

Det Kgl. Danske Videnskabernes Selskab.  
Biologiske Meddelelser. **VI**, 2.

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

**II. PHÆOPHYCEÆ**

BY

**F. BØRGESEN**



**KØBENHAVN**

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

1926

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Whereas the first part of this work dealt with the *Chlorophyceæ* of the Canary Islands, this second part contains a list of the *Phæophyceæ*.

That I have been able in a comparatively short time to work out this group is primarily due to the fact that Professor SAUVAGEAU, of Bordeaux, visited the islands (Teneriffe) especially for the purpose of studying some groups of the Phæophyceæ, and that he has published several important papers on Canarian brown algæ as a result of his investigations. He has also, in several other monographic works on brown algæ especially from France, given a description of some of the species which I found at the Canary Islands, and on account of this the work has been much easier to me.

Furthermore, the late Professor KUCKUCK has been working with several of the algæ of this group now found on the islands, and has published several monographic papers about them, for instance his fine examination of *Nemoderma tingitana*.

Dr. HAMEL of the Muséum National d'Histoire Naturelle, Paris, has again rendered me the great service of lending me a collection of algæ from MONTAGNE'S Herbarium specially collected on the islands by WEBB.

I am also much indebted to Dr. ACHILLE FORTI of Verona for sending me several Canarian specimens from

PICONE's Herbarium collected on the islands by Captain d'ALBERTIS especially at Lanzarote.

In Part I I have already mentioned the interesting discovery of *Nemoderma tingitana* by Professor SAUVAGEAU at Orotava, where this peculiar alga occurs as small brown discs on the rocks in very exposed places.

Among the more interesting discoveries in my own collection I shall here mention *Padina Vickersiae* Hoyt (= *Padina variegata* auctorum) a species very characteristic of the West Indies and adjacent shores of America, but not previously known from other places; and also the two West Indian *Ectocarpus*-species: *Ect. Rallsiae* and *Ect. rhodochortonoides*.

Among earlier finds of characteristic species common to the Canary Islands on the one side of the Atlantic and the West Indies and adjacent shores of America on the other side I should like also to mention *Sporochnus Bolleanus*, first found by BOLLE at the Canary Islands and later on by SINTENIS at Portorico, according to HAUCK; *Aglaozonia canariensis*, found at Orotava by SAUVAGEAU, and shortly after at St. Croix by myself; *Zonaria lobata*, known from the Cape and the Canary Islands on this side of the Atlantic and from Brazil and the West Indies on the other side; and *Sargassum Desfontainesii*, known from the Makaronesian Islands and from the West Indies and Venezuela.

In this connection it is also of interest that, of the 55 species of brown algæ mentioned in the following list, no less than 22 species are common to the West Indies and the Canary Islands.

The drawings of microscopic preparations were made

by myself in pencil, Mr. OVE ROSTRUP has since drawn them in Chinese ink for reproduction.

The habit illustrations have been drawn by Mr. OVE ROSTRUP.

To the Trustees of the Carlsberg Foundation I am much indebted for a grant especially for the production of the drawings, and to the Rask-Ørsted Foundation for a grant towards the translation into English.

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# PHÆOPHYCEÆ

## I. Ectocarpales.

### Fam. 1. *Ectocarpaceæ*.

#### *Pylaiella* (Bory) Kjellm.

##### 1. *Pylaiella fulvescens* (Schousboe, Thuret) Bornet.

BORNET, ED., Note sur l'Ectocarpus (*Pylaiella*) *fulvescens* Thuret (Revue génér. de Bot., t. 1, 1889, p. 5, pl. 1); Les Algues de P.-K.-A. Schousboe (Mémoires . . . Cherbourg, t. 28, 1892, p. 247). SAUVAGEAU, C., Note sur l'Ectocarpus (*Pylaiella*) *fulvescens* Thuret (Journ. de Bot., 1896, p. 47). BØRGESEN, F., Mar. Alg. D. W. I., vol. II, p. 431.

*Conferva fulvescens* Schousboe mscr.; Icon. ined., t. 115.

*Ectocarpus fulvescens* Thuret in Algæ Schousboeanæ, nos. 109—110.

This species has been found by M<sup>lle</sup> VICKERS. About its occurrence she writes: "Dans les flaques à marée haute. Antera, le centre de la baie de Confital. Décembre à février".

Gran Canaria: Bahia del Confital (M<sup>lle</sup> VICKERS).

Geogr. Distrib. Atlantic coast of France, Spain, Morocco, Canary Islands, West Indies.

#### *Ectocarpus* Lyngb.

BATTERS proposed that the oogamous *Ectocarpus*-species should be included in a new genus *Giffordia*, and in OLT-MANN'S "Morphologie und Biologie der Algen" these forms are referred to a special family: The *Giffordiaceæ*. As this



division does not seem to me to be a natural one, I have not made use of it in the following list.

My view by the way coincides with that of BORNET, KUCKUCK<sup>1</sup> and with that of SAUVAGEAU who has especially studied these forms.

I have not even separated *Ectocarpus pusillus* with its immobile spores from *Ectocarpus*. In case it was desirable to divide this species from *Ectocarpus*, BORNET proposed the name *Acinetospora* for it, but BORNET himself does not advocate such a division.

### 1. *Ectocarpus confervoides* (Roth) Le Jolis.

LE JOLIS, Alg. mar. Cherbourg, p. 75. KUCKUCK, Beitr. zur Kenntn. ein. Ectocarpus-Arten der Kieler Förde, p. 19.

*Ceramium confervoides* Roth, Catalecta bot., I, p. 151.

The specimens I have found of this species are small, forming, together with several other epiphytes, a low dense felt about 1—2 mm high upon *Pterocladia capillacea*.

The plant forms small tufts, being fixed to the substratum by creeping rhizoids from which new erect filaments arise. Rhizoids are also given off from the cells in the lower part of the filaments, but not in great numbers (Fig. 2 b).

<sup>1</sup> KUCKUCK, PAUL, Neue Untersuchungen über Nemo-derma in Wissenschaftl. Meeresuntersuch. Neue Folge. V. Bd. Abt. Helgoland, p. 146.

Fig. 1. *Ectocarpus confervoides* (Roth) Le Jolis. Part of a filament with sporangia. (About 170 : 1).

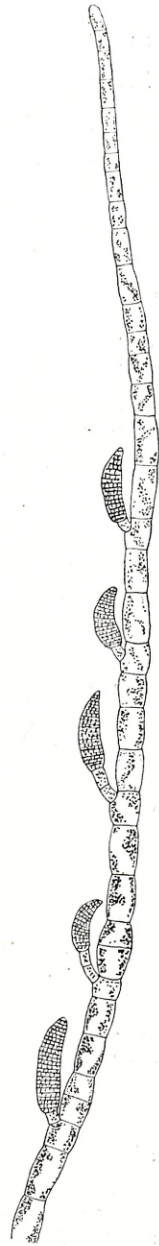


Fig. 1.

The erect filaments were as a rule unramified (Fig. 1), only rarely have I found filaments provided with a few branches.

Near the base the filaments are thinner, increasing in size higher up to about a third part of their length, whence they slowly taper upwards.

Hairs are not present.

The cells in the filaments have a length which is at first almost the same as their breadth, but increases till it becomes about  $2\frac{1}{2}$  times as great. Having reached this size, the cells divide, division being possible in any part of the filaments.

The thicker filaments have a breadth of about  $27\ \mu$ , decreasing upwards to about  $11\ \mu$ .

The filaments are usually clearly moniliform.

Chromatophores are found in all the cells. They have the shape of broad ribbons in the young cells, in the

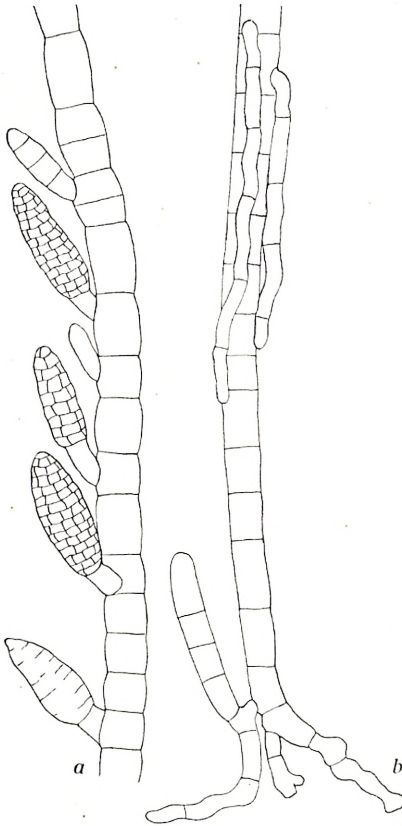


Fig. 2. *Ectocarpus confervoides* (Roth) Le Jolis. *a*, part of a filament with sporangia. *b*, base of a filament with rhizoids. (About 300:1).

older ones they are thinner, or divided into several discs. The plurilocular sporangia (Fig. 1, 2 *a*) are spindle-shaped, often curved, pedicellate or terminating short branches, rarely sessile.

Now and then I have also found a sporangium placed terminally upon a filament.

The sporangia had a breadth of about  $25-30 \mu$  and a length of about  $75 \mu$ .

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

Gran Canaria: At the old tower San Christoballo south of Las Palmas.

Geogr. Distrib. Atlantic Ocean, Mediterranean Sea etc.

## 2. *Ectocarpus rhodochortonoides* Børgs.

BØRGESEN, F., Mar. Alg. D. W. I., vol. I, p. 170.

When I described this species I based my description of it upon very little material. That it could be such a polymorph species as regards the shape of sporangia as I have now found it to be in my Canarian specimens I did not imagine (compare Fig. 3 and 6). To be sure I have given in fig. 135 (l. c.) some

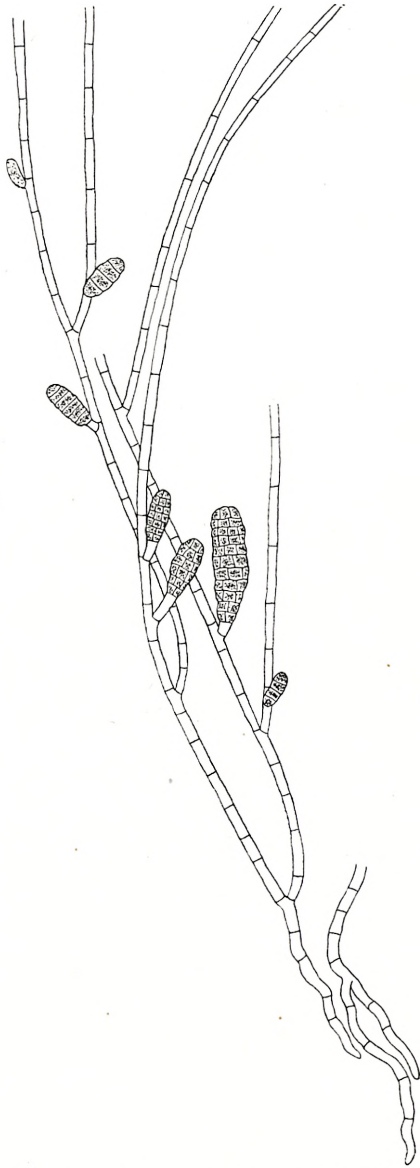


Fig. 3. *Ectocarpus rhodochortonoides* Børgs. Part of a plant with sporangia of different shape. (About 160 : 1).

figures of the very few, and, as I thought, abnormal sporangia, found in the West Indian material. When therefore in my Canarian collection I at first came across specimens in which the sporangia were nearly all ellipsoidal in shape with the basal part enclosed in the chalk skeleton of the host plant, *Cymopolia barbata*, I took it for a new species.

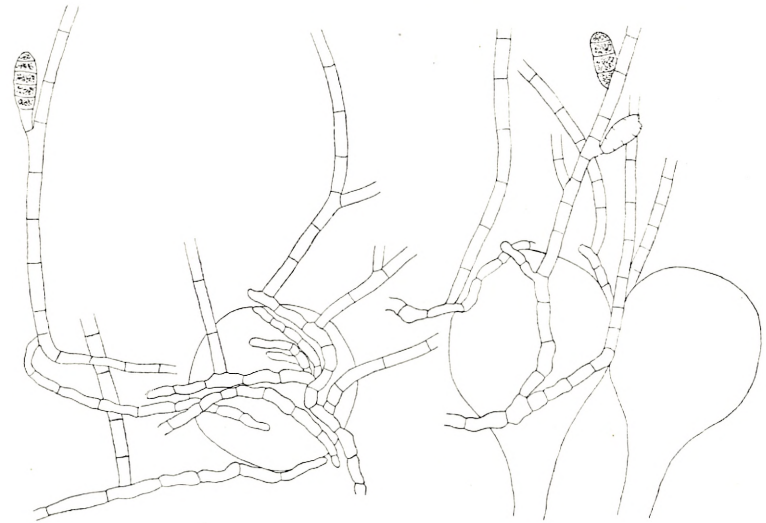


Fig. 4. *Ectocarpus rhodoortonoides* Borgs. Bases of plants, the creeping filaments of which are fixed to the vesicles of *Cymopolia barbata*. (About 180:1).

It was only later on, after finding a good deal more material, and in this also specimens in which the characteristic, broad cylindrical, nearly rectangular, sporangia prevailed, that I was convinced that I had to do with the same plant that I had found in the West Indies.

On account of this I think it reasonable to give here a fuller description of the Canarian plant.

As mentioned above several of the specimens were found upon *Cymopolia barbata*, upon which this plant forms a dense, low felt, about 1—2 mm high. The basal

part of the plant is endophytic, penetrating into the calcareous skeleton between the vesicles of the host (Fig. 4). It consists of creeping filaments composed of lengthened cells with waved uneven surface, the length of which is about 2—3 times as great as their breadth, which is between 7 and 11  $\mu$ .

The creeping filaments interlace over the spherical surfaces of the facets of the host plant, and may in older plants gradually fuse into a more or less perforated or almost continuous plate (Fig. 4).

From this basal part the erect filaments arise. In their lower part these filaments are about 10—13  $\mu$  thick, tapering slowly upwards and ending in a long more or less colourless hair, the diameter of which may be as small as about 3—4  $\mu$  (Fig. 3). The cells in the filaments are about 35  $\mu$  long, becoming gradually longer upwards to about 80—90  $\mu$  in the hair. A marked growing zone I have not found, the division of the cells taking place intercalarily round in the filaments except in the upper part.

The chromatophores are not much developed, and have the shape of irregularly formed ribbons or plates.

The filaments are not so very much ramified. The branches usually occur in the basal part of the filaments and are given off without any order on all sides. The branches are as a rule not ramified, but may sometimes give rise to a few short branches.

The plurilocular sporangia occur scattered upon the filaments and branches. Most of them are sessile, but pedicellate ones occur frequently, and sometimes they are terminally placed upon short branches (Figs. 5, 6).

The shape of the sporangia is very variable (Fig. 6). In some of the specimens most of the sporangia were,

as mentioned above, ellipsoidal-cylindrical, with broadly rounded apex and often tapering evenly downwards, the sporangia thus having a clavate shape. More rarely short

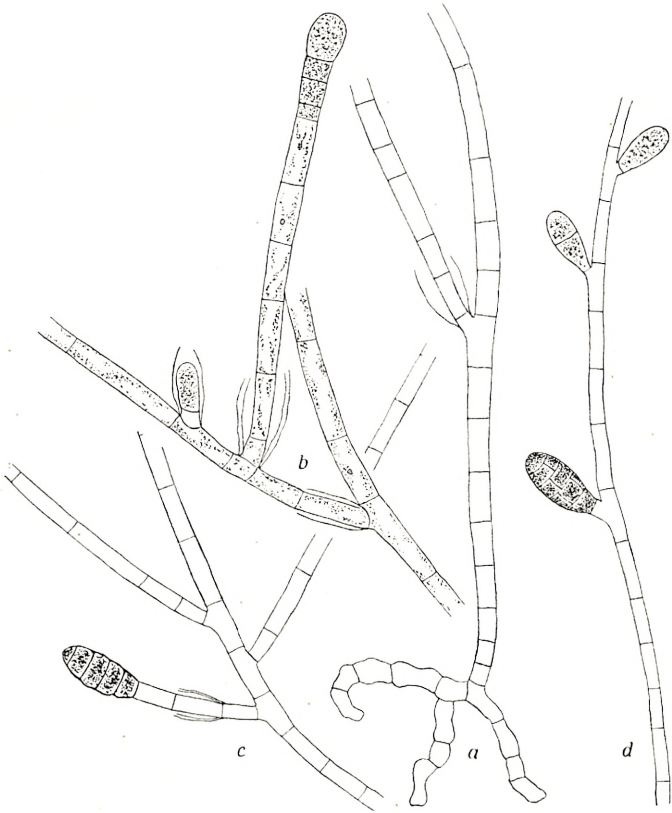


Fig. 5. *Ectocarpus rhodochorlonoides* Børgs. *a*, base of a plant with creeping filaments; *b* and *c*, ramified filaments with sheaths at the base of the branches; *d*, a filament with young sporangia. (About 200:1).

and broad sporangia occurred. In other specimens, however, the sporangia were all or nearly all short and broad, quite like those found in the West Indian specimens. These broad sporangia, too, often taper a little downwards.

In accordance with their variable shape the size of the

sporangia, too, is very variable. Thus the large sporangium in fig. 3 is  $78 \mu$  long and  $31 \mu$  broad; on the other hand the smaller sporangium nearest to it is only  $42 \mu$  long and

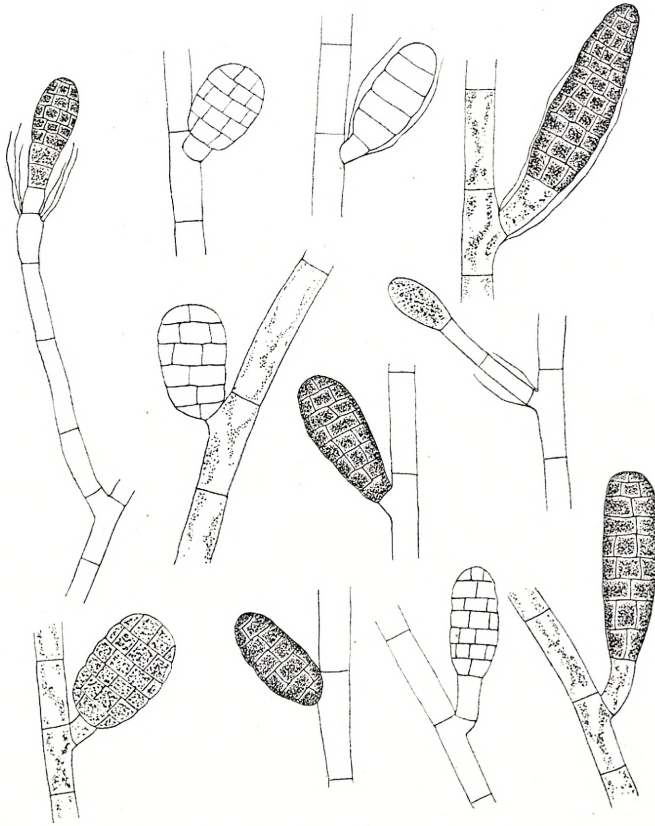


Fig. 6. *Ectocarpus rhodochortonoides* Børgs. A series of sporangia of different shape and size, some of which are sessile, others pedicellate or placed terminally upon short branches. (About 250 : 1).

$24 \mu$  broad. The usual size of the short, broad sporangia is about  $26-29 \mu$  broad and  $33-45 \mu$  long.

When a sporangium is emptied a new one is often developed in the place of the old one (compare Fig. 6).

Also at the base of the branches sheaths often occurred

(Fig. 5). Whether we have in such cases always to do with emptied sporangia from the base of which a branch has been developed, I dare not say. In some specimens such sheaths are rather common.

I have not found this in my W. I. material. I have examined it again, and only in one case have I found a sporangium growing out in an emptied one. But I may point out that in the Canarian material this did not always occur.

According to this description it cannot be denied that the plants from both sides of the Atlantic agree perfectly, and that there is no doubt as to their identity. To be sure, the basal part in the Canarian plants found upon *Cymopolia* was in a way endophytic, embedded in the chalky skeleton of the host, but it must be taken into consideration that *Padina*, upon which the West Indian plant was growing, has also often a chalky incrustation in which the base of the plant may be embedded. But the plant is also able to grow quite epiphytically. Thus I have found it growing abundantly upon *Dictyota dichotoma*. In these specimens the plurilocular sporangia had nearly all the typical broad rectangular shape.

This plant is surely closely related to *Ectocarpus monocarpus* Ag. But to get any clear idea of this species is rather difficult on account of the rather poor descriptions of it, and so much the more as the fine figure of it drawn by KUCKUCK and published in the new edition of OLTMANN'S "Morphologie", vol. II, p. 12, fig. 297 is very different as regards ramification and shape of the sporangia from KÜTZING'S figures of the plant in "Tabulæ Phycologicæ", vol. V, tab. 73, II and 75, I. As regards the shape of the sporangia, the ellipsoidal ones of my plant come



rather near those figured by KÜTZING while on the other hand the proportionately much broader and more ovate sporangia in KUCKUCK's figures are very different from those found in my plant. And that it can scarcely have anything to do with this species appears also from the fact that KUCKUCK, in a letter to me in 1914, writes about my plant: "Diese Art ist mir durchaus neu", and that just at a time when his large work on the Phæophyceæ was rather near its completion.

Finally this plant also in several respects shows similarity to the *Ectocarpus variabilis* Vickers (Liste des Algues marines de la Barbade, p. 59; Phycologia Barbadosensis, Part II, pl. XXXI) which I know only from the figures and description of M<sup>lle</sup> VICKERS. The size and the whole habit of the plant, its ramification etc. seem to agree in most points with *Ectocarpus rhodoortonoides*. But to judge from the figures of M<sup>lle</sup> VICKERS the cells in her plant do not become longer upwards and the filaments do not end in long hairs. The shape of the plurilocular sporangia is also different, these being as a rule lanceolate-oblong to oval in M<sup>lle</sup> VICKERS' plant, thus differing much from the short broad ones found in my plant.

This plant has been found in not too much exposed places near low water mark.

Gran Canaria: Playa de Santa Catalina, Bahia del Confital.  
Geogr. Distrib. West Indies. Canary Islands.

### 3. *Ectocarpus siliculosus* (Dillw.) Lyngb. partim.

LYNGBYE, Tentamen, p. 131, tab. 43 C. *Conferva siliculosa* Dillw., Brit. Conf., p. 69.

forma arcta (Kütz.) Kuck.

KUCKUCK, P., Ectoc. Kieler Förde, p. 18.

*Ectocarpus arctus* Kütz., Phycologia generalis, p. 289. HAUCK, Meeresalgen, p. 328.

This plant seems to be a rather common epiphyte upon larger algæ, *Cymodocea nodosa* etc.

It is fixed to the substratum by means of numerous rhizoids issuing from the basal cells, and rhizoids are

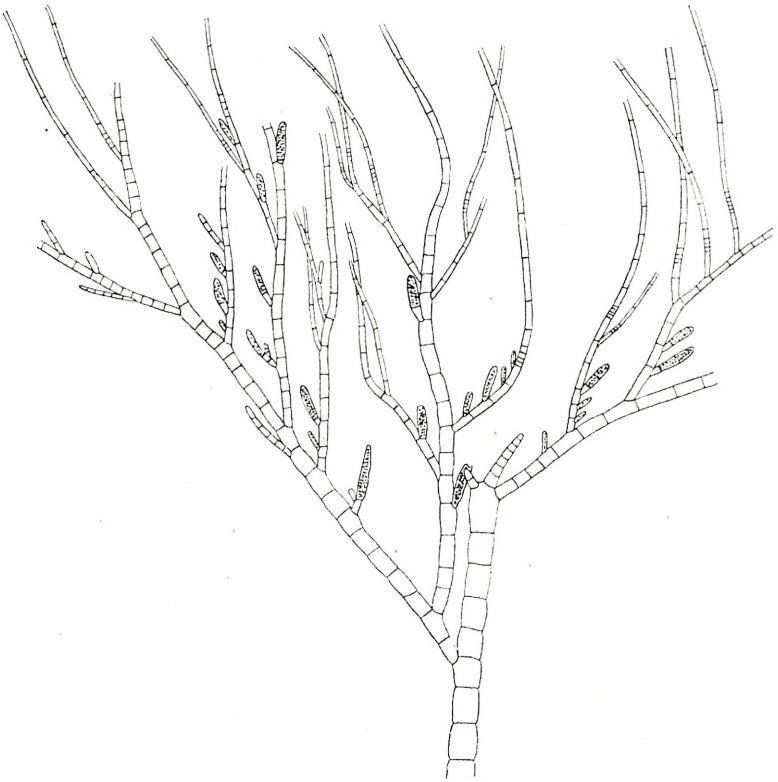


Fig. 7. *Ectocarpus siliculosus* (Dillw.) Lyngb. f. *arcta* (Kütz.) Kuck.  
Part of a plant. (About 65:1).

upon the whole richly present in the lower part of the filaments, these being often quite covered by downward growing rhizoids.

The cells in the main filaments have a breadth of about 70—80  $\mu$  and their length is usually 1—2 times as great as their breadth. Higher up, the thickness of the

filaments decreases slowly, the uppermost branches reaching only a breadth of about  $22 \mu$ . The filaments often taper rather suddenly at their apex and run out into long colourless hairs having a small growth-zone at their base (Fig. 7).

The chromatophores have the shape of irregularly bent and ramified thin ribbons, forming a more or less open network round the cell.

The ramification of the plant is rich, the branches being given out to all sides.

The plurilocular sporangia are usually ovate spindle-shaped or more lengthened. They are of very variable size, especially as to length: about  $80-150 \mu$  long and  $27-35$  broad. The sporangia are both sessile and pedicellate.

Unilocular sporangia were found in some of the specimens. These and the plurilocular ones occur in the same plant, often side by side (Fig. 8). They are ovate in shape, about  $26-30 \mu$  broad and  $32-35 \mu$  long. They are placed upon a short pedicel, commonly consisting of a single cell, very rarely of two cells.

The Canarian form seems to agree quite well with the description of HAUCK, l. c.; on the other hand it differs somewhat from that of KUCKUCK.

In this connection I wish to point out that the Canarian plant seems to be very like a plant KUCKUCK in his posthumous manuscript has referred to *Ectocarpus spinosus* to judge from the figure published in the second edition of OLTMANN'S "Morphologie u. Biologie der Algen", vol. II,

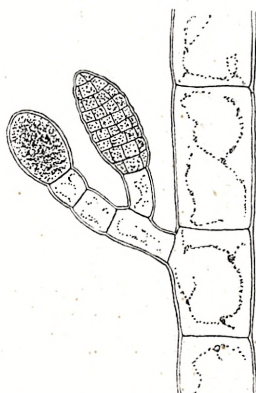


Fig. 8. *Ectocarpus sili-culosus* (Dillw.) Lyngb. f. *arcta* (Kütz.) Kuck. A unilocular and a plurilocular sporangium placed upon the same branch. (About  $270:1$ ).

p. 7, fig. 291. HAUCK in "Meeresalgen" refers *Ectocarpus spinosus* as a synonym to *Ectocarpus arctus* Kütz., but by reason of the well developed colourless hairs of this plant it would perhaps be better to consider it a separate species.

*Ectocarpus siliculosus* has already been recorded from the Islands by various investigators, and most probably we have to do with the above-mentioned variety.

The plant occurred in high lying rockpools in rather exposed places and near low water mark in sheltered ones.

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

Geogr. Distrib. Along the west coast of Europe, Mediterranean Sea, Bermuda Islands.

#### 4. *Ectocarpus virescens* Thuret.

THURET in FLAHAULT, Herborisations algologiques d'automne au Croisic (Bull. Soc. bot. France, t. XXXV, 1888, p. 382). SAUVAGEAU, C., Sur "l'*Ectocarpus virescens*" Thuret et ses deux sortes de sporanges pluriloculaires (Journ. de Bot., nos. 6 and 7, 1896).

Before giving my reasons for naming the Canarian plant *Ectocarpus virescens* and not *Mitchellæ* I will give a short description of the plant together with some few figures (Fig. 9, 10).

The main filaments in the Canarian specimens are about  $50 \mu$  thick and the cells of which they consist usually 2—3 times as long, now and then up to 4 or 5. The cells in the filaments are often somewhat barrel-shaped. Division of the cells takes place here and there in the filaments. Upwards as the filaments become more and more branched, the filaments decrease in size, the uppermost end of the filaments being often not more than about  $10 \mu$  broad or even less. Near the base of the branches a growth-zone is usually present. Above it the

cells in the branches and branchlets become gradually longer, the cells at the same time containing fewer and fewer chromatophores, the uppermost cells being practically



Fig. 9. *Ectocarpus virescens* Thur. Part of the thallus with plurilocular sporangia (meiosporangia). (About 80:1).

colourless. The young branchlets taper quickly upwards, being acute at their summit.

The chromatophores are small roundish discs, in the young cells like short ribbons.

Above the zone of growth the branchlets and sporangia are formed.

The sporangia have the characteristic shape of this species, being nearly cylindrical with broadly rounded apex (Fig. 10). Usually they are 24—28  $\mu$  broad and 48—75  $\mu$  long. The largest sporangium I have measured was 28  $\mu$

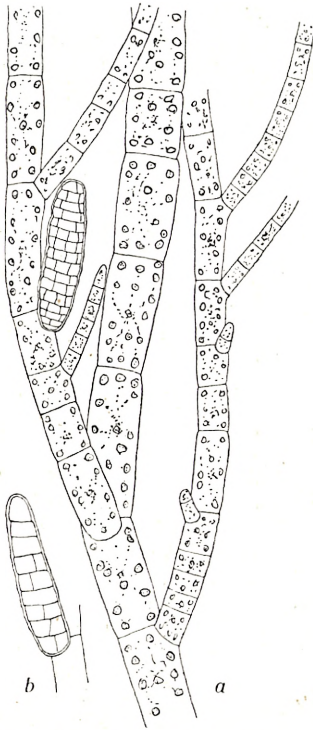


Fig. 10. *Ectocarpus virescens* Thur. *a*, part of the thallus with a meiosporangium; *b*, a megasporangium. (About 180:1).

broad and 109  $\mu$  long. As is well known SAUVAGEAU has in this species found two kind of sporangia. In most of my material meiosporangia occurred only, but in one collection plants with megasporangia were present. The loculi in these had a height of about 12  $\mu$ , while those in the meiosporangia were 6  $\mu$  high only. For the rest SAUVAGEAU has already found both kind of sporangia in Canarian specimens collected by M<sup>lle</sup> VICKERS.

In my West Indian algal flora I have at some length discussed the question whether or not *Ectocarpus virescens* Thur. is identical with *Ect. Mitchellæ* Harv. The difficulties concerning this question have arisen from the fact that THURET published his species as a nomen nudum only, and HARVEY's figures and description in "Nereis Bor.-Am.", vol. I, p. 142 are not good. On account of this HARVEY's plant was for several years unnoticed. However, COLLINS in "Notes on New England Marine Algæ", V (in Bull. Torr. Bot. Club, vol. 18, 1891, p. 337)

states that he had examined an *Ectocarpus* which he means is referable to HARVEY'S plant. He gives a description of the plant, at the same time pointing out the very great affinity which is present between the American plant and *Ectocarpus virescens*, saying that, in case they really are identical, the name of HARVEY as the oldest must be preferred.

Later on COLLINS together with HERVEY in "The Algæ of Bermuda", p. 69 mention *Ectocarpus virescens* as a synonym of *Ectoc. Mitchellæ*, and BATTERS in his "Catalogue of the British Algæ" does the same, and likewise COTTON in the Algæ of Clare Island, p. 94. In consequence of the note of COLLINS which SAUVAGEAU had overlooked when working out his detailed examination of *Ectocarpus virescens* (in Journal de Bot., 1896, p. 17) SAUVAGEAU (in "Algues de Gascogne", p. 22), after having examined American specimens which COLLINS had sent him, expresses his opinion as follows: "La plus grande ressemblance existe en effet entre la plante des côtes de France et celle de Massachussets, et elles semblent bien appartenir à une même espèce". Later on SAUVAGEAU seems to have altered his view in this matter. In a letter of  $27/4$  16 he writes to me: "Par suite pour éviter une synonymie ultérieure, il me paraissait plus simple et plus prudent de maintenir les deux espèces séparées, tout en faisant ressortir leur ressemblance". This letter I received from SAUVAGEAU when working out my West Indian *Ectocarpus* species, and SAUVAGEAU also at the same time kindly sent me some French material and fine preparations of HARVEY'S original plant to compare with my plants. As a result of my comparison I found that the French plant had often many short tapering branchlets (comp. SAUVAGEAU'S Fig. 1, l. c. p. 100) and not

such well developed hairs as are present in the West Indian plant, the hairs in the French plant being much more rich in chromatophores while those in the West Indian plants are practically colourless. In this respect HARVEY's plant agreed well with the French specimens. But how far these differences are due to anything but different age of the plants and especially different conditions of life seems doubtful to me. In every case the Canarian specimens I have examined show most likeness in this respect to my West Indian plants, the hairs containing very few chromatophores.

Then two characters only are left, separating the American plant from the European one, namely: 1) the two kind of sporangia discovered by SAUVAGEAU in the European and until now not found in the Atlantic-American plant,<sup>1</sup> and 2) the green colour of the European plant when dried in contrast to the rusty-brown of the American plant.

As to these characters the Canarian plant as stated above has both kind of sporangia like the European plant. As to the colour, on the other hand, it is more difficult to say exactly how it is in the Canarian plant, my specimens being nearly all much mixed together with other species, but to judge from a few more unmixed specimens this seems to take an intermediate position, their colour being brownish green.

When I therefore have called the Canarian plant *Ectocarpus virescens* it is because it has the two kind of sporangia. And should the two kind of sporangia be found also in the American plant, which would not surprise me,

<sup>1</sup> SETCHELL and GARDNER have in a plant from Southern California found both kind of sporangia (in *The Marine Algae of the Pacific Coast of North America*. Part III, *Melanophyceae*, p. 428, 1925).



then of course HARVEY's name as the oldest must be given also to the European-Canarian plant.

This species has been found several times growing as an epiphyte upon various algæ, e. g. *Cymopolia* and upon leaves of *Cymodocea nodosa*. It was found in somewhat sheltered or quite sheltered localities near low-water mark.

Gran Canaria: Playa de Santa Catalina in various places; here it has also been collected by M<sup>lle</sup> VICKERS. Bahia del Confital.  
Geogr. Distrib. From Great Britain to the Canary Islands.

### 5. *Ectocarpus Rallsiæ* Vickers.

VICKERS, A., Liste des Algues mar. de la Barbade (Ann. Sciences Nat., Bot., 9<sup>ième</sup> Série, vol. I, 1905, p. 59); Phycologia Barbadosensis, Part II, pl. 32. BØRGESEN, F., Mar. Alg. D. W. I., vol. I, p. 169.

Intermingled with other algæ growing upon *Cymopolia barbata* I have several times found an *Ectocarpus* which I think is referable to this species (Fig. 11).

As is the case with the West Indian plant (compare M<sup>lle</sup> VICKERS's short diagnosis and figures and my description, l. c.) the Canarian plant is not much ramified. From the basal creeping filaments the erect filaments arise. From these the branches are given off irregularly on all sides, longer ones from the basal part, and shorter ones higher up.

The filaments have a breadth of about 20—25  $\mu$  and do not taper much upwards. They run out into a long colourless hair and have a growth zone at their base. The length of the cells is very variable, being about 2—6 times greater than the breadth, intercalary division also taking place now and then.

The cells from which sporangia or branches issue are short, their length being rarely more than twice their breadth. Often two short cells with sporangia or branches are found together (comp. fig. 11).

The chromatophores have the shape of small roundish discs.

The sporangia are either pedicellate or sessile. Unilocular and plurilocular sporangia occur together in the same plant.

The plurilocular sporangia have the characteristic shape

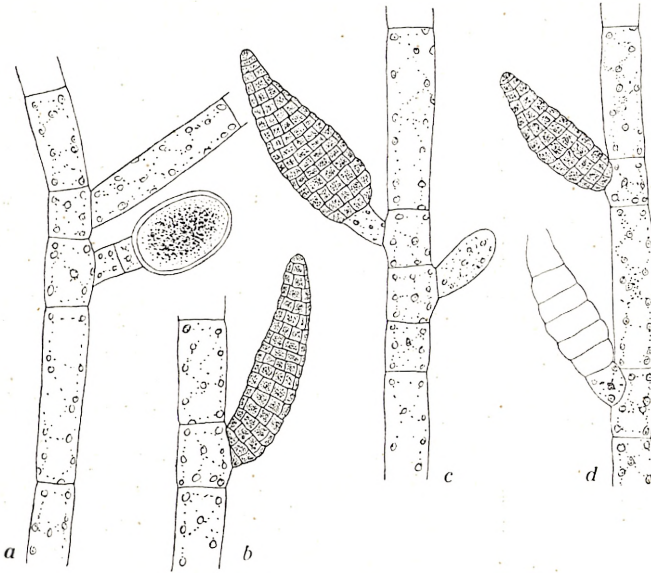


Fig. 11. *Ectocarpus Rallsiae* Vickers. *a*, a filament with unilocular sporangium; *b*, *c*, *d*, filaments with plurilocular sporangia. (About 200 : 1).

of this species, being ovate-cylindrical, tapering rather suddenly at the apex (Fig. 11). Generally they are somewhat oblique, being bent a little upwards. They had a length of as much as  $100 \mu$  and a breadth of as much as  $35 \mu$ .

I have not seen many unilocular sporangia. They are oval in shape, about  $45 \mu$  long and  $30 \mu$  broad; in one I found two cells in the pedicel (Fig. 11 *a*).

As is clear from this description, the Canarian plant closely resembles the West Indian one, the only difference

being that the sporangia seem in all respects to be a little smaller.

As already pointed out in my West Indian algal flora, this species comes near to *Ectocarpus irregularis* as regards the shape of its sporangia, but it differs from the latter in being less ramified and in having often pedicellate sporangia and proportionally more slender plurilocular sporangia.

Gran Canaria: Playa de Santa Catalina, near Las Palmas.  
Geogr. Distrib. West Indies, Canary Islands.

### 6. *Ectocarpus irregularis* Kütz.

KÜTZING, F., *Phycologia germanica*, p. 234; *Species Algarum*, p. 454; *Tab. phycol.*, vol. V, tab. 62, fig. 1. HAUCK, *Meeresalgen*, p. 328. BORNET, *Algues Schousboe*, p. 245. KUCKUCK in OLTMANN'S, *Morphol. Alg.*, vol. II, fig. 294, p. 9.

This plant is found as an epiphyte upon various algæ, e. g. *Asperococcus*, *Cymopolia*, *Cystoseira*, *Halopteris* etc. or intertwined among other species of *Ectocarpus*; M<sup>lle</sup> VICKERS found it upon *Liagora elongata*.

The base of the filaments is fixed to the substratum by means of rhizoids issuing from the cells in this part of the plant. But rhizoids are also often given off higher up in the thallus (Fig. 12 a), and now and then it happens that the summits of the filaments are transformed into rhizoids (Fig. 13). I have not met with rhizoids running down along the wall of the filaments.

The erect filaments are about 25—31  $\mu$  thick, decreasing slowly upwards to about 15—17  $\mu$ , which is the thickness of the hairs. The cells may be as much as 4—5 times as long as they are broad, and are generally 2—4 times as long.

The growth of the filaments is trichothallic (Fig. 14), a growth-zone being found at the base of the young branches,

which gradually occupies a higher position in the filaments as growth continues; but in addition intercalary divisions are also found here and there in the filaments, as is seen

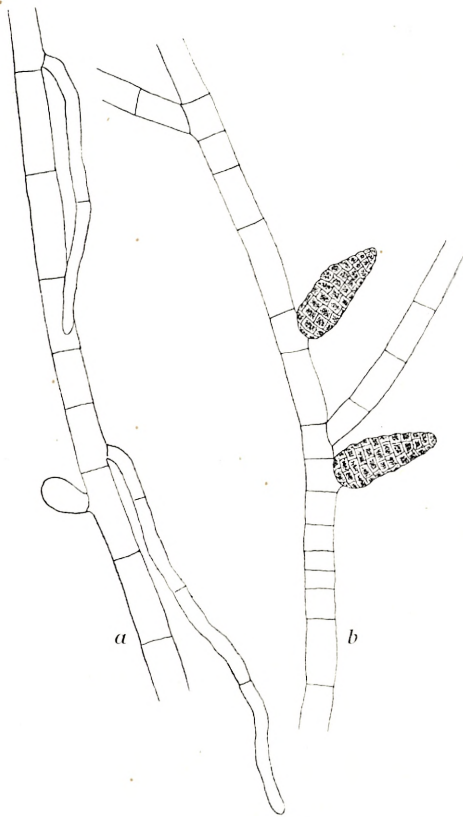


Fig. 12. *Ectocarpus irregularis* Kütz. *a*, basal part of a filament with rhizoids. *b*, filament with sporangia and intercalary zone of division. (About 175 : 1).

in my figure 12 *b* and in KUCKUCK's fine picture in OLTMANN'S *Morphologie* vol. II, 1922, p. 9, fig. 294.

The chromatophores are in the young newly divided cells lobed plates; in the older cells they are like short staves or roundish discs.

The ramification is very irregular, the branches issuing without any order on all sides, in some cases from nearly all the cells in the filaments; in others they are more scattered, with longer distances between them. Some of the branches be-

come long, but most of them remain short, becoming trichothallic in their growth, and carrying some few sporangia below the growth zone (Fig. 14).

The plurilocular sporangia are generally formed just below the growth zone in the branches, while they are spread on all sides of the main filaments.

The cells carrying the sporangia remain short. In most cases the sporangia are placed solitarily, but it sometimes happens that two occur side by side, given off from two adjacent cells in the filaments.

The sporangia have a very characteristic shape, being more or less obliquely ovate-lanceolate, tapering upwards



Fig. 13. *Ectocarpus irregularis* Kütz. Filaments with sporangia and rhizoids. (About 125:1).

rather suddenly as a rule. The sporangia are about 60—85  $\mu$  long and 28—35  $\mu$  broad. They are sessile, but very rarely one may find a pedicellate sporangium with a short basal cell (compare Fig. 14, the lowermost sporangium).

Unilocular sporangia were not found.

The related species, *Ect. coniferus*, which I have found in the West Indies, is very much like this species in its way of growing and its whole habit, but it is in all respects a good deal larger, for instance the main filaments reach a breadth of up to about 40  $\mu$ , and the sporangia

are about  $40\ \mu$  broad and  $110\ \mu$  long. Also the shape of the sporangia is somewhat different in the two species, those of *Ectoc. coniferus* being often a good deal broader in proportion at their base, often reminding one somewhat

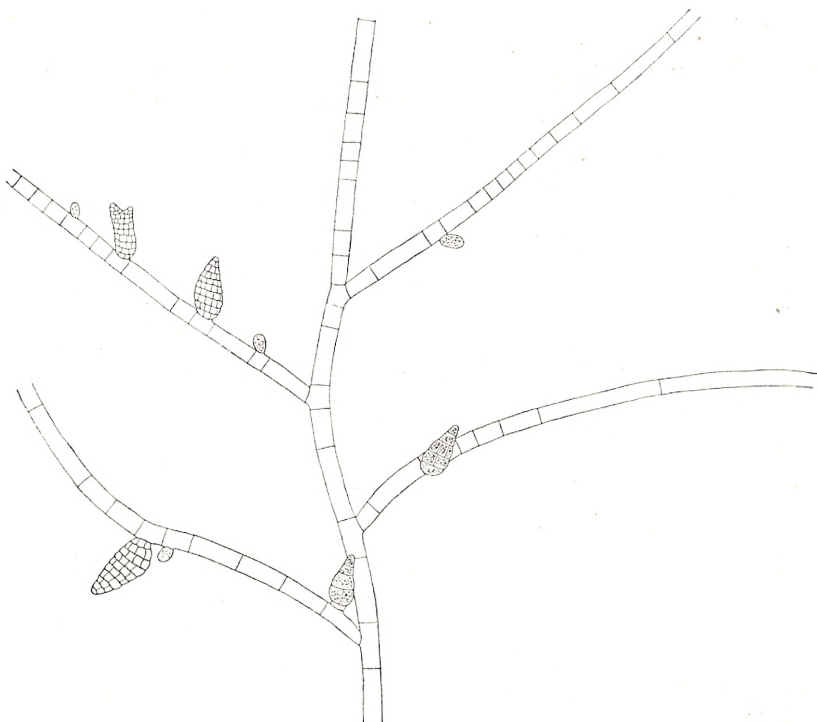


Fig. 14. *Ectocarpus irregularis* Kütz. Part of a ramified filament with plurilocular sporangia (About 90:1).

of those of *Ect. Hincksiae*, and, as is usually the case in this species, the sporangia are often placed in long rows on the upper sides of the branches. And the very characteristic placing of the sporangia, just in the axil of the branches in *Ectocarpus coniferus*, is not found in *Ectocarpus irregularis*.

Regarding the much related species *Ectoc. Rallsiae* compare my remarks, p. 25.

In *Sylloge Algarum*, vol. III, Fucoideæ, p. 538 DE TONI refers this species to *Ectocarpus simpliciusculus* Ag.; I rather doubt if this can rightly be done. I have not seen any specimens of C. AGARDH, and his description in "Flora", 1827, vol. II, p. 639 says very little. In "Species Algarum", vol. II, p. 47 a somewhat fuller description is to be found. But when it says about the sporangia: "Capsulae laterales, crebrae, ovatae vel lanceolatae, sessiles", this description cannot be said to give an idea of their characteristic shape in this species.

And when J. AGARDH in his account of the plant (in "Species Algarum", vol. I, p. 16) describes the sporangia as "cylindraceo-ellipsoideis, breviter pedunculatis" this description is still less in agreement with the sessile sporangia of *Ectoc. irregularis*. Most probably, therefore, C. AGARDH has based his description of *Ectocarpus simpliciusculus* upon another plant.

In "Algen d. Forschungsreise S. M. S. Gazelle" ASKENASY gives the description of an *Ectoc. simpliciusculus* var. *viliensis*. If this plant is correctly named, it shows that *Ectocarpus simpliciusculus* is very different from *Ectoc. irregularis*, but judging from the characteristic shape of the sporangia, I think ASKENASY'S plant is to be referred to *Ect. indicus*, as M<sup>me</sup> WEBER VAN BOSSE also points out in Part I of the "Siboga-Algæ", p. 130.

On the other hand it cannot be denied with regard to KÜTZING'S diagnosis of *Ect. irregularis* (in "Phycologia Germanica", p. 234) that his description is not very appropriate either, for when, for instance, he describes the sporangia in this way: "Spermatoiden zahlreich, kurz gestielt, breit eiförmig, sehr stumpf abgerundet", it is very perplexing. And his figure too in "Tabulæ Phycologicæ", vol. V tab. 62

is not very characteristic, even if one of the sporangia figured shows the peculiar shape of the sporangia of this species rather well.

In "Meeresalgen", Hauck, p. 328 gives a short but rather good description of the plant, also pointing out that the sporangia are sessile, very rarely pedicellate.

But it is BORNET who, in "Algues de Schousboe", p. 245, upon some specimens "assez mal conservés et ne se présentent pas à un examen satisfaisant", gives surely the most exhaustive description of this species.

The plant was found in more exposed as well as sheltered places on rocky shores somewhat above low water mark. Once it was collected in a rock-pool near high water mark. When growing in sheltered places it is sublittoral.

M<sup>lle</sup> VICKERS was the first who found it in the Islands.

Gran Canaria. Playa de Santa Catalina in various places. Bahía del Confital (VICKERS,!).

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

### 7. *Ectocarpus pusillus* Griffiths.

GRIFFITHS in WYATT, Algæ Danmonienses, no. 212, 1835. BORNET, ED., Note sur quelques *Ectocarpus* (Bull. Soc. Bot. France, tome 38, 1891, p. 356 where more literature is named). SAUVAGEAU, C., Note sur l'*Ectocarpus pusillus* Griffiths (Journ. de Bot., 1895). Les *Acinetospora* et la sexualité des Tiloptéridacées (ibid., t. 13, 1899).

*Acinetospora pusilla* (Griff.) Born., l. c. p. 370; DE TONI, Sylloge Algarum, vol. III, Fucoidæ, 1895, p. 566.

non *Ectocarpus pusillus* Kütz.

This interesting, small *Ectocarpus* has been found several times growing upon various algæ, e. g. *Corallina*, *Cymopolia* etc. It forms very intricate small tufts intermingled among other algæ.



ASKENASY (in Bot. Zeit., 1869, p. 785) and BORNET have described the peculiar, large, immobile spores characteristic of this species, and later on SAUVAGEAU gave a very de-

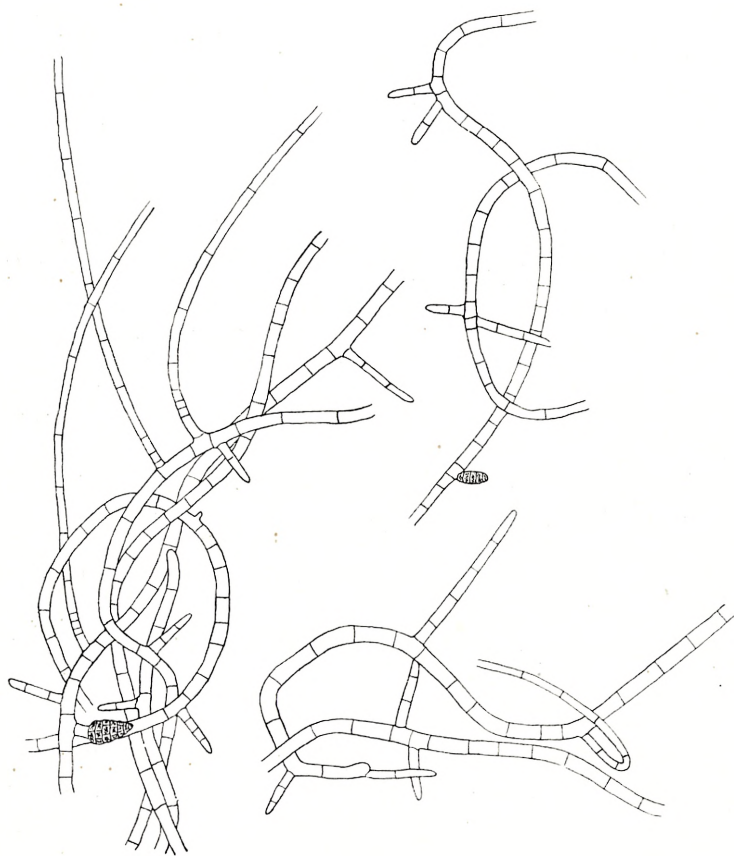


Fig. 15. *Ectocarpus pusillus* Griffiths. Parts of the filaments with short spine-like branchlets from the upper part of the thallus. (About 60 : 1).

tailed description of the building up of this species and described several varieties of it. Of these it seems to me that the Canarian plant in several respects shows some likeness to the var. *riparia* Sauvag.

From the basal, much intertwined creeping filaments (Fig. 16 *a*) rhizoids are given off downwards, and erect filaments upwards. The rhizoids are often rather long.

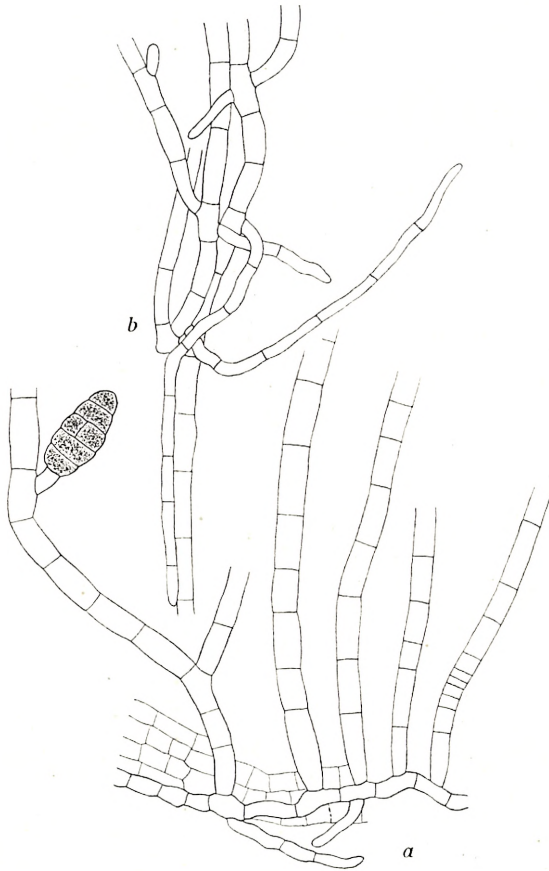


Fig. 16. *Ectocarpus pusillus* Griffiths. *a*, part of the base of a plant  
*b*, rhizoids breaking out from filaments higher up in the thallus. (About  
200 : 1).

They fix themselves to other algæ, often encircling them. Their diameter is about  $15 \mu$ .

But rhizoids do not only issue from the basal parts of the filaments. They are often given off rather high up in

the erect filaments as shown in fig. 16 *b*. These rhizoids usually fix themselves to neighbouring filaments, but it sometimes happens that they run down along the mother filament.

The erect, long filaments have usually several intercalary zones of growth; they are very irregularly ramified; for long stretches they are without any branches, while in other parts they are more or less densely ramified.

The branches develop in various ways. Some of them grow into long filaments, but most of them remain short. Some of the short branches have a zone of growth near their base, above which they run out as long colourless hairs (Fig. 15). These branches are chiefly found in the lower part of the thallus. But most of the branches, and especially those higher up in the thallus, consist of a few cells only, forming the short, spine-like branchlets characteristic of this species, by means of which its filaments are intertwined with each other and with other algæ (Fig. 15).

These branchlets, "crampons" as BORNET calls them, are given off without any order. In parts of the filaments a branchlet issues from almost all of the cells, in others they are much scattered. They are usually straight, sometimes a little curved.

The filaments have a diameter of about 17—31  $\mu$ . The cells are cylindrical and about 3—5 times as long as they are broad.

The chromatophores have the shape of small roundish discs in the older cells; in the younger ones or near the growth-zones they are oblong or like short ribbons.

The plurilocular sporangia are either sessile, or pedicellate (Fig. 17). Their shape is ovate-oblong, or sub-cylindrical, often somewhat curved, and they occur scat-

tered without any order along the main filaments. Their size varies a good deal; usually it is about  $60-80\ \mu$  long and  $30-50\ \mu$  broad. They are divided into rather large

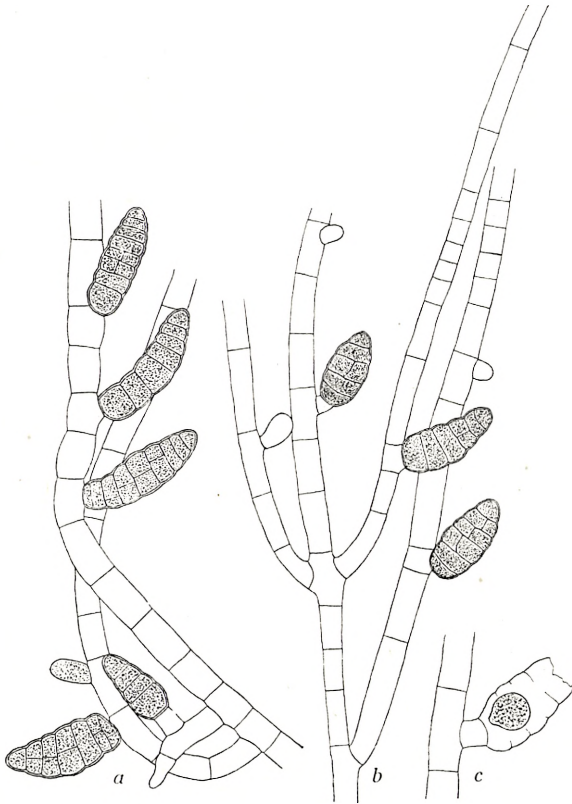


Fig. 17. *Ectocarpus pusillus* Griffiths. *a*, *b*, filaments with plurilocular sporangia. *c*, an emptied sporangium with an immobile spore left. (About 200 : 1).

loculi, about  $13-20\ \mu$  high. In a nearly emptied sporangium one of the large immobile spores was still left. As fig. 17 *c* shows, it had begun to grow, having formed a small outgrowth at one side. Its diameter was about  $22\ \mu$ .

In several of the specimens I have found, the sporangia were present in great number near the base of the plant,

as BORNET also observed. Upon the whole in the Canarian specimens the sporangia usually occurred in the lower part of the thallus; in the upper filaments provided with the "crampons" the sporangia did not occur at all, or occurred more rarely. I mention this here because SAUVAGEAU (l. c. p. 28) has only occasionally found sporangia in the young plant, and because he points out that in the more developed plant the sporangia were abundantly present in the filaments provided with "crampons".

As already mentioned above, it seems to me that our plant approaches rather closely to the var. *riparia* Sauv., the cells and sporangia being nearly of the same size as in this variety, and the whole manner of growth being probably similar.

If one wants to divide the *Phaeosporæ* according to the different ways of development of their organs of fructification, one is obliged, as BORNET pointed out, to refer this species to a special family for which he proposed the name of the *Acinetosporæ*, calling the genus *Acinetospora*, but, regarding the systematic grouping of this species, it seems to me, as THURET in "Études phycologiques", p. 24, BORNET, l. c. and SAUVAGEAU, 1895 l. c. point out, it is more natural to lay most stress upon the vegetative organs in this group, keeping our plant in the genus *Ectocarpus*. Because of his discovery of monospores in this species SAUVAGEAU has pointed out in a later very interesting treatise (1899, l. c.), that its name of *Acinetospora pusilla* is more justified than earlier.

This species was found in rather exposed places near low water mark.

Gran Canaria: Playa de Santa Catalina near Las Palmas.  
Geogr. Distrib. The English and French coasts. Rovigno in the Adriatic Sea.

### 8. *Ectocarpus Battersii* Bornet.

BORNET in SAUVAGEAU, Sur quelques Algues phéosporées parasites, Journ. de Bot., t. VI, 1892, p. 126 (name only). SAUVAGEAU, C., Note sur l'*Ectocarpus Battersii* Bornet, Journ. de Bot., 1895. BATTERS, E., A Catalogue of Brit. Marine Algæ, p. 30.

var. *mediterranea* Born., in SAUVAGEAU, Note, l. c. p. 8.

This small plant, so instructively described by SAUVAGEAU, has been gathered several times and in different stages of development.

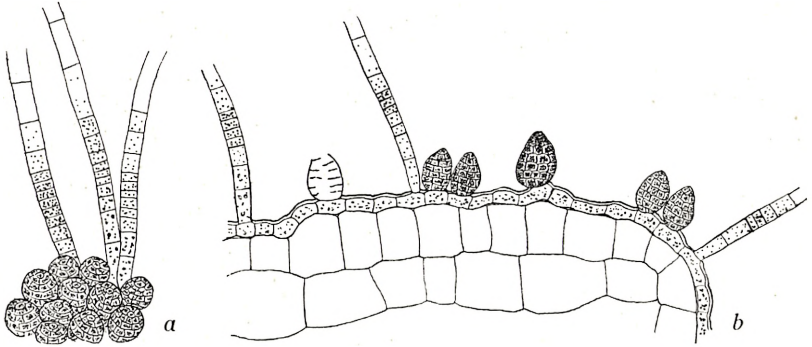


Fig. 18. *Ectocarpus Battersii* Bornet. *a*, part of the felt-like tuft seen obliquely from above. *b*, transverse section of the thallus. (About 225 : 1).

Fig. 18 shows a young phase of the plant; it was found upon a specimen of *Taonia* still in vigorous growth. The parasite formed a dense, low (scarcely more than  $\frac{1}{2}$  mm. high) felt upon the host plant. When examined more closely it was found that the plant consisted of short unramified filaments, ending in long hairs, and below, between the filaments, of numerous densely placed sporangia.

A transverse section of the thallus of the host together with that of the parasite shows a picture quite like that given by SAUVAGEAU, l. c., fig. 1. The basal filaments of the parasite are creeping in the thick epidermal membrane

of the host and from these the sporangia and filaments arise (Fig. 18 *b*).

The filaments, as mentioned above, are quite unbranched. They have, somewhat above their base, a growth-zone above which they end in a long colourless hair (Fig. 18). The filaments have a breadth of about  $12\ \mu$ .

The sporangia are ovate, somewhat attenuated upwards, about  $28-31\ \mu$  long and  $20-23\ \mu$  broad, being thus a good deal smaller than those found upon the filaments of the adult plant. Most of them are sessile, but some have a quite short pedicel about  $6\ \mu$  high. In the specimens he examined SAUVAGEAU found some sporangia placed terminally upon short filaments, but such did not occur here. Besides the creeping, parasitic filaments the plant consisted only of sporangia and erect filaments, the last mentioned ending in long hairs. This plant of course represents a quite young stage.

The *Taonia* upon which this plant was growing was found in a very exposed locality.

More developed plants of *Ectocarpus Battersii* were found upon old specimens of *Taonia Atomaria*.

In most cases the basal filaments of these specimens were easily separated from the rather decayed host plants of which the uppermost layer of the membrane was loosened together with the parasite.

The erect filaments (Fig. 19) are very densely placed. A few, usually 1—3, branches are as a rule given off from them. Like the main filaments all the branches end in long colourless hairs.

The filaments are about  $20\ \mu$  thick. Just where they emerge from the basal filaments (Fig. 19), the erect ones are thinner, about  $12\ \mu$ , but very soon they reach their

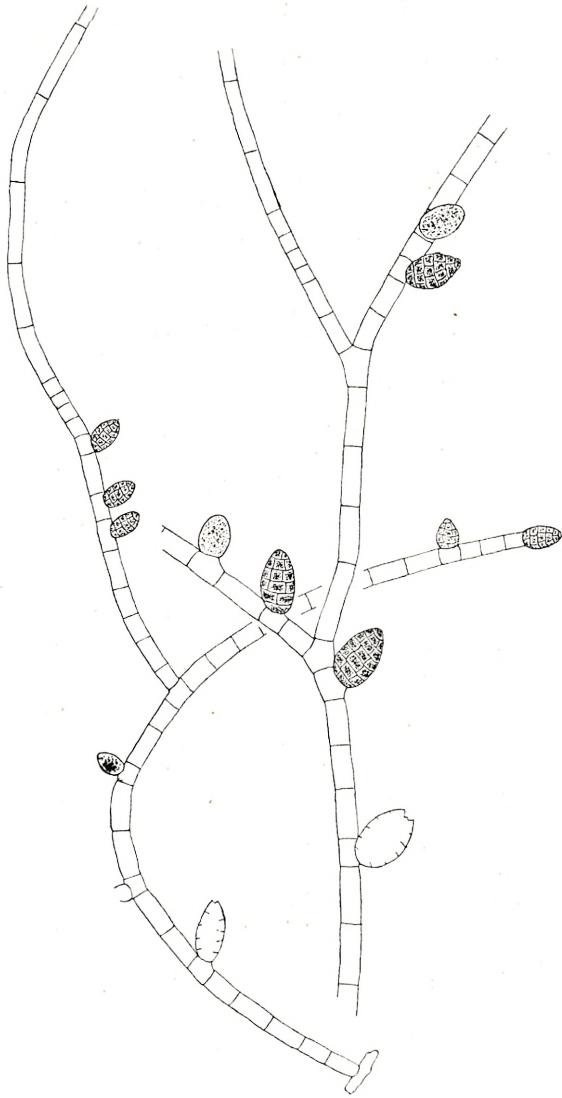


Fig. 19. *Ectocarpus Battersii* Bornet. Erect filaments with plurilocular sporangia. (About 175:1).

normal size, and this decreases very little upwards, the hairs being usually about 14—15  $\mu$ , rarely tapering to about 11  $\mu$  at the upper end.



In the basal part, but also sometimes higher up, rhizoids are present; now and then a rhizoid is also given off from the basal cell of the branches. The rhizoids are usually about  $10\ \mu$  thick.

The chromatophores are, in the young cells, small, irregularly lobed plates, and in the older, roundish or somewhat elongated discs.

In the Mediterranean form as well as in that from England, SAUVAGEAU commonly found sessile or pedicellate sporangia issuing from the basal cells. Though these are so numerous in the young plant I have not been able to find them in the adult specimens. In the Canarian plant the sporangia were all placed upon the erect filaments. I have found only plurilocular sporangia (Fig. 19). These are ovate-oblong, obtuse, usually about  $30\ \mu$  broad and  $50\ \mu$  long.

The sporangia are nearly always sessile; I have only rarely found pedicellate ones. They occur at short intervals along the main filaments and below the growth-zone in the branches. The sporangia are often placed unilaterally.

The cells in the filaments from which a sporangium is given off are always short, this being also the case with the cells from which the branches take their origin. These cells are about as long as they are broad, while the other cells in the filaments are about 2—3 times longer than they are broad.

Finally I have found a few loose specimens (Fig. 20—21) occurring intermingled among other *Ectocarpus*, for instance, *Ectocarpus pusillus* and *Ectocarpus paradoxus*. These specimens remind one very much of this species, but nevertheless differ in some respects from it.

In one of the specimens a part of the base was pre-

served (Fig. 20), showing that it consisted of creeping filaments; the cells in the filaments had uneven, wavy surfaces and were about 1—2 times as long as broad.

From the basal filaments erect ones are given off. Most

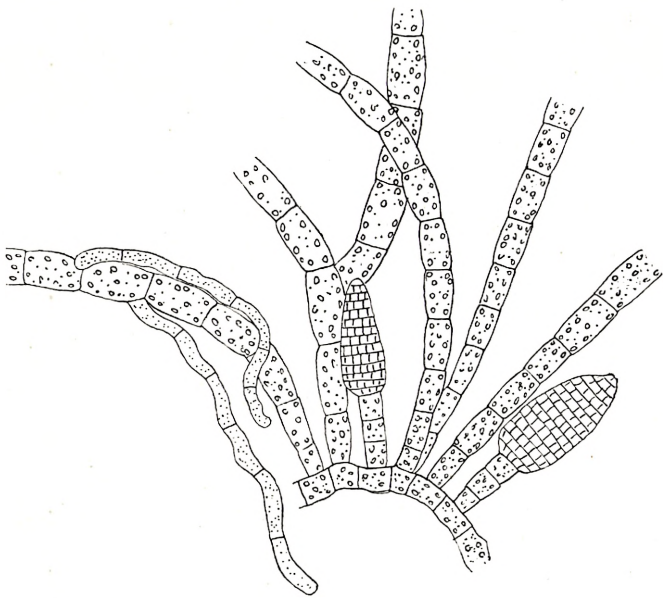


Fig. 20. *Ectocarpus Battersii* Bornet. Forma. Part of the base of a plant. (About 300 : 1).

of these filaments grow long; but some remain quite short, composed of a single or a few cells only, and bearing terminally placed plurilocular sporangia.

The erect filaments (Fig. 21) are about 19—24 up to 27  $\mu$  thick near their base decreasing evenly upwards to about 16—20  $\mu$ . The length of the cells is rather variable, about 1—3 times as long as broad. Intercalary divisions take place now and then. In the upper end of the filaments a marked growth zone is present, and above it follows a long colourless hair.

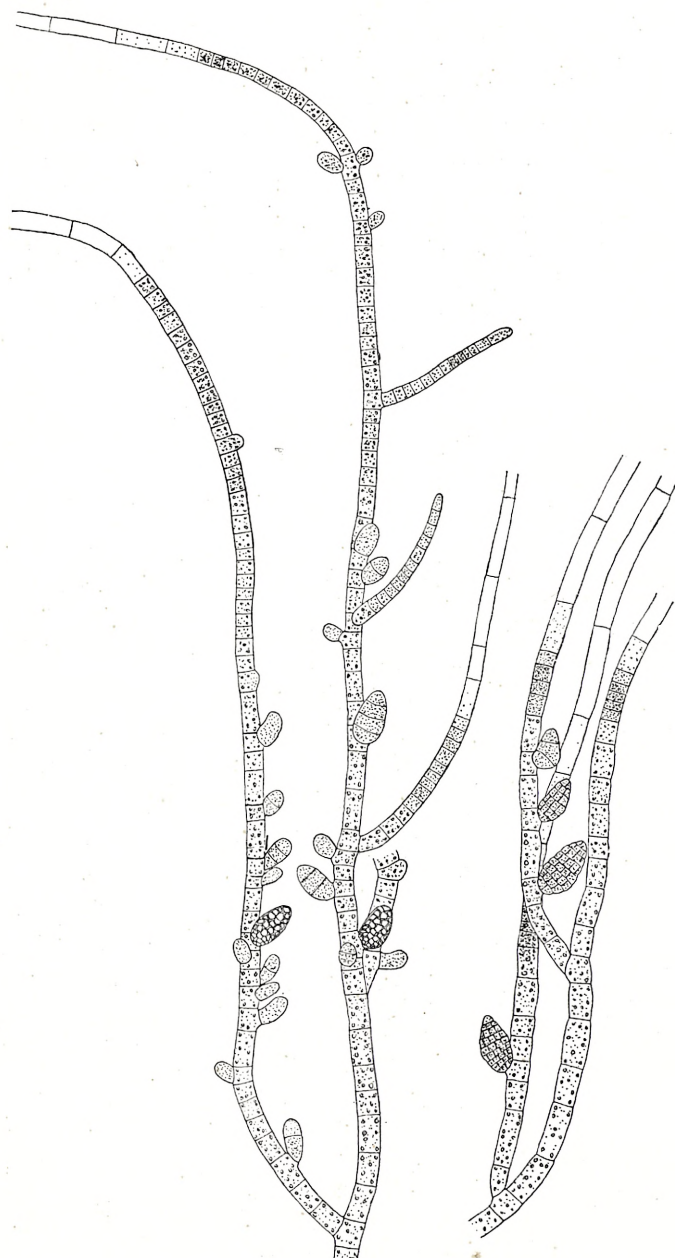


Fig. 21. *Ectocarpus Battersii* Bornet. Forma. Parts of erect filaments with plurilocular sporangia. (About 150:1).

The filaments are in the lower part richly ramified, branches are given off to all sides without any order. Once I have found a branch and a sporangium issuing oppositely from the same cell. Like the main filaments the branches have a growth zone in their upper end and above it a colourless hair.

From the lowermost cells in the erect filaments rhizoids are given off now and then (Fig. 20). The rhizoids grow downwards along the wall of the mother filament, or they fix themselves to adjacent filaments and, when reaching the substratum, fix them to it.

The chromatophores are small roundish discs.

The plurilobular sporangia are of different shape. Those found at the base of the plant are ovate-ellipsoidal to spindle-shaped. They are about 35—45  $\mu$  broad and 80—120  $\mu$  long.

The sporangia on the erect filaments, on the other hand, are ovate, often bent a little obliquely upwards. They are sessile, more rarely pedicellate. They are placed solitarily, being given off irregularly to all sides of the filaments. In a few cases I have found what I presume to be two young sporangia being given off oppositely from the same cell; as mentioned above I have also once found a branch and a sporangium placed oppositely the same way.

The ovate sporangia are about 25—28  $\mu$  broad and 43—58  $\mu$  long.

Unilocular sporangia were not observed.

Regarding the shape and size of the ovate sporangia, and upon the whole the habit of these specimens, it must be admitted that they show much likeness to *Ectocarpus Battersii*, but they differ from it by the greater dimensions of all parts of the thallus, and by richer ramification. Had

I found it upon *Taonia Atomaria* I should nevertheless not have hesitated in regarding it as a forma *major* of this species, but so long as it is not known whether or not it occurs on this species, I prefer to leave these specimens unnamed.

The host plant, *Taonia Atomaria*, upon which *Ect. Battersii* grows, occurs at the islands as well in exposed as in more sheltered places and then often in lowlying rock-pools.

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

Geogr. Distrib. South of England, France down to the Canary Islands. Mediterranean Sea.

### 9. *Ectocarpus paradoxus* Mont.

MONTAGNE, C., in MORIS, G. et DE NOTARIS, G., *Florula Caprariæ*, Torino 1840, n. 175, t. V., fig. 1—3 (non vidi). ARDISSONE, *Phycologia Mediter.*, vol. II, p. 73.

*Ectocarpus cæspitulus* J. Ag., *Alg. mediterr.* 1842, p. 26. DERBÈS et SOLIER, *Mémoire . . . Algues*, p. 49, pl. 14, fig. 9—11. HAUCK, *Meeresalgen*, p. 327. KJELLMAN, *Skandinav. Ectocarp.*, p. 60, tab. 2, fig. 6.

The determination of the rather few specimens of this plant which I have found has troubled me a good deal, since the description of this species is as yet rather poor, and the good figure of KUCKUCK published in OLTMANN'S *Morphologie* vol. II, fig. 295, shows a plant which has indeed sporangia of rather variable shape, but not as variable as those found in the Canarian plant.

This was found together with several other species upon *Cymopolia barbata*, *Corallina* etc. It forms small, dark, brown tufts, about 1 cm high.

From the basal, more or less horizontal, creeping filaments long rhizoids are given off, which are also often

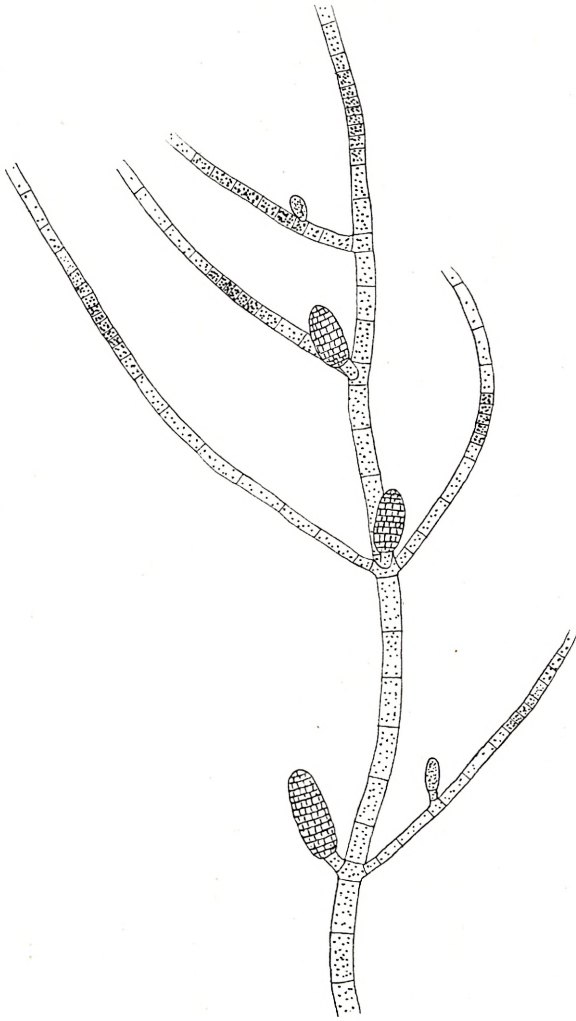


Fig. 22. *Ectocarpus paradoxus* Mont. Part of a filament with sporangia.  
(About 66 : 1).

found higher up in the erect filaments, issuing usually from the basal cell in the branches or from the short cells in the main filaments.

The erect filaments (Fig. 22) have a marked zone of

growth which gradually moves upwards as the filaments increase in length. Below the growth-zone the filaments carry branches and sporangia, above it they run out as long colourless hairs.

The filaments are about 34—40  $\mu$  broad. They do not taper much upwards. The cells from which the branches

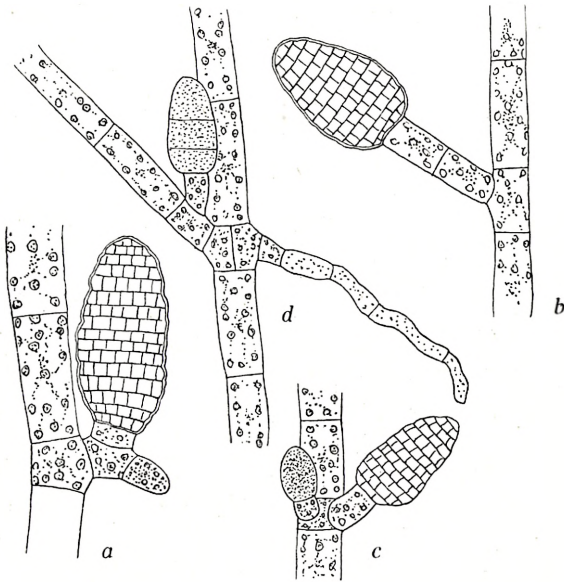


Fig. 23. *Ectocarpus paradoxus* Mont. *a, b, c*, parts of filaments with plurilocular sporangia. *d*, part of a filament with rhizoid, the cell from which this is given off being divided by a longitudinal wall. (About 210 : 1).

and sporangia are given off, are always short, often broader than they are long. The other cells in the filaments are as much as 3—5 times as long as they are broad.

The chromatophores are discshaped, in the young cells oblong or like short ribbons.

The filaments are more or less ramified. The branches are mostly given off without any order at unequal intervals in all directions. Sometimes two branches, or a spor-

angium and a branch, issue from the same joint; they are most often opposite, also it happens that three branches or pedicellate sporangia are given off verticillately from the same cell.

Some of the branches may grow out into long filaments,

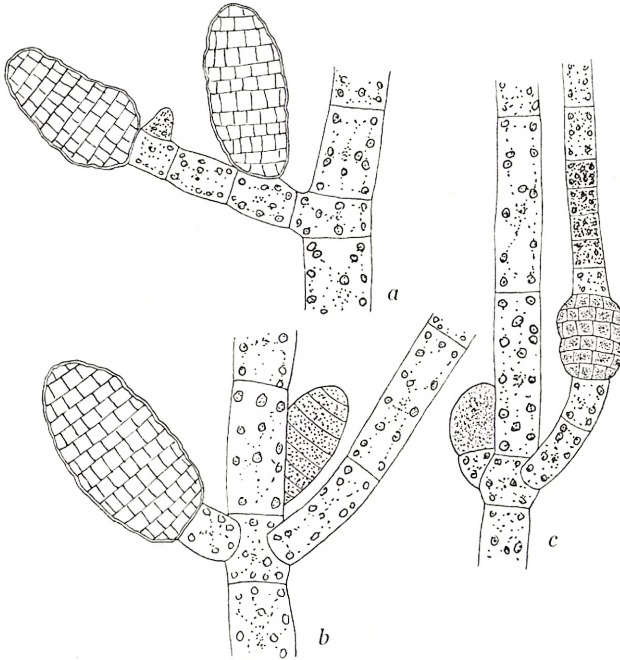


Fig. 24. *Ectocarpus paradoxus* Mont. a, b, filaments with plurilocular sporangia. c, a sporangium proliferous from the apex. (a, b, about 275 : 1, c, about 200 : 1).

but most of them remain short, having the growth zone near their base, and running out as long colourless hairs.

The plurilocular sporangia are scattered without any order along the filaments and branches below the growth zone. They are in most cases pedicellate, but sessile sporangia occur now and then (Fig. 24 a), and it sometimes happens, too, that the sporangia are placed termin-



ally upon a short branch composed of a few cells (Fig. 23 b, 24 a).

The shape of the sporangia is rather variable. The most common form is oblong-cylindrical, but many sporangia are oval or ovate. Their apex is as a rule broadly rounded. Once I have found a sporangium proliferous from the apex (Fig. 24 c).

With regard to the size of the sporangia their breadth lies usually between 35 and 60  $\mu$  and their length between 85 and 120  $\mu$ . I give here the breadth and length of some sporangia selected at random: 42  $\times$  105  $\mu$ , 35  $\times$  110  $\mu$ , 60  $\times$  110  $\mu$ , 45  $\times$  97  $\mu$ , 47  $\times$  105  $\mu$ , 50  $\times$  120  $\mu$ .

When I found this plant I at first believed it to be *Ect. Lebelli*; but after a more thorough examination it soon became clear to me that it was *Ectocarpus paradoxus*. That a comparison between the two species is to some extent warranted, becomes clear when we compare, for instance SAUVAGEAU'S<sup>1</sup> fig. 4 B of *Ect. Lebelli* with the drawings of KUCKUCK published in OLTMANN'S Morphologie p. 11, fig. 296 and called *Ectocarpus "paradoxus"*. And in this respect it was also of interest to me to see that KUCKUCK in his drawings and notes of this species in his posthumous manuscript has written on one of the sheets of paper<sup>2</sup>: "*Ectocarpus Lebelli = paradoxus*". But as mentioned by OLTMANN'S, KUCKUCK also calls this species *Ectocarpus Kosselii*, which shows that we must not attach too much weight to the names used in his manuscript.

But in any case the two species in question are very

<sup>1</sup> SAUVAGEAU, C., Observations relatives à la sexualité des Phéosporées, Journal de Botanique, vol. IX, 1897, p. 9.

<sup>2</sup> I am much indebted to Professor MIELCK, Director of the Biological Station, Heligoland, for the permission to see them.

different when compared more closely. Through the kindness of Professor SAUVAGEAU I have been able to compare my plant with fine material of *Ectocarpus Lebelii* partly collected by himself partly by THURET. With regard to the more essential characters I shall here point out that the vegetative filaments of *Ectocarpus Lebelii* reach only about half the breadth of those of *Ectocarpus paradoxus*, and that in *Ectocarpus Lebelii* we have antheridia, first discovered by THURET, and later described by SAUVAGEAU in the above quoted paper.

As mentioned above, this plant was found as an epiphyte growing upon *Cymopolia* and other algæ in shallow water in a rather sheltered locality.

Gran Canaria. Playa de Santa Catalina.

Geogr. Distrib. Mediterranean Sea, Holland, Sweden.

### 10. *Ectocarpus globifer* Kütz.

KÜTZING, F., *Phycologia generalis*, p. 289; Tab. phycolog. vol. V, tab. 42, II. BORNET, E., Note sur quelques *Ectocarpus* in Bull. Soc. bot. France, 1891, vol. 38, p. 358, tab. VII, fig. 6—7.

*Ectocarpus pusillus* Kütz., Spec. Alg., p. 450; Tab. Phycologicae, vol. V, tab. 48, II.

*Ectocarpus insignis* Crouan, Florule du Finistère, p. 163. HOLMES, Two new british *Ectocarpi* (Journ. of Bot., XXV, 1887, p. 161, pl. 274, fig. 1).

A few small tufts of this plant were found together with many other epiphytes upon *Cymopolia barbata*, and once it was also found upon an old leaf of *Cymodocea nodosa*. As regards the confusion of this species with *Ectocarpus pusillus* (compare for instance HAUCK, Meeresalgen, p. 327, where *E. globifer* is given as a synonym of *Ectocarpus pusillus*) I refer the reader to BORNET's above-quoted note in which he explains how this curious mistake arose.

In this paper BORNET gives a good figure of the sporangia, and also a comparison of this species with the nearly related species *Ectocarpus paradoxus*, but not a more detailed description. I shall therefore give a short description of it here; especially as my specimens are a good deal ramified, being in this respect also very like *Ect. paradoxus*.

From the basal more or less ascending filaments rhizoids are given off. These rhizoids are woven together, forming an intertwined mass fixed to the substratum.

The basal part of the erect filaments are rather thin, about  $25\ \mu$  broad; but they soon become thicker, the normal breadth of the main filaments being up to about  $50\text{--}60\ \mu$ .

After an usually rather short unramified part, the filaments give off some branches (Fig. 25). The branches are

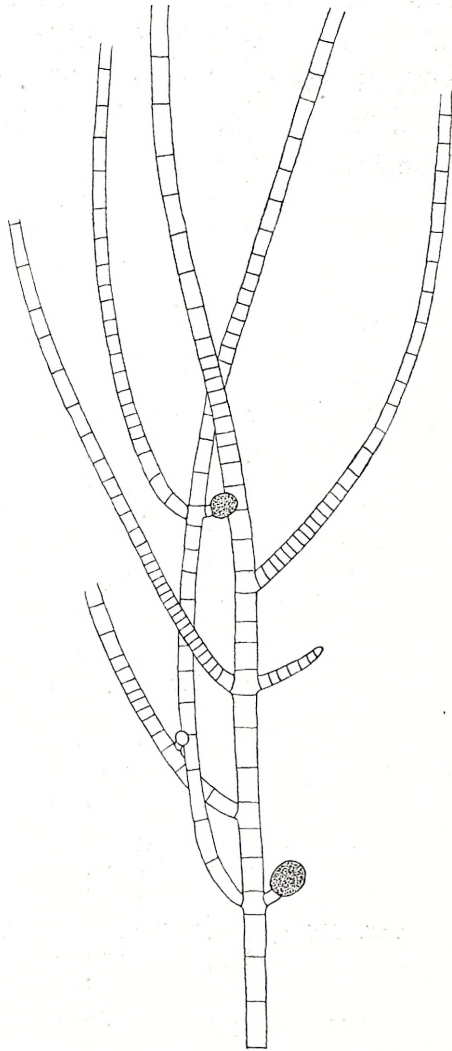


Fig. 25. *Ectocarpus globifer* Kütz. Part of the thallus with sporangia. (About 66:1).

often opposite, but often, too, a single branch only is given off from the cells in the filaments. The branches issue without any order on all sides. In the specimens I have seen, the filaments may give rise to 5—6 pairs or single branches, rarely more.

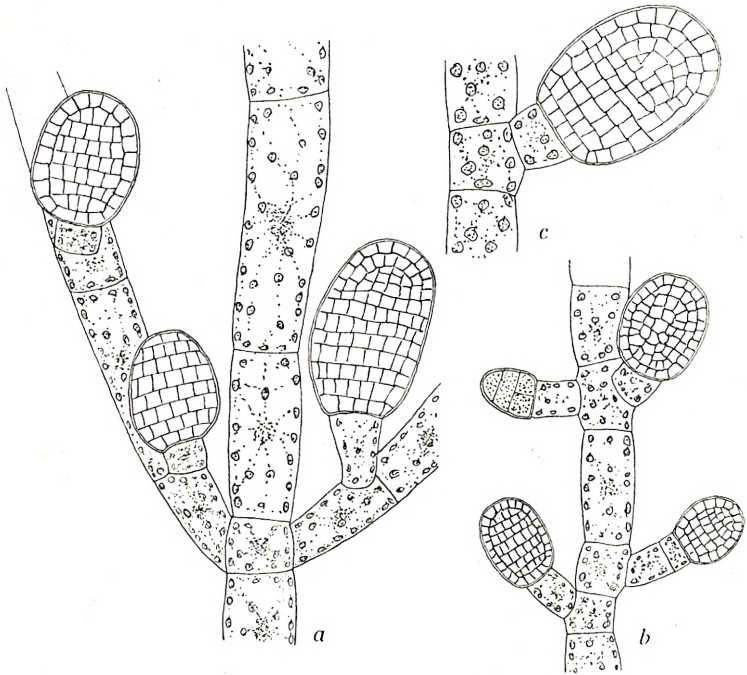


Fig. 26. *Ectocarpus globifer* Kütz. Parts of filaments with sporangia.  
(a, c, about 250:1, b, about 175:1).

Above the uppermost branch a zone of growth is present in which the cells are quite short, their length being scarcely half their breadth, and filled with chromatophores, protoplasm etc. Above the growth-zone the cells gradually become longer, the filaments ending in long colourless hairs.

The cells in the filaments, below the growth zone, are mostly about 2—3 times as long as they are broad, rarely

more. The cells carrying sporangia or from which branches are given off are short, about as long as they are broad.

The chromatophores are small, disc-shaped plates, more or less connected with one another and with the central body by protoplasmic prolongations (compare BORNET, S excellent figure).

The sporangia (Fig. 26) have a very characteristic shape, being short and roundish-ovate or broadly ovate-ellipsoidal. More rarely some longer ones are found which are nearly ellipsoidal (Fig. 26 a). As a rule the sporangia are pedicellate, the pedicel consisting of quite a short cell; but I once found a sessile sporangium, and in another one two cells were present in the pedicel.

The size of the sporangia is somewhat variable, but they are usually about  $60 \mu$  to  $70 \mu$  broad and  $70-90 \mu$  long.<sup>1</sup>

As pointed out by BORNET, this species reminds one somewhat of *Ectocarpus paradoxus* side by side with which it was growing. BORNET (l. c. p. 360) gives several of the characters which separate the two species. For instance the filaments of *Ectocarpus globifer* are less ramified and often more elongated, and the plurilocular sporangia are not only much shorter but also broader than those of *Ectocarpus paradoxus*. And to this I should like to add that the filaments, at any rate in the Canarian specimens, were somewhat broader than those of *Ectocarpus paradoxus*.

This species is found in rather sheltered places near low water mark.

Gran Canaria: Playa de Santa Catalina. In the sheltered part of Bahia del Confital.

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

<sup>1</sup> But the sporangia can reach much larger dimensions; in a specimen I have collected in the harbour of Monaco a sporangium was  $125 \mu$  long and  $80 \mu$  broad.

### 11. *Ectocarpus terminalis* Kütz.

KÜTZING, F., *Phycologia germanica*, p. 236. KJELLMAN, Skandin. Ectocarp., p. 54, tab. 2, fig. 7. KUCKUCK, P., *Bemerk. zur mar. Algenveg. Helgoland*, II, p. 376, fig. 3. BORNET, E., *Algues de Schousboe*, p. 244.

The specimens (Fig. 27, 28) I have found seem to agree quite well with KUCKUCK's description. They were growing upon an old *Dictyota dichotoma*.

The basal layer consists of creeping filaments, the cells of which have an uneven waved surface (Fig. 27 a, 28). They are a little more than twice as long as they are broad, their diameter reaching a length of as much as 18—19  $\mu$ . The filaments form a more or less dense disc, but are easily torn loose from each other. From this basal layer two kind of erect filaments arise, as a rule shorter ones terminated by plurilocular sporangia, and longer ones terminated by hairs. The last mentioned have generally a longer basal part composed of a number of vegetative assimilating cells. At a height of about 400  $\mu$  (I have observed this in several filaments) the hairs begin, and their growth-zone is surrounded by a caliciform sheath (Fig. 27). The cells in the vegetative part are about 13  $\mu$  thick and 26  $\mu$  long. They contain a number of disc-shaped or more ribbon-like parietal chromatophores.

The plurilocular sporangia occur terminally upon shorter or longer filaments. The sporangia are fusiform, about 20  $\mu$  broad and 65  $\mu$  long. When a sporangium is emptied, a new one is developed from the base of the old one, and as this process may take place several times one often finds a series of old walls above each other (Fig. 28).

A peculiarity, often noticeable in the Canarian plant, was that the rejuvenating cell growing up in the old emptied sporangium was often divided dichotomously by a

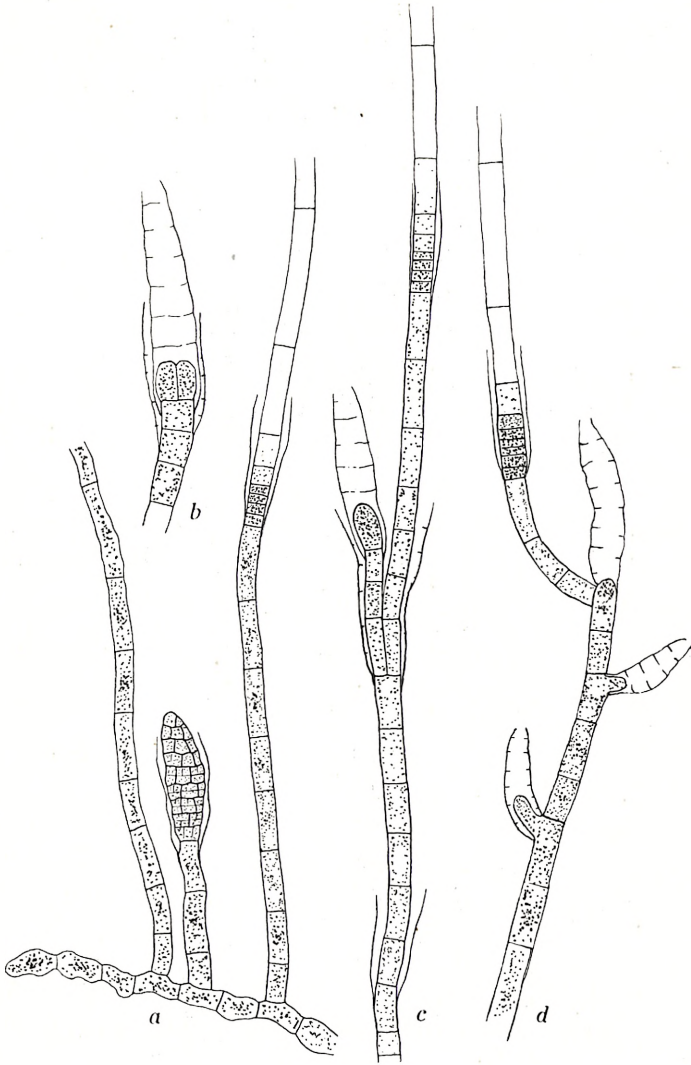


Fig. 27. *Ectocarpus terminalis* Kütz. *a*, Part of a plant with creeping filament; *b*, an emptied sporangium from the base of which two sporangia are developed; *c*, filament with emptied sporangium from which two branches are developed, one with sporangium and one with hair; *d*, filament with lateral and terminal sporangia and a lateral branch. (About 350 : 1).

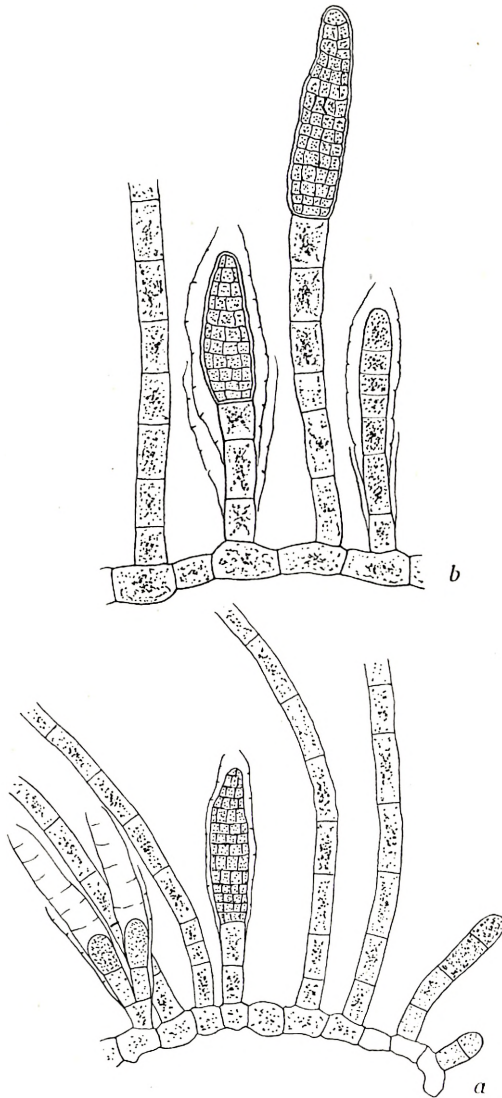


Fig. 28. *Ectocarpus terminalis* Kütz. Creeping filaments with branches and sporangia; in *a* to the left an emptied sporangium from which two now emptied sporangia are developed. (About 350 : 1).

longitudinal wall, the result of which was that two sporangia were formed side by side instead of one (Fig. 28 *a*,



27 b). I have also once found a sporangium and a vegetative filament ending in a hair side by side, surrounded by the remnants of the old sporangium (Fig. 27 c). I have, by the way, very rarely seen ramified filaments (Fig. 27 d).

The plant was found in a rather sheltered place somewhat below low water mark.

Gran Canaria. Bahia del Confital.

Geogr. Distrib. Swedish coast of the Kattegat, Heligoland, from the Orkney Islands southwards, Morocco, Rovigno in the Adriatic Sea, Puertorico.

## 12. *Ectocarpus speciosus* (Børgs.) Kuck.

KUCKUCK, in OLTMANN'S, Morphologie u. Biologie der Algen. 2<sup>te</sup> Aufl., vol. II, p. 13, fig. 300.

*Myrionema speciosum* Børgs., The Marine Algæ of the Færøes (Botany of the Færøes, Part II, p. 421, fig. 78).

Upon a specimen of *Dictyota ligulata* were found a few small tufts of an alga showing much likeness to the *Myrionema speciosum* described by me in "The marine Algæ of the Færøes", pag. 421 and still more to the form figured in OLTMANN'S "Morphologie", 2<sup>nd</sup> edition, vol. II, p. 13, fig. 300, after a drawing by KUCKUCK.

The tufts of the Canarian plant reached a height of about 300  $\mu$ . Owing to scarcity of material I have not succeeded in getting good transverse sections of the plant, and can not therefore say exactly how the base is built up, but as far as I have been able to see, we have to do with basal horizontal filaments creeping upon the surface of the host, and forming gradually a more or less coherent monostromatic layer (Fig. 29 a). The cells in these filaments are about 15—18  $\mu$  long and 6—8  $\mu$  broad.

From these basal filaments the erect ones arise. They

may reach a length of as much as  $300\ \mu$ . They have a longer vegetative basal part in which the cells are about  $8\text{--}9\ \mu$  thick, and their length, which is at first nearly the same as their breadth, may become 2—3 times greater.

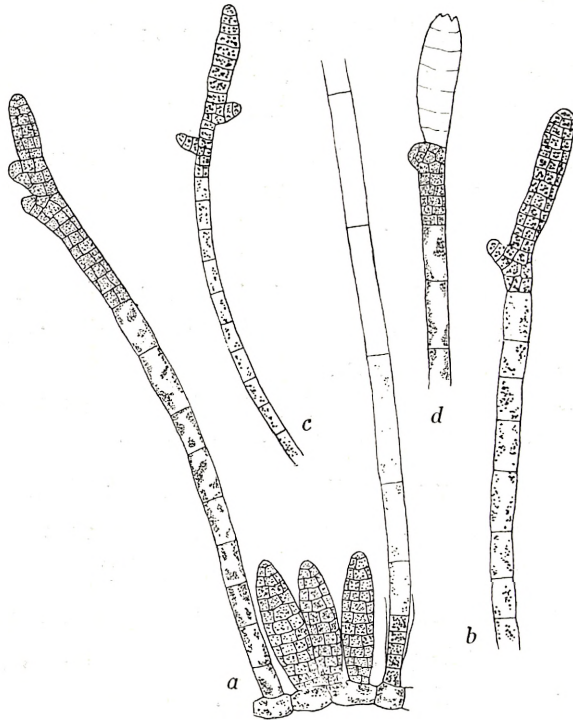


Fig. 29. *Ectocarpus speciosus* (Børgs.) Kuck. *a*, part of a plant from the basal creeping filament of which sessile sporangia are developed and filaments, one with a hair and another with terminally placed sporangia. *b*, *c*, *d*, filaments ending in plurilocular sporangia, in *d* a part of the sporangium is emptied. (*a*, *b*, *d*, about 275 : 1, *c*, about 200 : 1).

The cells most probably contain only one, parietal, much branched and irregularly formed chromatophore.

At their upper ends the filaments become transformed into plurilocular sporangia (Fig. 29, *a*, *b*, *c*, *d*). The cells are divided here not only by transverse walls but also by

longitudinal or more obliquely placed walls into many small loculi; 5—6 or more segments take part in the division. On some of the segments short outgrowths, usually placed on the same side, are sometimes present. The fructiferous part of the filaments is about  $12\ \mu$  thick.

Besides the sporangia placed terminally upon the filaments there are others which are sessile or pedicellate, issuing immediately from the horizontal filaments (Fig. 29 a). These sporangia are nearly cylindrical or taper towards either end, and are about  $50\ \mu$  long and  $12\ \mu$  broad.

Finally, intermingled among the assimilating and fructiferous filaments, but not in great quantity, filaments showing trichothallic growth are present (Fig. 29 a). These filaments have near their base a growth-zone above which the cells rapidly grow longer, the filaments running out in a colourless hair. In these specimens no hairs occurred upon the erect filaments.

Furthermore I have found a few plants upon *Pterocladia capillacea*. Besides plurilocular sporangia unilocular sporangia were also present (Fig. 30). The formation of the latter takes place in the way that the upper end of the filaments are divided into a number of cells. From these cells unilaterally placed outgrowths, one from each cell, are given off, and these outgrowths together with the cells form the sporangia. The zoospores escape through a hole in the upper end of the outgrowths.

In one of the plants a lateral hair was found (Fig. 30 b). It quite agreed with those found in the Færoëse plant.

As already mentioned above, this plant shows much likeness to *Myrionema speciosum*, or to be more exact to a form which KUCKUCK has later on referred to this species. Compared with the typical form as I have described and

figured it, the Færoëse plant differs in some important details from the Canarian plant by its much larger unilaterally placed, oblong plurilocular sporangia, and, moreover, these divide first, and then, later on, the division also takes

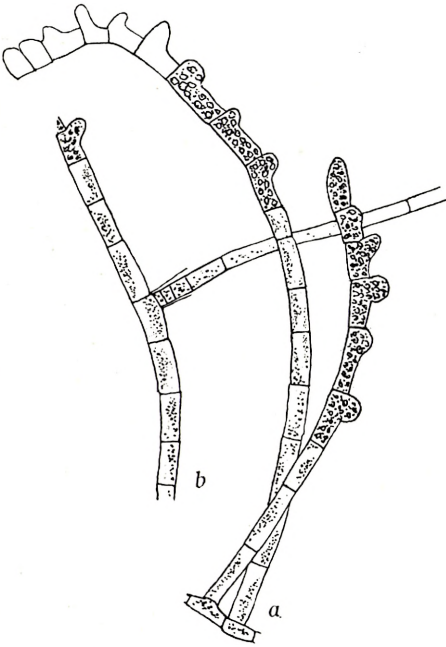


Fig. 30. *Ectocarpus speciosus* (Børgs).  
 a, erect filaments with unilocular sporangia. b, a filament with a lateral hair.  
 (About 275 : 1).

place in the cells from which the sporangia originate, the whole summit of the filament being thus transformed into a large plurilocular sporangium. And furthermore the characteristic lateral (rarely terminally placed) hairs found in the Færoëse plant seem to be rare in the Canarian plant. On the other hand the sporangia in KUCKUCK's plant rather resemble in shape those of the Canarian plant. The *Composnema speciosum* f. *piliferum* Setchell and

Gardner<sup>1</sup> differs especially from the Færoëse plant in that the plurilocular sporangia in the long filaments are as a rule intercalary, the filaments being terminated by a hair, which was more rarely the case in the Færoëse plant. Of the many forms SETCHELL and GARDNER have described in the paper quoted below, the one to which

<sup>1</sup> SETCHELL, W. A. and N. L. GARDNER, Phycological Contributions II to VI in Univ. of Calif. Publ. in Botany, vol. 7, p. 353.

the Canarian plant seems to show most likeness is a form of *Componema secundum* Setchell and Gardner, l. c. p. 361, tab. 37, fig. 2.

How far one is entitled to refer this and several other species, as SETCHELL and GARDNER have done, to the genus *Componema* of KUCKUCK seems questionable to me. At any rate KUCKUCK's plant has remarkable stratified walls which are not present in my plant, and nothing is said about this fact with regard to the species of SETCHELL and GARDNER.

Gran Canaria. Playa de Santa Catalina.

Geogr. Distrib. The Færøes, Clare Island, West Coast of Sweden, Heligoland.

## **Componema Kuck.**

### **1. *Componema gracile* Kuck.**

KUCKUCK, P., *Componema*, ein neues Genus der Phaeosporeen (Wissensch. Meeresunters., Neue Folge, 3. Bd., Abt. Helgoland, Heft 1, 1899).

The few specimens I have found of this fine little plant seem to agree quite well with KUCKUCK's description and fine figures. It occurred in a collection of calcareous and other small algæ scraped off from the rock with a knife.

The plant (Fig. 31) forms low dense tufts. Through cutting it loose from the rock the basal layer was wanting in most specimens but in one specimen I found the creeping parts composed of irregularly bent filaments from which the densely placed, erect, assimilating filaments arise. These are at the base about 7—8  $\mu$  thick, becoming gradually a little thicker upwards to 11  $\mu$ . In the basal part the cells are about twice as long as they are broad, and higher up they are usually about  $1\frac{1}{4}$ — $1\frac{1}{2}$  times as long as they are



Fig. 31. *Compsomena gracile* Kuck. a, part of the thallus with creeping filaments from which erect filaments with sporangia and a lateral hair are given off; b, filament with sporangia; c, a ramified filament. (About 275 : 1).

broad. The filaments are as a rule unbranched, but now and then a filament occurs from which, usually near its base, a branch is given off. Each cell contains a generally well-developed, often irregularly lobed, parietal chromatophore.

The hairs are placed laterally, near the base of an erect filament (Fig. 31 *a*). They have their zone of division a little above their base, which is covered by a caliciform sheath. Such sheaths may also occur now and then upon the assimilating filaments.

The plurilocular sporangia are found half-way up the erect filaments. It sometimes happens that at least two sporangia develop gradually from the same branch. The sporangia were in my specimens mostly sessile, but a few occurred which had a shorter or longer stalk, in the last case composed of several cells. They are podlike in shape, usually broadest near the base, tapering upwards and often somewhat curved. The sporangia are about  $15 \mu$  broad and  $130 \mu$  long.

It is evident from this description that the Canarian plant as regards its whole habit, size of the different organs etc. quite agrees with KUCKUCK's description. But there are some differences. For instance, the assimilating filaments, which are as a rule not ramified, may in rare cases be branched, while KUCKUCK expressly says that the assimilating filaments in his plant are unbranched, carrying only hairs and sporangia. Nevertheless I do not think we can lay so much stress upon this especially as at any rate one of the filaments in KUCKUCK's Fig. 6 (that to the right) seems to be branched.

And further, KUCKUCK says in his diagnosis that the basal layer is a disc composed of a single layer of cells. In the specimen in which I found the basal filaments preserved, these were at any rate free, but of course, there is the possibility that the filaments have been torn loose from each other when the plant was loosened from the rock.

KUCKUCK found a marked stratification of the cell wall in his plant. This was also present in the Canarian plant, though not in such a high degree as in the plant from Rovigno. Especially at the upper end of the assimilating filaments stratifications like those depicted in Fig. 8 by KUCKUCK were clearly seen, forming shorter or longer divergent sheaths in the wall, or short caliciform sheaths, but I have not found in the Canarian plant so many as are found in KUCKUCK's fig. 9. As mentioned above, a large caliciform sheath encircles the base of the hairs, and I have also now and then found similar but smaller sheaths upon the assimilating filaments.

The plant was found near high water mark upon a reef exposed to the full force of the open sea.

Gran Canaria. Bahia del Confital.

Geogr. Distrib. Rovigno in the Adriatic Sea.

### *Fam. Myrionemaceæ.*

#### **Myrionema Grev.**

##### **1. Myrionema vulgare Thur.**

THURET in LE JOLIS, Liste Alg. mar. Cherbourg, p. 82. SAUVAGEAU, Sur quelques Myrionemacées, p. 25.

A few specimens of this plant were found upon an old *Dictyota dichotoma*. The specimens had plurilocular sporangia (in March) and agree well with SAUVAGEAU's figures. Compare also those of KYLIN in "Algenfl. schwed. Westküste", p. 34.

The plant was collected in a somewhat protected place near low water mark.

Gran Canaria. Bahia del Confital.

Geogr. Distrib. Atlantic Ocean, Mediterranean Sea etc.



## Ascocyclus Magnus.

### 1. *Ascocyclus orbicularis* (J. Agardh) Magnus.

MAGNUS, P., Die bot. Ergebnisse der Nordseefahrt, 1874, p. 73.  
KJELLMAN, Handbok, p. 80. KYLIN, Algenflora schwed. Westküste, p. 39.

*Myrionema orbiculare* J. Ag., Spec. Alg., vol. I, p. 48. HAUCK, Meeresalgen, p. 321.

Some small tufts of this plant (Fig. 32) were found upon an old specimen of *Dictyota dichotoma*.

I have in my plants found only sporangia, ascocysts and hairs, my observations thus agreeing with those of KYLIN. As presumed by KYLIN the young sporangia most probably act as assimilating organs.

In the Canarian specimens, as is seen in the figures, the plurilocular sporangia are renewed several times, a whole series of sheaths of emptied sporangia being often found round the new one.

The ascocysts were, in accordance with KYLIN'S description, near the edge of the plant short, obovate-lanceolate with brown contents, in the older parts of the thallus on the other hand long and nearly cylindrical, much longer than the plurilocular sporangia and without the brown contents.

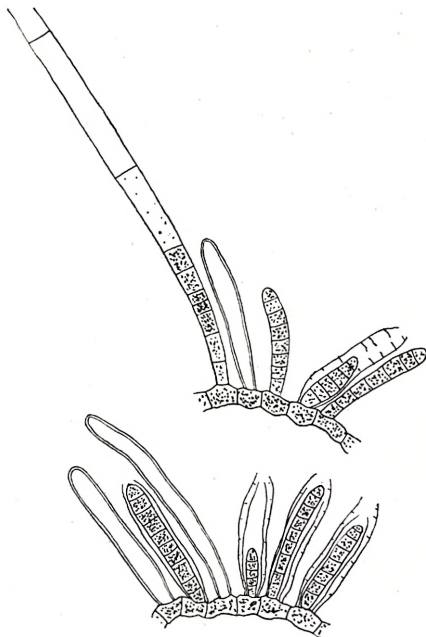


Fig. 32. *Ascocyclus orbicularis* (J. Ag.) Magnus. Parts of the plant.  
(About 350 : 1).

The plant was found in a somewhat sheltered place somewhat below low water mark.

Gran Canaria. Bahia del Confital.

Geogr. Distrib. Atlantic coast of Europe, Mediterranean Sea.

## Ralfsia Berk.

### 1. *Ralfsia verrucosa* Aresch.

ARESCHOUG, *Phyceæ Scand. Mar.*, p. 140.

The material I have gathered is rather scarce and all sterile. A transverse section of the thallus shows that the specimens have a more or less marked bilateral growth like the specimens from Cherbourg which REINKE mentions in "Algenflora", p. 48. The Canarian form is surely much related to the form from Morocco which SCHOUSBOE found and which KUCKUCK has described in "Bemerk. zur marin. Algenfl. von Helgoland", p. 244.

SAUVAGEAU found some specimens at Orotava, of which I have seen preparations. These specimens have sporangia. They are clavate, about 100  $\mu$  long and 30  $\mu$  broad, the assimilating filaments reaching a length of up to 200  $\mu$ , being thus somewhat larger than those KUCKUCK found in the plant from Morocco. Regarding the size, the sporangia agree very well with those I have found in *Ralfsia expansa* from St. Thomas.<sup>1</sup> I do not refer the Canarian plant to *Ralfsia expansa* because the Canarian plant has not such a thick thallus as that found in the West Indian form.

That *Ralfsia expansa* comes very near to *R. verrucosa* I have pointed out in the paper quoted.

Teneriffe, Orotava (SAUVAGEAU,!).

Geogr. Distrib. From Norway to the Canary Islands, Mediterranean Sea, Atlantic coast of North America.

<sup>1</sup> BØRGESEN, F., *Mar. Alg. D. W. I.*, vol. 1, p. 191.

## Nemoderma Schousb.

### 1. *Nemoderma tingitana* Schousb.

SCHOUSBOE, P. K. A., Icon. ined., t. 128; Descript. p. 131 according to BORNET, Les Algues de P. K. A. Schousboe, p. 241. KUCKUCK, P., Beiträge zur Kenntnis der Meeresalgen, 10 (Wiss. Meeresunters., Neue Folge, V. Bd. Abt. Helgoland, 1912, p. 117).

This peculiar alga was, as is well known, first discovered by SCHOUSBOE in Morocco where its classic growing place is near the small village of Agla between Tangier and Cape Spartel. That SCHOUSBOE himself knew that he had made an interesting discovery is evident from his mentioning it as "hanc Algam singularem", and he described it and pictured it in his "Icones". But this interesting discovery, and upon the whole his descriptions and illustrations of the species contained in his large collection, remained disregarded and unpublished until finally BORNET in 1892 published his well known work: "Les Algues de P. K. A. Schousboe". In his great veneration for SCHOUSBOE BORNET has here tried to save for him all that had not yet been published.

Thus SCHOUSBOE's genus *Nemoderma* has been preserved.

BORNET here gives a good description of the plant together with some fine figures of it.

Later on KUCKUCK in 1901 went to Tangier in order to examine this interesting alga. He published his results in the above-mentioned fine publication. In this he not only gives a very detailed description of the plant and its development, but he also accounts for a very remarkable rhythmical development of the organs of fructification in correlation to the tide, the period of fructification taking place at neap-tide.

At the Canary Islands SAUVAGEAU has found the plant

at Puerto Orotava, where I too have gathered it. It grows here in very exposed places somewhat above low water mark, where it is nearly always wet with the spray and is therefore difficult to collect. It forms small, thin, brownish, lubricous, very firmly adherent expansions on the rocks.

SAUVAGEAU gathered specimens with unilocular sporangia on the 10th of January, otherwise until the 12th of February all the specimens collected by him were sterile. The specimens I collected in the month of January were all sterile.

SAUVAGEAU found the plant later on in the Mediterranean Sea<sup>1</sup> at Banyuls-sur-Mer and the surrounding coasts, where it occurs abundantly.

Gran Canaria: Puerto Orotava (Sauvageau,!).

Geogr. Distrib. Morocco, Canary Islands, Mediterranean Sea at Banyuls-sur-Mer and environs.

### *Fam. 3. Spermatochnaceæ.*

#### **Nemacystus** Derb. et Sol.

##### **1. Nemacystus erythræus** (J. Ag.) Sauvag.

SAUVAGEAU, C., A Propos des Cystoseira, p. 51.

*Cladosiphon erythræum* J. Ag., Spec. Alg., vol. I, p. 55.

SAUVAGEAU has found this species growing upon *Sargassum vulgare* var. *diversifolium*. The specimens had plurilocular sporangia at the end of January.

Teneriffe, Orotava (SAUVAGEAU).

Geogr. Distrib. North of Spain, Red Sea, New Caledonia, Japan.

<sup>1</sup> SAUVAGEAU, C., Le Nemoderma tingitana est une Algue Méditerranéenne (Comptes rendus des séances de la Société de Biologie, t. LXII, p. 272, 1907).

*Fam. 4. Sporochneaceæ.***Sporochnus** Ag.**1. Sporochnus Bolleanus** Mont.

MONTAGNE, Sylloge Cryptogam., p.393. KÜTZING, Tab. Phycolog., vol. IX, tab. 81, fig. 2.

By the kindness of Dr. ACHILLE FORTI I have been able to see not only a piece of the original plant collected by BOLLE at Isla de Lobos, but also a piece of the plant from Lanzarote mentioned in PICCONE's list.

Lanzarote: Arrecife (D'ALBERTIS), Isla de Lobos (BOLLE).  
Geogr. Distrib. Canary Islands, West Indies.

**Nereia** Zanardini.**1. Nereia filiformis** (J. Ag.) Zanard.

ZANARDINI, Sulla Desmarestia filiformis di Giacobbe ACARDH (in Atti del VII Congresso degli scienz. ital. Napoli, 1845, p. 121).  
Desmarestia filiformis J. Ag., Alg. Medit., p. 43.

This species has been recorded from the islands by PICCONE in "Crociera del Corsaro", p. 27.

Dr. ACHILLE FORTI has most kindly allowed me to see a small specimen of the plant.

Lanzarote: Arrecife (D'ALBERTIS).  
Geogr. Distrib. Mediterranean Sea, Morocco, Canary Islands.

*Fam. 5. Scytosiphonaceæ.***Scytosiphon** Ag.**1. Scytosiphon Lomentaria** (Lyngb.) Endl.

ENDLICHER, Mant. Bot. sist. Gener. Plant. Supplem. III., p. 25.  
*Chorda Lomentaria* Lyngb., Hydrophyt., p. 74, tab. 18, E.  
*Scytosiphon Lomentarium* J. Ag., Spec. Alg., vol. 1, p. 126.

The specimens found are small, the largest ones reaching a length of about 10 cm. The plant occurred in rock-pools near high water mark in somewhat exposed places. Plants collected late in March had plurilocular sporangia.

*Chorda Filum* Mont., l. c., p. 143 is most probably this species. According to kind information from Dr. HAMEL no specimens of it from the Canary Islands are to be found in the Muséum National d'Hist. Nat., Paris. Regarding its occurrence at the islands MONTAGNE writes: "Hab. Ad promontorium *Punta de Melenera dictum*, in insulâ Canariâ à cl. DESPRÉAUX lecta".

Gran Canaria. Playa de Santa Catalina where it has also been collected by M<sup>lle</sup> VICKERS.

Geogr. Distrib. Extensive in arctic and northern temperate seas, Mediterranean Sea, Pacific Ocean at Japan and coast of North America.

## *Fam. 6. Asperococcaceæ.*

### **Asperococcus** Lamour.

#### 1. *Asperococcus bullosus* Lamour.

LAMOUREUX, Essai Thalassiophytes, 1813, p. 62, tab. 12, f. 5.  
BORNET & THUR., Études Phycolog., p. 16, tab. VI.

*Encoelium bullosum* Ag., Spec. Alg., vol. I, p. 146.

The specimens I have found were all small, the largest ones being about 4 cm. long and  $\frac{3}{4}$  cm. broad.

The colour of the plants was rather faded, and it was evident that the specimens had now, at the end of March, passed the point of their highest development, since the plant doubtless disappears during the hot summer-time.

In this connection it is of interest to compare its behaviour at the Canary Islands with KYLIN's<sup>1</sup> observation

<sup>1</sup> KYLIN, Studien über die Algenflora der schwedischen Westküste, 1907.

about its development at the Swedish coast of Kattegat: "Einjährige Sommerart, mit Sporangien im Juli—September".

The specimens had unilocular sporangia only; the plurilocular sporangia, first found by BUFFHAM,<sup>1</sup> seem to be rarer.

The plant occurred in rock-pools near high water mark.

Gran Canaria: Playa de Santa Catalina near Castillo, where it was also found by M<sup>lle</sup> VICKERS.

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

## 2. *Asperococcus compressus* Griffiths.

GRIFFITHS in HOOKER, Brit. Flora, vol. II, p. 278.

MONTAGNE mentions *Asperococcus echinatus* (Mert.) Grev. from the Canary Islands, l. c., p. 143. However, Dr. HAMEL informs me that in the Muséum National d'Hist. Nat., Paris no specimens of it are present in MONTAGNE's Herbarium. Therefore, MONTAGNE has most probably made a mistake as the distribution of *Asperococcus echinatus* would also seem to suggest.

On the other hand, Dr. HAMEL has most kindly sent me two specimens of an *Asperococcus* dried on small pieces of paper upon which is written "Canaria", and upon one specimen in pencil: "*Asperococcus compressus* Griff." They are very small, very fructifying and much decayed specimens, of which the basal parts only are left. They are growing gregariously upon a branch of a *Cystoseira*. They are provided with a rather long stalk; in fact, comparing them with my specimens of *Asp. bullosus*, the stalk

<sup>1</sup> BUFFHAM, The plurilocular Zoosporangia of *Asperococcus bullosus* and *Myriotrichia clavæformis*. Journal of Botany, vol. 29, p. 321, pl. 314.

is at least double as long as those of the latter, and it develops quite gradually into the narrow thallus, while in the specimens of *Asperoc. bullosus* the transition is much more abrupt. As far as I could see, the paraphyses consisted, of 4—5 cells, while in *Asperococcus bullosus* they have generally only 1—3 cells. This seems to show that the above mentioned determination is right, and that we really have to do with *Asperococcus compressus*. So far as I know this species has not before been mentioned from the Islands. If the two specimens are those which MONTAGNE considered to be *Asperoc. echinatus*, then regarding the occurrence of this species at the islands he writes: "Hab. Ad oras insulæ Canarariæ Fucaceis parasiticam invenit cl. DESPRÉAUX."

Geogr. Distrib. Atlantic coast of England, France, Morocco, Mediterranean Sea, Cape of Good Hope.

### Fam. 7. *Encoeliaceæ*.

#### *Colpomenia* Derb. et Sol.

##### 1. *Colpomenia sinuosa* (Roth) Derb. et Sol.

DERBÈS, A. et A. SOLIER, Mémoire sur quelques points de la physiologie des Algues, p. 11.

*Ulva sinuosa* Roth, Catal. Bot., III, p. 327, tab. XII.

*Stilophora sinuosa* Ag. in Flora, X, 1827, p. 642. MONTAGNE in WEBB et BERTHELOT, l. c. p. 144.

It occurs on rocks or epiphytically upon other algæ near low water mark, being often laid dry for a short time. It is found both in exposed and in more sheltered places. SAUVAGEAU found plurilocular sporangia in December, and I found them upon specimens collected in January.



Teneriffe: Orotava (SAUVAGEAU,<sup>1</sup>). Gran Canaria: Playa de Santa Catalina, Bahía del Confital where it has also been found by M<sup>lle</sup> VICKERS. MONTAGNE writes about its occurrence at the Islands: "Ad portum Orotava insulæ Teneriffæ *Padinæ lobatæ* variisque aliis Fucaceis parasitica lecta". It is most probably common.

Geogr. Distrib. Widely spread in all warmer seas, in the Atlantic Ocean as far north as to the south coast of England.

## Hydroclathrus Bory.

### 1. *Hydroclathrus clathratus* (Bory) Howe.

HOWE, M. A., in BRITTON and MILLSPAUGH, The Bahama Flora, 1920, p. 590.

*Fucus clathratus* Bory msct. in AGARDH, Spec. Alg., vol. I, p. 412.

*Encoelium clatratum* Ag., Spec. Alg., vol. I, p. 412.

*Hydroclathrus cancellatus* Bory, Dict. class., VIII, p. 419 (non vidi).

SAUVAGEAU has collected fine specimens at Orotava. In "A propos des *Cystoseira* de Banyuls et de Guéthary" SAUVAGEAU at p. 52 says about it: "Encore jeune en décembre, il se développa beaucoup pendant mon séjour et portait des organes pluriloculaires à la fin de janvier. On le trouve dans les flaques à *C. canariensis* ou *C. discors* ou dans des creux de rochers ensoleillés au même niveau, restant rarement à sec."

I have collected it in several places at Las Palmas in low lying rock pools; it had plurilocular sporangia in specimens gathered in the beginning of March.

Teneriffe: Orotava (SAUVAGEAU)<sup>1</sup>. Gran Canaria: Playa de Santa Catalina in several places, Christoballo. In WEBB et BERTHELOT, Iles Canaries MONTAGNE writes about its occurrence: "In Canariâ et imprimis loco qui *Punta de Melenera* audit hancee Algam legit cl. DESPRÉAUX".

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

<sup>1</sup> According to GAIN et MIRANDE it has also been found at Teneriffe by BOURGÉAU.

## II. Sphacelariales.

### Fam. 1. *Sphacelariaceæ*.

#### *Sphacelaria* Lyngb.

##### 1. *Sphacelaria tribuloides* Meneghini.

MENEGHINI, Lettere al Corinaldi, 1840, p. 2, no. 1 (non vidi).  
SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 123 and p. 237.

Specimens with propagula were collected by SAUVAGEAU upon *Cystoseira* in the month of January.

Teneriffe: Puerto Orotava (SAUVAGEAU).

Geogr. Distrib. Seems to occur in most warm and temperate seas, in the Atlantic as far north as Scotland.

##### 2. *Sphacelaria furcigera* Kütz.

KÜTZING, F., Tabulæ Phycologicae, vol. V, p. 27, tab. 90, fig. II.  
SAUVAGEAU, C., Remarques sur le Sphacélariacées, p. 145.

SAUVAGEAU found specimens with propagula in the month of January. They were growing upon *Cystoseira discors*. I collected plants with propagula in March.

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

Geogr. Distrib. All warm and temperate seas, in the Atlantic Ocean as far north as the Færøes.

##### 3. *Sphacelaria Hystrix* Suhr.

SUHR in REINKE, Uebersicht der bisher bekannten Sphacelariaceen (Berichte der deutschen bot. Ges., Bd. 8, 1890, p. 208).  
SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 173.

On the Canary Islands this species is a very common parasite upon *Cystoseira Abies Marina*, the branches of which are often quite covered with the small tufts of the *Sphacelaria*. In other countries where this species does not occur, it is a parasite upon *Cystoseira ericoides*. SAUVAGEAU has

found *Sphacelaria Hystrix* growing upon these two species only, the *Cystoseira Abies Marina* in the Canary Islands being substituted for *Cystoseira ericoides*, this species being a rare one at the Canary Islands only occurring, as it seems, at Lanzarote. On the other hand the nearly related species *Sphacelaria cirrhosa* has its abode upon *Cystoseira discors*. With regard to this matter SAUVAGEAU writes p. 225: "On a vu précédemment que tous les exemplaires de *Sphacelaria* du groupe *cirrosa* que j'ai étudiés sur le *C. ericoides*, le *C. fibrosa* et l'*Halidrys* étaient parasites et correspondaient aux *S. Hystrix* et *S. bipinnata* et que tous ceux étudiés sur le *C. discors* étaient épiphytes et correspondaient au *S. cirrosa*. Si le fait est sans exception, il facilitera beaucoup la détermination."

However, near Las Palmas on Gran Canaria, I have found this species growing upon *Cystoseira discors* also. The specimens were fructifying, richly provided with male and female organs, and upon the whole quite like those I found upon *Cystoseira Abies Marina*. And furthermore, transverse sections of the basal part showed that they were parasitic, so there can not be any doubt as to the correctness of the determination.

At Orotava SAUVAGEAU collected plants with antheridia, unilocular and plurilocular sporangia and propagula in December and January, and I collected plants with the same organs with the exception of unilocular sporangia, at Orotava in January and at Las Palmas in March. The unilocular sporangia seem to be rarest, and are, according to SAUVAGEAU, found only upon Canarian specimens; they were first discovered by REINKE.<sup>1</sup>

<sup>1</sup> REINKE, J., Beiträge zur vergl. Anatomie und Morphologie der Spacelariaceen. (Bibl. Bot., Heft 23, 1891, p. 13, tab. 3, fig. 5).

The *Sphacelaria cirrhosa* Ag. in MONTAGNE's list of species, l. c., p. 149 is, according to SAUVAGEAU (l. c. p. 174), like *Sphacelaria Hystrix*. And most probably the *Sphacelaria cirrhosa* var. *subsecunda* Grun. in PICCONE's "Alghe", l. c., p. 53 belongs to this species too; I have not seen any specimens of it.

This species seems to be common on the islands and has been found there by most investigators.

Geogr. Distrib. From the Atlantic coast of France down to the Canary Islands.

#### 4. *Sphacelaria fusca* Ag.

AGARDH, Spec. Alg., vol. II, p. 34. SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 206.

This species was found once by SAUVAGEAU; it had propagula in the month of January.

Teneriffe: Orotava (SAUVAGEAU).

Geogr. Distrib. The Atlantic coast of England and France, Australia.

#### 5. *Sphacelaria cirrhosa* (Roth) Ag.

AGARDH, C., Systema, 164. SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 211.

*Conferva cirrosa* Roth, Catalecta Botanica, fasc. II, p. 214.

This species was collected by SAUVAGEAU upon *Cystoseira discors*; the specimens had unilocular sporangia in December and unilocular sporangia and propagula in January.

Teneriffe, Orotava (SAUVAGEAU).

Geogr. Distrib. From the Færøes down to the Canary Islands, Mediterranean Sea, Australia.

PICCONE, l. c. p. 54, mentions *Sphacelaria bipinnata* as found on the islands. But as pointed out by SAUVAGEAU,

l. c., p. 196 the host plants upon which this species occurs, namely: *Halidrys siliquosa* and *Cystoseira fibrosa*, are not found at the islands so PICCONE's determination is open to doubt.

## Halopteris Kütz.

### 1. *Halopteris scoparia* (L.) Sauvag.

SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 349.

*Conferva scoparia* Linné, Systema Naturæ, II, p. 720.

*Stypocaulon scoparium* Kütz., Phycol. gener., p. 293.

*Sphaecclaria scoparia* Mont., l. c. p. 149.

With regard to the development and structure of this species I refer the reader to the very thorough descriptions of SAUVAGEAU.

The specimens I have collected of this species were nearly all sterile; only a few gathered in January had unilocular sporangia.

In more exposed places this plant occurs near low water mark on rocks, or in rock pools somewhat higher up. In sheltered localities, e. g. in the lagoon-like bay behind the reef in the bottom of Bahia del Confital, I have gathered it at a depth of about two or three meters growing upon rocks or on stones.

This species seems to be common at the islands and has been gathered by most investigators.

Geogr. Distrib. From Great Britain down to the Cape de Verde Islands, West Indies, Mediterranean Sea, Australia etc.

## Cladostephus Ag.

### 1. *Cladostephus verticillatus* (Lightf.) Lyngbye.

LYNGBYE, H. C., Tentamen Hydrophytol. Dan., p. 102. SAUVAGEAU, C., Remarques sur les Sphacélariacées, p. 488; Recherche

de la paternité du *Cladostephus verticillatus* (Bull. de la Station biol. d'Arcachon, 1906, 9<sup>e</sup> année, Extrait, p. 27) where synonyms are mentioned.

*Conferva verticillata* Lightf., Flora Scotica, vol. II, 1777, p. 984.

SAUVAGEAU has in the above quoted work: "Remarques sur les Sphacélariacées" given a very detailed description of this plant to which I refer the reader.

I have collected only a few specimens of *Cladostephus* and refer them all to *Cl. verticillatus*. I have found plurilocular sporangia in only one of the specimens. Unilocular sporangia were not found. The plant occurred in low-lying rock pools in rather exposed places.

According to SAUVAGEAU the *Cladostephus Bolleanus* Mont.,<sup>1</sup> p. 398, no. 1417 is this species. And the same is the case with *Cladostephus spongiosus* which MONTAGNE mentions in p. 148. SAUVAGEAU who has examined MONTAGNE'S specimens writes l. c. p. 590: "Sa présence aux Canaries est douteuse et il semble manquer dans toute la Méditerranée."

Gran Canaria: Playa de Santa Catalina, Christoballo. M<sup>lle</sup> VICKERS writes about it: "Rochers à basse mer", she gives no localities for it. "In littore Canariæ à Cl. DESPRÉAUX lectus", according to MONTAGNE. Lanzarote: Arrecife (BOLLE).

Teneriffe: SAUVAGEAU.

Geogr. Distrib. According to SAUVAGEAU, l. c. p. 602: "Océan Atlantique: des Orcades et d'Helgoland jusq'aux Canaries, Terre-Neuve, Nord des États-Unis. Méditerranée: De Gibraltar jusque dans la mer Noire. Australia".

<sup>1</sup> MONTAGNE, C., Sylloge generum specierumque Cryptogamarum etc. Parisiis, MDCCCLVI.

### III. Cutleriales.

#### *Fam. 1. Cutleriaceæ.*

#### **Aglaozonia** Zanard.

##### 1. *Aglaozonia canariensis* Sauvageau.

SAUVAGEAU, C., Observations sur quelques Dictyotacées et sur un *Aglaozonia* nouveau. BØRGESEN, F., Two crustaceous brown algæ from the Danish West Indies (Nuova Notarisia, Serie 23, 1912); Marine Algæ of the D. W. I., vol. I, p. 193, fig. 150.

I gathered this plant in very exposed places at Puerto Orotava, the same locality in which SAUVAGEAU originally found it.

It was growing upon remnants of calcareous algæ which it closely covered. It was very firmly attached to the substratum.

The material, although preserved in spirits, had kept its brown colour rather well. Looked at through a lens the thallus is seen to follow evenly the sinuated surface of the substratum. It has a somewhat lobed edge, and when it meets with another thallus it sometimes overlaps it. It is somewhat striated, some darker stripes occurring here and there.

SAUVAGEAU has already given a detailed description of the plant, at the same time pointing out its very striking resemblance to *Zonaria variegata*. Therefore I shall restrict myself here to give some figures of the plant together with a short description of the structure of the thallus, at the same time comparing it with the West Indian plant I collected on the very exposed North-West coast of St. Croix.

Fig. 33 *a* shows a transverse section of the thallus from rather near the edge. Here already the dorsiventrality of

the thallus, much more developed in the older part of it, is clearly seen by the more divided cortical layer on the upper side. In the Fig. 150 *a* in my West Indian algal flora the dorsiventrality is already much more pronounced, and

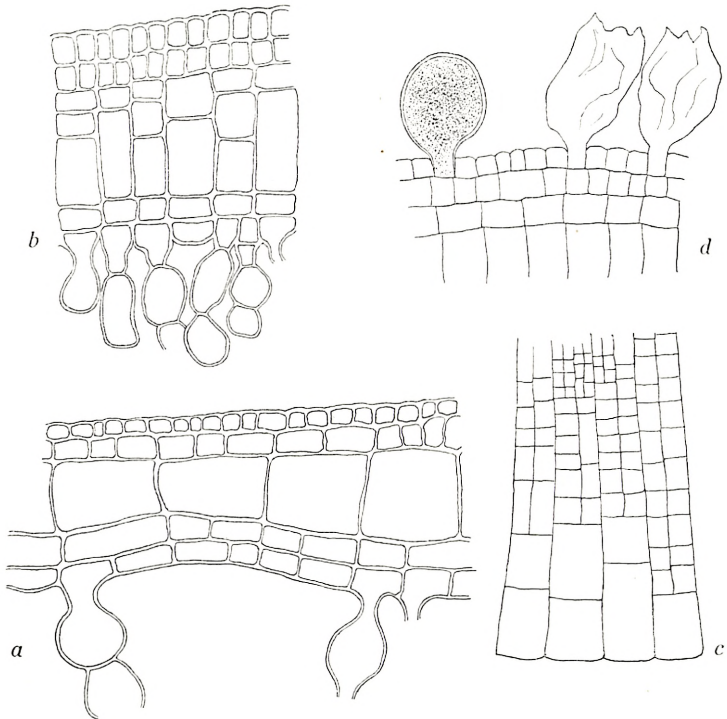


Fig. 33. *Aglaosonia canariensis* Sauvag. *a*, *b*, transverse sections of the thallus; *c*, part of the margin of the thallus; *d*, transverse section of the thallus with sporangia (two emptied). (About 180:1).

this is still more the case in Fig. 33 *b*. Here we have on the upper surface two layers of small cortical cells, and beneath, 1—2 cells cut off from the large ones in the middle of the thallus, while on the side below we have only two layers of cells and these are broader, not divided like the cortical cells of the upper surface.



This figure reminds very much of the *Ralfsia ceylanica* Harvey figured by Miss E. BARTON (Mrs. GEPP) and which I have supposed to be a related form of the plant under discussion.<sup>1</sup>

In Fig. 33 *c* is drawn part of the edge of a plant seen from above. This shows the characteristic division of the original rows of cells into 2—3—4 and not into two rows alone, as is the case in *Zonaria variegata*.<sup>2</sup> If this figure is compared with the corresponding one of the West Indian plant (Fig. 150 *b*), it is seen that this has much broader marginal cells. However, such broad marginal cells are not common in the West Indian plant either; probably, the fragment shown in the figure was drawn only because it so clearly showed the division of the cells. As a rule the cells in the West Indian plant are quite like those drawn in Fig. 150 *c*, the diameter of the cells in plants from both sides of the Atlantic reaching a length of about 40  $\mu$ .

But it is not only in the structure of the thallus that dorsiventrality is to be observed; it is also seen in the fact that the characteristic moniliform rhizoids are developed from the underside of the thallus only and the scattered groups of hairs from the upperside alone.

Here the sporangia occur. As I have not found these

<sup>1</sup> When I found that the thallus of *Zonaria variegata* from Easter Island (in SKOTTSBERG, The Natural History of Juan Fernandez and Easter Island, vol. II, p. 266, fig. 14) was much thicker than the one I know from the West Indies and in this respect was very like *Ralfsia ceylanica* Harv., I was somewhat troubled regarding my view that HARVEY'S plant should be a related form of *Aglaozonia canariensis*. Having now had the opportunity of examining good material of *Aglaozonia canariensis* and of *Zonaria variegata* from exposed places, I am inclined to believe that my first view was the right one.

<sup>2</sup> Compare RICHARDS, H. M., Notes on *Zonaria variegata* Lamx. (Proceed. of the Amer. Acad. of Arts and Sciences, 1890, p. 83, fig. 1) and my fig. 152 in Mar. Alg. D. W. I., vol. I, p. 198.

in my material I have in Fig. 33 *d* drawn a part of the thallus with sporangia from a preparation of SAUVAGEAU. While the hairs, as SAUVAGEAU has already pointed out, have a well-developed indusium (compare my Fig. 150 *d* of the West Indian plant) the sporangia have no indusium. They occur scattered or in small groups upon the older parts of the thallus, taking their origin from the cortical cells. They are pyriform in shape, about  $60\ \mu$  long and  $80\ \mu$  broad.

At the Bahama Islands HOWE seems to have found a similar plant.

Teneriffe: Orotava (SAUVAGEAU, l.).

Geogr. Distrib. Canary Islands, West Indies, Indian Ocean?

## IV. Laminariales.

### Fam. 1. *Laminariaceæ*.

#### *Laminaria* Lamour.

##### 1. *Laminaria pallida* Grev.

GREVILLE in J. AGARDH, Spec. Alg., vol. I, p. 134. KÜTZING, Spec. Alg., p. 574. LE JOLIS, Examen des espèces confondues sous le nom de *Laminaria digitata* auct., p. 589. BORNET, Algues de Schousboe, p. 252.

*Laminaria digitata*, Mont., Fl. Canaries, p. 143.

This species has been collected once at the islands by DESPRÉAUX. LE JOLIS has examined the specimens and writes about them, l. c. p. 571: "Dans son Histoire naturelle des îles Canaries, M. LE Dr. MONTAGNE a décrit un *Lam. digitata*; je dois faire observer que la plante des îles Canaries n'appartient pas à cette espèce, mais bien au *Lam. pallida* Grev. (J. Ag. Sp. Alg. I, p. 134). J'ai pu m'en assurer

de la manière la plus positive par l'autopsie de l'un des deux seuls échantillons recueillis à Gomera par DESPRÉAUX et qui est conservé dans l'herbier de BORY-ST. VINCENT."

By the courtesy of the Paris Museum I have been able to see the two existing specimens of this plant from the Islands. The one is a complete specimen with a stipe about 4 cm long, which very suddenly passes over into the broad ovate-lanceolate lamina. This is about 30 cm. high and 18 cm broad and deeply split up into several segments of different breadths. The other specimen is incomplete, consisting of some fructiferous segments only.

Gomera: DESPRÉAUX.

Geogr. Distrib. Southern Atlantic shore of Europe, Morocco, Canary Islands, Cape.

## Ecklonia Hornem.

### 1. *Ecklonia radiata* (Turn.) J. Ag.

J. AGARDH, Sp. Alg., vol. I.

*Fucus radiatus* Turner, Fuci, vol. II, p. 134.

f. *exasperata* (Turn.) De Toni.

DE TONI, Sylloge Alg. vol. III, p. 354.

*Capea biruncinata* Mont., Iles Canaries, vol. 3,2, p. 140, tab. VII.

This stately plant has only once, so far as I know, been gathered at the islands, namely by DESPRÉAUX. I have been able to see a fine specimen of it belonging to the Muséum National d'Histoire Naturelle, Paris. It is most probably the same specimen from which tab. VII in MONTAGNE'S work has been drawn.

Regarding its occurrence at the islands MONTAGNE says: »... tandem ad rupes maritimas insulæ Canariæ specimina fructificationibus perfectis onusta à cl. Despréaux lecta sunt.«

Geogr. Distrib. Canary Island, Cape de Verde Islands and adjacent coast of Africa, Cape, Algoa Bay, coast of Chile, Australia, New Zealand etc.

*Macrocystis planicaulis* Ag. (= *Macrocystis pirifera* (Turn.) Ag.) is mentioned by C. AGARDH in "Revision der Algen-gattung *Macrocystis*", p. 299 in this way: "Specimen etiam mihi dedit DESFONTAINES, quod ad Insulas Canarias lectum dicebatur".

To this MONTAGNE remarks, l. c. p. 140: "La présence de cette plante sur le littoral canarien me paraît fort douteuse, à moins qu'elle n'y ait été apportée par les courans. Elle n'existe point dans la collection soumise à mon examen, et je ne la cite ici que pour avoir lu dans le mémoire de M. AGARDH qu'il en tenait de DESFONTAINES un échantillon annoté comme originaire de cette localité."

I quite share the doubt of MONTAGNE as to the possibility of this plant being a Canarian one. The specimen found has surely been a drift-plant cast up by the waves at the shores of the islands. But this is also of much interest.

## V. Dictyotales.

### Fam. 1. *Dictyotaceæ*.

#### *Dilophus* J. Ag.

##### 1. *Dilophus Fasciola* (Roth) Howe.

HOWE, M. A., The marine Algae of Peru, p. 72.

*Fucus Fasciola* Roth, Cat. Bot., I, p. 146, pl. 7, fig. 1.

*Dictyota Fasciola* Lamour, Journ. de Bot., vol. 2, p. 43, 1809.

(At least as to the typical, name-bringing part according to Howe).

*Dictyota repens* J. Ag., Alg. Med., p. 38. KÜTZING, F., Tab. Phycol., vol. 9, pl. 9, fig. 1.

*Dilophus repens* J. Ag., Till Algern. System, 2. afd. p. 106.

The thallus of this genus differs from that of *Dictyota* in that it consists, at any rate in its lower part, of at least two layers of large cells besides the surrounding

cortical layer. In the basal creeping, nearly terete filaments a transverse section shows that it is composed of several cells without any order. Higher up the thallus is composed of one layer of large cells (besides the cortical layer) and is thus built up quite in accordance with that of *Dictyota*.

The plant has large groups of hairs scattered over its surface.

The tetrasporangia occur scattered on both sides of the thallus. They are usually solitary, but two or three together are also often found placed in rows. Plants with tetrasporangia were gathered in March.

To this species I have furthermore referred a few larger specimens of which I have had only dried material. The specimens agree with the figures of *Dictyota cirrosa* Suhr in KÜTZING'S Tabul. Phycologicae, vol. IX, tab. 19. As the lowermost part of the plants are wanting, I have not been able to find more than one layer of cells in these plants, but nevertheless I think it most appropriate to refer them to this species. In doing so I am also most probably in agreement with BORNET who, referring to the figures of KÜTZING drawn after plants from Morocco, has examined similar specimens in SCHOUSBOE'S Herb. and found two layers of cells in their base.

M<sup>lle</sup> VICKERS mentions *Dictyota Fasciola* Lamx. in her list of algæ from the islands. I have not seen any of her specimens, but I am most inclined to consider her plants as belonging to this species too, her specimens being collected just in the same locality where I have found mine.

Also PICCONE mentions *Dictyota Fasciola* from the islands and Dr. ACHILLE FORTI has most kindly sent me

some small fragments of this plant. These too are most probably referable to this species.

This species was found in low-lying rock pools in sheltered places, and in high-lying ones near or above high water mark on exposed coast.

Gr. Canaria. Playa de Santa Catalina near Castillo; Bahía del Confital (M<sup>lle</sup> VICKERS, l.).

Lanzarote: Isla Graciosa (d'ALBERTIS).

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

## Dictyota Lamour.

### 1. *Dictyota dichotoma* (Huds.) Lamour.

LAMOUREUX, Exposit. des caract. du genre *Dictyota* (Journ. de botanique, 1809, t. II, p. 42).

*Ulva dichotoma* Huds. Flora anglica, p. 476.

This species seems to be common on the shores of the islands.

It usually prefers sheltered localities. The best developed, large specimens were gathered in a sheltered bay with shallow water about a few meters deep. Here it was found in large bushes upon stones or pieces of rocks lying on the sandy bottom.

In more exposed places the specimens become smaller and more robust.

Most of the specimens collected were sterile, some few had tetrasporangia or oogonia.

The *Dictyota navosa* Suhr mentioned by MONTAGNE, l. c., p. 145 most probably belongs to this species. The specimens I have borrowed from the Paris Museum are at any rate not *Dict. navosa* but should be referred to *Dict. dichotoma*, I have seen 3 specimens, all gathered at

"Canaria", two of these by WEBB and the third by BOURGÉAU. However, MONTAGNE writes about its occurrence: "Hab. Frondibus *Sargassi fissifolii* parasitantiem inveni, hinc insulæ Teneriffæ (*Punta de Teno*) civis". This seems to show that he has seen some other specimens from Teneriffe.

About the occurrence of *Dict. dichotoma* MONTAGNE writes: "Ad littora Canariensia vulgaris". It has also been found by many investigators at the islands.

Geogr. Distrib. From Norway southwards to the Canary Islands, Mediterranean Sea, West Indies, Red Sea etc.

## 2. *Dictyota linearis* (Ag.) Grev.

GREVILLE, *Algæ britannicæ*, p. XLIII; J. AGARDH, *Spec. Alg.*, vol. I, p. 90.

*Zonaria linearis* Ag., *Spec. Alg.*, vol. I, p. 134.

In my collection I have not found any specimen referable to this species. Nevertheless it does not seem to be rare on the islands. Thus M<sup>lle</sup> VICKERS mentions it as common from November to February. And PICCONE, l. c. p. 25, also mentions this species as found on the islands. Dr. ACHILLE FORTI has allowed me to see a fine little specimen collected by Capt. D'ALBERTIS at Arrecife.

Furthermore the *Dictyota implexa* Lamx. mentioned by MONTAGNE, l. c., p. 145, is, to judge from MONTAGNE's description, referable to this species. And the *Dictyota divaricata* mentioned by PICCONE, l. c. p. 25, is most probably also to be referred to this species.

Gran Canaria: Bahia del Confital (VICKERS). Teneriffe: Santa Cruz (D'ALBERTIS). Lanzarote: Arrecife (D'ALBERTIS).

Geogr. Distrib. Mediterranean Sea, Cadiz, Morocco, Canary Islands, West Indies etc.

### 3. *Dictyota ligulata* Kütz.

KÜTZING in Bot. Zeit., 1847, p. 53; Spec. Alg., p. 554; Tab. Phycol. vol. IX, tab. 18. J. AGARDH, Spec. Alg., vol. I, p. 98; Til Algernes System., V, p. 95; Analecta Algologica, Contin. I, p. 73.

This species was rather common along the shores of Gran Canaria from Puerto de la Luz to Las Palmas. It often grows here in rather high-lying rock pools or on rocks near low water mark in somewhat sheltered places.

I found specimens with tetrasporangia and oogonia. The tetrasporangia occurred scattered in a broad zone occupying the middle of the thallus on both side of it. They are either placed solitarily or united in small groups, 3—5 sporangia together.

The oogonia are found in small roundish or oval groups scattered on both side of the thallus.

Gran Canaria: Playa de Santa Catalina, where it was found also by M<sup>lle</sup> VICKERS.

Geogr. Distrib. From south of England to the Canary Islands.

PICCONE, l. c. p. 54, mentions *Dictyota crenulata* var. *Canariensis* GRUN. collected by LIEBETRUTH at Gran Canaria. I have not seen the specimen. DE TONI in Syll. Alg., vol. III, p. 270 put a ? against the determination.

## Padina Adans.

### 1. *Padina Pavonia* (L.) Gaillon.

GAILLON, Dict. des sciences nat., vol. 63, p. 371 (non vidi).

*Fucus Pavonius* L. Spec. Plant., Edit. Secunda, Tomus II, p. 1630.

As it was pointed out by REINKE<sup>1</sup> in his full description of this species, and later also by HAUCK,<sup>2</sup> its charac-

<sup>1</sup> REINKE, J., Entwicklungsgeschichtliche Untersuchungen über die Dictyotaceen des Golfes von Neapel. Nova Acta d. kgl. Leop.-Carol.-Deutschen Akademie der Naturforscher. Bd. XI. Dresden 1878, p. 15.

<sup>2</sup> HAUCK, F., Ueber einige von J. M. Hildebrandt im Rothen Meere und Indischen Ocean gesammelte Algen. Helwigia, Bd. 26, 1887, p. 42.



teristic feature is that in well developed plants a continuous row of sporangia is found upon each side of the row of hairs. In OLTMANN'S "Morphologie", vol. II, 1922, p. 179, fig. 433,<sup>5</sup> a good figure of a transverse section of the thallus shows this arrangement. In less vigorous plants, on the other hand, only one row of sporangia is developed as a rule, though a few scattered groups of sporangia may also be found on the other side of the row of hairs.

This was the case in the Canarian plants of which I have found only tetrasporic specimens. In these specimens, on the upper side of the row of hairs, a broad continuous belt of sporangia had been formed. On the lower side, as a rule, no sporangia occurred at all, except that in some cases a few small scattered groups were found. The young sporangia are to begin with covered with the continuous cuticula which later on bursts.

In the rows of sporangia we find the oldest near the row of hairs, the sporangia becoming younger and younger towards the outside.

*Padina Pavonia* occurs near low water mark upon rocks and stones, or is found in rock pools, the walls of which are often quite covered with it. It grows in more exposed as well as sheltered places.

It has been gathered by most investigators and is most probably common.

Geogr. Distrib. Along the Atlantic coast from Great Britain to the Canary Islands; Mediterranean Sea.

## 2. *Padina Vickersiæ* Hoyt.

HOYT in BRITTON & MILLSPAUGH, The Bahama Flora, *Algæ* contributed by M. A. HOWE, p. 595, New York, June 20, 1920.

*Spatoglossum variegatum* Kütz., Spec. Alg., p. 560, 1849.

*Zonaria variegata* Kütz., Tab. Phycol., vol. 9, tab. 73, fig. 2.

*Padina variegata* Hauck, Hedwigia, Bd. 26, 1887, p. 42. BØRGESEN, Mar. Alg. D.W. I., vol. 1, 1914, p. 205.

*Padina Howeana* Børgs., Mar. Alg. D.W. I., vol. II, p. 442, <sup>21/10</sup> 1920.

non *Dictyota variegata* Lamour., Expos. des caractères du genre Dictyota (Journ. de Bot., t. II, 1809, p. 40).

As I have mentioned in "The Mar. Algæ of the Danish West Indies", vol. II, p. 442, HOWE has pointed out that we cannot follow HAUCK in using the name *variegata* for this plant since the *Dictyota variegata* Lamx. is = *Zonaria variegata* according to HOWE's examination of the original specimens of LAMOUREUX. Therefore in the list of addenda and corrections to my treatise, p. 442, I proposed to call the plant *Padina Howeana*. Meanwhile, shortly before my paper came out, HOYT (l. c.) had called it *Padina Vickersia*, which name, therefore, must now be preferred.

I have only found in the Canary Islands a few small plants of this species hitherto only known to exist in the West Indies.

The specimens found agree very well with my description and figures of this species, l. c.

Like my figure 157 the rows of fructiferous organs (the specimens found are female) alternate regularly with rows of hairs, which is characteristic of this species. A well developed indusium is present, formed by the gradually lifted and bursting cuticula. A transverse section of the thallus shows that it is composed of four layers of cells, and sometimes as many as six layers or more in the older parts.

The specimens found were small, about 6 cm high only. They were collected near low water mark growing upon rocks in exposed places.

Teneriffe: Orotava.

Geogr. Distrib. West Indies.

## Taonia J. Ag.

### 1. *Taonia Atomaria* (Woodw.) J. Ag.

J. AGARDH, Spec. Alg., vol. I, p. 101.

*Ulva Atomaria* Woodw. in Transactions of the Linnean Society, vol. III, 1797, p. 53.

*Padina Atomaria* Mont. in Iles Canaries, l. c. p. 146.

In "Entwicklungsgeschichtliche Untersuch. über die Dictyotaceen des Golfes von Neapel" (Nova Acta, Bd. 40, no. 1,

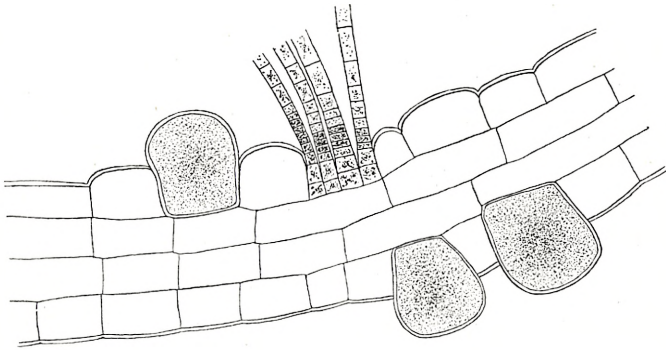


Fig. 34. *Taonia Atomaria* (Woodw.) J. Ag. Transverse section of the thallus with sporangia and a group of hairs. (About 125:1).

1878) REINKE has given a very detailed description of this plant, to which I refer the reader.

The specimens found were tetrasporic. The sporangia are formed upon both sides of the thallus (Fig. 34). Their development begins near the sinuate rows of hairs on both sides of them but the sporangia are gradually developed over the whole surface of the thallus. They occur either in small groups or solitarily. The shape of the sporangia, when seen from above, is oblong, and they are always placed in such a way that their longitudinal axis is parallel to that of the thallus. No indusium covers either the hairs or the sporangia. Fig. 34 shows a transverse section of the

thallus with two layers of almost clear cells in the middle, and on both sides of this a single layer of cortical cells which are rich in chromatophores and from which both the hairs and the sporangia originate.

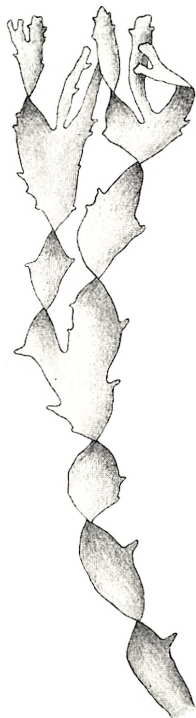


Fig. 35.

*Taonia Atomaria.*

Part of narrow, spirally twisted thallus from very exposed place. (About 2:1).

REINKE did not succeed in finding antheridia. These are described by SAUVAGEAU in a note: Sur les Anthéridies du *Taonia Atomaria* (Journ. de Bot., vol. 11, 1897, p. 86).

The specimens from Teneriffe were collected in a very exposed locality and therefore represents what is markedly a surf form (Fig. 35). The specimens are divided up into numerous quite narrow laps about 1—2 mm broad. Along their edges numerous larger or smaller tooth-like outgrowths are present, giving the edge a serrate appearance. Furthermore the laps are generally spirally twisted. In "Meeresalgen", p. 308 HAUCK mentions what is probably a very similar form from the Adriatic Sea.

The plants from Gran Canaria were gathered in low lying rock-pools in a rather sheltered place, and they had therefore a thallus with much broader and fewer laps.

Teneriffe: Puerto Orotava. Gran Canaria: Castillo near Puerto de la Luz, Playa de Santa Catalina, Playa de las Canteras (M<sup>lle</sup> VICKERS). About its occurrence MONTAGNE writes, l. c. p. 146: "Hab. ad oras insulæ Canariæ rara ex cl. DESPRÉAUX."

Geogr. Distrib. From Great Britain to the Canary Islands, Mediterranean Sea.

## Zonaria Ag.

### 1. *Zonaria variegata* (Lamour.) Ag.

C. AGARDH, Synopsis Alg. 1817, p. XX.

*Dictyota variegata* Lamour., Nouv. Bull. Sci. Soc. Philom., I. p. 331, 1809.

*Gymnosorus variegatus* (Lamour.) J. Ag., Analecta algolog., cont. I, p. 11, 1894.

This plant which seems to be very common on the islands has been examined in great detail by SAUVAGEAU in his "Observations sur quelques Dictyotacées etc." On p. 7 SAUVAGEAU describes the two forms in which it occurs, namely that with a creeping thallus horizontally expanded upon the rocks, and that with an erect thallus. SAUVAGEAU has found not only tetrasporangia but also octosporangia. In my collection I have found tetrasporangia.

Regarding the structure of the thallus, which has been described in detail by SAUVAGEAU, compare also RICHARDS, "Notes on *Zonaria variegata*, Lamx." and my remarks and figures in "The Marine Algæ of the D. W. I", vol. I, p. 197 and "Marine Algæ, from Easter Island", p. 266.

At the Canary Islands I usually collected the plant in very exposed places, where it grows, as is also pointed out by SAUVAGEAU, near low water mark and below it. In the West Indies I found it in deeper water only, from 10—40 meters. The creeping form is usually found on horizontal rocks, especially in rock pools, while the erect form grows upon vertical rocks, preferring narrow crevices etc.

SAUVAGEAU found it with tetrasporangia and octosporangia in January and February; I have specimens with tetrasporangia gathered in January.

MONTAGNE does not mention this species in his list, in spite of the fact that good specimens of it are to be found

in WEBB's collection. But the reason is that he has confused this species with *Zonaria lobata*; compare below p. 94.

The plant is no doubt common on the islands as it has been gathered by most of the investigators.

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

## 2. *Zonaria Tournefortii* (Lamx.) Montagne.

MONTAGNE, Flore d'Algérie, p. 32. BORNET, Algues Schousboe, p. 230.

*Fucus Tournefortii* Lamouroux, Dissertations sur plusieurs espèces de Fucus, 1805, p. 44, tab. 26, fig. 1.

*Fucus flavus* Clemente Simon de Roxas, Ensayo sobre las variedades. . . . Madrid 1807, p. 310.

*Zonaria flava* (Clem.) Ag., Synopsis Alg. Scandinaviæ, p. XX. SAUVAGEAU, C., Observations sur quelques Dictyotacées et sur un Aglaozonia nouveau (Bull. Stat. Biolog. d'Arcachon, 1904—5, 8<sup>e</sup> année).

*Padina Tournefortii* Montagne, Iles Canaries, vol. III, 2, p. 146.

As pointed out by SAUVAGEAU, who (l. c.) has given a very detailed description of this fine plant, it grows in very exposed places in hollows in the rocks or by preference in places where it is more or less shaded by projecting rocks. In such places it is found somewhat below low water mark, and so is never left dry. It is therefore only possible to collect it on calm days. In this semi-darkness where the water is always moving, its somewhat phosphorescent, nearly purple thallus sways up and down; taken up from the water its colour is brown.

Besides the peculiar sporangia containing eight spores already mentioned by BORNET,<sup>1</sup> SAUVAGEAU has found sexual plants both male and female. To judge from SAUVAGEAU's specimens the sexual ones are much smaller than those

<sup>1</sup> BORNET, ED., Études phycologiques, p. 57.

with sporangia and also much rarer. In my own collection I have only found plants with sporangia.

Fig. 36 shows a longitudinal section of the thallus through a sorus with sporangia. According to the description of SAUVAGEAU the thallus consists of a medullary layer of four rows of long, rectangular cells, covered on both side by a layer of smaller epidermal cells richer in chromatophores. In transverse section it is seen that the

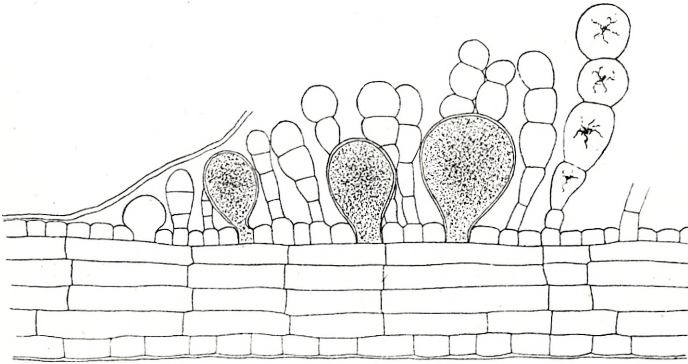


Fig. 36. *Zonaria Tournefortii* (Lamx.) Mont. Transverse section of the thallus through a sorus with sporangia and paraphyses. To the left the lifted cuticula is seen. (About 180 : 1).

medullary cells are nearly quadratic. The sporangia and the paraphyses between them are formed by the cells of the epidermis. When they grow up the cuticula is lifted, forming over the young sorus an indusium which bursts later on.

The paraphyses are formed of barrelshaped or nearly spherical cells.

The sporangia occur on both sides of the thallus. My specimens were collected in January.

MONTAGNE calls this plant *Padina Tournefortii*. I have not seen any specimens of his. Dr. HAMEL informs me that

no specimens of this species are to be found in the Muséum National d'Histoire Naturelle, Paris.

MONTAGNE writes about its occurrence: "Ad littora Canariensia frequens" and it has also been found there by most investigators.

Geogr. Distrib. From Cadiz to the Canary Islands, Mediterranean Sea, Açores, Brazil.

### 3. *Zonaria lobata* Ag.

AGARDH, C., Systema Alg., p. 265.

*Styopodium lobatum* Kütz., Tab. Phycol., vol. IX, tab. 63, fig. 1.

*Spatoglossum versicolor* Kütz., Tab. Phycol., vol. IX, tab. 41, fig. 1.

*Padina lobata* Mont., l. c. p. 146 (ex parte).

To the description of SAUVAGEAU (Observations sur quelques Dictyotacées etc. p. 5) I have nothing to add.

MONTAGNE has evidently confused this species with *Zonaria variegata*. This seems apparent not only from his description of *Padina lobata* but also from the fact that he does not mention *Zonaria variegata* in his list. And this supposition was quite confirmed when I saw the specimens of *Padina lobata* Mont. belonging to the Muséum d'Hist. Nat., Paris. I have seen two sheets of paper upon which different specimens are mounted. Upon one of them the label bears the inscription: "*Zonaria lobata* Ag." Upon the label of the other sheet is written: "*Styopodium laciniatum* Kütz." and below it: "*Padina lobata* Montagne. Canar." *Styopodium laciniatum* is just KÜTZING's name for *Zonaria variegata* and one finds good specimens of this species on this sheet. All the specimens of MONTAGNE were collected by WEBB at Teneriffe.

Of the specimens I have collected in January some had tetrasporangia. SAUVAGEAU has also found male plants.

The plant grows in very exposed places under over-



hanging rocks, or in narrow crevices somewhat below low water mark and is therefore difficult to collect.

In Bahia del Confital, Gran Canaria, I have collected fine large specimens in a somewhat more sheltered locality behind the reef. They were growing at a depth of about two meters at low tide upon stones.

Teneriffe: Puerto Orotava (SAUVAGEAU,!), without locality (WEBB, LIEBETRUTH). AGARDH mentions Teneriffe as one of the growing places for this plant. Gran Canaria: Bahia del Confital, Playa de Santa Catalina; M<sup>lle</sup> VICKERS has here found specimens washed ashore.

MONTAGNE writes about its occurrence: "Hab. Ad littora Canariensis vulgaris videtur, cum ex oris Canariæ, Teneriffæ, Lancerottæ, Palmæque relata sit".

Geogr. Distrib. Both sides of the Atlantic ocean: Canary Islands, Cape, Brazil, West Indies.

## Dictyopteris Lamx.

### 1. *Dictyopteris polypodioides* (Desf.) Lamouroux.

LAMOUREUX in Journal de Bot., II, p. 19 (Extraits).

*Fucus polypodioides* Desf., Flora Atlantica, vol. II, p. 421.

*Haliseris polypodioides* (Desf.) Ag., Spec. Alg., vol. I, p. 142.

Only a few small specimens of this species were found. They were collected upon a reef in a very exposed locality, and were on that account much beaten by the waves. The specimens were growing near low water mark.

Gran Canaria: Bahia del Confital. M<sup>lle</sup> VICKERS gives no special locality; she writes only: "Dans les trous des rochers à marée basse. D. Décembre à mars". MONTAGNE, l. c. p. 147 says about it: "Rarissimé ad littora insulæ Canariæ à cl. Despréaux lecta."

Geogr. Distrib. From Heligoland and the English coast down to the Canary Islands, Brazil, the Mediterranean Sea, Red Sea, south coast of Africa, Japan, Tasmania etc.

## V. Fucales.

### Fam. 1. *Fucaceæ*.

#### Fucus L.

##### 1. *Fucus spiralis* L. emend. Batters.

BATTERS, E. A. L., A Catalogue of the British Marine Algae, Journ. of Bot. 1902, p. 501 (name only). BØRGESEN, F., The marine Algæ of the Færøes, 1902, p. 472; *Fucus spiralis*, Linné, or *Fucus platycarpus*, Thuret: A question of nomenclature (Linnean Society's Journal, vol. 39, 1909).

var. *platycarpa* (Thur.) Batt., l. c. p. 50. BØRGESEN, l. c. p. 472, 3.

f. *limitanea* (Mont.).

*Fucus vesiculosus* L. var. *limetaneus*, MONTAGNE, l. c., p. 139.

Independently of each other BATTERS and I came in 1902 to the same conclusion regarding the naming of this plant. My paper was issued November 15. BATTERS' "Catalogue" was published as a supplement to the Journal of Botany, and as the sheet in which *Fucus* is treated appeared in the Sept. No. of the Journal, BATTERS has the priority.

But while BATTERS' "Catalogue" is a mere list, I have given some reasons for my view in my Færøese treatise. And later on in the note quoted above regarding the correct nomination, according to my view, of this species I have shown, what is also proved by the small preserved specimens in LINNÉ's Herbarium in the possession of the Linnean Society, London, that we could rightly keep up Linné's name for this species, viz.: *Fucus spiralis*, while SAUVAGEAU<sup>1</sup>

<sup>1</sup> SAUVAGEAU, C., Sur deux *Fucus* récoltés à Arcachon (*Fucus platycarpus* et *F. lutarius*). (Bull. Stat. biol. d'Arcachon, 1908, 11<sup>e</sup> année). SAUVAGEAU, C., Une question de nomenclature botanique. *Fucus platycarpus* ou *Fucus spiralis*. (ibid. 1909, 12<sup>e</sup> année). SAUVAGEAU, C., A propos de quelques *Fucus* du Bassin d'Arcachon. (ibid., 1923).

on the other hand quite as decisively insists that LINNÉ's name should be replaced by THURET's *Fucus platycarpus*. After these few remarks regarding the name of this plant used by me, I restrict myself to referring the reader to the respective papers from both sides regarding this question; here I shall merely point out that when summing up shortly the results of my paper regarding the main forms of this species, I gave the following survey:

*Fucus spiralis* L.  
with the varieties    var. *typica* Børgs.  
                              f. *limitanea* (Mont.)  
                              var. *platycarpa* (Thur.) Børgs.

This I now want to correct here as follows:

<i>Fucus spiralis</i> L. emend. Batters.	
var. <i>typica</i> Børgs.	var. <i>platycarpa</i> (Thur.)
= <i>F. spiralis</i> L.	Batters.
f. <i>nana</i> (Stackh.) Batters. <sup>1</sup>	= f. <i>limitanea</i> (Mont.). <sup>2</sup>

Exactly in the same way as we find, in the northern seas, an even transition from var. *typica* to forma *nana* when passing from sheltered to exposed coast,<sup>3</sup> so also we meet with the same reduction of var. *platycarpa* to forma *limitanea* under similar conditions in more southern seas.<sup>4</sup> And now it is of much interest that the small dwarf form from exposed coasts, whether it has its origin from var. *typica* or var. *platycarpa*, is exactly the same form, the specimens

<sup>1</sup> BATTERS, l. c. p. 50.

<sup>2</sup> BORNET in *Algues de Schousboe* p. 254 calls it plainly forma *nana*.

<sup>3</sup> Compare my remarks, l. c. 1902, p. 475—7.

<sup>4</sup> Compare SAUVAGEAU, *Sur les Algues marines du golfe de Gascogne* (*Journ. de Bot.* t. XI, 1907, p. 6—7).

being so similar to each other that it is quite impossible to distinguish them from each other.<sup>1</sup> Therefore we can only keep up the two forms theoretically, for practically we are unable to separate them from each other when we do not know their origin.

At the Canary Islands only the var. *platycarpa* with f. *limitanea* occurs. Forma *limitanea* is found in exposed

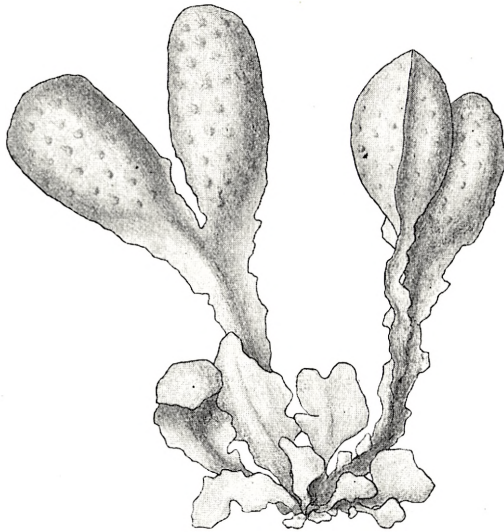


Fig. 37. *Fucus spiralis* L. f. *limitanea* (Mont.). (About 2 : 1).

places, especially upon cliffs facing north, and it can grow here somewhat above high water mark where it is constantly wetted by the spray. The specimens (Fig. 37) may

<sup>1</sup> Having made a thorough comparison of my Canarian specimens of this form with my large collection of dwarf forms from the Færøese coast, the only difference I have found is that the thallus of the dwarf Canarian specimens is sometimes somewhat broader than that of the Færøese specimens and that the thallus of the former may have some more cryptostomata than the latter. But these broader specimens were gathered in somewhat more sheltered places, those from the most exposed localities being quite as narrow as the Færøese specimens.

be very small, often reaching a length of a few cm. only. When the localities are more sheltered the specimens grow larger, passing gradually into var. *platycarpa*. Of plants belonging to it one can find specimens up to 15 cm., rarely more. It is not common, as compared with its occurrence in more northern seas, and in quite sheltered places I have not met with it.

When MONTAGNE writes (l. c., p. 139) regarding its frequency: "Ad rupes maritimas Canariæ rarissimus" this on the other hand, cannot be said to be quite right, since this plant is on the contrary often rather common in cooler places, in any case during the winter months.

Teneriffe: Puerto Orotava (SAUVAGEAU,!). Gran Canaria: Playa de Santa Catalina and Christoballo (M<sup>lle</sup> VICKERS,!), Bona-dero (M<sup>lle</sup> VICKERS), without locality (WEBB et BERTHELOT according to MONTAGNE).

Geogr. Distrib. Along the West coast of Europe down to the Canary Islands.

*Halidrys siliquosa* (L.) Lyngb. is mentioned by MONTAGNE, l. c., p. 129 as occurring on the islands according to BORY, who stated that it had been found there. But, as MONTAGNE points out, he has never seen any specimen of it from the islands in the herbaria he has examined, and as it has never been found by other investigators, BORY's statement is surely incorrect.

## Cystoseira Ag.

### 1. *Cystoseira ericoides* (L.) Ag.

AGARDH, C., Species Algarum, p. 52. SAUVAGEAU, C., A Propos des Cystoseira, p. 184.

*Fucus ericoides* L., Spec. Plantarum, Edit. secunda, T. II, p. 1631.

Regarding the occurrence or non-occurrence of this species on the Canary Islands SAUVAGEAU writes, at p. 201 as follows: "On est mal renseigné sur la présence du *C. ericoides* dans les îles africaines; je ne l'ai pas vu à Ténériffe et M<sup>lle</sup> VICKERS ne l'a pas récolté à la Grande Canarie. MONTAGNE le cite d'après les *Essais sur les îles Fortunées*, de BORY où l'espèce est nommée sans autre indication; il signale aussi sa var. *selaginoides* Ag. rejetée à Lancerote. L'Herbier THURET renferme un fragment marqué par BORY "Lancerote, îles Canaries par WEBB et BERTHELOT, 1835" et aussi le no. 20 des *Algæ maderenses* de MANDON marqué "*C. ericoides* Ag. (Lenorm.) Madère" qui pourrait en effet appartenir à cette espèce. Cela est même d'autant plus probable que j'ai vu (Herbier du Muséum) un fragment fructifié et un petit individu en assez mauvais état rapporté par la mission CRUDEAU des côtes de Mauritanie (Baie de l'Ouest.)"

According to this the occurrence of this species on the islands seems somewhat doubtful.

When, however, I think it justifiable to accept this species as a Canarian one, I refer to a specimen which Dr. HAMEL most kindly sent me for examination. This specimen was collected at Lanzarote by BOLLE in 1851. It belongs to Herb. MONTAGNE and is determined as *Cystoseira ericoides* Ag. It seems to me difficult to refer this specimen to any other species even if in one respect, namely the want of any marked main stem, it differs from the typical *Cystoseira ericoides*.

As because of the uncertainty regarding the occurrence of this species at the Islands I wanted very much to have an authentic declaration from Professor SAUVAGEAU regarding this specimen, I sent him a small piece of the plant.

And Prof. SAUVAGEAU answered me most kindly as follows: "Il est difficile, sur un fragment d'apprécier le *C. ericoides*. Autant qu'on peut en juger, cependant, le fragment de l'Herb. MONTAGNE semble bien lui appartenir. Dans mes *Cystoseira* (page 201) je dis d'ailleurs que WEBB et BERTHELOT semblent l'avoir récolté à Lancerote. Il serait donc possible que le *C. ericoides* se trouve à Lancerote et pas à Teneriffe ni à Las Palmas." By the reason of this I consider *C. ericoides* as a Canarian species.

Lanzarote: (BOLLE, WEBB et BERTHELOT).

Geogr. Distrib. Atlantic coast of Europe and Africa from England down to Morocco and Lanzarote. Mediterranean Sea: Alger.

## 2. *Cystoseira Abies-marina* (Turner) C. Ag.

AGARDH, C., *Species Algarum*, p. 54. SAUVAGEAU, C., *A Propos des Cystoseira*, p. 96 and 392.

*Fucus Abies-marina* Turner, *Fuci*, pl. 249.

This species is characterized by its creeping thallus and want of main stems.

As pointed out by SAUVAGEAU it occurs near low water mark at Orotava even in much exposed places. Off Orotava, where I tried to dredge at depths of about 10—20 fathoms, I looked in vain for it. On the other hand at Gran Canaria M<sup>lle</sup> VICKERS has dredged it at depths of 10—40 m. In Bahia del Confital I myself gathered it in 5 to 10 m. of water.

*Cystoseira Abies-marina* is very often much infested by *Sphacelaria Hystrix*. It fructifies during the winter months, but what its development is during the summer is not known.

This species has been found by most investigators and is most probably common on all the islands.

Geogr. Distrib. Its occurrence seems to be restricted to the Makaronesian Islands.

### 3. *Cystoseira canariensis* Sauvageau.

SAUVAGEAU, C., A propos des *Cystoseira* de Banyuls et de Guéthary, p. 334.

*Cystoseira barbata* ex parte Mont. non al. MONTAGNE, Iles Canaries, 137.

I am much indebted to Professor SAUVAGEAU for having confirmed my determination of one of the specimens in my collection which I have referred to this species.

*Cystoseira canariensis* is a small, elegant plant growing in dense tufts. It reaches a height of about 4—12—14 cm. I have collected it in highlying rock pools near or somewhat above high water mark at Gran Canaria, and SAUVAGEAU found it in similar localities at Orotava. After having said that *Spyridia filamentosa* grows in the uppermost rock pools in which the water is renewed only in heavy sea, SAUVAGEAU continues: "Dans les flaques inférieures à celles-ci, couvertes par la marée, où plutôt dans des trous larges ne se vidant jamais et dont l'eau s'échauffe au soleil, se rencontre le *C. canariensis* parfois mélangé au *C. discors*, mais ce dernier vit de préférence à un niveau un peu plus bas où l'eau se renouvelle plus régulièrement."

As pointed out by SAUVAGEAU in p. 335, the *Cystoseira barbata* of MONTAGNE is this species. Regarding its occurrence MONTAGNE writes, l. c., p. 138: "Ad littora Canariensia non infrequens, imprimis verò rupibus maritimis adhaerens, promontorii *Punta de Teno* dicti in insulâ Teneriffâ fertilis lecta." Of the var. *pumila* Mont. l. c., p. 135 there seem to be no specimens in MONTAGNE's Herb. SAUVAGEAU has not seen it, and I have not seen any specimen of it either. As pointed out by SAUVAGEAU, p. 339—40 KÜTZING in Tab. Phycologicae, vol. X, p. 18 has published a diagnosis of *Cystoseira pumila* Mont. in litt. and in pl. 50,



fig. 1 he also gives a figure of it after a specimen in Herb. Sonder. Meanwhile, with regard to this figure, SAUVAGEAU writes, after having pointed out that it does not answer in several respects to the dwarf form of *Cystoseira canariensis*: "Autant que j'en puis juger, le *C. pumila* n'entre donc pas dans la synonymie du *C. canariensis*."

PICONE l. c. p. 30 mentions *Cystoseira barbata* var. *pumila* Mont. from isola Graciosa. It cannot be said without examination of a specimen whether this plant is referable to the above-mentioned species or not.

Gran Canaria: Playa de Santa Catalina and Christoballo near Las Palmas.

Teneriffe: Puerto Orotava (SAUVAGEAU), Punta de Teno (WEBB).

Geogr. Distrib. Canary Islands.

#### 4. *Cystoseira discors* C. Ag. emend. Sauv.

AGARDH, C., Species Algarum, vol. I, p. 62. SAUVAGEAU, C., A propos des *Cystoseira*, p. 287 and 402.

The specimens I collected in the month of January at Orotava seem to agree very well with SAUVAGEAU's description of specimens found by him there in the same month. These specimens are rather small and slender and are fructiferous only at the uppermost ends, and if aerocysts are present at all they only occur solitarily. On the other hand specimens collected in the month of March had much more developed receptacles and more numerous aerocysts, often 2—3 above each other.

*Cystoseira discors* grows somewhat above low water mark, as is pointed out by SAUVAGEAU, a little lower down than *Cystoseira canariensis*. In rock-pools it is able to grow somewhat higher up.

Teneriffe: Orotava (SAUVAGEAU,!). Gran Canaria: Playa de Santa Catalina (!), without locality but most probably near Las Palmas (VICKERS). MONTAGNE writes about its occurrence: "Ad littus Canariense circa urbem Palmarum lecta" and about var. *paniculata* Ag.: Ad rupes, in littoribus insulæ Canariæ, legit hancce varietatem cl. DESPRÉAUX.

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

### 5. *Cystoseira abrotanifolia* C. Ag.

AGARDH, C., Species Algarum, vol. I, p. 63. SAUVAGEAU, C., A propos des *Cystoseira*, p. 341 and 405.

SAUVAGEAU collected this species at Orotava where I found it too. Like SAUVAGEAU's specimens mine were also small and sterile. The largest specimens I gathered were found at the end of March at Gran Canaria; but these specimens were still sterile and without vesicles. A specimen collected at the end of April 1845 by BOURGEOU had begun to fructify, according to SAUVAGEAU.

As is pointed out by SAUVAGEAU this species grows somewhat below low water mark; in rock pools it is able to grow somewhat higher up.

Teneriffe: Orotava (HILLEBRAND, SAUVAGEAU,!), Garachico (BOURGEOU). Gran Canaria: Las Palmas (BOLLE), Playa de Santa Catalina, Bahia del Confital. Lanzarote: Isla Graciosa (D'ALBERTIS).

Geogr. Distrib. Mediterranean Sea; in the Atlantic from Cadiz southwards to the Canary Islands.

In addition MONTAGNE mentions, l. c. p. 138, *Cystoseira fibrosa* C. Ag. and *Cystoseira Thunbergii* Ag. as found at the islands according to SUHR and TURNER. But MONTAGNE points out that in the herbaria he has seen he has not met with any specimens of these plants from the Canary Islands. *Cystoseira fibrosa* has its area of distribution from Ireland down to Morocco, and so might perhaps also occur

at the islands. On the other hand, *Cystoseira Thunbergii* Ag. = *Cystophyllum Thunbergii* J. Ag. occurs in China and Japan, and it cannot therefore be expected to occur in the Atlantic.

## Sargassum Ag.

### 1. *Sargassum Desfontainesii* (Turn.) C. Ag.

C. AGARDH, Spec. Algar., p. 25. J. AGARDH, Spec. Alg., p. 339; Spec. Sarg. Austral., p. 55. GRUNOW, A., Additamenta ... Sargass., p. 48.

*Fucus Desfontainesii* Turner, Fuci, III, tab. 190.

*Sargassum comosum* Mont., Iles Canaries, p. 135. KÜTZING, Tab. phycol., vol. XI, tab. 35, I.

*Fucus comosus* Poir., Encycl. VIII, p. 375 (non vidi).

This species is easily recognisable by means of its linear, several times furcated leaves, with broadly rounded axils. In some specimens, especially small young ones, the leaves may become a little broader. On the other hand, I should think that the broad-leaved specimens with serrate margins which J. AGARDH mentions (l. c. p. 55) belong to the var. *linearifolium* of *S. vulgare* mentioned below. Some specimens of this variety collected by GELERT near Las Palmas, REINBOLD regarded simply as broad-leaved specimens of the present species, referring to J. AGARDH's description.

While some of the specimens are richly provided with vesicles, these are quite absent in others.

I have collected fructifying specimens in March.

I found the plant in rockpools, near low water mark or somewhat above it, in comparatively sheltered places.

Not having seen POIRET's above quoted paper, I refer the reader to J. AGARDH's remark, l. c. p. 340, regarding his

reasons for not having used POIRET's name, which is older than TURNER's.

In his posthumous work on *Sargassum* GRUNOW mentions several varieties and forms of this species as occurring at the islands; to this I refer the reader.

This species has been found at the islands by most investigators and seems to be common.

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

## 2. *Sargassum vulgare* C. Ag.

C. AGARDH, Spec. Algarum, vol. I, p. 3. J. AGARDH, Species Sargassorum Austr., p. 108. GRUNOW, Additamenta ad cognitionem Sargassorum, p. 39.

*Fucus natans* Turner, Fuci, p. 99, tab. 46.

var. *typica* Børgs., Mar. Alg. D. W. I., vol. I, p. 218, fig. 169.

Compared with specimens from the West Indies it seems to me that the plants of this variety from both sides of the Atlantic are very much alike each others. The leaves in the Canarian plants are perhaps proportionally a little longer and narrower and the vesicles a little larger than those of the West Indian plants.

var. *megalophyllum* (Mont.) Grun.

GRUNOW, l. c., p. 39. *Sargassum megalophyllum* Mont., Flore d'Algérie, n. 7, p. 1. KÜTZING, Tab. phycologicae, vol. XI, pl. 23, 2.

M<sup>lle</sup> VICKERS, l. c. p. 302, mentions this form from Gran Canaria, which comes very near to the forma *flavifolia*, but as pointed out by BORNET in Algues de Schousboe, p. 258 this variety is distinguished by the presence of spines on the branches, and as my specimens have smooth branches I refer them to f. *flavifolia*.

f. *flavifolia* (Kütz.) Grun., l. c. p. 40.

*Sargassum flavifolium* Kütz., Spec. Alg., p. 615; Tab. Phycolog. vol. XI., pl. 26.

The specimens referred to this variety were partly dredged at a depth of about 15 fathoms near Santa Cruz, Teneriffe, and partly collected near low water mark in a more sheltered place at Playa de Santa Catalina, Gr. Canaria.

The specimens dredged in deep water are especially very much like KÜTZING'S above quoted figure in Tabulæ. The branches are smooth, without spines. The leaves reach a length of 6—8 cm. or even more, and are about 4 mm. broad. They have a serrate-dentate margin. Many of the leaves are deeply divided several times. The cryptostomata are placed in rows along the midrib on both side of it.

The vesicles are not especially numerous; they have the size of a small pea. The stalk has the length of the diameter of the vesicle or a little longer.

The receptacles are small, irregularly ramified.

The dried specimens have a yellow-brown colour.

The specimens from shallow water are rather like this form, but the leaves are not quite so long, about 5—7 cm.; on the other hand they are a little broader, about 4—6 mm. The leaves have a serrate margin with long teeth. The cryptostomata are scarcer, and are not so regularly placed, in two rows as in the specimens from deep water.

Finally, in a high-lying rock pool in the same locality I collected a form with very narrow leaves, 1—2 mm. broad only. The leaves have otherwise the same shape, and are much and deeply divided. The cryptostomata are very few in number and often quite absent.

Most probably a specimen in MONTAGNE'S Herb. belonging to the Muséum d'Histoire Naturelle, Paris and called

*Sargassum fissifolium?*

„ *diversifolium*

belongs to this variety, but as it was collected several years after the publication of MORTAGNE's list in "Iles Canaries", it is of course of less value for the right understanding of *Sargassum fissifolium* Mont.

f. *fissifolia* (Kütz.) Grun.

GRUNOW, l. c., p. 40. *Sargassum fissifolium* Kütz., Tab. Phycolog., vol. XI, tab. 30, fig. 2.

A few specimens in my collection show some likeness to the fig. quoted above by KÜTZING. And this is even more the case with a specimen in MONTAGNE's Herbarium collected by WEBB at Gran Canaria and called *S. fissifolium* Montagne.

Also the *Sargassum linifolium* var. *amygdalifolium* Mont. mentioned by M<sup>lle</sup> VICKERS is most probably referable to this form; I have not seen her specimens. The true *S. linifolium* is, according to GRUNOW, only found in the Mediterranean Sea.

f. *leptophylla* Grun., l. c., p. 40.

This form was, according to GRUNOW, found at the Canary Islands by LIEBETRUTH. Perhaps the form with very narrow leaves mentioned above under *flavifolia* belongs to this form.

var. *lanceolata* J. Ag., Spec. Sargass. Austral., p. 108.

GRUNOW, l. c. p. 41. *Sargassum megalophyllum* var. *humile* Mont., Fl. Algérie, pl. 1, fig. 2.

According to GRUNOW this var. has been collected at the islands by ASKENASY.

f. *diversifolia* Grun., l. c., p. 41.

*Fucus diversifolius* Turner, Fuci, tab. 103.

The specimens referred to this form are all small, not reaching a height of about 10 cm. All the specimens are

sterile and lack vesicles. The characteristic feature of this form is, as is pointed out by TURNER and shown in his figure, that the leaves are deeply forked several times. The leaves have a serrate-dentate margin. This form is evidently to be regarded as a reduced form, adapted to live in exposed places. The specimens were all collected at Puerto Orotava.

var. *furcata* (Kütz.) J. Ag.

J. Agardh, Spec. Sargass. Austral., p. 108. GRUNOW, l. c., p. 43. *Sargassum furcatum* Kütz., Tab. Phycologicæ, vol. XI, tab. 32, fig. 2.

f. *humilis* Grun.

This form, according to GRUNOW, has been found at the Canary Islands by ASKENASY. It is not impossible that some of the small forms mentioned above under f. *diversifolia* are more rightly referable to this form.

Finally, among "Formae dubiae", GRUNOW mentions l. c. p. 45 var.? *glandulipes* Grun. as found at the Canary Islands (Herb. Bory).

*Sargassum vulgare* is a common species at the islands and has been found there by many investigators.

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

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