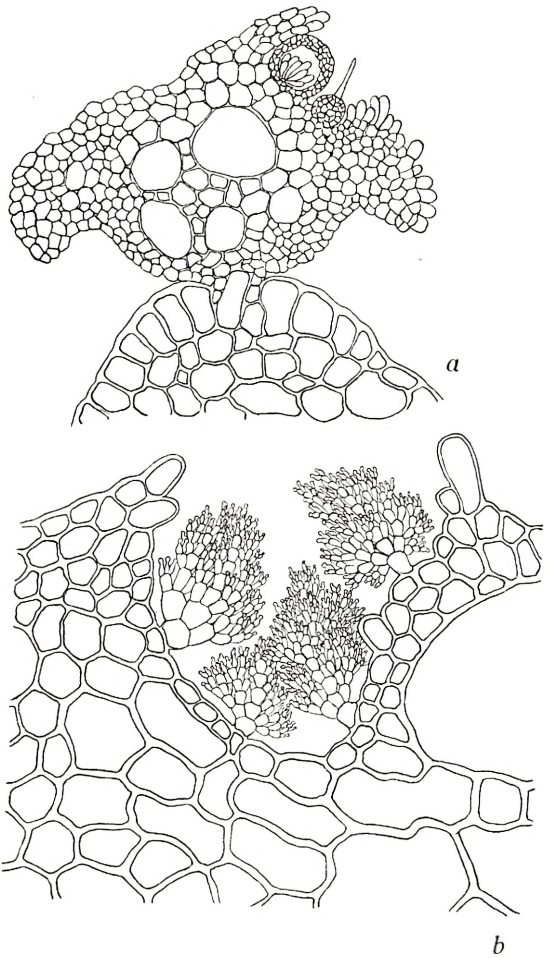

Fig. 27. *Janczewskia verrucæformis* Solms. *a*, transverse section of *Laurencia* with a young female thallus of *Janczewskia*. *b*, transverse section of a male plant. (*a*, about 85 : 1, *b*, about 270 : 1).

of the plant together with some figures of the tetrasporic and male plant.

The tetrasporangia (Fig. 28) are developed at the bottom

of small roundish depressions found scattered beside each other over the surface of the plant. A transverse section shows that these depressions are urceolate in shape, having

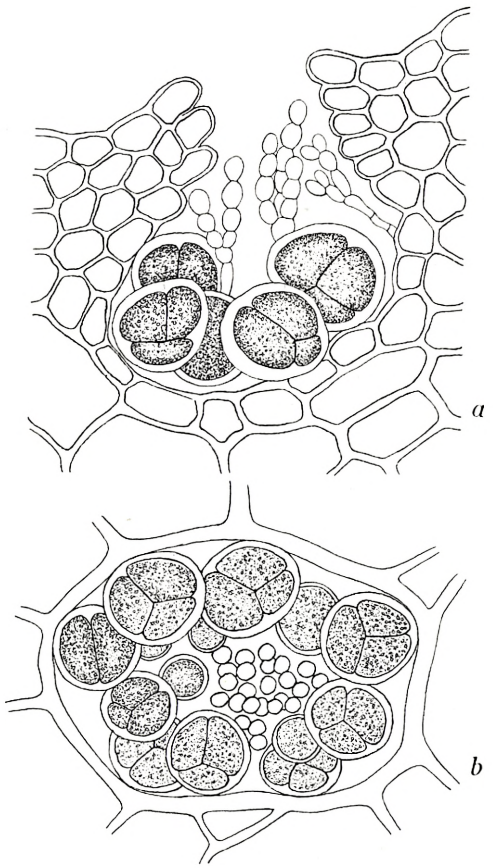

Fig. 28. *Janczewskia verrucæformis* Solms. *a*, a transverse section of a tetrasporic conceptacle; *b*, the same seen from above. (about 270 : 1).

a narrow ostiole above. From the bottom of the depressions ramified trichoblasts, composed of oval cells becoming bigger upwards, protrude more or less up to the ostiole. The tetrasporangia are tetrahedrally divided but not always quite regularly.

The antheridial bodies (Fig. 27 *b*) are likewise developed in depressions in the thallus which occur beside each other all over the surface of the thallus. The antheridial bodies are of pyramidal shape, having a central stem of larger cells from which numerous branches, becoming shorter upwards, issue to all sides; the end cells are the antheridia in which the spermatia are formed. Several antheridial bodies grow out from the bottom and sides of the depressions. Solms has drawn an antheridial body (l. c., pl. 3, fig. 15) which ends in moniliform filaments composed of cells increasing upwards. In my material I have looked for these filaments in vain. As according to Falkenberg the development of the antheridial bodies takes place in a similar way to that in *Laurencia* (compare the figures of Falkenberg, tab. 23. figs. 23—25) Solms has most probably drawn an androphore which was not yet quite developed.

As to the female plant I refer to Solms and Falkenberg's descriptions and to the figures of Solms.

The plant was found in rather exposed places near low water mark in the month of January.

Teneriffe: Orotava.

Geogr. Distrib. Hitherto found only in the Mediterranean Sea.

Ricardia Derb. et Sol.

1. **Ricardia Montagnei** Derb. et Sol.

Derbès et Solier in Annales Sc. Nat., Bot., IV. sér., t. V. p. 209, tab. 14, figs. 1—7. Zanardini, Icon. Adriat., vol. II, tab. LXI. Schmitz und Hauptfleisch in Engler und Prantl, Natürl. Pflanzenfam., Teil I, Abt. 2, p. 420. Hauck, Meeresalgen, p. 203.

This interesting small parasitic plant has been found several times upon *Laurencia obtusa* and *Laurencia perforata*;

and once two specimens were found upon *Chondria tenuissima.*

The genus *Ricardia* was described by DERBÈS et SOLIER in the year 1856 upon the Mediterranean plant, but the larger Californian species *Ricardia saccata* was already described by J. AGARDH in the year 1849[1] upon specimens originating from Herb. GREVILLE and by him referred to the genus *Chylocladia.*

KYLIN[2] has recently given a detailed description of the Californian plant and points out that the Californian and the Mediterranean plants are very closely related, the different sizes of the two plants being the essential difference between them. As to this question compare also FARLOW's remarks in his paper: "On some new or imperfectly known Algæ of the United States", I, 1889, p, 2. (Bull. Torr. Bot. Club, vol. 16, no. 1), and those by SETCHELL in his paper: "Parasitic Florideæ of California", p. 4 (Nuova Notarisia, Serie 16, 1905).

We will leave this as it is, but in one respect at any rate, according to my Canarian material, I am able to add besides the size one more character by which the Canarian specimens, and to judge from the figures of DERBÈS and SOLIER and ZANARDINI, also the Mediterranean ones differ from the Californian plant. The trichoblasts are unramified, while, according to KYLIN's figures, those in the Californian plant are often ramified.

As described by KILLIAN ("Zeitschrift f. Bot.", vol. 6, 1914, p. 230) and later beautifully figured by GRUBER in

[1] J. AGARDH, Algologiska bidrag (Öfversigt K. Vet. Akad. Förhandl., 1849, p. 89); cfr. also J. Agardh, Spec. Alg., vol. II, p. 738.

[2] KYLIN, H., Entwicklungsgeschichtliche Florideenstudien (Lunds Universitets Årsskrift. N. F. Avd. 2. Bd. 24. Nr. 4. 1928, p. 94).

Oltmanns "Morphologie und Biologie der Algen", 2nd edit., vol. III, p. 484—5, fig. 775, the plant is fixed to the host

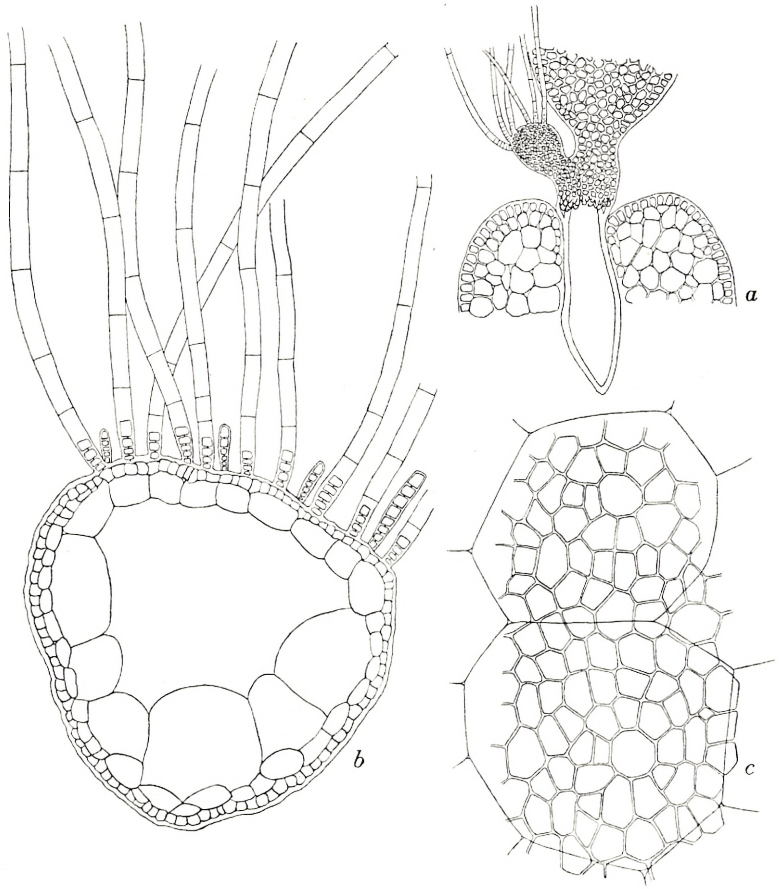

Fig. 29. *Ricardia Montagnei* Derb. et Sol. *a*, base of a plant; *b*, transverse section of a vesicle; *c*, small part of the cortical layer. (*a*, about 60 : 1, *b*, about 150 : 1; *c*, about 200 : 1).

plant by means of a very large thick-walled basal cell; this cell is nearly cylindrical in its upper end and tapers downwards (Fig. 29 *a*). The cell penetrates deeply into the tissue of the host. In the specimen figured by me the cell is about 120 μ thick and its wall 16 μ. The cortical layer

covering the whole plant is also present at the upper end of the large cell, but is wanting when it penetrates into the tissue of the host. I have not come across young sporelings, but KILLIAN describes and figures these p. 230, and KYLIN gives a detailed description of them and the development of the vesicles accompanied by very fine figures.

As a rule the plants are unramified but now and then I have found branched inviduals. Fig. 29 *a* shows such a case; a new vesicle is developed from the cortical layer at the upper end of the stalk. KYLIN has found the same in *R. saccata*.

As mentioned above, the plant is covered by a cortical layer; a glance at this will show that some of the cells of which it is composed are larger than the rest, roundish and rather regularly distributed over the surface; round these larger cells the smaller polygonal ones are arranged. One of these roundish cells lies nearly above the middle of each of the bigger cells inside the cortical layer (Fig. 29 *c*).

Fig. 29 *b* shows a somewhat oblique transverse section of a small young vesicle. The wall of the vesicle is seen to be composed of about 3 layers of cells, the largest facing the cavity; the diameter of these large cells often reaches a length of 150 μ or even more. At the upper end of the vesicle, where the trichoblasts are developed, the cells are smaller and, in the specimen examined, the wall consisted only of two layers of cells, namely the cortical layer and below a layer of larger roundish polygonal cells.

The trichoblasts have short coloured cells at their base, upwards the cells in these grow larger, become colourless and die away gradually. So far as I have seen the trichoblasts are, as mentioned above, always unramified composed of a single row of cells only. They are quite like

those I have found in the new genus *Stichothamnion* described below. Kylin mentions the peculiar fact that older and younger trichoblasts occur mixed together; this is also the case in *Ricardia Montagnei* (Fig. 29 *b*). The younger trichoblasts are to be considered as accessory ones, originating from the cells of the cortical layer.

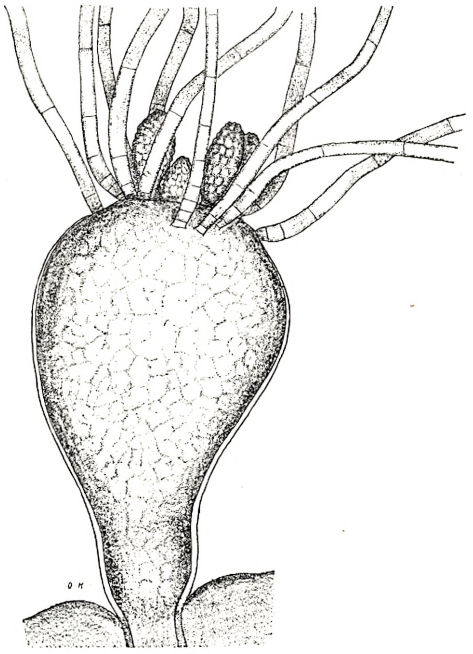

Fig. 30. *Ricardia Montagnei* Derb. et Sol. A male plant. (About 100 : 1).

Apart from sterile plants nearly all the material was antheridial (Fig. 30); of tetrasporic and female plants I have seen only one or two specimens of each.

The tetrahedrally divided sporangia are developed in the cortical layer. In the specimen I have seen they form a large sorus round the upper end of the vesicles.

The cystocarps are immersed in the thallus of the plant, forming only small roundish not very protruding elevations above it. They likewise occur near the upper end of the thallus. In *Ricardia saccata* Kylin has followed the development of the procarp and ripe cystocarp and given fine illustrations of them.

The antheridial bodies are developed from the trichoblasts. But while in *Ricardia saccata*, according to Kylin,

the lowermost or the two lowermost cells in the trichoblasts remain undivided, in the specimens of *Ricardia Montagnei* I have examined 3—4 of the lowermost cells in the trichoblasts remain undivided (Fig. 31). The other cells in the fertile trichoblasts become divided into a central and a number of pericentral cells. The last mentioned are again divided by walls in various directions into antheridia from which the spermatia are developed. Fig. 30 shows a small male plant and Fig. 31 the development of the androphores. The ripe androphores are ellipsoidal-cylindrical bodies about 80—100 μ long and 40 μ broad. Quite small male plants are fertile, on the other hand one of the largest plants I have seen was antheridial; it was $2^1/_4$ mm long and more than $1^1/_2$ mm broad and had innumerable quantities of androphores in all stages of development.

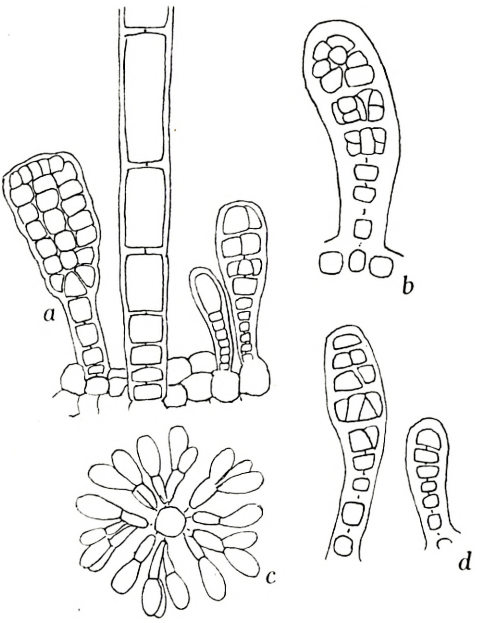

Fig. 31. *Ricardia Montagnei* Derb. et Sol. *a*, *b*, *c*, development of androphores; *d*, transverse section of androphore. (about 450 : 1).

As to the systematic position of this genus the opinions have varied much, but as KYLIN has pointed out, its proper place is among the *Rhodomelaceæ* since it is nearly allied to the *Laurencieæ*.

That this plant occurs at the Canary Islands has already

been stated by Gain and Mirande[1], who have found it in Herb. Bornet upon specimens of *Laurencia* gathered by Despréaux at Gran Canaria. Furthermore these investigators found this species in great number upon specimens of *Laurencia obtusa* originating from the Salvages Islands.

The plant is found in rather exposed places upon *Laurencia*, growing near or somewhat above low water mark. Furthermore a few specimens were found upon *Chondria tenuissima* collected in a quite sheltered locality.

Gran Canaria: Playa de Santa Catalina, Bahia del Confital, without locality (Despréaux).

Geogr. Distrib. Mediterranean Sea, Salvages Islands, Canary Islands.

Subfam. 2. Chondrieæ.

Chondria Harv.

Subgenus I. **Euchondria** Falkenb.

1. **Chondria tenuissima** (Good. et Woodw.) Ag.

Agardh, C., Spec. Alg., p. 352; Systema, p. 205. Thuret et Bornet, Études phycol. p. 88, tab. 43—48. Falkenberg, Rhodomelaceen, p. 195.

Fucus tenuissimus Good. et Woodw. in Linnean Transact., vol. III, 1797, p. 215.

I have twice found this species in different stages of development. One gathering consisted of a creeping form (forma *subtilis* Kütz?) very like a form distributed by Schiller in "Alg. Adriat. Exsicc.", no. 10.

It was found together with *Dilophus* etc. upon rocks near low water mark.

The decumbent filaments are fixed to the rocks by

[1] Gain, L. et R. Mirande, Note sur les Algues recuellies par M. L. Garreta aux Iles Salvages et Canaries (Bull. Mus. d'Hist. nat. 1912, no. 7).

means of vigorous hapters. The thallus has a diameter of about 500 μ in the more vigorous filaments, tapering to about 100 μ or less in the upper ramifications.

These specimens are tetrasporic.

The other time I met with this plant was in a very tranquil bay with stagnant water. I found only a small antheridial plant growing upon an old leaf of *Cymodocea nodosa*. The specimen was only about 2 cm high but it agreed perfectly with THURET and BORNET's excellent figures.

This specimen was gathered in the month of March and the tetrasporic plants mentioned above in the same month.

Upon the small antheridial plant two specimens of *Ricardia Montagnei* were growing; one of these was fixed to the stem of the *Chondria*, while the other one, a small young specimen, was placed, as is the rule with this plant, near the summit of a branch; but because of the pointed apex of this species of *Chondria*, it seemed difficult to the *Ricardia* to penetrate into the tissue of the host, the greater part of the long basal cell being bare. So far as I know, *Ricardia* has previously been found only upon *Laurencia*.

Chondria tenuissima seems not to have been met with at the Canary Islands before, but it is reported from the Salvages Islands by GAIN and MIRANDE (Bull. du Muséum d'Hist. naturelle, 1912, p. 481).

Gran Canaria: Playa de Santa Catalina, Bahia del Confital.

Geogr. Distrib. Warmer parts of the European Atlantic coast, Mediterranean Sea, West Indies etc.

Subgenus 2. **Coelochondria** Falkenb.

1. **Chondria dasyphylla** (Woodw.) Ag.

AGARDH, C., Spec. Alg., p. 350; HAUCK, Meeresalgen, p. 210. FALKENBERG, Rhodomelaceen, p. 197. BØRGESEN, Mar. Alg. D. W. I.,

vol. II, p. 258, figs. 251—2. De-Toni, Syll. Alg., Vol. IV, p. 842 (where more literature is mentioned).

Fucus dasyphyllus Woodw. in Trans. Linn. Soc., t. II, 1794, p. 239, pl. 23, figs. 1—3.

Of this species I have found a small female plant. It was growing upon a leaf of *Cymodocea nodosa* and was found in a quite sheltered locality with stagnant water. The specimen was gathered in the month of March. Piccone in "Crociera", p. 46 mentions this species as found at the Islands by Capt. D'Albertis.

Gran Canaria: Bahia del Confital. Lanzarote: Arrecife (D'Albertis).

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

Subfam. 3. Polysiphonieæ.

Polysiphonia Grev.

1. Polysiphonia macrocarpa Harv.

Harvey, W. H., in Mackay, Flor. Hibern., part 3, Algæ, p. 206. Bornet, E., Alg. de Schousboe, p. 306. Børgesen, F., Mar. Alg. D. W. I., vol. II, p. 274.

Polysiphonia pulvinata Harv., Phycol. Brit., pl. 102 B.

I have hesitated a little before referring the Canarian plant to *Polysiphonia macrocarpa* as in one respect it differs essentially from the West Indian plant as described by me, l. c. While in the West Indian plant the whole trichoblast is transformed into the androphores, in the Canarian plant only a part of the main stem is transformed, the two lowermost cells and a sidebranch issuing from the second cell remaining sterile (Fig. 32 *a*). So far as I have been able to see no information exists as to the building up of the antheridial bodies in the European plant. Among the species mentioned by Thuret et Bornet in "Études

phycologiques", p. 86, with reference to the varied development of the antheridial bodies in *Polysiphonia*, this species is not mentioned.

But it is perhaps very likely that some variations as to the development of the androphores are present in the same species[1] and as the plant in other respects agrees well with this species I do not consider it wrong to refer the Canarian plant to it.

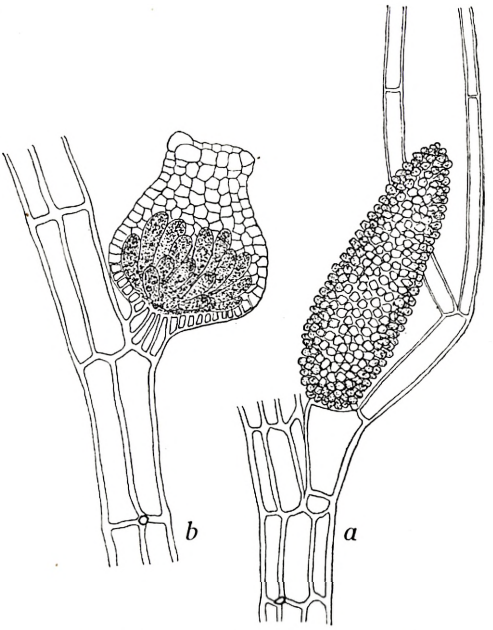

Fig. 32. *Polysiphonia macrocarpa* Harv. *a*, antheridial body; *b*, a cystocarp. (*a*, about 65 : 1; *b*, about 120 : 1).

As in the West Indian plant, here also the branches issue from the mother branch without any connection with the trichoblasts; compare my figure 274, l. c. The trichoblasts are arranged in a screw to the left with a $^1/_4$ divergence. The tetrasporangia (Fig. 33) are formed at the upper end of the filaments which may be branched or not, the fertile part is screw formed. The fertile segments have 6 pericentral cells of the length of the segments. The proportionally large cystocarps (Fig. 32 *b*) have the characteristic shape

[1] Compare in this respect ROSENVINGE's remarks regarding the variations of the antheridial bodies of *Polysiphonia* in "The Mar. Algæ of Denmark", Part III, Rhodophyceæ III, f. instance pp. 409, 437.

of this species, being urceolate with a rather long neck above. They are about 300 μ long and 280 μ broad.

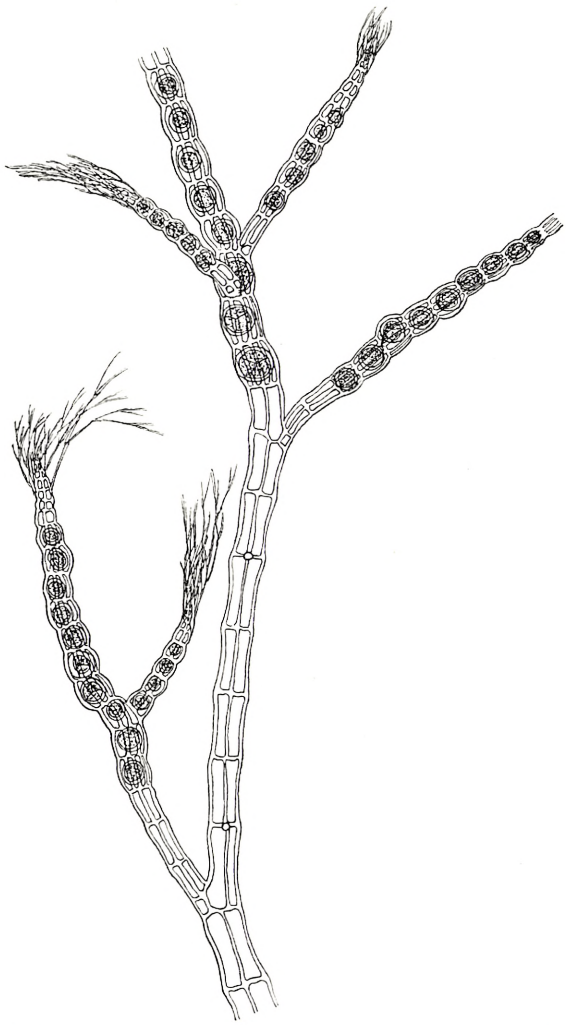

Fig. 33. *Polysiphonia macrocarpa* Harv. Part of tetrasporic plant. (about 50 : 1).

As mentioned above the antheridial bodies (Fig. 32 *a*) are formed by the main axis of the trichoblast with the excep-

tion of the two lowermost cells and a sterile branch issuing from the uppermost of these on its right side. They are subcylindrical in shape, often a little curved and tapering a little upwards, ending with a broadly rounded apex. In rare cases I have found a small sterile cell at the upper end. The antheridial body is about 180 μ long and 60 μ broad, the pedicel carrying it about 100 μ long and 40 μ broad.

At the base of the plant the main filaments had a breadth of up to 300 μ, in the middle of the plant about 170 μ. The length of the segments is about 250 μ.

Most probably the *Polysiphonia pulvinata* Spreng, mentioned by MONTAGNE l. c. p. 172, is referable to this species. The specimen of MONTAGNE which I have been allowed to see by the courtesy of Dr. HAMEL, Paris, is very small (scarcely 2 cm high) and sterile. It has four pericentral cells; it has been of interest to ascertain this, as the *Hutchinsia pulvinata* C. Ag. and most probably also *Conferva pulvinata* Roth both quoted by MONTAGNE, have six pericentral cells as pointed out by BORNET, l. c. p. 306.

The plant occurs in more or less exposed places between tide marks. Fruiting specimens are found from January to March.

Teneriffe: Orotava (SAUVAGEAU).

Gran Canaria: Playa de Santa Catalina, Bahia del Confital, without locality (WEBB). M^lle^ VICKERS mentions this species from Cristoballo with a?

Geogr. Distrib. From south of England to the Canary Islands, West Indies.

2. **Polysiphonia erythræa** (Schousboe) J. Ag.

AGARDH, J., Spec. Alg., vol. II, p. 996. BORNET, Algues de Schousboe, p. 308.

Hutchinsia erythræa Schousb. in herb.

Mlle Vickers mentions this species in her list of Canarian algæ. Bornet too refers to this species as a Canarian one.

Piccone in "Crociera", p. 56 mentions that Liebetruth has found *Polysiphonia gonathophora* Kütz. at the Islands (Teneriffe). I have not seen the specimen. Under this name Kützing has described two different forms, one with 4 pericentral cells (in "Phycologia Generalis", p. 426) and another with 6 pericentral cells (in "Spec. Alg.", p. 826). J. Agardh in "Species Algarum", vol. II, part III, p. 997 mentions that he has examined an authentic specimen of Kützing's with 4 pericentral cells and is of the opinion that this plant comes near to *Polysiphonia erythræa*. Without examination of Liebetruth's specimen it is of course impossible to say which of Kützing's species is in question.

As to its occurrence at the Islands Mlle Vickers writes: "Dans des petites flaques à marée haute. Rochers de Confital. Février. Parmi les exemplaires il y en a de magnifiquement fructifiés".

Geogr. Distrib. From the mouth of the Guadalquivir southwards to the Canary Islands.

3. Polysiphonia flocculosa (Ag.) Kütz.

Kützing, Spec. Alg., p. 832. J. Agardh, Spec. Alg., vol. II, 3, p. 1008. Bornet, Alg. Schousb. p. 309.

Hutchinsia flocculosa Ag., Syst. Alg., p. 152, Spec. Alg., vol. II, p. 61.

According to J. Agardh, l. c. and Bornet, l. c., this species occurs at the Canary Islands. Bornet points out that *Polysiphonia subcontinua* J. Ag. cannot be distinguished from *Polysiphonia flocculosa* (Ag.) Kütz.

Geogr. Distrib. Mediterranean Sea, Cadiz, Morocco, Canary Islands, Azores.

4. Polysiphonia violacea (Roth) Grev. emd. Rosenv.

Rosenvinge, L. Kolderup, Mar. Alg. Denm., Part III, Rhodophyceæ III, p. 422, figs. 365—375, where literature concerning this species is mentioned.

Ceramium violaceum Roth., Catal. bot., vol. I, p. 150.

The Canarian specimens seem to be in very good accordance with the description and fine figures of Rosenvinge quoted above[1]. The plant was found as an epiphyte upon larger algæ to which it was fastened by means of a bundle of rhizoids issuing from the basal cells in the stem and ending in discs; compare Rosenvinge's Fig. 365. The main stem is more or less covered by a cortical layer while the younger parts of the thallus are uncovered. The plant has four pericentral cells. In the main stems the segments are about as long as broad up to about 200 μ; in the younger branches the segments often reach a length of more than twice the breadth. The trichoblasts are well developed and placed in a screw to the left with about $^1/_4$ divergence.

The branches issue in the axils of the trichoblasts (Fig. 34 *a*). They are formed with longer or shorter distance between them. Secondary branches originating from the axils are often present.

In the tetrasporiferous shoots (Fig. 34 *b*) a sporangium is developed in each segment, often forming a long un-broken row. Of the 6 pericentral cells in the fertile part, one is shorter, having a short cell developed at its base. The fertile shoots become twisted as the sporangia are formed to the left side of the trichoblasts of the same joint.

The antheridial bodies (Fig. 35 *a*) are developed by the

[1] Comp. also Rosenvinge: Bidrag til Polysiphonia's Morfologi (Botanisk Tidsskr., vol. 14, 1884, p. 27, tab. 1—2, figs. 33—47).

main axis of the trichoblast with the exception of the two lowermost cells, further the uppermost of these cells is provided with a sterile branch on its right side. As pointed out by Rosenvinge a torsion takes place with the result

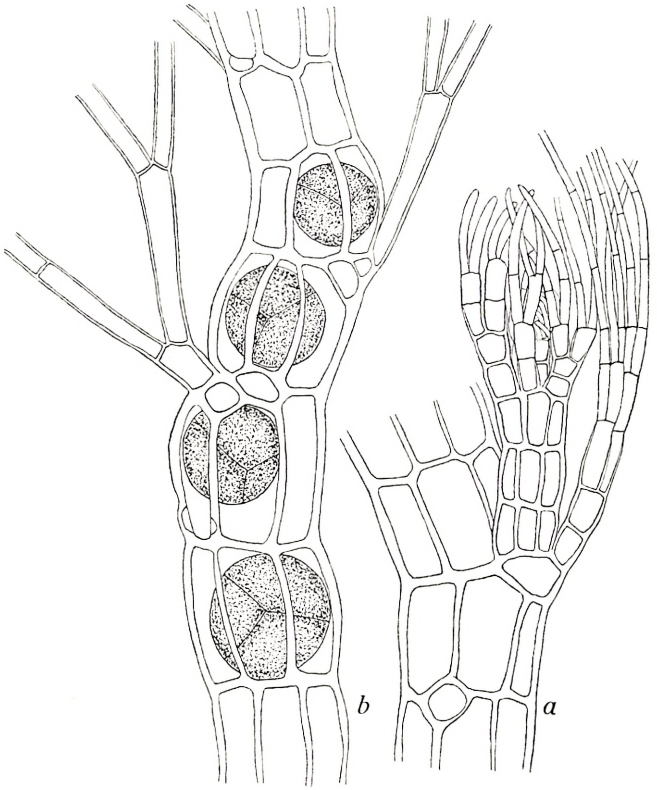

Fig. 34. *Polysiphonia violacea* (Roth) Grev. *a*, trichoblast with axillary shoot. *b*, shoot with tetrasporangia. (about 200 : 1).

that the sterile branch is turned towards the periphery, the trichoblasts in this way forming a protective cover over the androphores. In the Canarian plant the antheridial bodies had as a rule one or two sterile cells at their upper ends; this was not the case in the Danish plants.

The cystocarps (Fig. 35 *b*) are urceolate in shape with

a narrow ostiole surrounded by a ring of somewhat larger cells than those found lower down in the wall of the fruit.

The Canarian form is no doubt most nearly related to the forma *subulata* of this rather variable species; compare in this

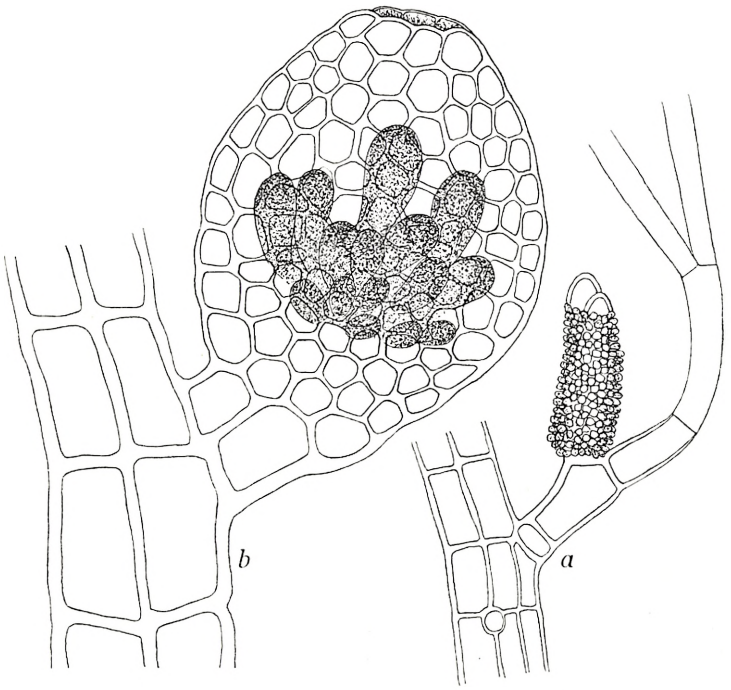

Fig. 35. *Polysiphonia violacea* (Roth) Grev. *a*, trichoblast with androphore. *b*, a nearly ripe cystocarp. (about 200 : 1).

respect FALKENBERG's critical remarks in "Rhodomelaceen", p. 118.

It was found with tetrasporangia, antheridia and cystocarps in the month of March.

It occurred in shallow and rather stagnant water in a sheltered place.

Gran Canaria: Bahia del Confital.

Geogr. Distrib. The Atlantic coast of Europe and North America, Mediterranean Sea.

Polysiphonia stricta Grev. is mentioned by Montagne, l. c., p. 171. According to kind information from Dr. Hamel, Paris, no specimens of this plant are to be found in Herb. Montagne. As *Polysiphonia urceolata*, to which species *Polysiphonia stricta* is to be referred, has not been found in the Atlantic Ocean further south than at the coast of England and France the determination is doubtful.

5. **Polysiphonia breviarticulata** (Ag.) Zanard.

Zanardini, Synopsis alg. adriat., 1841, p. 61 (non vidi). J. Agardh, Spec. Alg., vol. II, p. 1007. Kützing, Spec. Alg., p. 815; Tab. Phycol., vol. XIII, tab. 64. Hauck, Meeresalgen, p. 233, (where several synonyms are mentioned).

Hutchinsia breviarticulata Ag., Syst., p. 153.

The few specimens found form low dense tufts among *Corallina*. The plant has decumbent filaments fixed to the substratum by means of rhizoids. From these filaments the erect ones grow up. These are much ramified and as the branches are directed upward and issue from the mother branch at acute angles, the system of branches gets a fastigitate appearance. The branches taper much upwards (Fig. 36 *a*). At the base the main filaments are about 400 μ thick, while the filaments near the summits are often scarcely 20 μ thick.

The plant lacks a cortical layer with the exception of the lowermost parts of the filaments where an incipent formation of a cortical layer is found. The length of the segments varies about 100 μ. In the basal part of the filaments the peripheral walls are about 35 μ thick and the walls between the cells about 20 μ.

The young parts of the thallus are densely enveloped in trichoblasts but these are shed rather early. The tricho-

blasts are as a rule developed from each segment and placed regularly in a screw to the left with a $^1/_4$ divergence.

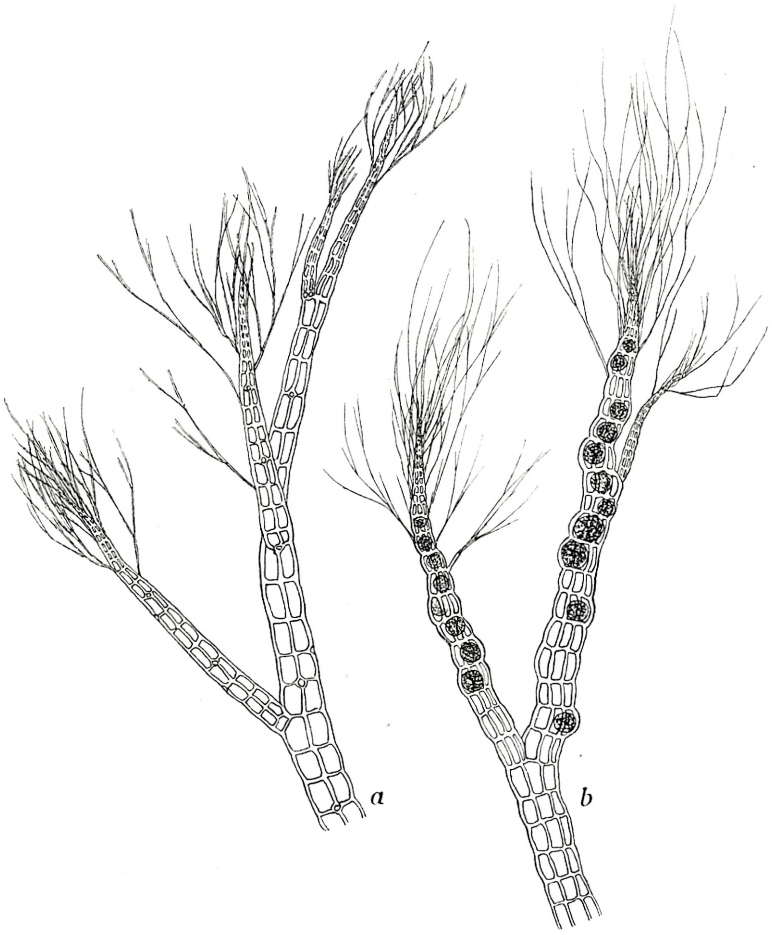

Fig. 36. *Polysiphonia breviarticulata* (Ag.) Zanard. *a*, summit of branch; *b*, branch with tetraspores. (about 80 : 1).

The branches issue in the corner of the trichoblasts (Fig. 37 *a*).

The distance between the branches is very variable. Adventitious branches are often developed especially upon the thicker filaments.

The ripe cystocarp (Fig. 37 *b*) is broadly urceolate, about 500 μ broad and long; the short broad neck consists of a row of large cells; the shape of the cystocarp comes very near to that of *P. Brodiæi* (compare Rosenvinge's Fig. 382 in Mar. Alg. Denm., Rhodophyceæ, III.). The antheridial bodies (Fig. 38) are formed by the main axis of the trichoblasts with the exception of the two lowermost joints and a sterile branch issuing to the right from the uppermost

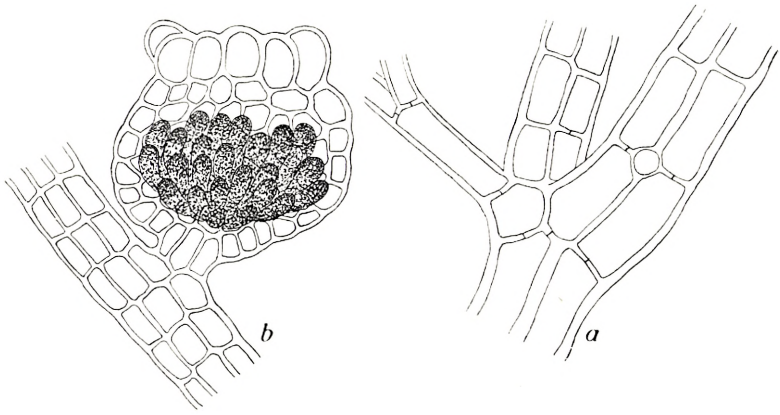

Fig. 37. *Polysiphonia breviarticulata* (Ag.) Zanard. *a*, base of trichoblast with axillary shoot; *b*, a cystocarp. (*a*, about 250 : 1; *b*, about 80 : 1).

of these. The antheridial bodies are proportionally short about 80 μ long and 32 μ broad. No sterile cells are present at their summits.

The tetrasporic filaments (Fig. 36 *b*) are screwformed about 75 μ thick.

The plant was found near low water mark in rather exposed localities; it had tetrasporangia and sexual organs in the month of March.

Gran Canaria: Playa de las Canteras, Christoballo.
Geogr. Distrib. Mediterranean Sea.

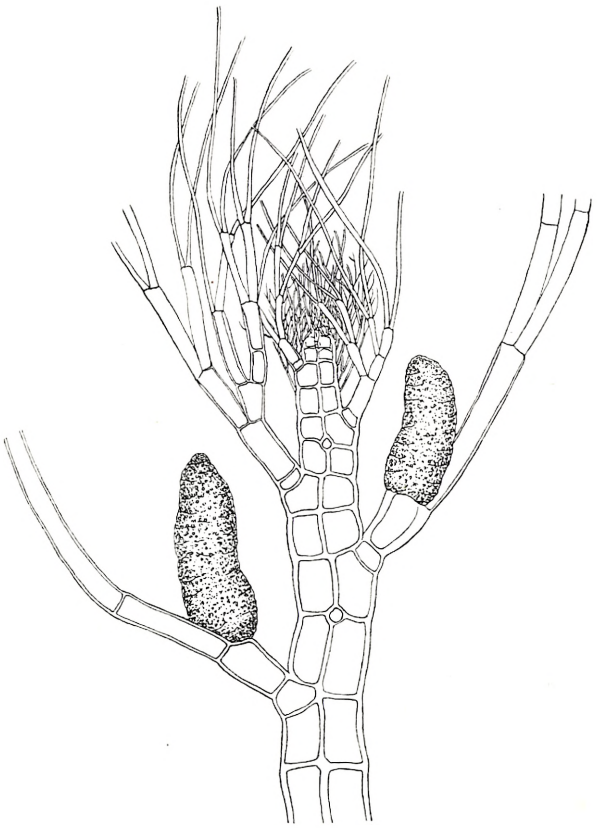

Fig. 38. *Polysiphonia breviarticulata* (Ag.) Zanard. Upper end of a filament with androphores (about 250 : 1).

6. Polysiphonia elongata (Huds.) Harv.

Harvey in Hooker, Brit. Flora, 1833, p. 333; Phycol. Brit., pl. 292, 293. Falkenberg, Rhodomelaceen, p. 126, tab. 21, figs. 6—9. Rosenvinge, Mar. Alg. Denm., Part III, Rhodophyceæ III, p. 415 (where more literature!).

Conferva elongata Hudson, Fl. angl., II, p. 599.

This species is mentioned by Piccone, in "Crociera del Corsaro", Alghe, p. 47 as found at the Islands by Capt. D'Albertis. Dr. Achille Forti has most kindly allowed me to see the specimen found in Piccone's herbarium. It

consists of 3—4 bare pieces about 5—6 cm long and 1^{mm} broad without branches or trichoblasts. A transverse section shows 4 pericentral cells covered by a dense cortical layer. Judging by this, we have no doubt before us *Polysiphonia elongata*, and its occurrence at the Canary Islands is quite natural as it occurs at the shores of Morocco where it was found by Schousboe. The Canarian form surely comes near to the forma *Ruchingeri* (*Hutchinsia Ruchingeri* Ag., Spec. Alg., vol. II, p. 86).

Isola Graciosa (D'Albertis).

Geogr. Distrib. Along the European Atlantic coast down to the Canary Islands, Mediterranean Sea.

7. Polysiphonia flexella (Ag.) J. Ag.

J. Agardh, Alg. Medit., p. 140; Spec. Alg., vol. II, p. 1014. Kützing, Spec. Alg., p. 833; Tab. Phyc., vol. XIV, tab. 19. Hauck, Meeresalgen, p. 231.

Hutchinsia flexella Ag., Spec. Alg., vol. II. p. 63.

Polysiphonia acanthothricha Kütz., Spec. Alg., p. 833; Tab. Phycol., vol. XIV, tab. 21.

Polysiphonia Solieri Kütz., Tab. Phycol., vol. XIV, tab. 89.

The plant has decumbent filaments fixed to the substratum by rhizoids; from these filaments branches spring, some erect others more or less decumbent, and when near a suitable substratum, become fixed to it by rhizoids.

The plant has 4 pericentral cells which gradually in the older thallus are covered by a cortical layer.

The upward-directed part of the thallus consists of a system of main branches which carries shorter branches in all directions. These shorter branches are placed in a screw with a $^1/_4$ divergence, one branch upon each segment. Now and then it happens that such a branch becomes more vigorous and develops into a main branch. From the bran-

ches short, thornlike branchlets are given off, often composed of a few segments only. These dwarfish shoots (Fig. 39)

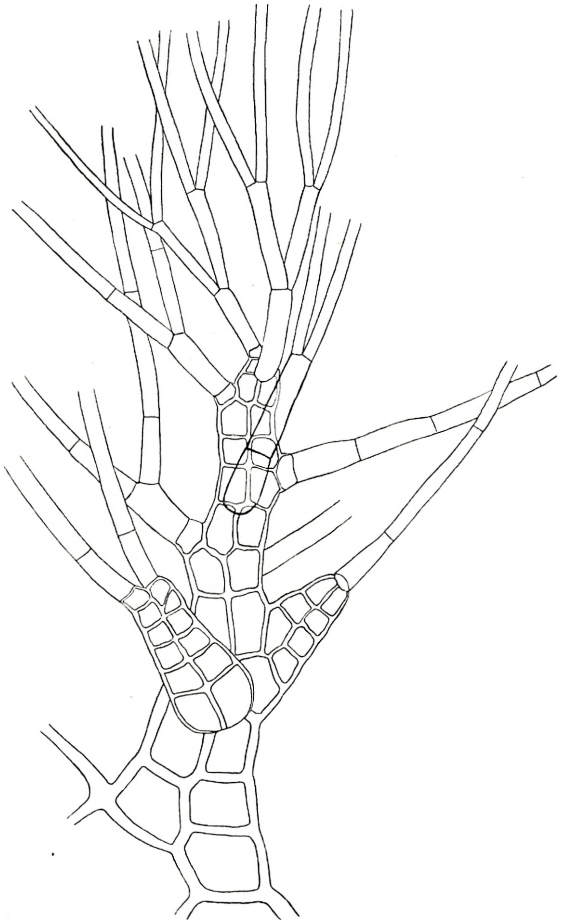

Fig. 39. *Polysiphonia flexella* (Ag.) J. Ag. A thornlike dwarf shoot. (about 150 : 1).

are placed in a screw like the branches, and give off trichoblasts from each segment; the thornlike branchlets issue only in the basal part of the branches, higher up trichoblasts are developed.

I have found only a few tetrasporangia; these are

formed at the ends of the branches which become screw-formed.

The antheridial bodies are figured by Derbès et Solier in "Mémoire sur quelques points de la Physiologie des Algues", p. 74, pl. 20, fig. 7.

The *Dasya Solieri* mentioned by Montagne in "Iles Canaries", p. 168 is surely this species. I have not seen any specimen of it, but as *Hutchinsia flexella* is quoted as a synonym by Montagne, and as Dr. Hamel most kindly informs me that Montagne has written upon the wrapper = *Polysiphonia flexella*, I think there cannot be any doubt about it.

In "Crociera", p. 47 Piccone mentions *Polysiphonia flexella* Ag. var. *acanthotricha* (Ktz.) as found at the Islands. Dr. Achille Forti has allowed me to see a specimen of this plant which is in good accordance with the above quoted figure of Kützing.

This species was found in somewhat exposed localities near low water mark. It had tetrasporangia in March.

Gran Canaria: Bahia del Confital, Christoballo, Punta de Melenera (Despréaux). Lanzarote: Isola Graciosa (D'Albertis).

Geogr. Distrib. From the Gulf of Gascogne southwards to the Canary Islands, Mediterranean Sea, Japan.

8. Polysiphonia spec.

A *Polysiphonia* characteristic by its rather regularly subdichotomous ramification (Fig. 40) has been found several times, but as it was quite sterile I have preferred to let it remain unnamed.

The plant has 7 pericentral cells (Fig. 41 *f*). The base consists of decumbent filaments fixed to the substratum by means of unicellular rhizoids provided with a coralliform

lobed disc. The thallus is about 120 μ thick, tapering upwards to about 40—50 μ; the segments are about 60 μ long.

The erect filaments are rather regularly repeatedly subdichotomously divided. The angles between the branches are often almost right angles.

The trichoblasts are in some parts of the thallus quite

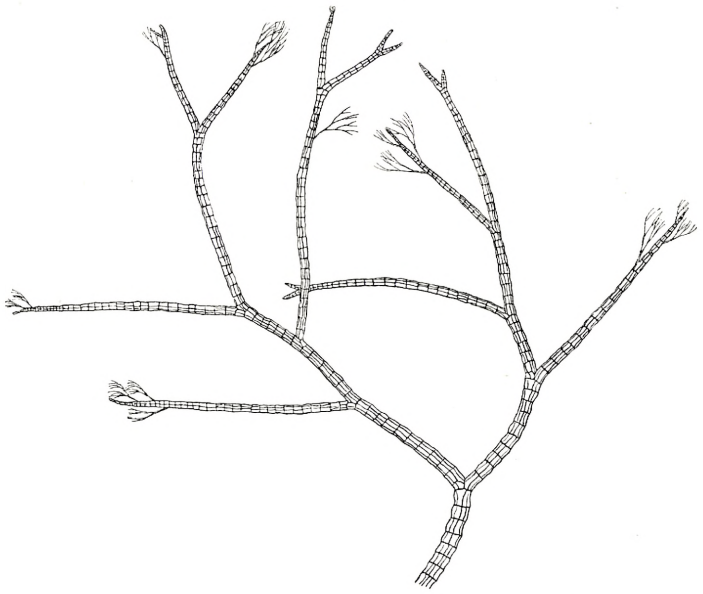

Fig. 40. *Polysiphonia spec.* Part of the thallus showing the characteristic way of ramification. (About 25 : 1).

wanting in others more or less abundantly present; they seem to be given off rather irregularly with varying divergence and with a varying number of segments between them (Fig. 41 *c*). The branches are issued with no connection to the trichoblast (41 *a*, *e*).

This plant is no doubt closely related to *Polysiphonia variegata* but as described by FALKENBERG ("Rhodomelaceen", p. 119.) and also by myself (Mar. Alg. D. W. I., vol. II, p. 270,

fig. 265.) the branches in this species issue from the corner of the trichoblasts.

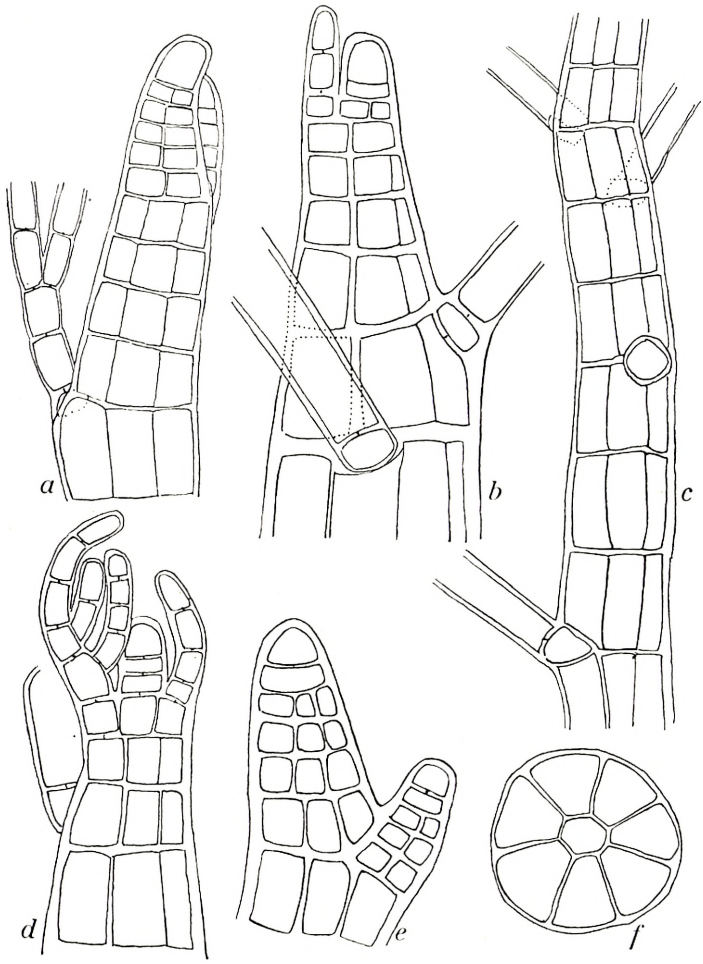

Fig. 41. *Polysiphonia spec.* *a*, *b*, *d*, *e*, summits of the thallus showing development of trichoblasts and branches; *c*, part of a filament ; *f*, transverse section of the thallus. (*a*, *c*, *d*, *f*, about 350 : 1; *b*, *e*, about 450 : 1).

The plant was found near low water mark in more or less exposed places.

Gran Canaria: Near Las Palmas at Playa de Santa Catalina, Castillo, etc.

9. Polysiphonia myriococca Mont.

MONTAGNE, Iles Canaries, p. 170. KÜTZING, Tabulæ Phycologicæ, vol. XIII, tab. 94.

Of this plant I have, through the kindness of Dr. HAMEL, Paris, seen two small tetrasporic specimens mounted upon mica and belonging to Herb. MONTAGNE.

The plant has 8 or about 8 pericentral cells; the thicker filaments are about 175 μ thick. The tetrasporangial branches are much ramified, the broadest are about 150 μ thick and they taper quickly upwards. In the upper end the branches are richly provided with trichoblasts. The thicker branches have a well developed cortical layer. The branches seem to be placed in the axils of the trichoblasts, but I was not able to ascertain this with certainty from the dried up material, as the trichoblasts are very densely placed in the younger parts of the thallus and adhere firmly to each other and to the thallus.

In the description of this plant MONTAGNE remarks that the cystocarps and tetrasporangia are present in the same specimens; in the tetrasporic specimens I have seen, no cystocarps are found.

KÜTZING's above quoted figure gives a quite good illustration of the tetrasporic plant.

As to its occurrence MONTAGNE writes: "In littore portûs *La Madera* insulæ Canariæ, Maio 1839 à cl. DESPRÉAUX inventa". According to PICCONE, "Crociera" p. 56, this species has also been gathered at Teneriffe by LIEBETRUTH.

Geogr. Distrib. Canary Islands.

10. Polysiphonia furcellata (Ag.) Harv.

HARVEY in HOOKER, Brit. Flora, vol. II, p. 332. Phycologia Britannica, tab. VII. J. AGARDH, Spec. Alg., vol. II, p. 1025. MON-

TAGNE, Iles Canaries, p. 172. KÜTZING, Tab. Phycol., vol. XIII, tab. 79. HAUCK, Meeresalgen, p. 239. BORNET, Algues Schousboe, p. 311.

Hutchinsia furcellata Ag., Spec. Alg., vol. II, p. 91.

Polysiphonia lævigata Kütz., Spec. Alg., p. 822; Tab. Phycol., vol. XIII, tab. 84.

Polysiphonia coarctata Kütz., Spec. Alg., p. 807; Tab. Phyc., vol. XIII, tab. 37.

SAUVAGEAU has gathered several specimens of this species at Orotava. The specimen I have examined had 8 pericentral cells. It was of interest to ascertain this as it agrees with BORNET's statement (l. c.) that the Atlantic form of this plant has 8 pericentral cells while the plant from the Mediterranean Sea has 9. The ramification is subdichotomous and the young branches are in a characteristic way bent towards each other as shown in the figures of HARVEY and KÜTZING quoted above.

The specimens of SAUVAGEAU examined by me were sterile. SAUVAGEAU found the plant "à basse mer en février".

Teneriffe: Orotava (SAUVAGEAU). Gran Canaria: Castillo (M^lle^ VICKERS), Gando (DESPRÉAUX).

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

11. **Polysiphonia fruticulosa** (Wulf.) Spreng.

SPRENGEL, Systema Vegetabilium, vol. IV, 1827, p. 350, J. AGARDH, Spec. Alg., II, p. 1028. KÜTZING, Spec. Alg., p. 836; Tab. Phycol., vol. XIV, tab. 28, figs. e—h. MONTAGNE, Iles Canaries, p. 170.

Fucus fruticulosus Wulf., in Jaquin Coll., p. 159 (non vidi).

Rytiphlœa fruticulosa Harv., Phyc. brit., p. 220.

Polysiphonia Wulfeni J. Ag., Alg. medit., p. 144. KÜTZING, Spec. Alg., p. 836; Tab. phycol., vol. XIV, tab. 28, a—d.

(Comp. DE-TONI, Sylloge Alg., vol. IV, p. 950 for more synonyms).

I have not found this species myself but Dr. HAMEL has most kindly allowed me to see a specimen of MON-

TAGNE's herbarium from the Canary Islands. It is a small tetrasporic plant. All the branches are densely covered by a cortical layer. BORNET (in "Algues de Schousboe", p. 313) has found that in the Mediterranean plant 3 bare segments are between those with a branch, while in the Atlantic 4 or more rarely 5 segments are between those with the branches. In the Canarian specimen I have seen no more than 3 segments between the branches and the Canarian plant thus agrees in this respect with the Mediterranean form; BORNET calls this form var. *Wulfenii*.

Regarding the locality MONTAGNE writes l. c.: "Ad promontorium *Punta de Melenera* dictum, rupibus submarinis, quæ serie inter se connexæ non nisi æstus æquinoctialis recessu nudantur, adnascens a cl. DESPRÉAUX lecta".

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

Polysiphonia nigrescens Harv. is mentioned as found at the Canary Islands by MONTAGNE, "Iles Canaries", p. 170. Through the kindness of Dr. HAMEL I have had the privilege of seeing a small Canarian specimen of this plant originating from MONTAGNE's Herbarium. Having examined this specimen I feel sure that it cannot be *Polysiphonia nigrescens* but most probably *Polysiphonia fruticulosa*.

That it cannot be *P. nigrescens* is easily seen when we compare the Canarian plant with ROSENVINGE's detailed description and fine figures in "Mar. Alg. Denm.", Part III, Rhodophyceæ III, p. 439—45, figs. 392—401. Thus the bases of the branches of *Polysiphonia nigrescens* make this species easily recognizable by the fact that not only the basal joint of the branches, which have only 4—6 pericentral cells, but also nearly half of the next joint in the branches

is in connection with the mother branch. This is not found in the Canarian specimen, and besides, this plant is clad with a dense cortical layer up to the youngest summits of the plant while in *P. nigrescens* it is the older parts of the plant which are covered by a cortical layer. The plant has 8—9 pericentral cells.

The specimen of Montagne showed much likeness to fig. *d* in Kützing's Tab. Phycolog., vol. XIV, tab. 29, showing a form of *P. fruticulosa* which he called *Polysiphonia humilis*.

As to its occurrence at the Islands Montagne only writes: "Ad littora Canariensia non infrequens".

12. Polysiphonia nutans Mont.

Montagne, Iles Canaries, p. 171. Kützing, Spec. Alg., p. 814; Tabulæ Phycol., vol. XIII, tab. 58.

According to Dr. Hamel, Paris, no specimen of this species is found in Herb. Montagne; but M^me^ Dr. Anna Weber van Bosse, Eerbeck, has been so very kind as to allow me to see the specimen which is found in Kützing's Herbarium and upon which Kützing has based his figure in "Tabulæ Phycologicæ".

Because of the very small specimen I have dared only to examine a very little bit of the plant. It is a young tetrasporic plant. It early acquires a cortical layer because of which it is rather difficult to see exactly the number of pericentral cells when no transverse section is at hand, but so far as I have seen the plant seems to have about 12 pericentral cells. Montagne says: "Striis 5—7" but this surely refers only to one side of the thallus. The segments are proportionally short about 40 μ high. As drawn by Kützing there are numerous vigorously developed trichoblasts at

the summit of the branches but their arrangement and the formation of the branches in eventual connection with these I have not been able to ascertain.

As to its occurrence at the Islands MONTAGNE writes: "Ad littora *Canariæ* insulæ à cl. Despréaux detecta".

Geogr. Distrib. Canary Islands.

13. Polysiphonia subulifera (Ag.) Harv.

HARVEY in HOOKER, Journ., I, 1834, p. 301; Phycologia Britannica, tab. 227. KÜTZING, Tab. Phycol., vol. XIV., tab. 27. HAUCK, Meeresalgen, p. 244.

Hutchinsia subulifera Ag., in Bot. Zeit., 1827, p. 638.

Polysiphonia ramellosa Kütz., Spec. Alg., p. 835; Tab. Phycol., vol. XIV, tab. 26.

Polysiphonia armata J. Ag., Alg. med., p. 142.

SAUVAGEAU has gathered fine specimens of this plant at Orotava. It occurred upon various species of *Cystoseira* upon which it formed bushes up to a height of more than 10 cm.

In the specimen I have examined I have found about 16 pericentral cells. The plant is characterized by its ramification as generally from about every 5 segments a short spinelike branchlet, branched or not, is given off. Some of these branchlets grow out to main branches.

The branches are developed in the axils of the trichoblasts.

The divergence between the trichoblasts is about $^1/_{10}$ of the circumference, but on account of the considerable distance which is present between those standing above each other or remaining basal cells of these, and because the thallus is often a little twined, an exact determination of the divergence cannot be made without examination of undried material.

Some of the specimens had tetrasporangia, these are formed in the branchlets which become swelled and screw-formed. The specimens with tetrasporangia were gathered in the month of February. In a preparation of this species of Savageau's I have once seen two sporangia formed next to each other in the same segment, a peculiarity characteristic e. g. of *Ophidocladus*, *Ctenosiphonia* and the group *Amansieæ* but not found in *Polysiphonia*.

In "A Propos des Cystoseira", p. 339 Sauvageau mentions an interesting observation he has made regarding this *Polysiphonia*; he says: "A la fin de janvier, un *Polysiphonia* muni de 15—16 siphons, ressemblant au *P. subulifera* Harv. prenait un grand développement parmi les *C. canariensis* et *discors* et enchevètrait leur branches dans un inextricable réseau. J'ai constaté récemment, en pratiquant des coupes pour étudier les cryptes, que ce *Polysiphonia* émet des crampons pénétrant dans l'épaisseur du *Cystoseira*, où il constitue des renflements; le parasitisme de cette Floridée serait intéressant à étudier".

Teneriffe: Orotava (Sauvageau).

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

14. Polysiphonia opaca (Ag.) Zanard.

Zanardini, Synopsis alg. Adriat., p. 63 (non vidi). J. Agardh, Alg. medit., p. 143; Spec. Alg., vol. II, 3, p. 1056. Hauck, Meeresalgen, p. 246. Falkenberg, Rhodomelaceen, p. 120, tab. 21, figs. 10—11. De-Toni, Syll. Alg., vol. IV, sect. 3, where more literature is mentioned.

Hutchinsia opaca Ag., Systema, p. 148; Spec. Alg., vol. II, p. 97.

The few specimens found reach a height of about 3 cm. The decumbent branches are fixed to the substratum by means of unicellular rhizoids several of which often issue from

the same segment; from these decumbent filaments the erect ones grow up. These have nearly the same breadth through their whole length, tapering very little upwards (Fig. 42 *a*).

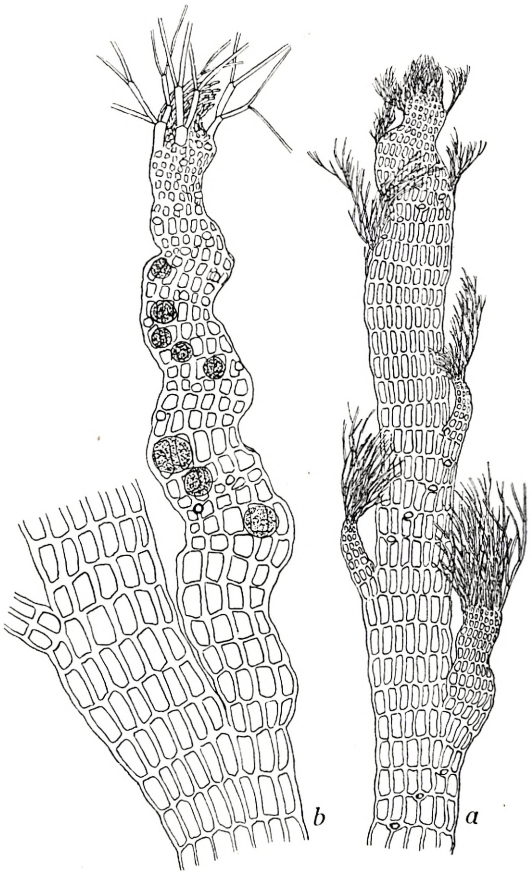

Fig. 42. *Polysiphonia opaca* (Ag.) Zanard. *a*, summit of the thallus showing arrangement of trichoblasts and branches. *b*, branch with tetrasporangia. (*a*, about 35 : 1, *b*, about 70 : 1).

In the lower part of the filaments their breadth is about 400 μ, near their summit 220—250 μ rarely less. By reason of this the erect filaments are rather rigid and straight.

The plant I have examined has 19 (sometimes 20) peri-

central cells; compare Fig. 43 *b* of a transverse section of the thallus. In the form found the segments are proportionally short, 125—130 μ long, and the walls between the cells are thick. The trichoblasts are well developed, thick and robust, the basal cells reaching a breadth of about 50 μ; they are shed rather early but by means of the remaining large basal cells their place is easily seen even after they have dropped off (Fig. 42 *a*). In the thick part of the thallus the trichoblasts are placed in a screw to the left with a divergence of about $^1/_{10}$ of the circumference, in the thinner ones with about $^1/_4$ divergence, which divergence FALKENBERG gives for the plant.

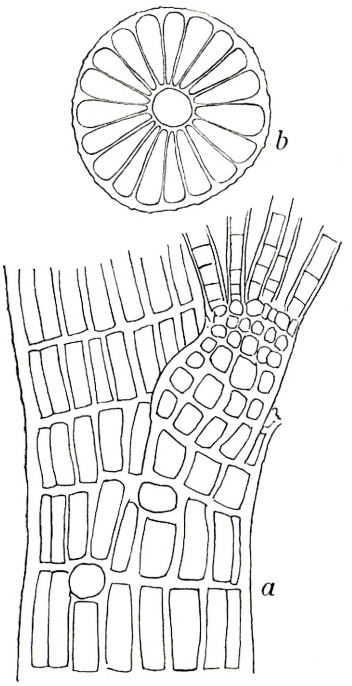

Fig. 43. *Polysiphonia opaca* (Ag.) Zanard. *a*, part of the thallus with a branch. *b*, transverse section of the thallus. (*a*, *b*, about 100 : 1).

By reason of the numerous densely placed trichoblasts at the apex of the filaments it is very difficult to see the origin of the branches; FALKENBERG points this out too and his result is: "Aber da nach dem Abfallen der dickwandigen Blattzellen die Blatnarbe zunächst deutlich sichtbar bleibt, so steht die Natur der normalen Seitensprosse als seitlich verschobener Achselproducte der Blätter zweffellos fest".

The branches are formed very irregularly with a rather varying number of bare segments between those carrying a branch, but often 5—6 bare segments occur between those

provided with branches. The branches are often placed nearly alternately with a divergence of about 180° (Fig. 42 *a*) often also with much less divergence. By far most of the branches remain rudimentary as small dwarfish shoots composed only of a few quite short segments (Fig. 42 *a*, 43 *a*). In the young parts of the thallus these small branches are provided with a number of trichoblasts. Now and then one of the branches grows out to a long shoot.

The tetrasporangia (Fig. 42 *b*, 44) are developed in the branches, one in each segment; they are arranged in a spiral to the left, the whole branch becoming screwformed in that way. The sporangia are about 90 μ long.

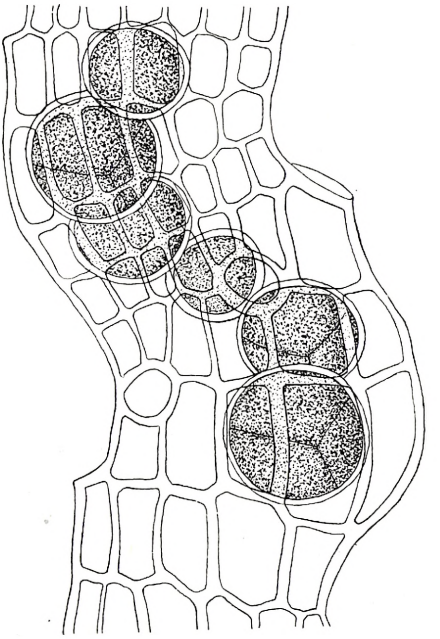

Fig. 44. *Polysiphonia opaca* (Ag.) Zanard. Part of a tetrasporic branch. (about 200 : 1).

Polysiphonia opaca (Ag.) Zanard. is mentioned by Piccone in "Crociera", p. 48 as found by Capt. d'Albertis at the Islands. Dr. Achille Forti has most kindly allowed me to see a small specimen found in Piccone's Herbarium which surely belongs to this species.

I collected this plant in an exposed locality near low water mark. It had tetrasporangia in the month of March.

Gran Canaria. Bahia del Confital.
Geogr. Distrib. Mediterranean Sea.

Alsidium C. Ag.

1. Alsidium corallinum C. Ag.

AGARDH, C., Aufzählung etc. (Flora, II, 1827, p. 639.). MONTAGNE, Iles Canaries, p. 154. HAUCK, Meeresalgen, p. 213.

The few sterile specimens I have found of this species were rather poorly developed; they were found in low-lying rock-pools in which a layer of water a few cm. high was retained during ebb-tide, the specimens reaching only that height too. M^lle^ VICKERS seems to have found her specimens under similar conditions. Those examined were sterile.

FALKENBERG in "Rhodomelaceen", pp. 164—167, following KÜTZING, divides this species into two: *Alsidium lanciferum* Kütz., Tab. Phycol., vol. XV, tab., 33 *c*, *d* and *Alsidium corallinum* Kütz., ibd. tab. 33 *a*, *b*. Because of my specimens being rather poorly developed and sterile I must point out that I here take the species in the extension of AGARDH, comprising both the forms of KÜTZING. HAUCK in "Meeresalgen" does the same.

Gran Canaria: Cristoballo (M^lle^ VICKERS), Playa de Santa Catalina, Castillo (M^lle^ VICKERS), without locality (DESPRÉAUX). Lanzarote: Arrecife (d'ALBERTIS).

Geogr. Distrib. Mediterranean Sea, Canary Islands.

Subfam. 4. Pterosiphonieæ.

Pterosiphonia Falkenb.

1. Pterosiphonia pennata (Roth) Falkenb.

FALKENBERG, P., Rhodomelaceen, p. 263, tab. 2, fig. 1—2.
Ceramium pennatum Roth, Catalecta botan., vol. II, p. 171.
Hutchinsia pennata Ag., Systema, p. 146.

Polysiphonia pennata J. Ag., Alg. medit., p. 141; Spec. Alg., vol. II, 3, p. 928. KÜTZING, Spec. Alg., p. 803; Tab. Phycol., vol. XIII, tab. 23, fig. e—f. BORNET, E., Algues de Schousboe, p. 317. (Cfr. DE-TONI, Sylloge Alg. for more literature).

FALKENBERG l. c., and before him REINKE and BERTHOLD have described this fine little alga; to their descriptions I refer the reader. It seems to be common at the parts of the shore of Gran Canaria which I have examined. It creeps on rocks and stones fastened to the substratum by means of unicellular rhizoids ending in a small lobed disc. It prefers dark places below the rocks or crevices somewhat above low water mark in more or less exposed places. It grows here together with other small creeping red algæ for instance *Griffithsia setacea, Herposiphonia, Gelidium pusillum, Lomentaria articulata* etc.

Gran Canaria: Playa de Santa Catalina (M^lle^ VICKERS,!) Castillo.

Geogr. Distrib. Mediterranean Sea, from the coast of France southwards to the Canary Islands.

Subfam. 5. Herposiphonieæ.

Herposiphonia Nägl.

When working out my West Indian material of this genus I at first came to the conclusion that the two species *Herposiphonia tenella* and *H. secunda* were most probably to be considered as forms only of the same species. But later on, having succeeded in finding two different types of antheridial plants I altered my view, presuming that we had really to do with two different species.

The form I referred to *Herposiphonia secunda* had rather robust antheridial bodies (compare my fig. 428 in "Mar. Alg. D. W. I", vol. II, p. 470) with a single large sterile

cell at their upper end; furthermore the rather few antheridial bodies were present at the upper end of the branchlets. In the other form which I presumed to belong to *Herposiphonia tenella*, the antheridial bodies (compare my figure 420, l. c. p. 473) were found scattered up along the branchlets, and the androphores were more slender, attenuated upwards and terminated by a sterile part composed of a few cells.

At the Canary Islands *Herposiphonia* is a very common plant. I have therefore had a good deal of material to work with and this has only served to comfirm my opinion that we have to do with two species. I have several times in the same collection found plants of both species, viz.: some as a rule more slender showing the characteristic ramification of *H. tenella*, and others more robust with the rather irregular and reduced ramification of *Herposiphonia secunda*. In the following I therefore mention both the species.

1. Herposiphonia tenella (Ag.) Nägl.

NÄGELI, C., *Herposiphonia* (in SCHLEIDEN und NÄGELI, Zeitschrift für wissenschaftl. Botanik, 3—4 Heft, Zürich 1846, p. 238, tab. VIII). AMBRON, H., in Bot. Zeitung, 1880, p. 197, pl. IV, figs. 9—11, 13—17. FALKENBERG, P., Rhodomelaceen, p. 304. BØRGESEN, F., Mar. Alg. D. W. I., vol. II, pp. 286 and 472.

Hutchinsia tenella Ag., Spec. Alg., vol. II, p. 65.

Polysiphonia tenella J. Ag., Alg. Mediterr., p. 123; Spec. Alg., vol. II, pars. III, p. 919.

To this species I refer all the forms showing the very characteristic and regular ramifications of the species as described by FALKENBERG. The specimens are as a rule slender, but robust specimens with short thick branchlets occur. Of this species I have found only tetrasporic plants gathered in the month of March.

The plant grows in sheltered as well as in exposed places. It is often an epiphyte upon other algæ, but it is also found upon rocks together with various small creeping algæ.

It grows near low water mark.

The plant is most probably common at the Islands.

Geogr. Distrib. Mediterranean Sea, Morocco, West Indies, Ceylon etc.

2. Herposiphonia secunda (Ag.) Nägl.

NÄGELI, *Herposiphonia* (in SCHLEIDEN und NÄGELI, Zeitschr. f. wiss. Bot., 1846, p. 238, tab. VIII). AMBRONN in Bot. Zeitung, 1880, p. 198, tab. IV, figs. 8, 11—12. FALKENBERG, P., Rhodomelaceen, p. 307, tab. 3, figs. 10—12. BØRGESEN, Mar. Alg., D. W. I., vol. II, p. 469.

Hutchinsia secunda Ag. Syst., p. 149; Spec. Alg., vol. II, p. 106.

Polysiphonia secunda Zanard., Synopsis Alg., p. 64. J. AGARDH, Alg. Medit., p. 122.

The specimens referred to this species have as a rule a robust thallus with proportionally short and thick branchlets. The ramification is characteristic by the fact that not all the segments give rise to branchlets or branches and that the ramification upon the whole is more irregular.

Of this species I have found tetrasporic plants (Fig. 45 *a*) and intermingled between these some antheridial plants which I presume are referable to this species. Fig. 45 *b* shows a branchlet of one of these male plants. When compared with the male plants I found in the West Indies (compare my Fig. 428) and referred to this species, one difference is conspicuous. In the West Indian plant only a single large sterile cell terminated the antheridial body while in the Canarian specimens 3 sterile cells or therabout were found at their upper end.

The plant is a common epiphyte upon other larger

algæ for instance *Galaxaura*, *Stypocaulon*, *Cymopolia*, *Corallina* etc. and occurs near or somewhat above low water mark. It grows in exposed places but is also found in

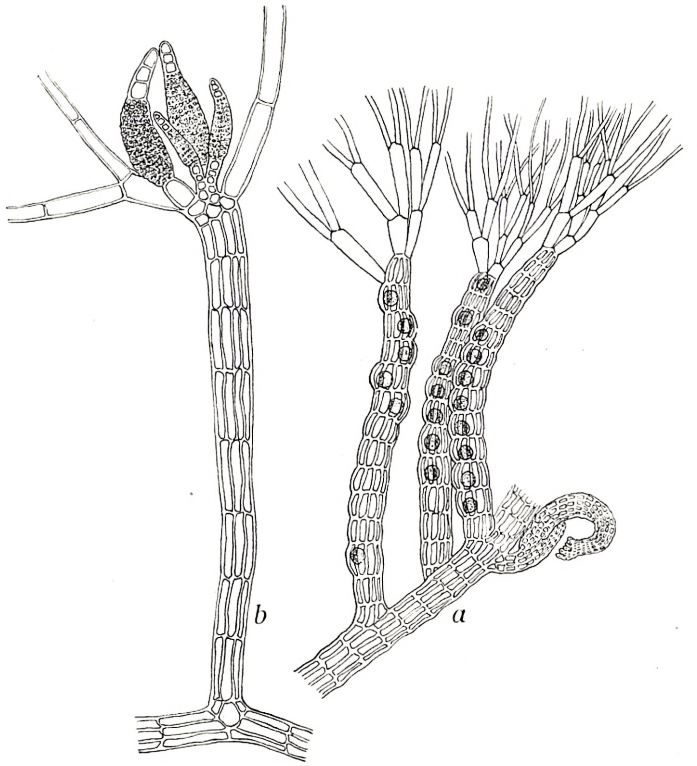

Fig. 45. *Herposiphonia secunda* (Ag.) Nägl. *a*, part of a tetrasporic plant. *b*, a branchlet with androphores. (*a*, about 50 : 1; *b*, 80 : 1).

quite sheltered ones. Plants with antheridia and tetrasporangia are found in March.

Montagne, in "Iles Canaries", p. 172 calls it *Polysiphonia secunda*.

This plant seems to be common at the Islands.

Geogr. Distrib. Mediterranean Sea and adjacent warmer parts of the Atlantic, Canary Islands, West Indies, Ceylon. Most probably wide-spread.

Dipterosiphonia Schmitz and Falkenb.

1. **Dipterosiphonia dendritica** (Ag.) Falkenberg.

FALKENBERG, P., Rhodomelaceen, p. 324. BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 292.

Hutchinsia dendritica Ag., Systema, p. 146; Spec. Alg., vol. II, p. 104.

Polysiphonia dendritica J. Agardh, Spec. Alg., vol. II, pars. III, p. 916.

Referring the reader to FALKENBERG's and my description of this species I can state here that the Canarian plant

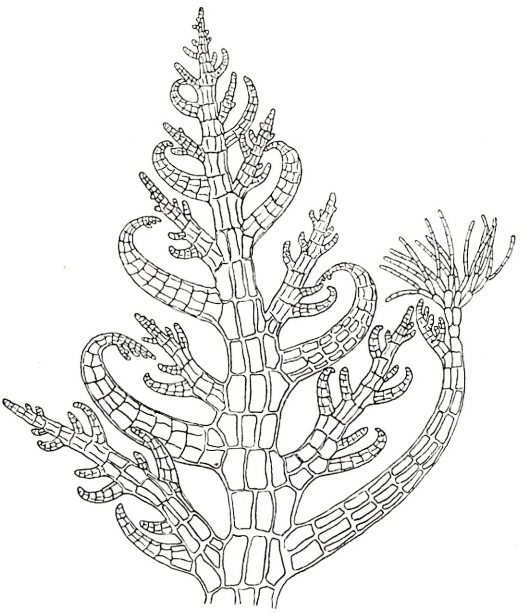

Fig. 46. *Dipterosiphonia dendritica* (Ag.) Falkenb. Part of the thallus with trichoblasts. (About 70 : 1).

of which I have had a good deal of material seems to be in good accordance with the Brazilian as well as the West Indian plant. In the West Indian material I have seen only very few and poorly developed trichoblasts and in the

Canarian specimens these were also in most cases quite absent. But in one cellection from Gran Canaria: Bahia del Confital specimens occurred in which the trichoblasts were richly developed (Fig. 46). They are formed at the upper end of the branchlets, when these have reached the necessary degree of development. And the branchlets in this form showed also another peculiarity, the young branchlets becoming much curved during the development. The curving is already seen in the quite young branchlets contrasting with the non curved long shoots. This curving increases more and more during the further growth and when at its height is so strong that the summit of the branchlets almost touch the main axis. But just at this point of development the branchlets gradually straighten out and the trichoblasts are thus able to protrude freely upon both sides of the plant. In fig. 46 the oldest branchlets are not yet quite straight. Fig. 47 shows the upper end of a branchlet with the first developed trichoblasts. In most cases only a few, two to four, trichoblasts are developed at the end of the branchlets.

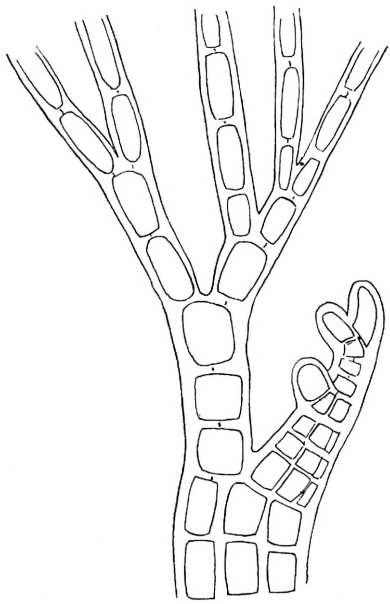

Fig. 47. *Dipterosiphonia dendritica* (Ag.) Falkenb. Summit of branchlet with trichoblasts. (about 360 : 1).

In one of the gatherings tetrasporangia were present. They are formed in the branchlets or in short branches

growing out from these. SAUVAGEAU has also gathered specimens with sporangia; in his specimens the sporangia were formed only in the unbranched branchlets.

The plant occurred upon exposed coasts near or somewhat above low water mark. It creeps upon various algæ for instance *Hypnea musciformis*, *Gelidium*, *Corallina* etc. It had tetrasporangia in the month of March.

Teneriffe: Orotava (SAUVAGEAU,!). Gran Canaria: Christoballo, Playa de Santa Catalina, Bahia del Confital, without locality (LIEBETRUTH).

Geogr. Distrib. West Indies, Brazil, Australia, Easter Island, Canary Islands.

2. **Dipterosiphonia rigens** (Schousboe) Falkenb.

FALKENBERG, P., Rhodomelaceen, p. 325.

Ceramium rigens Schousboe, Alg. Schousboe no. 487.

Polysiphonia rigens J. Ag., Alg. medit., p. 122. BORNET, Les Algues de P. K. A. Schousboe, p. 305.

This plant has once been found rather abundantly creeping upon *Chondria* and *Laurencia* which together with several other algæ, for instance *Polysiphonia flexella*, *Dilophus Fasciola*, *Herposiphonia secunda*, *Corallina* etc. formed dense low carpets upon the rocks. This plant has quite the same characteristic way of ramification as *Dipterosiphonia dendritica* but nevertheless, as pointed out by FALKENBERG, this is not always so easily observable, as in this species the branches are more dorsally placed while in *Dipterosiphonia dendritica* the branches are placed laterally along the sides of the main stem. And add to this that several of the branches, especially in more poorly developed specimens, remain quite rudimentary, showing the way of ramification still more indistinctly. KÜTZING's quite mistaken figure ("Tab. Phycol.", vol. XIII, tab. 36) reproduced in HAUCK's

"Meeresalgen", p. 98 may also, as pointed out by Falkenberg, be attributed to this fact.

The specimens I have seen were all sterile. The plant was found in a somewhat exposed place near low water mark.

Gran Canaria: Bahia del Confital. This species is said by Piccone (in "Crociera", p. 56) to have been found at the Islands (Gran Canaria) by Liebetruth. I have not seen the specimen.

Geogr. Distrib. Mediterranean Sea, Cadiz, Morocco, Canary Islands.

Subfam. 6. Amansieæ.

Vidalia Lamour.

1. Vidalia volubilis (L.) J. Ag.

J. Agardh, Spec. Alg., vol. II, p. 1121. Hauck, Meeresalgen, p. 250. Falkenberg, P., Rhodomelaceen, p. 424, tab. 7, figs. 8—17.

Fucus volubilis L., Systema Naturæ, ed. X, p. 1344.

This species is mentioned by Piccone in "Crociera", p. 49, as found at the Canary Islands by Capt. D'Albertis.

In "Algues de Schousboe", pp. 301, 2 Bornet also says that it occurs at the Canary Islands.

Lanzarote: Arrecife (D'Albertis). Isola Graciosa (D'Albertis).

Geogr. Distrib. From Cadiz southwards to Senegal, Mediterranean Sea.

Rytiphlæa C. Ag.

1. Rytiphlæa tinctoria (Clemente) C. Ag.

Agardh, C., Systema, p. 160; Spec. Alg., vol. II, p. 52. Falkenberg, Rhodomelaceen, p. 438, tab. 8, figs. 28—31.

Fucus tinctorius Clem., Ensayo, Madrid 1807, p. 316.

Regarding synonyms of this multinominal plant comp., De-Toni, Sylloge Alg., vol. IV, sect. III, p. 1095.

I have gathered this plant in several places in not too exposed localities in the environs of Las Palmas. It forms more or less dense tufts upon stones near low-water mark where it often occurs in low-lying rock pools retaining the water during ebb-tide.

The specimens I have examined were sterile.

It has been found at the Islands by most investigators and is no doubt common. MONTAGNE l. c. p. 152 writes about its occurrence: "Ad littora insulæ Canariæ a cl. DESPRÉAUX lecta. Etiam ad Teneriffam fide Ag."

Geogr. Distrib. From Brest to the Canary Islands, Mediterranean Sea.

Halopithys Kütz.

1. Halopithys pinastroides (Gmel.) Kütz.

KÜTZING, Phycologia generalis, p. 433, tab. 52, fig. II; Spec. Alg., p. 840; Tab. Phycol., vol. XV, tab. 27. FALKENBERG, Rhodomelaceen, p. 472, tab. 9., figs. 1—5.

Fucus pinastroides Gmel., Hist. Fuc., p. 127, tab. 11, fig. 1.

In the material brought home of this plant I found a small male tuft. The antheridial bodies have earlier been figured by DERBÈS et SOLIER, "Mém. Physiologie des Algues", p. 74, pl. 21, figs. 3—7. FALKENBERG l. c. p. 474 calls their figures "abenteuerlich", I prefer to call them not very successful, and so I give a new one here.

The antheridial bodies (Fig. 48) are developed upon the young curved tips of the side branches. They are placed in a row upon the dorsal convex side of these. The development seems to take place in good accordance with that found in *Rytiphlæa* as this is figured by FALKENBERG, tab. 8, fig. 28—31. But I was not able to follow the development with certainty as the material had dried up in the

glass. The fully developed androphore has the shape of a short clavate body composed of a short two-celled stalk with thick walls and an ovate fertile part in which the antheridia radiate to all sides from the central part. The fertile part is about 125 μ thick and 170 μ long, while the stalk reaches a breadth of about 40 μ.

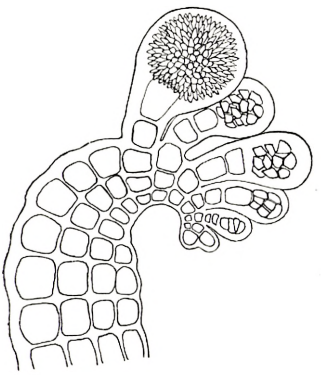

Fig. 48. *Halopithys pinastroides* (Gmel.) Kütz. Summit of a branch with androphores. (about 200 : 1).

The antheridial plant was a good deal more slender than the sterile and female specimens.

Plants with antheridia and cystocarps were gathered in the month of March.

The plant occurs in rather exposed places near low water mark. Behind the reef in Bahia del Confital it grows at a depth of 1—3 meters at low tide.

Montagne calls the plant *Rhodomela pinastroides* Ag.

The plant is most probably rather common at the Islands and has been found by most investigators.

Geogr. Distrib. From south of England down to the Canary Islands, Mediterranean Sea.

The genera *Ctenosiphonia, Ophidocladus, Lophosiphonia* and *Stichothamnion.*

Stichothamnion nov. gen.

Frons dorsiventralis, teres, non corticata, cellulas centrales et pericentrales continens, composita ex surculo repente incremento infinito et ramulis erectis incremento definito, endogenis, dorsaliter uniseriatim dispositis.

Surculus rhizoideis uniseriatis adfixus, subdichotome ramosus, ramis exogenis ex divisione cellularum apicalium ortis.

Ramuli erecti, plus minusve subdichotome divisi, in superiori parte trichoblastos simplices perlongos gerentes e cellulis cylindricis divisione cellularum apicalium ortos.

Tetrasporangia singula in suo quodque fertili articulo superioris partis ramulorum oriuntur.

Corpuscula antheridiorum subcylindrica, pedicellata, ex trichoblastis mutatis formata.

Cystocarpia urceolata, ostiolo apicali protracto angusto instructa.

Stichothamnion cymatophilum[1] nov. spec.

Frons in thallo *Ralfsiæ verrucosæ* repens, ad 4^{mm} et ultra alta, surculum ca 60 μ latum, articulis ca 25 μ longis, 8 (7—9) cellulas pericentrales continentibus.

Rhizoidea ca 1^{mm} longa in superiori parte ca 30 μ in inferiori ca 12 μ lata. Ramuli erecti in parte basali ca 30—35 μ, in media parte usque ad 70 μ lati; trichoblasti ca 16—20 μ lati usque ad 2^{mm} longi.

Tetrasporangia ca 50 μ lata, 40 μ longa. Corpuscula antheridiorum ca 200 μ longa, 20 μ lata. Cystocarpia 250 μ longa, 175 μ lata.

This peculiar small alga (Fig. 49) is found on a highly exposed locality on the north-west coast of Gran Canaria where the unbroken Atlantic rollers constantly wash over the rocks. On these rocks a crust of algæ was present mostly consisting of *Ralfsia verrucosa* but also of *Compsonema gracilis, Phæophila floridearum,* several *Cyanophyceæ* etc. though *Ralfsia verrucosa* was the dominant plant covering

[1] Derived from κῦμα, a wave, and φίλος, dear, fond of.

the rocks more or less densely, and it was upon the crusts of this alga that *Stichothamnion cymatophilum* was growing, sending down its very vigorous rhizoids not only through

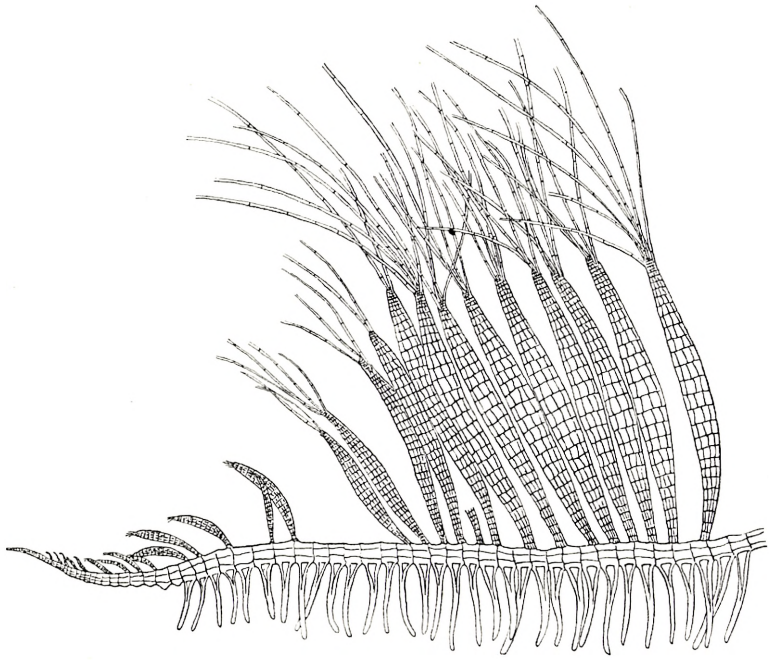

Fig. 49. *Stichothamnion cymatophilum* nov. spec. Part of a young sterile plant. (about 50 : 1).

the assimilating filaments of the *Ralfsia* but far down into its firm tissue below.

Besides I have found some few specimens in a gathering of various algæ scraped loose from rocks south of Las Palmas. Whether the plant was here growing on crusts of *Ralfsia* I have not been able to ascertain. The description below is based upon the plant from the first mentioned locality.

The plant consists of a creeping rhizome-like stem with indefinite growth and branchlets with restricted growth

issuing from the dorsal side of the stem. The plant shows marked dorsiventrality. No cortical layer is developed.

The rhizome is fastened to the substratum by means of a row of very vigorous, thickwalled unicellular rhizoids. The rhizoids are as a rule given off one from each segment and are placed in a single continuous row along the ventral side of the rhizome. The rhizoids are about 1000 μ long and at the upper end about 30 μ broad, tapering somewhat downwards. Their walls are very thick, about 12 μ, and the lumen of the cells therefore very narrow.

The rhizome grows in length by means of a large conical apical cell with rounded apex (Fig. 50), from the basal end of this cell narrow disc-formed segments are cut off by vertical walls. The segments grow gradually thicker and are divided into a central and about 8 (7—9) pericentral cells. The fully developed rhizome is about 60 μ thick and the segments about 28 μ long when fully developed. The rhizome has thick walls about 8 μ thick. The development of the rhizoids occurs at some distance from the apex of the rhizome.

The branching of the rhizome takes place in the following way; the apical cell is divided by an oblique and curved wall into a smaller top cell uppermost and a large cell below (Compare Fig. 50 *b* the apical cell below). From the basal end of this large cell a disc-formed segment is cut off by a new somewhat curved wall almost perpendicular upon the first formed wall (Fig. 50 *c*). The high subconical cell created in this way and lying next to the old apical cell is the top cell of the new branch. From both apical cells segments are cut off at the back ends (Fig. 50 *c*), and as the filaments arising in this way grow out in somewhat deviating directions, they are soon

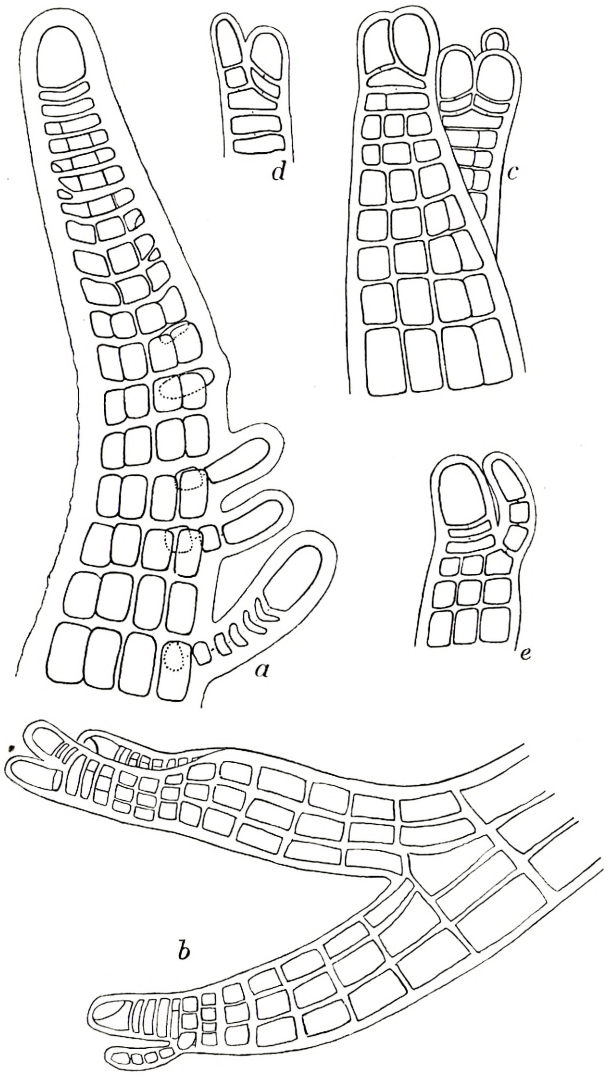

Fig. 50. *Stichothamnion cymatophilum* nov. spec. *a*, apex of rhizome showing the struture of the young thallus, near the upper end with secondary pore-formation and lower down the development of the branchlets; *b*, *c*, show different stages of the branching of the rhizome; *d*, *e*, show small dwarfish trichoblasts, such are also seen in figs. *b*, *c*. (*a*, *c*, *d*, *e*, about 450 : 1; *b*, about 350 : 1).

separated (Fig. 50 *b*). Ordinarily the branching seems to take place in this way only, but a few times I have seen

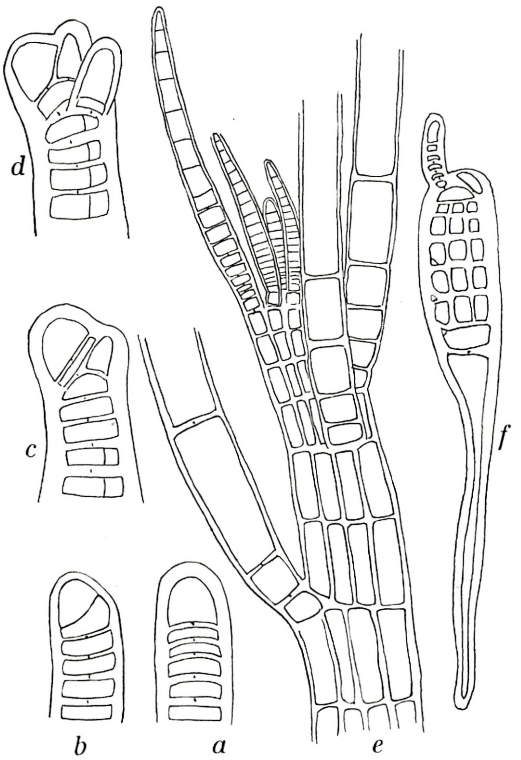

Fig. 51. *Stichothamnion cymatophilum* nov. spec. *a*—*d*, summits of young branchlets showing development of trichoblasts; *e*, upper end of a branchlet with trichoblasts; *f*, a sporeling. (*a*—*d*, about 500 : 1; *e*, about 250 : 1; *f*, about 360 : 1).

an adventitious branch issuing from the side of a rhizome in its older part.

As a rule the rhizome is destitute of trichoblasts, but now and then it happens that a small trichoblast is found near the apex (comp. Fig. 50 *b*, *c*, *d*, *e*). The trichoblasts found here are generally quite dwarfish, consisting only of a few cells; very rarely I have found them more developed.

These trichoblasts are dropped very early, in the older parts of the rhizome I have never seen them.

Opposite to the rhizoids on the upper side of the rhizome the branchlets are developed. As soon as the division of the segments in the central and pericentral cells is accomplished, the development of the branchlets begins (Fig. 50 *a*). The branchlets are endogenous taking their origin from the central cells. From the foremost end of the central cell on its upper side a small cell is cut off, and this beginning of the branchlet forces its way out between the pericentral cells. The branchlets grow in length in the same way as the rhizome by means of a large apical cell from which low disc-formed or somewhat curved segments are cut off below. The segments grow in size and are gradually divided into a central and about 8 pericentral cells; the lowermost segment has a smaller number, about 5—6 (Fig. 52 *e*). The young branchlets are as a rule bent towards the foremost end of the plant (Fig. 49); later on they are straight and directed upwards. The branchlets are generally much more slender at the base than higher up, at the base the breadth varies from about 30—55 μ, while higher up the breadth is about 70 μ.

When the branchlets have reached some length, they begin to form trichoblasts found only in the upper end of these. When a trichoblast is going to be formed, a segment is cut off from the apical cell by an oblique curved wall (Fig. 51 *b*). This segment is divided by an oblique wall, almost perpendicular to the first wall, into a somewhat curved segment below and a smaller cell above, which is the apical cell of the trichoblast (Fig. 51 *c*). From the basal end of this apical cell a great number of short cells richly filled with chromatophores are cut off. When a sufficient

number of cells are formed the apical cell stops dividing, is lengthened and gradually the cells downwards in the

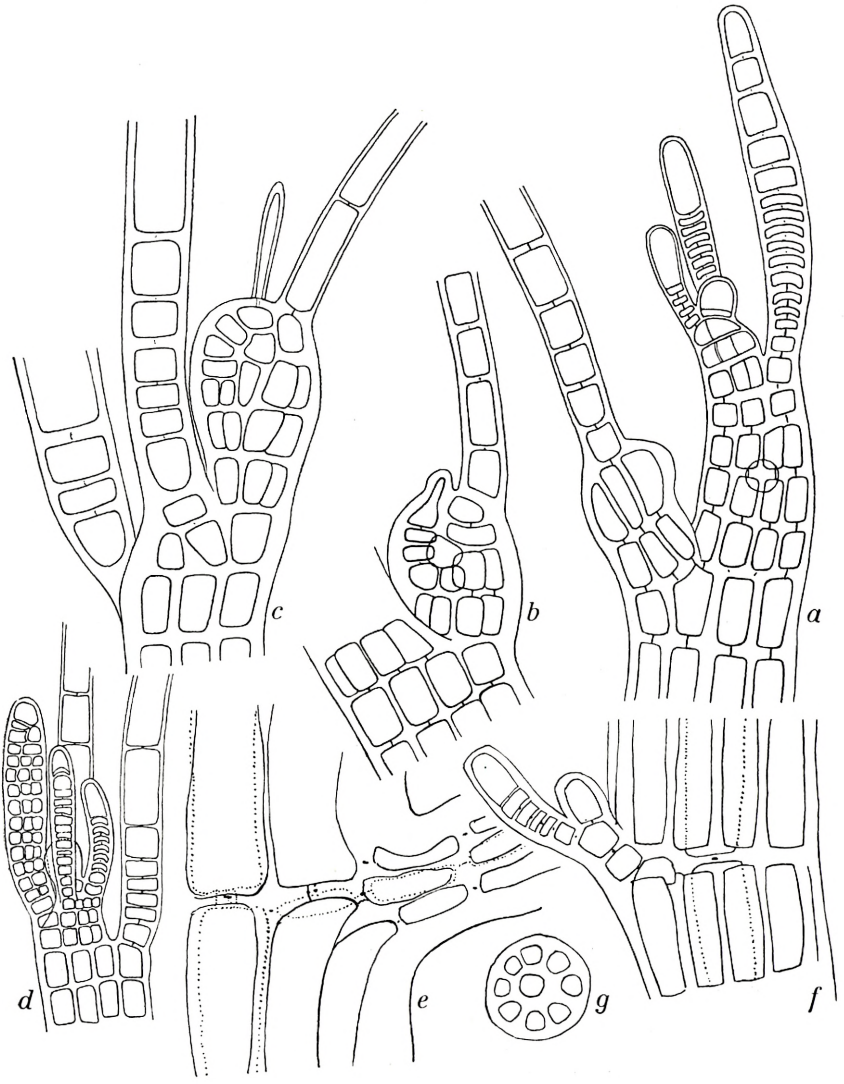

Fig. 52. *Stichothamnion cymatophilum* nov. spec. *a, b, c,* showing development of procarp; *d,* development of androphores; *e,* base of a branchlet; *f,* an adventitious branch; *g,* transverse section of the thallus. (*a, b, c, e, f,* about 450 : 1; *d,* about 360 : 1; *g,* about 250 : 1).

trichoblast become lengthened, colourless and, after a while, die away; this process is carried on until all the cells formed in the young trichoblast have grown out into long colourless cells. The trichoblasts are never branched and form only one long filament. They are about 20 μ broad in the basal part, tapering upwards to about 16 μ or a little more. The length of the cells in the upper end of the trichoblast is often more than 300 μ. The trichoblasts when fully developed are very long, often more than 2 mm, and form a protecting cover above the plant the lowermost part of the trichoblast probably doing assimilating work. The trichoblasts (Fig. 51 *e*) are placed in a screw-line up along the branchlets, as a rule with about $^1/_4$ divergence, so the fifth trichoblast is placed above the first one. They are not always developed from each segment, often in between one or two segments are bare.

Tetrasporic as well as male and female plants were found. The various kinds of organs of fructification are present in different plants.

The tetrasporic and female plants are by far the most vigorously developed, reaching a height of up to about 4 mm without the trichoblasts, while the male plants do not reach more than half that size. The branchlets in the tetrasporic and female plants are often repeatedly subdichotomously ramified (Fig. 53), while the male plants are less divided. The division is no doubt performed like that of the rhizome, but on account of the densely placed trichoblasts which cover the apical cell I have not succeeded in observing the division itself. The branches grow straight upwards, issuing at a very acute angle from the main branch. From the older part of the branches it may happen that an adventitious branch is given off. These are endogenous

and take their origin from the central cell. But such branches are rare and surely of less significance (Fig. 52 *f*).

The tetrasporangia (Fig. 54 *a*) are formed one in each segment in a row upwards and, when trichoblasts are present, placed in a not very marked screw. The sporangia are somewhat broader than long, about 50 μ broad and 40 μ long.

Also the male plant (Fig. 54 *b*) is subdichotomously divided but not so much as the tetrasporic plants; it is also much smaller. The antheridial bodies are formed by the trichoblasts and occupy these completely with the exception of the two lowermost cells, the upper one of these forming a short stalk (Fig. 54 *c*). Very rarely a sterile cell is found at the upper end of the androphore. The quite young trichoblast destined to be transformed into an antheridial body is in the beginning very like the sterile trichoblast, being composed of a large number of short segments above each other, but these are soon divided into a central and some pericentral cells from which after several divisions the antheridia are formed (Fig. 52 *d*). The fully developed anthe-

Fig. 53. *Stichothamnion cymatophilum* nov. spec. *a*, part of a tetrasporic and *b* of a cystocarpic branchlet. (*a*, about 30 : 1, *b*, about 40 : 1).

ridial body is subcylindrical in shape, tapering a little at the upper and lower end. It is often a little curved. The

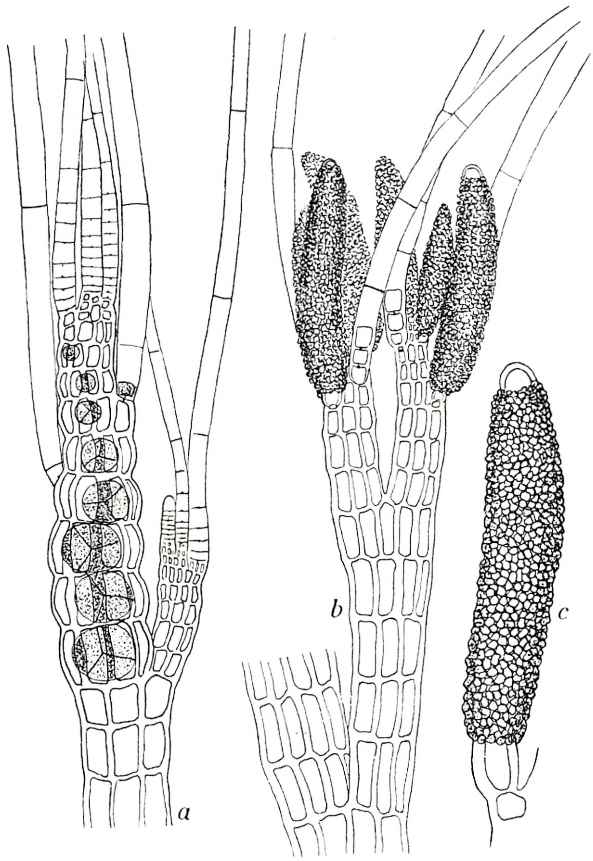

Fig. 54. *Stichothamnion cymatophilum* nov. spec. *a*, part of a tetrasporic branchlet. *b*, upper end of a branchlet with androphores. (*a*, *b*, about 200 : 1; *c*, about 400 : 1).

androphores reach a length of about 200 μ and a breadth of about 20 μ.

As mentioned above, the branchlets in the well developed female plant are branched. The cystocarps are formed near the upper end of the branchlets (Fig. 53 *b*).

Fig. 52 *a* shows the basal part of a carpogoniferous trichoblast in which in accordance with what is commonly the case in the *Rhodomelaceæ*, the two lowermost segments in the trichoblast have become plurisiphonous, the uppermost of these, the most vigorously developed, being the fertile one from which the procarp originates. In Fig. 52 *b* a further stage of development is demonstrated, the carpogonial branch is formed and the trichogyne begins to grow out. Fig. 52 *c* shows a still more developed young cystocarp. The trichogyne has grown out to some length, and the non-fertile part of the trichoblast from which the procarp is developed has got long colourless cells and will soon be dropped.

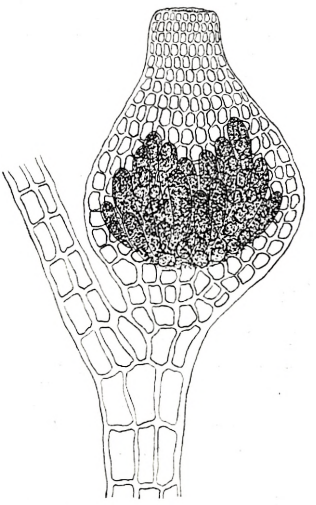

Fig. 55. *Stichothamnion cymatophilum* nov. spec. A nearly ripe cystocarp. (about 70 : 1).

The ripe cystocarp (Fig. 55) is oval-urceolate with a thick short stalk; upwards the cystocarp tapers to a rather long neck ending in a small ostiole. The cystocarp is about 250 μ long and 175 μ broad.

Once a few sporelings of this plant were found (Fig. 51 *f*). They consisted of a long rhizoid pierced in the *Ralfsia* crust and above it first an undivided segment and then some divided ones forming together a clavate body. In one of the young plants a trichoblast was developed. But none of the sporelings showed the slightest trace of the development of the rhizome, which would have been of much interest. In this respect I refer the reader to FALKENBERG's remarks on *Herposiphonia* in "Rhodomelaceen", p. 302.

If now we ask to which group of the *Rhodomelaceæ* our plant is most nearly related, then the nearest forms are to be looked for in the small dorsiventral creeping forms described by Falkenberg in his monograph of the *Rhodomelaceæ*.

By its marked dorsiventrality and sharply differentiated main branches with indefinite growth and branchlets with definite growth our plant reminds one much of the *Herposiphonieæ*, but it is sharply separated from these by the fact that all the branches in the *Herposiphonieæ* are formed exogenously. In the *Polyzonieæ* the branches with definite growth are formed exogenously while the branches with indefinite growth are endogenous and formed later. In some respects our plant may also remind one of some forms of *Lophosiphonia*[1] in which creeping filaments with erect branches are found, but here all ramification is endogenous and there is no sharp differentiation between long and short branches. By the dorsal branches placed in one row on the rhizome *Stichothamnion* also reminds one very much of *Ophidocladus*, but besides other differences our plant differs in a very essential way from this plant, because *Ophidocladus* has two sporangia in each segment.

And finally *Stichothamnion* differs from most of the *Rhodomelaceæ* by its monosiphonous trichoblasts. Very similar trichoblasts are present in *Richardia Montagnei* (compare p. 77) and according to Falkenberg ("Rhodomelaceen", p. 177) such are also found for instance in *Roschera* (*Tolypiocladia*) *glomerulata*. This I am able to confirm by means of a specimen I collected in India. Small dwarfish trichoblasts composed of a single row of cells may appear now

[1] This seems especially to be applicable to *Lophosiphonia? Calothrix* (Harv.) De-Toni, *Polysiphonia Calothrix* Harv., "Phycol. Austral"., tab. 185 C; compare also Kützing's figure in "Tab. Phycol"., vol. XIV, tab. 38.

and then in the *Rhodomelaceæ*, ROSENVINGE, for instance, mentions (in "Sur les organes piliformes des Rhodomelacées", Oversigt over d. kgl. danske Vidensk. Selsk. Forhandl., 1903, no. 4, p. 456, fig. 6) some small trichoblasts found in *Polysiphonia fastigiata.*

As already mentioned above, this plant is found in a very exposed locality; it grows there somewhat below high water mark upon more or less perpendicular rocks constantly washed by the sea even during ebb tide; and furthermore it is found in a somewhat more sheltered locality south of Las Palmas. In fertile condition it was gathered at the end of March.

Gran Canaria: The Arrecife reef in Bahia del Confital near Las Palmas, near Christoballo south of Las Palmas.

Ctenosiphonia Falkenb.

Ctenosiphonia hypnoides (Welw.) Falkenb.

FALKENBERG, Rhodomelaceen, p. 485, tab. 9, figs. 11—15.

Polysiphonia hypnoides Welw. in J. AGARDH, Spec. Alg., vol. II, 3, p. 933. BORNET et THURET, Notes algolog., fasc. I, pl. XXIV.

Of this species known from Spain, Portugal and Morocco and recently found also at Guernsey[1], I have twice come across some quite small fragments.

The specimens had 16—17 pericentral cells in each of the rather short segments. The branches are placed in two rows on both side of the creeping basal stem, as a rule one from each segment and mutually alternating. Most of the branches have limited growth, their summits are curved, turning the concave side towards the apex of the main stem; on the convex side a single row of trichoblasts is

[1] LYLE, LILIAN, The marine Algæ of Guernsey (Journ. of Bot., vol. 58, 1920, Suppt. II, p. 20).

present. As described by Falkenberg the branches originate endogenously from the central cell. From the undermost side of the creeping stem unicellular rhizoids are developed, ending in a small disc.

The specimens were sterile.

The plant was found in very exposed localities; at Orotava it occurred together with *Nemoderma tingitana*, growing upon rocks.

Teneriffe: Orotava. Gran Canaria: Playa de Santa Catalina.

Geogr. Distrib. From the English Channel southwards to the Canary Islands.

Ophidocladus Falkb.

Ophidocladus simpliciusculus (Crouan) Falkenb.

Falkenberg, P., Rhodomelaceen, p. 488, tab. 9, figs. 16—20.

Polysiphonia simpliciuscula Crouan, Fl. Finistère, p. 157, tab. 31, no. 199.

M^lle^ Vickers mentions this species in her list of algæ p. 304 as found on some rocks near Las Palmas in the month of March. But she adds: "Exemplaires très jeunes".

Geogr. Distrib. From the coast of France southwards to the Canary Islands, Mediterranean Sea, Australia.

Lophosiphonia Falkenberg.

Lophosiphonia obscura auct., Howe.

Howe in Britton, Flora of Bermuda, Algæ, p. 521[1].

Lophosiphonia obscura (Ag.) Falkenb., Rhodomelaceen, p. 500. Børgesen, Mar. Alg. D. W. I., vol. II, p. 294, figs. 292—294.

[1] Howe having examined the type specimen of C. Agardh's *Hutchinsia obscura* points out here that this plant is not the *Lophosiphonia obscura* of recent writers but *Lophosiphonia subadunca* (Kütz.) Falkenb.

Polysiphonia obscura J. Ag., Alg. Mediterr., p. 123; Spec. Alg., vol. II, p. 943. KÜTZING, Spec. Alg., p. 808; Tab. Phycol., vol. XIII, pl. 40 *a, b.*

Polysiphonia reptabunda Suhr, KÜTZING, Tab. Phycol., vol. XIII, pl. 34 *b.*

Polysiphonia adunca Kütz., Tab. Phycol., vol. XIII, pl. 40 *c, d, e.*

Referring the reader to FALKENBERG's detailed description and my remarks and figures in the above quoted paper I shall shortly mention here that the plant has a creeping, rhizome-like stem fixed to the rocks by means of unicellular rhizoids ending in a lobed disc. Two, three or more rhizoids are given off from each segment. The apex of the creeping stem is often a little curved, turning the concave side to the substratum. The ramification is rather irregular; most of the branches are placed in a row upon the dorsal side of the creeping stem, but now and then branches are also given off from the sides of the rhizome. Furthermore the distance between the branches is very variable as sometimes only one sometimes two or more segments are left bare between those giving off branches. Some of the branches get continual growth, others are short. The young branchlets have the apex curved against that of the mother branch, in their upper end trichoblasts are formed, as a rule regularly from each segment, and placed with a divergence of about $^1/_4$. The branchlets may remain short but later on they often become ramified.

Specimens with tetraspores were found in the month of March.

The plant was found near low water mark in more or less exposed localities, creeping among other algæ.

Gran Canaria: Playa de Santa Catalina, Christoballo.
Teneriffe: Orotava. REINBOLD in "Die Meeresalgen der deut-

schen Tiefsee-Expedition" 1898—1899, p. 27 mentions this species as occurring at the Canary Islands, though with a?

Geogr. Distrib. Mediterranean Sea, warmer parts of the Atlantic Ocean, West Indies.

Subfam. 7. Lophothalieæ.

Lophocladia Schmitz.

1. Lophocladia trichoclados (Mert., C. Ag.) Schmitz.

Schmitz, Fr., Die Gattung Lophothalia (Ber. d. deutsch. bot. Ges., Bd. XI, 1893, p. 222). Falkengerg, P., Rhodomelaceen, p. 553. Børgesen, F., Mar. Alg. D. W. I., vol. II, p. 302, figs. 304—312.

Conferva trichoclados Mert. mscr.

Griffithsia trichoclados Ag., Spec. Alg., vol. II, 1828, p. 132.

Dasya lophoclados Mont. in Ann. Sc. Nat., Bot., II. sér., 1842, p. 254. Harvey, Nereis Bor.-Am. II, p. 65.

Polysiphonia lophoclados Kütz., Spec. Alg., p. 834; Tab. Phycol., vol. XIV, tab. 22, figs. a, b.

Dasya trichoclados J. Ag., In Historiam Algarum Symbolæ, Linnæa, vol. 15, 1841, p. 32; Spec. Alg., vol. II, pars 3, p. 1229. Vickers, Fl. Alg. Canar., p. 304.

Lophothalia (*Lophocladia*) *trichoclados* J. Ag., Till Algernes Systematik, XI, Florideæ, p. 64.

All the specimens I have gathered were sterile. But M^lle^ Vickers has found many plants with stichidia. These fructiferous organs seem to be the commonest. Nearly all my West Indian material was tetrasporic, of male and female plants I have only once found some small bits. M^lle^ Vickers gathered tetrasporic plants in Nov.—April. In the West Indies I gathered tetrasporic plants in Jan.—March and antheridial and cystocarpic plants in March.

The plant occurred on a rather exposed coast. It is a sublittoral alga most probably growing in deep water. Like M^lle^ Vickers, I have found it cast ashore only. For instance

it was very common upon the Playa de la Canteras at Gran Canaria. On the other hand I have not found it at Teneriffe.

Gran Canaria: Playa de Santa Catalina; Playa de las Canteras (M^lle^ VICKERS,!).

Geogr. Distrib: West Indies, Canary Islands.

Subfam. 8. Dasyeæ.

Dasya C. Ag.

1. Dasya Arbuscula (Dillw.) Ag.

AGARDH, C., Spec. Alg., vol. II, p. 121. J. AGARDH, Spec. Alg., vol. II, 3, p. 1221. HARVEY, Phycol. Brit., tab. 224. KÜTZING, Tab. Phycol., vol. XIV, tab. 83. FALKENBERG, Rhodomelaceen, p. 622.

Conferva Arbuscula Dillw., Brit. Conf., pl. G (nec tab. 85).

The few specimens I have gathered of this species were sterile with the exception of a single tetrasporic plant; this specimen was found in the month of March. SAUVAGEAU has gathered it with tetrasporangia in December.

This species grows near low water mark in rather exposed places.

Teneriffe: Orotava (SAUVAGEAU).

Gran Canaria: Playa de Santa Catalina (GELERT,!), Bahia del Confital, Boñadero (M^lle^ VICKERS). MONTAGNE mentions this species, l. c. p. 168, but he gives no locality for it. Lanzarote: Arrecife (D'ALBERTIS).

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea, Guadeloupe (?).

2. Dasya ocellata (Gratel.) Harv.

HARVEY in HOOKER, Brit. Flora, vol. II, part 1, p. 335; Phycologia Brit., pl. 40. KÜTZING, FR., Spec. Alg., p. 796; Tabulæ Phycol., vol. XIV, pl. 61. J. AGARDH, Spec. Alg., vol. II, pars 3, p. 1207. ZANAR-

DINI, Icones Phyc. Adriat., pl. 42 A. FALKENBERG, Rhodomelaceen, p. 622, tab. 18, figs. 1—4.

Ceramium ocellatum Gratel., Diss. no. 2, fig. 11 (non vidi).

Dasya simpliciuscula Ag., Spec. Alg., vol. II, p. 122.

I have found only a few specimens of this plant. They were met with in the very same locality where M^lle^ VICKERS was the first to find this species at the Islands. It occurs near low-water mark in a somewhat sheltered place. Specimens with stichidia were found in the month of March.

Gran Canaria: Playa de Santa Catalina (M^lle^ VICKERS,!).

Geogr. Distrib. Warmer parts of the European Atlantic coast, Morocco, Mediterranean Sea, West Indies.

3. Dasya corymbifera J. Ag.

AGARDH, J., In Hist. Alg. Symbolae (Linnæa, vol. XV, 1841, p. 31); Spec. Alg., vol. II, p. 1219. HAUCK, Meeresalgen, p. 253. Compare DE-TONI, Syll. Alg., p. 1199 where several synonyms are to be found.

This species is mentioned by BORNET in "Algues de Schousboe", p. 320 as occurring at the shores of the Canary Islands.

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea, West Indies etc.

4. Dasya pedicellata Ag.

AGARDH, C., Systema Alg., p. 211. COLLINS & HERVEY, Alg. Bermuda, p. 130.

Dasya elegans (Mart.) Ag., Spec. Alg., vol. II, p. 117. KÜTZING, Phycol. gener., p. 414, pl. 51; Tab. Phycol., vol. XIV, tab. 59. FALKENBERG, Rhodomelaceen, p. 618.

Dasya Baillowiana Montagne, Iles Canaries, p. 165.

For more synonyms see DE-TONI, Syll. Alg., vol. IV, p. 1201.

According to MONTAGNE, "Iles Canaries", p. 165 this species has been found at the Islands by DESPRÉAUX

and by Capt. D'ALBERTIS as mentioned by PICCONE in his list, p. 50. The specimen of MONTAGNE's herbarium which Dr. HAMEL has allowed me to see is part of a cystocarpic plant, while that of PICCONE's herbarium which Dr. ACHILLE FORTI has most kindly given me an opportunity of seeing is a small sterile plant.

As to its occurrence at the Islands MONTAGNE writes: "Ad littora insulæ Canariæ, imprimis loco *Cuesta de Silva* dicto à cl. DESPRÉAUX lecta. A mari profunda cum rete extracta".

Gran Canaria: Cuesta de Silva (DESPRÉAUX), Lanzarote: Arrecife (D'ALBERTIS).

Geogr. Distrib. Mediterranean Sea, the warmer Atlantic shores of Europe and North America, West Indies.

Dasyopsis Zanard.

1. **Dasyopsis plana** (Ag.) Zanard.

ZANARDINI, Saggio class. Ficee (1843), p. 52 (non vidi). FALKENBERG, Rhodomelaceen, p. 662.

Dasya plana Ag. in Bot. Zeit. 1827, p. 645. ZANARDINI, Iconographia Adriat., vol. II, p. 79, tab. 60 A. HAUCK, Meeresalgen, p. 255.

Eupogon planus Kütz., Tab. Phycol., vol. XIV, tab. 88, figs. a, b.

Eupogon cervicornis Kütz., Tab. Phycol., tab. 87, figs. b, d.

According to PICCONE, "Crociera del Corsaro", p. 50, this species has been found at the Islands by Capt. D'ALBERTIS. Dr. ACHILLE FORTI, Verona, has most kindly allowed me to see a specimen.

Lanzarote: Arrecife (D'ALBERTIS).

Geogr. Distrib. Mediterranean Sea, Canary Islands.

Heterosiphonia Mont.

Heterosiphonia Wurdemanni (Bail.) Falkenb.

FALKENBERG, P., Rhodomelaceen, p. 638, pl. 16, fig. 11. BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 324, figs. 326—8.

Dasya Wurdemanni Bailey, Harvey, Nereis Bor. Am., vol. II, p. 64, tab. XV, C. Kützing, Tab. Phycol., vol. XIV, pl. 81. J. Agardh, Spec. Alg., vol. II, p. III, p. 1191. Zanardini, Icon. Phycol. Adriat., vol. II, pl. 53 A.

Var. *typica* Børgs., l. c. p. 325, fig. 326.
Var. *laxa* Børgs., l. c. p. 326, fig. 327.

Falkenberg has pointed out that in the Mediterranean Sea two different forms of this species are found, namely a more robust and very squarrose form which is like the original specimen from Key West (compare Harvey, l. c.) and a slender and not so squarrose form. These forms both of which I have found in the West Indies, I have proposed to call respectively var. *typica* and. var. *laxa*. These forms also occur at the Canary Islands. The var. *typica* is the common form occurring as an epiphyte on various algæ on the predominantly exposed shores of the Canary Islands. The var. *laxa* on the other hand has been found only in one locality, namely the quite sheltered locality in the innermost tranquil bay of Confital between the Isleta and Gran Canaria.

Falkenberg, having made no exact observations himself as to the occurrence of these two varieties, has suggested that they are due to different external life conditions, var. *typica* should be a low water form, while var. *laxa* was supposed to be a deep sea form. This supposition of Falkenberg has in so far been confirmed by the occurrence of these forms at the Canary Islands as var. *typica* is found at the open coast, while var. *laxa* is found only in a sheltered locality where, with the exception of the light, conditions prevail almost similar to those in deep water.

Nearly all the specimens I have examined were sterile,

only a few times I have found tetrasporic plants; they were gathered at the end of March.

This plant seems to be common at the Islands and is mentioned by most investigators.

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

Genera incertæ sedis.

Falkenbergia Schmitz.

1. **Falkenbergia Hillebrandii** (Bornet) Falkenberg.

Falkenberg, P., Rhodomelaceen, p. 689. Børgesen, F., Some new or little known W. I. Florideæ, II (Bot. Tidsskr., vol. 30, 1910, p. 199); Mar. Alg. D. W. I., vol. II, p. 331, figs. 332, 333. Collins and Hervey, Alg. Bermuda, p. 122. Kylin, H., Über Falkenbergia Hillebrandii etc. (in Bot. Notiser, 1928, p. 233).

Polysiphonia Hillebrandii Bornet in Ardissone, Phycologia Mediterranea, vol. I, p. 376.

Polysiphonia Doubletii Sauv. Sur une Floridée (Polysiphonia Doubletii mscr.) renfermant de l'iode á l'état libre (C. R. de l'Acad. des Sciences, t. 181. Paris 1925).

Falkenbergia Doubletii Sauv. mscr. in Bulletin de la Station biologique d'Arcachon, 22iême Année, 1925.

The Canarian specimens quite agree with the West Indian plant as described by me in the papers quoted above. The breadth of the more vigorous filaments was as much as 50 μ. All the specimens were sterile.

At the shores of France Sauvageau found a plant which he at first called *Polysiphonia Doubletii*, but shortly afterwards referred to *Falkenbergia*, a plant which according to my view cannot be separated from *Falkenbergia Hillebrandii*, and Kylin (l. c.) has arrived at the same opinion.

In my paper (1910) I have mentioned some peculiar large bodies found in the pericentral cells and which I at

that time wrongly presumed to be the nuclei. According to the later observations of Sauvageau (l. c. p. 17) these bodies are what Sauvageau calls ioduques, and according to him iodine in free condition is present in them. Kylin, l. c., does not think that the iodine is found here in free condition. As to this interesting question I refer the reader to the papers quoted where more literature is mentioned.

This species is found near low-water mark fixed to and felted among larger algæ, for instance especially *Halopteris scoparia*, between the branches of which Sauvageau also found the *Falkenbergia Doubletii* to be very common.

Gran Canaria: Playa de Santa Catalina (Mlle Vickers,!) Bahia del Confital (Mlle Vickers,!). Its occurrence at the Islands has already been stated by Falkenberg (l. c. p. 690), who found it among exsiccata of the late Mr. Franc Collins.

Geogr. Distrib. Atlantic coast of France, Canary Islands, Mediterranean Sea, West Indies.

Halodictyon Zanard.

1. Halodictyon mirabile Zanard.

Zanardini, G., Saggio di classificazione natur. etc., 1843 (non vidi); Icones Phyc. adriat., vol. I, p. 17, tab. V. Kützing, Spec. Alg., p. 662; Tab. Phycolog., vol. XII, tab. 36. Hauck, Meeresalgen, p. 258. Falkenberg, Rhodomelaceen, p. 692, tab. 15, figs. 1—20.

Of this plant which, so far as I know, has not earlier been met with at the Canary Islands, I have found a few specimens, a quite small, young tetrasporic specimen and an old specimen loaded with mature and emptied stichidia. They were both found intermingled among other algæ.

As is well known, the thallus is composed of filaments of cells forming together an irregular network. The cells in the old part of the thallus have a diameter of up to about 170 μ, and the walls are thick; the length of the cells is

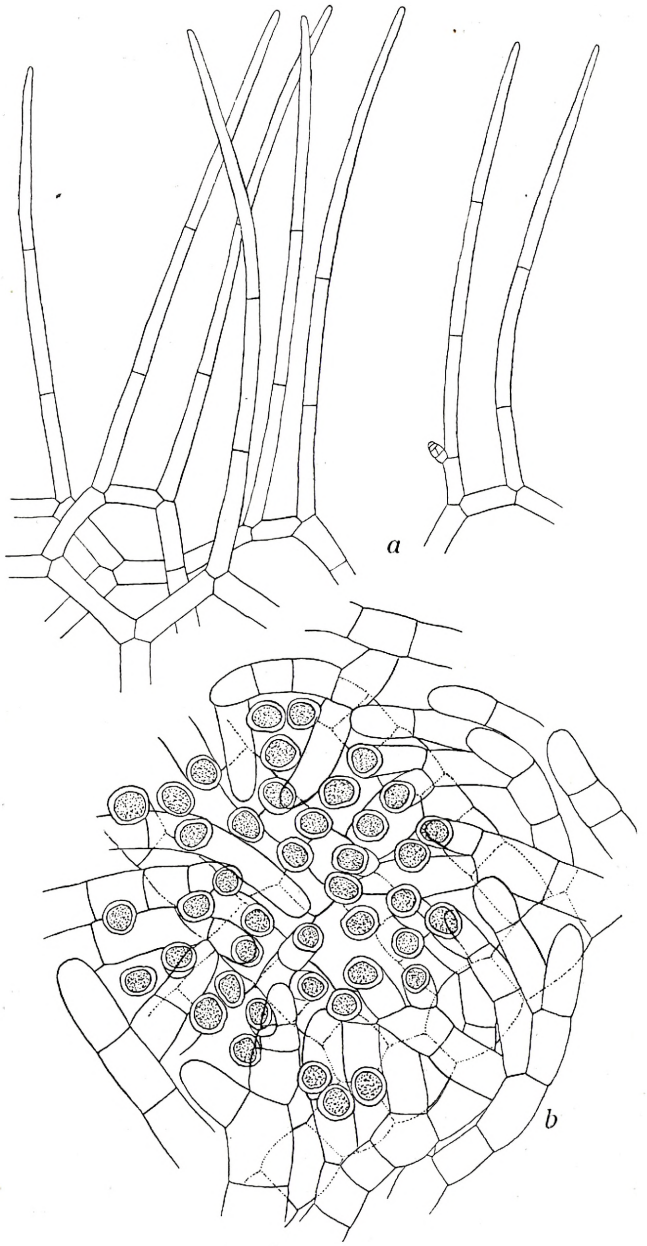

Fig. 56. *Halodictyon mirabile* Zanard. *a*, peripheral filaments of the thallus. *b*, meristem seen from above with numerous upward directed tips of filaments and, from lower adjustment, filaments with short cells arranged in squares are seen. (*a*, about 60 : 1, *b*, about 270 : 1).

about 400—500 μ. The cells are nearly cylindrical tapering just a little at the transverse walls. At the periphery of the thallus the ends of the filaments are free (Fig. 56 *a*). These free ends are composed of very thin and long cells; in the young specimen the cells taper to a breadth of about 25 μ; their apex is obtuse.

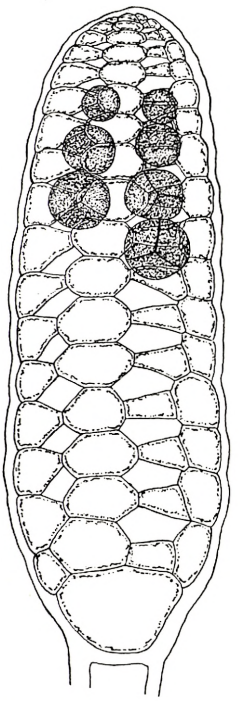

Fig. 57. *Halodictyon mirabile* Zanard. A ripe, half emptied stichidium. (about 170 : 1).

In the small specimen I have found the meristem (Fig. 56 *b*); Falkenberg did not succeed in finding it in *Halodictyon mirabile*, but he gives a description of it in the Australian species *H. robustum* and *H. arachnoideum*. That of *Halodictyon mirabile* seems to be in good accordance with that of the Australian plants. Falkenberg describes it in this way (p. 693): "An der Spitze des cylindrischen Pflanzenkörpers, von Kreisen der immer kürzer werdenden freien peripherischen Sprösschen umgeben, liegt eingesenkt der aüssert kleinzellige flache Vegetationspunkt, dessen Zellen bisweilen so dicht gedrängt liegen, dass man den Eindruck einer zusammenhängenden Zellplatte bekommt". The figure shows what I have been able to see in my very scarce material. Judging from this it seems to me that Falkenberg is right in his supposition that in the beginning we have to do with a nearly parenchymatic tissue composed of very short cells which are gradually lengthened and at the same time separated.

Falkenberg has found that the plant is fixed to the

substratum by means of hapters ending in a small disc; compare his fig. 2. I could not find such hapters in my plant; on the other hand I have several times seen the uppermost ends of the still free filaments become rhizoid-like.

Fig. 57 shows a ripe stichidium. As observed by FALKENBERG two sporangia are developed in each segment, and they are covered by three cells each. The sporangia form two longitudinal rows in the stichidia. When the tetrasporangia have escaped, a large open polygonal hole is found just above the place where the sporangia occurred. In this way the wall of the stichidia get a reticular appearance reminding one for instance of that of *Tænioma*.

While in my material I have found only tetrasporangia, FALKENBERG has also found antheridia and cystocarps.

As is pointed out by FALKENBERG, this plant is surely closely related to the *Delesseriaceæ*.

It was found with ripe stichidia at the end of March. It occurred near low water mark as an epiphyte upon other algæ in a rather exposed place.

Gran Canaria: Bahia del Confital.

Geogr. Distrib. Mediterranean Sea, Morocco(?), Canary Islands, Barbados (according to M^lle^ VICKERS).

Fam. 3. ***Delesseriaceæ.***

Subfam. 1. Sarcomenieæ.

Tænioma J. Ag.

1. Tænioma perpusillum J. Ag.

AGARDH, J., Nya alger från Mexico (Öfvers. k. sv. Vet.-Akad. Förhandl., 1847); Spec. Alg., vol. II, p. 3, p. 1257. BORNET, E., Algues de Schousboe, p. 297. BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 338, fig. 337.

Tœnioma macrourum Thuret in Bornet et Thuret, Notes algolog., fasc. I, p. 69, pl. XXV. Falkenberg, P., Rhodomelaceen, p. 709, pl. 15, figs. 21—29[1].

This small creeping plant has been found several times intermingled among other small algæ and forming together with them low dense carpets upon the rocks. All the specimens I have seen were sterile. It grows near low-water mark or somewhat above in more or less protected places.

Gran Canaria: Near Las Palmas in several places: Christoballo, Playa de Santa Catalina etc.

Geogr. Distrib. Morocco, Mediterranean Sea, Cape West Indies, Pacific Ocean etc. Seems to be wide-spread in warmer seas.

Cottoniella Børgs.

Cottoniella fusiformis nov. spec.

Frons rosea, usque ad 12 cm alta et ultra, corticata, irregulariter ramosa, ramis fusiformibus in superiori parte plus minus arcuatis. Segmenta ex cellula centrali et quatuor cellulis pericentralibus et duobus marginalibus composita. Filamentis monosiphoneis sæpe binis ex eodem segmento in latere ventrali concavo ramorum ortis. Rami adulti ca 700 μ et ultra crassi. Filamenta usque ad 1^{mm} longa ex cellulis cylindraceis ca 16 μ latis composita.

The plant (Fig. 58) forms soft rosy-red tufts up to a height of about 12 cm or more. All the specimens I have gathered were plants torn loose and wanting the base except one in which the base was preserved. It consists of several small more or less coherent discs from which the main stem arises.

[1] Compare also: Thompson, Elisabeth Ilsley, The morphology of Tænioma. (Bull. Torr. Bot. Club, vol. 37, 1910, p. 97).

In the lowermost part of the specimens I have examined, the filaments are more than 1 mm thick, decreasing evenly up-

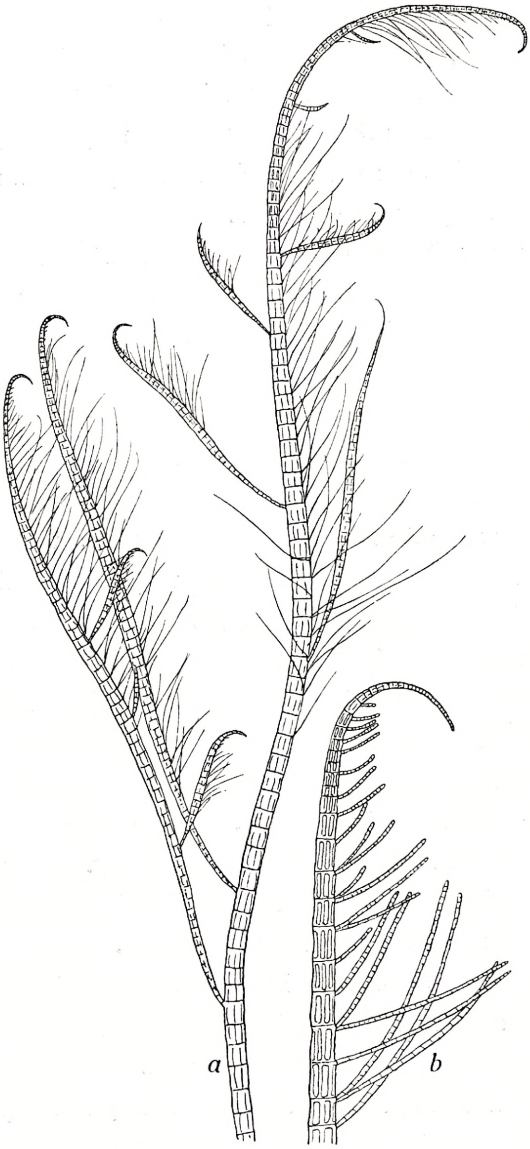

Fig. 58. *Cottoniella fusiformis* nov. spec. *a*, part of the thallus; *b*, upper end of a branch. (*a*, about 60 : 1; *b*, about 90 : 1).

wards. The plant is irregularly ramified, the branches issuing at varying distances from each other. In the upper end the branches are usually more or less curved, often so much that they remind one of the horns of chamois. The young branches are markedly fusiform, being much slenderer at their base than in the middle whence they slowly decrease upwards. For instance a branch was 45 μ broad at its base and about 120 μ in the middle.

The young branches are provided with long monosiphonic filaments emerging secundly from the ventral, usually more or less concave, side of these. Two filaments next to each other are often, but far from always, given off from the upper end of each segment (Fig. 58 *b*); in this case the filaments form a double series up along the branches. In many segments, however, we find only one filament issuing from each joint, and it may happen, though rarely, that 3 filaments are developed from the same joint. Many segments have no filaments at all.

The monosiphonic filaments consist of cells about 16 μ broad. The basal cell in these is short, almost as long as broad and more or less immersed in the branches. Higher up in the filaments the cells get longer, cylindrical, up to about 5—6 times their breadth. In the older parts of the thallus the filaments gradually drop away. As to the anatomical development of the thallus it agrees well with that of *Cottoniella filamentosa* and *C. arcuata*.

In the summit of the branches we find a large subcylindrical-conical apical cell (Fig. 59 *a, b, c*) with rounded apex about 30 μ long and 16 μ broad. From the base of this cell disc-shaped short cells are gradually cut off. These cells slowly increase in size and are then divided at first by one longitudinal wall on one side of the thallus

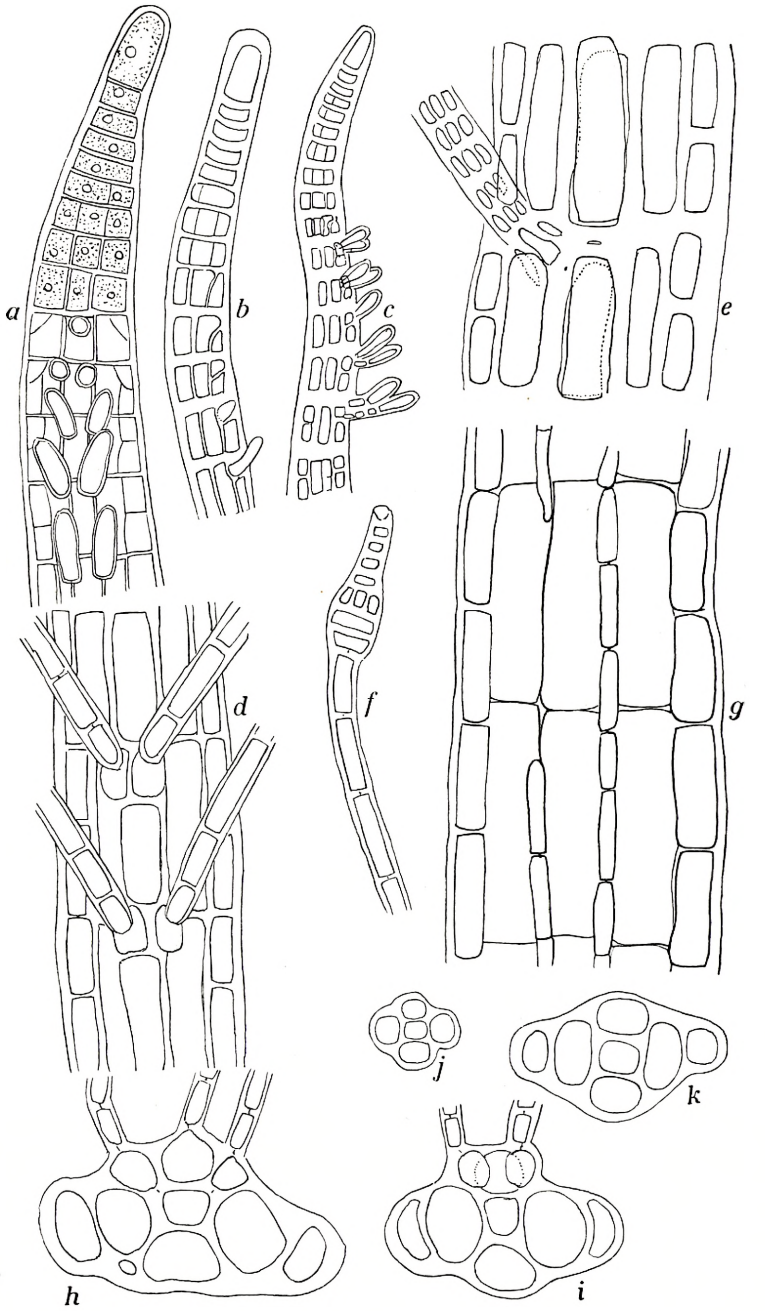

Fig. 59. *Cottoniella fusiformis* nov. spec. *a*, *b*, *c*, summits of the thallus; *d*, part of thallus with pairs of filaments; *e*, base of a branch; *f*, a filament with a polysiphonous segment; *g*, development of the cortical layer; *h*, *i*, transverse sections of the thallus with filaments; *j*, *k*, transverse section of young thallus. (*a*, about 450 : 1; *b*, about 370 : 1; *c*, about 300 : 1; *d*, *e*, *f*, *g*, about 200 : 1; *h*, *i*, *j*, *k*, about 250 : 1).

and just afterwards by another longitudinal wall on the opposite side; thus the thallus is composed of three cells, a larger broader cell in the middle and two smaller ones on both sides. Presently the broad cell in the middle is divided by two longitudinal walls almost at right angles with the two earlier walls into three cells, the thallus now consisting of a central and four pericentral cells, the two first developed pericentral cells being the larger ones. Compare Fig. 59*j* showing a transverse section of the thallus in this stage of development. From this figure it will be seen too that the thallus in transverse section is oval. During further growth the thallus increases gradually in size and soon the upper outmost corners of the two pericentral cells developed first are cut off by oblique walls and just afterwards the nethermost corners are cut off by longitudinal walls (Fig. 55*a*). These two cells grow in length and gradually get cylindrical, each having half the length of the other cells in the segment. The transverse section of the thallus is now as shown in Fig. 59*k*. Thus the building up of the thallus is accomplished, setting apart the cortical layer found in the older thallus.

But already long before the above described division of the thallus has taken place some small cupola-like outgrowths are seen protruding from the upper ends of the segments in the young thallus (Fig. 59 *a*, *b*, *c*). These outgrowths are the beginning of the monosiphonic filaments characteristic of *Cottoniella*.

In case only one filament is developed from each segment, a single short cell is cut off from the apical end of the central cell. From this cell the monosiphonic filament is developed. When two filaments issue from the same segment, two cells are cut off from both sides of the apical

end of the central cell (compare Fig. 59 *a*, *c*, *d*, *i*). In case, and this is very rare, 3 filaments are present, the third filament seems to be developed from the pericentral cell (Fig. 59 *h*), but I have only once succeeded in getting a transverse section of the thallus showing this. The morphological value of the filaments I shall not discuss as long as fertile specimens are still unknown. I shall only point out here that I have once come across a filament (comp. Fig. 59 *f*) in which longitudinal division had taken place. It is of interest as it reminds one of similar cases found by ROSENVINGE in the trichoblasts of *Polysiphonia*[1].

As in *Cottoniella arcuata* adventitious branches with continuous growth are developed at some distance from the summit of the thallus and without any definite distance between them (Fig. 58). These branches are as a rule placed laterally on one of the sides of the monosiphonic filaments. They are formed endogenously from the upper end of the central cell and subserve the ramification of the plant.

The older parts of the thallus get covered by a more or less coherent cortical layer. Fig. 59 *g* shows the development of it. The more vigorous rows of cells on both sides of this figure are the cells cut off by peripheral walls from the pericentral cells as mentioned above; the thinner rows of cells covering the intervals between the pericentral cells originate from rhizoid-like filaments growing out from these. Gradually, as more rhizoids are developed, and the cells in these increase in size and grow together, a continuous cortical layer is formed.

As the previously found species of *Cottoniella* are sterile,

[1] ROSENVINGE, L. KOLDERUP, Sur les organes piliformes des Rhodomelacées (in Oversigt k. danske Vidensk. Selsk. Forhandl., 1903, p. 457).

it is very regrettable that the Canarian species is not fertile either.

As to the anatomical building up of the thallus the Canarian plant agrees very well with *Cottoniella filamentosa* as described by Howe and with my description of *Cottoniella arcuata*. The most essential differences between these 3 forms are the following. While in *Cottoniella filamentosa* the summits of the thallus are not much curved and the monosiphonous filaments form only a single row, in *Cottoniella arcuata* the summits of the filaments are more or less arch-shaped and provided as a rule with two rows of filaments, these being placed in a zig-zag line, one on each segment, and generally on the convex side of the thallus. In *Cottoniella fusiformis* the upper ends of the thallus too are rather often curved, but the monosiphonous filaments are here as a rule placed on the concave ventral side of the filaments, and often in two rows, as two filaments usually issue from each segment in this species[1].

But I will not deny that it may possibly be difficult to maintain all these forms when more material can be examined. Should it be possible later on to find these plants

[1] A fourth species *Cottoniella sanguinea* from Brazil has recently been described by Howe, (Howe, M. A., Notes on some marine Algæ from Brazil and Barbados, p. 192 in Journ. Washington Acad. Sc., vol. 18, 1928). As no figures are published of its anatomical structure, I know it only from Howe's description and from a dried specimen which Dr. Howe most kindly has sent me. But on account of its very soft, mucous consistency, it is very difficult to examine it, as it adheres firmly to the paper. This species has often, according to Howe, five pericentral cells, the summits of the branches are nearly straight and the branches are provided with secund monosiphonous filaments the arrangements of which I have not been able to see. Furthermore the marginal cells do not seem to be very much developed. Because of its dark purple carmine colour it differs also from the other hitherto known rosa red coloured *Cottoniella* species.

in a fertile state, it might perhaps contribute to a better understanding of these species.

The anatomical building up of the thallus, too, is in good agreement with that of *Sarcomenia miniata* as described and figured by Madame WEBER (Journ. of Bot. vol. 34, 1896, p. 281, pl. 359) but besides other differences this plant entirely lacks the monosiphonous filaments, so characteristic of *Cottoniella*.

M^lle^ VICKERS mentions in her list *Sarcomenia miniata*. As her specimens are gathered in the same locality where I found *Cottoniella fusiformis*, I had some doubts as to the correctness of this determination. Upon my request Professor É. DE WILDEMAN, Musée botanique de l'État, Bruxelles, has most kindly allowed me to see M^lle^ VICKERS' specimens, and the examination of these has proved that they all belong to *Cottoniella*, as they are all provided with the long unilaterally placed monosiphonic filaments characteristic of this genus, established, it is true, several years after M^lle^ VICKERS published her list. Upon dried material the determination of these plants is rather difficult on account of their softness and delicacy, adhering strongly to the paper as they do. As they were found in the same place as *Cottoniella fusiformis*, one would naturally expect them to be of this species, and in one of the specimens examined I have also found cases in which two monosiphonic filaments were given off from the same segment; but in another specimen I found only a single filament issuing from the same joint, which would seem to indicate that it is *C. filamentosa* we have to do with.

M^lle^ VICKERS dredged her specimens at a depth of 6—10 meters in the somewhat sheltered bay near the harbour of Las Palmas. My specimens were cast ashore on the

beach of this bay or found in the net of fishermen dredging here.

Gran Canaria: Playa de Santa Catalina (M^lle^ Vickers,!).

2. Cottoniella filamentosa (Howe) Børgs.

Børgesen, F., Mar. Alg. D. W. I., vol. II, pp. 477—9.

Sarcomenia filamentosa Howe, Phycological Studies, II (Bull. Torrey Bot. Club, vol. 32, 1905, p. 571, pl. 27 and 29, figs. 1—11).

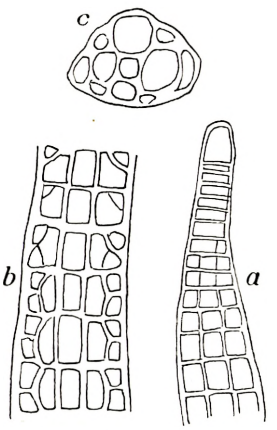

Fig. 60. *Cottoniella filamentosa* (Howe) Børgs. *a*, apex of a filament; *b*, part of the thallus showing the formation of the marginal cell; *c*, transverse section of the thallus showing 4 pericentral cells, 2 marginal cells and cortical cells. (*a*, *b*, about 350 : 1; *c*, about 80 : 1).

On a specimen of *Stypocaulon scoparium* I have found a small epiphyte which I think is referable to this species, described by Howe. I have also been able to compare it with an original specimen of Howe's in my herbarium. The species is especially to be distinguished by the fact that the monosiphonic unbranched filaments, so characteristic of the genus *Cottoniella*, in this species, as described by Howe, are placed in a single row up along the middle of the ventral side of the branches. The summits of the branches in this species are not much curved, often nearly straight. And finally the development of the marginal cells is, on both sides of the thallus, proportionally more vigorous and earlier than in *Cottoniella arcuata* and in *Cottoniella fusiformis*.

Fig. 60 shows the apex of a branch; uppermost the large apical cell is seen, lower down the formation of the peri-

central and central cells begins to take place. Fig. 60 *b* shows the formation of the rather vigorous marginal cells. A cross-section (Fig. 60 c) shows that the plant has four pericentral cells. In the older parts of the thallus the branches are covered by a more or less continuous cortical layer, having the same origin as described above for *Cottoniella fusiformis*.

In the young monosiphonic filaments the cells are rather short, in the fully developed filaments about 3—4 times as long as broad. The breadth of the filaments is about 16 μ. As with all formerly found plants of this genus the specimens were sterile.

This species has been described upon specimens found at Florida, the only place where it was known, so it is interesting that it has now been found at the Canary Islands.

M^lle^ VICKERS has also gathered this species at the Islands, as at any rate one of the specimens in her herbarium, here referred to *Sarcomenia*, is this species. I am much indebted to Professor É. DE WILDEMANN, Bruxelles for the allowance to see M^lle^ VICKERS' specimens.

The plant was found near low water mark in a somewhat sheltered place.

Gran Canaria: Playa de Santa Catalina near Las Palmas (M^lle^ VICKERS,!).

Geogr. Distrib. Florida, Canary Islands.

Subfam. 2. Delesserieæ.

Hypoglossum Kütz.

1. Hypoglossum Woodwardi Kütz.

KÜTZING, Phycol. gen., p. 444, tab. 65, fig. 1; Spec. Alg., p. 875; Tab. Phycol., vol. XVI, tab. 11, figs. a—c.

Fucus Hypoglossum Woodw. in Linn. Transact., vol. II, London 1794, p. 30, tab. 7.

Delesseria Hypoglossum Lamx., Essai... Thalassioph., p. 36. Harvey, Phycol. Brit., tab. II. J. Agardh, Spe. Alg., vol. II, p. 693; Epicr., p. 489, Montagne, Iles Canaries, p. 150.

This species occurs near low water mark upon rocks, where it grows among other small algae, for instance *Pterosiphonia pennata, Gelidium* etc. It is found in rather exposed places. Tetrasporic plants are found in March.

Gran Canaria: Playa de Santa Catalina (M^lle^ Vickers,!), Castillo, Boñadero (M^lle^ Vickers). Montagne does not mention any locality.

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea, Bermuda.

Subfam. 3. Nitophylleæ.

Acrosorium Zanard.

Acrosorium uncinatum (J. Ag.) Kylin.

Kylin, H., Studien über die Delesseriaceen (Lunds Universitets Årsskrift. N. F., Avd. 2, Bd. 20, 1924, Nr. 6, p. 78).

Nitophyllum uncinatum (Turn.) J. Ag., Species Alg., vol. II, p. 654; Epicrisis, p. 465.

Fucus laceratus var. *uncinatus* Turner, Fuci, tab. 68, figs. c. d.

Aglaophyllum laceratum Mont., var. *uncinatum* Turner, Montagne l. c., p. 151.

This species occurs near low water mark in rather exposed places or sublittorally. Specimens with tetrasporangia have been found in March.

It seems to be common at the Islands and has been found there by most investigators.

Geogr. Distrib. From the English coast southwards to the Canary Islands, Mediterranean Sea.

Additional remark to *Trailliella intricata* Batt.

When mentioning this species at p. 9 I said that I had seen sterile material only. On looking through some preparations of Canarian algæ I have found one containing this species with sporangia. As these organs have so far only been found a few times, namely in England by BATTERS and in Denmark by ROSENVINGE, it seems to me of interest to note that fructiferous specimens also occur at the Canary Islands. As said in the descriptions (compare the literature quoted p. 9), the tetrasporangia occur in the erect filaments near their upper ends, as a rule two to four sometimes up to six together in a row. BATTERS has figured the tetrasporangia (l. c. 1900) and KYLIN has made a drawing of them after a slide from BATTERS preserved in Herb. AGARDH, Lund, and finally ROSENVINGE has l. c. given an illustration of them. The plant with tetrasporangia was gathered at the end of March.

INDEX OF SPECIES

together with more essential synonyms, the last mentioned printed in Italics

Færdig fra Trykkeriet den 10. Juni 1930.

BIOLOGISKE MEDDELELSER

UDGIVNE AF

DET KGL. DANSKE VIDENSKABERNES SELSKAB

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