CONTRIBUTIONS FROM THE BERMUDA BIOLOGICAL STATION FOR RESEARCH.

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With Six Plates.

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Bermuda consists of a little group of islands of not more than twenty square miles of dry land, lying in latitude 32° 14′–32° 23′ north and longitude 64° 38′–64° 53′ west, about 700 miles southeast of New York, and 600 miles east of the coast of South Carolina. They are some three or four hundred miles south and east of the Gulf Stream. This situation accounts for the very marked uniformity as well as the mildness of the climate of the islands.

All of Bermuda now above sea level consists of limestone, from a fine sand to hard crystalline rock. The lime comes from the various organisms inhabiting the water, in part animal but more largely vegetable;[1] many of these lime-producing algae are included in the following pages, but Lithothamnium and its allies, stony algae belonging to the Florideae, which furnish the larger part of the material, we have not been able to include here. The fine powder formed from the remains of these various organisms is carried by the wind and spread out over the ground. Rainwater dissolves a certain amount of it, which when the water dries up is deposited and acts as a cement. Crystallization goes on more or less within the masses after formation, and so some parts become much harder than others. Erosion from rain or from the sea is continually going on, and its action being greater in the softer than in the harder parts, we have a great variety of fantastic forms along the shore, and many caves underground.

It has long been supposed that there was a core of solid rock under the limestone, but only recently have any definite data been obtained in regard to it. Pirsson, 1914, gives the particulars in regard to a boring made in the hope, which was not fulfilled, of obtaining a supply of fresh water. The boring was in Southampton parish, about a mile west of Gibbs Hill Lighthouse, 135 feet above sea level. To 380 feet

1 For a summary of the results of investigations as to the parts taken in the formation of "coral" islands, by animal and vegetable organisms, see Howe, 1912.

below the surface it was the ordinary soft limestone; then to 695 feet, earthy, decomposed lava, in the lower part of the range with fragments of solid lava, sometimes waterworn; then to 1413 feet, the lowest point reached, solid lava. Considering these data in connection with our knowledge of the present under-water Bermuda, the slope from the present island to the ocean floor, the conclusion is reached that a great volcanic cone was formed, perhaps in the early Eocene, with its summit where the present island is, rising about 11,000 feet above the sea. The 718 feet above the bottom of the boring and an unknown distance below consist of the unchanged lava of the cone; the 315 feet layer above this was produced by the disintegration of the upper part of the cone; the foraminifera found in the 380 feet of limestone indicate that its formation, by the same processes that are now at work, began before the end of the Eocene; while the occurrence of the limestone 245 feet, and the decomposed lava 560 feet below sea level, indicate a long-continued subsidence.

At the present time there are no bodies of fresh water on the islands; rain water sinks almost immediately into the porous soil, which is also honeycombed by large and small caves and passages; brackish water can be obtained at sea level anywhere, but strictly fresh water nowhere. A curious instance of this permeability was told us by Mr. Reid Trott, owner of the aquarium known as the Devil's Hole; this is on the shore of Harrington Sound, distant a quarter of a mile, rather high ground, from the south shore; in a southerly storm the surf is very heavy on the south shore, and white from the fine lime of the beaches; within a day or two the water in the aquarium becomes milky. The only visible outlet of Harrington Sound is by the narrow passage at Flatts Bridge; but though the rise and fall of the tide in the Sound is only a few inches, it has been calculated that it represents a flow through unseen passages of much more than passes under the bridge. Devonshire Marsh forms a sort of bowl, with higher ground on all sides; surface drainage into this fills the ditches with practically pure fresh water after rains, but it soon disappears, and only a few species of fresh water algae are able to avail themselves of the short opportunity.[2]

A few species of "Fucus" are mentioned by Turner, Icones Fucorum, 1808–1819, but actually our knowledge of the algae of Bermuda

2 A * is placed before the name of each fresh water or terrestrial species listed, including some Myxophyceae found here within range of tides, though not normally marine.

begins with the list published in the Canadian Naturalist by the Rev. Alexander F. Kemp (Kemp, 1857), who visited the islands in 1856 and collected somewhat extensively. Sixteen years later J. J. Rein, who had been a tutor in an English family at Bermuda, published two papers on the vegetation of the islands, one of them with a list of the algae (Rein, 1873). In 1881 Prof. W. G. Farlow made quite extensive collections, and some of the material obtained was distributed in the set of exsiccatae, Farlow, Anderson & Eaton, Algae Exsiccatae Boreali-Americanae. At a later visit, in 1900, Farlow collected additional species, a few of which were distributed in Collins, Holden & Setchell, Phycotheca Boreali-Americana, but otherwise no publication has been made of the material collected by him. The Challenger Expedition visited Bermuda, and the results are given in a preliminary paper (Dickie, 1874) and in a volume of the Results of the Challenger Expedition. In these are included the species listed by Kemp and Rein and those distributed by Farlow, with comparatively few additions. In the Journal of Botany George Murray published a Catalogue of West Indian marine algae (Murray, 1889), including in it the Bermuda lists above mentioned; noting that Bermuda did not belong to the West Indies, geographically or politically, but might be considered as having a similar flora. Setchell, 1912, is a paper calling attention to several species in the Farlow herbarium. Longer or shorter lists of algae occur in local publications, traveller's guides etc., but based on the papers above noted, and adding nothing to what is found in them. Occasional references to Bermuda occur in general works, but only as citations from the works mentioned, or referring to some specimen collected by Farlow.

Through the kindness of Mrs. Jane A. Sutherland, daughter of Mr. Kemp, we have been able to examine his collection, which still includes nearly all the species listed by him. Professor M. Möbius very kindly sent us for examination the Rein algae, now preserved in the collection of the Senckenbergischer Gesellschaft at Frankfurt a/m.; by the favor of Dr. D. Prain, Director of the Royal Botanic Gardens, Kew, we have examined specimens of the species added by the Challenger expedition; and Professor Farlow has given every facility for the study of his rich material, including beside his own collecting, specimens collected by G. Tucker in 1856 and Walter Faxon in 1882. In the collection of one of the writers is a considerable number of algae collected in 1890 by W. S. Wadsworth.[3] Miss Wilkinson of Ripleigh,

3 A similar set is in the herbarium of the University of California.

Hamilton, has kindly allowed us to refer to an interesting collection she has made, and we are also much indebted to her for information as to stations of some of the rare species. In 1882 Miss Kate Peniston, now Mrs. Matthews, sent one of us some algae from the Harrington Sound region; comparatively few specimens, but including some of much interest. Several species from Bermuda are recorded by Dr. M. A. Howe in his papers in the Bulletin of the Torrey Botanical Club, and some of them have been distributed in the Phycotheca Boreali-Americana. An occasional specimen from some other collector will be noted in its appropriate place. Collections were made by ourselves in the years from 1911 to 1917, during which period one or the other of us has been in Bermuda rather more than half of the time, collecting in practically all parts of the islands and in all months except June. While future additions are of course to be expected, we think that the main characters of the algal flora are fairly settled, and the greater part of the species determined. A special effort has been made to distribute in the Phycotheca Boreali-Americana as full a representation as possible of Bermuda algae, and fascicles XXXVIII, XXXIX, XLI, XLII and XLIV consist entirely of specimens from the islands.[4] We have distributed in this way every species of which sufficient material was available.

A number of new species are described and figured in the following pages, and we have tried to give all details of value in regard to them. In case of other species, whenever we could add anything to previous knowledge of them, we have tried to do so, but no full descriptions have been given except for new species, varieties etc. Concise keys however, have been furnished, and we think will prove useful. We have been rather full in notes as to character of station, as this is something sadly lacking in many floras. Exact localities have been given, for the aid of future students, and the date of collecting is given by month, but it has not seemed necessary to give the year. No full synonymy is given, but pains have been taken to give for each species the proper name under the international rules; the original name, if published under another genus; and when possible reference to a good figure. Whenever specimens from Bermuda have been distributed in the Alg. Am.-Bor. Exsicc. or in the P. B.-A., reference is given by number. Other references are given in cases

[4] A set of these fascicles will be found at the Bermuda Agricultural Station, to whose Director, Mr. E. J. Wortley, we are indebted for many kindnesses during our visits to the islands.

where it seemed desirable, especially from distinctively American works, like Harvey, Nereis Boreali-Americana and Börgesen, The Marine Algae of the Danish West Indies. The latter is specially useful in connection with the present work, being a careful study of the marine flora of a small group of islands, of character not unlike Bermuda, though somewhat farther south. As Börgesen's work is still incomplete as this paper goes to press, full comparisons are not yet possible.

We had hoped to publish with the present paper somewhat full comparisons of the floras of Bermuda and other regions, but the list for the Danish West Indies, perhaps the most instructive, is not fully available. We have reluctantly had to omit from our list the families Rhizophyllidaceae, Squamariaceae and Corallinaceae; without careful study of the types any conclusions in these critical families would be uncertain, and in the present European conditions such study has not been practicable. In view of this we have made only a short statement, by classes, showing the percentage of the Bermuda species common to nine of the best known regions where a similarity might be expected. If later we are in position to take up the families now omitted, and a full account of the algae of the Danish West Indies is available, the proposed full comparison may be made. In the present comparison we have not included the Class Myxophyceae; first because the species of this class are largely cosmopolitan, second because in many regions where the other classes are fairly well known, the Myxophyceae have been little studied. We have considered a species as common to two regions, though represented by different forms or varieties in each; pelagic species, known only as washed ashore, have not been included.

Percentage of Bermuda algae represented in other floras.

	Chlorophyceae	Phaeophyceae	Rhodophyceae	Total
Great Britain	28	34	26	27
N. and NW. France	24	30	26	25
Bay of Biscay	11	20	25	18
Mediterranean	29	34	33	31
Canaries	19	28	23	21
New England	22	24	16	19
Florida	32	43	44	40
Jamaica	38	63	32	41
Barbados	33	41	32	33

The nine regions used in the above comparison are not equally well known; the affinity to an intensively studied region like Great Britain is somewhat overstated, that to a less thoroughly studied region, like the Canaries, understated; but some general indications may be obtained. Perhaps the most striking is the distinctness of the Bermuda flora, having only 41 per cent in common with Jamaica, and not so much in common with any of the others. Taking the three classes represented, there is only one in which more than half the species are common to another region, again Jamaica, which has 63 per cent of the Bermuda brown algae. Taking all the regions, the similarity is greatest in the brown algae, least in the green. The affinities of the Bermuda flora are evidently strongest with the Florida-West India region, next with the Mediterranean, and after that with more northern localities. New England has probably the least in common with Bermuda of all the regions compared, its slight numerical superiority over the Canaries being probably due to the less thorough exploration of the latter.

The following list of important stations, with indication of the characters of each, will, we think, be of use to future collectors; in a region where the coast line is so long in proportion to the surface area, many such stations must exist, but we think we have listed the more important ones.

In this list of stations we aim to conduct our readers around the whole island and point out the places where we have found certain forms of algae most common. Driven in on all sides by the winds one will find abundance of *Sargassum natans* "gulfweed" of which the farmers make so profitable use as a fertilizer. This grows in mid-ocean and is never found attached to the shores. Other species of the same genus are found growing all about the island along with other litoral plants. Many other forms such as *Ulva, Bryopsis, Caulerpa, Codium, Laurencia, Dictyota, Padina, Spyridia* etc. will be found almost everywhere, and so will not require special mention. We will start from Hamilton, going west to Fairyland and Grasmere; there we shall find shallow water and abundance of plants. Breaking into the land opposite Agar's Island is a large bay; as we first come to it on our left we shall find a large growth of mangrove trees among the roots of which in shallow water we will find abundance of the endemic *Halymenia bermudensis,* the loose, small form. Farther along in front of a cottage is rich collecting ground; another of the new plants, *Chondria curvilineata* occurs here, and very large masses of *Valonia macrophysa;* a larger form of the *Halymenia* was gathered in abundance

in a little bay that comes up in front of the Grasmere Hotel. Beyond the hotel is a water called Mangrove Creek, lying between the hotel and Spanish Point, where good collecting may be had. At the extreme end of Spanish Point are two little bays, the larger of which is called Stovel Bay; this furnished good specimens of *Dudresnaya crassa* and Liagoras in the spring. It is well to make a careful search all about Spanish Point as far east as the Admiralty House. Beyond that as far as the Ducking Stool the shore is for the most part high and precipitous, and we did not find much to reward the climb down and up; but coming in a boat one finds a fairly rich flora, *Liagora* etc., at the base of the cliffs.

From the Ducking Stool to the Inlet of Harrington Sound most of the collecting was of the smaller forms, some of them microscopic. At one point, perhaps half a mile from the Inlet, was found at one time an abundance of *Coelarthrum Albertisii*, as it was also on the outer point of the Gibbet Islands. These two islands and the little beaches on either side, being near our place of abode, were carefully studied, and yielded from time to time several interesting things, among them the new *Lophosiphonia Saccorhiza*, growing on a *Codium; Halymenia Agardhii* and *Antithamnion cruciatum* var. *radicans* also occurred here. The Inlet of Harrington Sound is good collecting ground for several species; on the south side is plenty of *Ceramium nitens*, and on the wall of the Frascati Hotel may be found at all times a fine growth of *Callithamnion Halliae; Heterospora Vidovichii* also grew on this wall, and *Avrainvillea nigricans* grows buried in the mud in the lower part of the Inlet. Over on the north side in the shallow water one may find abundance of *Udotea* and *Penicillus*. Within the Sound near the bridge is always an abundance of *Wrangelia penicillata*, and always also *Griffithsia tenuis;* in Tucker's Bay at the west end of the Sound we first found *Neomeris annulata*, afterwards found at several other stations; farther to the north, in Major's Bay, were two or three species of *Bryopsis*. At the farther end of the Sound in a little cove near Walsingham House, called Dingle Bay, we found rich collecting; it is the best station for characteristic *Hypnea musciformis* and for *Champia parvula*, rare in Bermuda, and the only station for the new *Dasya spinuligera*, also the original station for *Nitophyllum Wilkinsoniae;* on the south side of the Sound we found our best growth of *Acetabularia crenulata* in a little pool near the chapel; the species is common in many other places, however; the shores of the Sound everywhere abound in species of *Bryopsis* and *Laurencia*.

About a mile north of Flatts Village we come to Shelly Bay, a fine

famous as a rich station; here in a single day in 1881 Farlow found *Dudresnaya caribaea, D. bermudensis, Calosiphonia verticillifera* and *Kallymenia perforata,* none of which except the second have been found in Bermuda since; we have made several visits to the island in the hope of finding them, but in vain, but each trip was rewarded by unexpected good things.

From Tucker's Town way along the South Shore to Ely's Harbor, a distance of some fifteen miles, the shore presents an alternation of long beaches and high precipitous rocks, with but here and there a bay where one can collect algae. The reef runs along parallel to the shore, from a quarter to a half a mile outside. There are two or three little bays in Southampton which we have not explored; but we have found that the flora of the west end of the island is not nearly as rich as that of the east end. On the south shore east of the meridian of Hamilton are a few bays that should be mentioned; these are in the neighborhood of Devil's Hole, viz., Pink Bay, Smith's Bay and Gravelly Bay; a reference to the text will show what plants have been collected in these localities; special attention is called only to the last of the three, Gravelly Bay. It is not more than a quarter of a mile across the island from Devil's Hole; it has proved a remarkably fertile place; it is the only station where we have found *Gracilaria horizontalis, Turbinaria tricostata* and *Dilophus guineensis,* though the latter was found by Farlow in Paget. The place is rich in several species of *Dictyota,* also in *Zonaria lobata* and *Dictyopteris Justii* in their seasons. Here also we first found *Trichogloea Herveyi,* and we have found it there every season since; a little cave near the bay has yielded a number of species, rarely found elsewhere.

About a mile farther along towards the west we come to what is known as Spanish Rock; here at the foot of a high precipice, *Colpomenia sinuosa* and *Hydroclathrus cancellatus* cover the rocks, and may be collected at low tide; another mile along in the same direction we come to Harris Bay, another good station; here several species of *Spyridia* and *Liagora* abound, also two species of *Sphacelaria, Wrightiella Blodgettii, Digenea simplex* and others; it is the only station for *Udotea conglutinata* and *Rosenvingia intricata.* Devonshire Bay just beyond we did not find very productive, but a mile and a half farther on is Hungry Bay, which will reward several visits at different seasons; Dictyotas and Dictyopteris abound here in summer, and in the tidal creek Howe collected *Acicularia Schenckii,* the only time it has been found in Bermuda; in this creek also is excellent *Ernodesmis verticillata. Geminella scalariformis* forma *marina* was found in a pool in the rocks on the west side of the bay.

Ely's Harbor and Mangrove Bay towards the west end of the group are noted for nothing in particular, but are by no means barren; in the former we found a better growth of *Porphyra atropurpurea* than elsewhere. Now crossing the land to the shore on the inside of the great hook that this end of the group makes, and going along to the neighborhood of Gibbs Hill light, we come to Jew's Bay and Heron Bay, in both of which good collecting may be had, especially in the latter, with its shallow still water and sunny exposure; we found it very fertile with several species of *Gracilaria, Laurencia, Spyridia, Chondria curvilineata* and other things. Coming back to Hamilton we may find something at Salt Kettle. The wall of the quay at Hamilton below low tide is well covered with algae, and a big timber float lying there yielded a rich harvest of *Polysiphonia foetidissima*. This brings us round to the point of beginning.

Class **MYXOPHYCEAE**.

Family CHROOCOCCACEAE.

Chroococcus Nägeli.

1. Cells 3–8 μ diam., 1. C. membraninus.
1. Cells 13–25 μ diam. 2. C. turgidus.

*1. C membraninus (Menegh.) Nägeli, 1849, p. 46; P. B.-A., No. 2151; *Pleurococcus membraninus* Meneghini, 1842, p. 34, Pl. IV, fig. 1. In brackish pool near race course, Aug.; in ditch in South Shore marshes, Sept., Collins. In the material from the locality first named the cells were dividing rapidly, and average smaller than in P. B.-A., No. 1201, about like Wittrock, Nordstedt & Lagerheim, No. 1538. Sometimes the division of the cells goes on so much faster than the separation of families that a mass resembling a *Microcystis* is formed.

2. C. turgidus (Kütz.) Nägeli, 1849, p. 46; *Protococcus turgidus* Kützing, 1845–49, p. 5, Pl. VI, fig. 1. In gelatinous masses in brackish pools, and in films on decaying algae near Flatts Bridge, April, Collins.

Synechocystis Sauvageau.

* S. aquatilis Sauvageau, 1892a, p. CXVI. On rocks near Hungry Bay, April; in cave, Agar's Island, Aug., Collins.

Synechococcus Nägeli.

* S. aeruginosus Nägeli, 1849, p. 56, Pl. I. E, fig. 1. Among other algae in brackish pool near race-course, Aug., Collins. Cells about 14 $\times$ 7 μ, which is rather small for this species.

Chroothece Hansgirg.

1. Cells seldom under 20 μ diam. 1. C. Richteriana.
1. Cells not over 3 μ diam. 2. C. cryptarum.

1. C. Richteriana forma marina Hansgirg, 1889, p. 5; P. B.-A., No. 702. Farlow; rather common on shaded stone work and on sides of caves, Collins.

2. C. CRYPTARUM Farlow in P. B.-A., No. 752; Forti, 1907, p. 30. Farlow; on walls and roofs of caves, often in company with *C. Richteriana*. *Gloeothece rupestris* often occurs in company with these two species, the whole forming a continuous stratum, generally one or two mm. thick, extending from just above low water mark to much above high water mark. Between tide marks it is a rich green and gelatinous, but beyond the range of tides it is yellowish or whitish and crumbly.

GLOEOCAPSA Kützing.

1. Cell without wall, 1.5–2 μ diam.; tegument yellow or brown. 1. G. fusco-lutea.
1. Cell without wall, over 2 μ diam.; tegument colorless or nearly so. 2.
2. Colony amorphous, soft; cell without wall, 2–5 μ diam. 2. G. montana.
2. Colony subspherical, firm; cell without wall, 4–6 μ diam. 3. G. atrata.

*1. G. FUSCO-LUTEA (Näg.) Kützing, 1849, p. 224; P. B.-A., No. 2153. *G. ambigua* var. *fusco-lutea* Nägeli, 1849, p. 50. On rocks, Hungry Bay, in company with *Synechocystis aquatilis*, April, Collins. The color of the tegument varies from dark brown to pale yellow.

*2. G. MONTANA Kützing, 1843, p. 173; 1845–49, p. 14, Pl. XIX, fig. 2. On wall of cave near Causeway, high up, April, Collins.

*3. G. ATRATA (Turp.) Kützing, 1843, p. 174, Pl. VI, fig. 1; *Globulina atrata* Turpin, 1830, Pl. V, fig. 6. On cliff, away from the sea, in company with *Scytonema* etc., Aug., Collins. The colonies are usually quite regularly spherical; they range from about 30 μ diam., containing only two cells, to above 140 μ diam., with hundreds of cells. The contents is bright green, somewhat granular; the surface inside the wall is usually thickly set with very short, bristle-like projections; bacterial?

GLOEOTHECE Nägeli.

1. Cell without tegument, about 2 μ wide. 1. G. confluens.
1. Cell without tegument, about 5 μ wide. 2. G. rupestris.

*1. G. CONFLUENS Nägeli, 1849, p. 58, Pl. I. G, fig. 1. On wall of shallow cave, by inland road, April, Collins.

*2. G. RUPESTRIS (Lyng.) Bornet in W. & N., No. 399, 1880; *Palmella rupestris* Lyngbye, 1819, p. 207, Pl. LXIX, fig. D; *G. membranacea* Bornet, 1892, p. 175. Common all about the islands in

clefts of rocks, rock pools, roadsides, within reach of salt water or far from it. As noted by Bornet, 1892, p. 175, it varies much in the appearance of the stratum, from thick gelatinous masses to thin films, also in the development of the concentric walls; in a rock pool of fresh water, near the Old Ferry road, we collected a form quite without these walls, closely resembling *Aphanothece microscopica*, P. B.-A., No. 552; but it seems probable that it is merely a state of the present species corresponding to Bornet's section I, in which he includes *Microcystis microspora* Menegh. This form distributed as P. B.-A., No. 2154. Lyngbye's specific name, used by Bornet in 1880, is the oldest, and must supersede the name used by Bornet in 1892.

Entophysalis Kützing.

E. granulosa Kützing, 1843, p. 177, Pl. XVIII, fig. 5; Bornet & Thuret, 1876, Pl. I, figs. 4 & 5. On rocks, North Shore, Aug., Collins.

Microcystis Kützing.

*M. marginata (Menegh.) Kützing, 1845–49, p. 6, Pl. VIII; *Anacystis marginata* Meneghini, 1836, p. 6; 1842, p. 93, Pl. XIII, fig. 1. With other algae on wall of cave near Causeway, April, Collins.

Merismopedium Meyen.

1. Families 50–150 μ square. 1. M. glaucum.
1. Families 1–4 mm. square. 2. M. convolutum.

*1. M. glaucum (Ehrb.) Nägeli, 1849, p. 55, Pl. I. D, fig. 1; *Gonium glaucum* Ehrenberg, 1838, p. 56, Pl. III, fig. 5. Among other algae in pool by race course, Aug., Collins.

*2. M. convolutum Brébisson in Kützing, 1849, p. 472; 1855, p. 13, Pl. XXXVIII, fig. IX. Among various algae in Harrington Sound; in cave at Gravelly Bay, Jan., Hervey.

Oncobyrsa Agardh.

O. marina (Grun.) Rabenhorst, 1865, p. 68; *Hydrococcus marinus* Grunow, 1861, p. 420. On *Dictyopteris Justii*, Gravelly Bay, Aug., Collins; on *Sphacelaria*, Spanish Rock, March, Hervey.

Chlorogloea Wille.

C. tuberculosa (Hansg.) Wille, 1900, p. 5, Pl. I, figs. 1–6; *Palmella ? tuberculosa* Hansgirg, 1892, p. 240, Pl. VI, fig. 9. On *Bostrychia, Catenella* etc., in company with other minute Myxophyceae.

Family CHAMAESIPHONACEAE.

Pleurocapsa Thuret.

P. conferta (Kütz.) Setchell, 1912, p. 229; *Palmella conferta* Kützing, 1845, p. 149; 1845–1849, p. 12, Pl. XVI, fig. IV. On *Rhodochorton spelunearum,* in cave, Agar's Island, Aug.; on *Gelidium pusillum,* Harrington Sound, April, Collins.

Hyella Bornet & Flahault.

H. caespitosa Bornet & Flahault, 1888a, p. 162; 1889, p. CLXV, Pl. X, figs. 7–8, Pl. XI. In dead shells, in company with *Gomontia, Mastigocoleus* and *Plectonema,* but usually the least abundant of the four.

Dermocarpa Crouan.

1. Cells scattered. 1. D. solitaria.
1. Cells laterally united in pulvinate expansions. 2. D. prasina.

1. **D. solitaria** sp. nov.; P. B.-A., No. 2155. Cellula solitaria, clavata, circa 8 μ diam., supra discum basale paullo majus; superne uniformiter incrassata, vel interdum prope basin parvam expansionem annulatam ferente, usque ad apicem rotundatam, circa 20 μ diam.; longitudine ad 75 μ; ad maturitatem in duas cellulas divisa, superiore in gonidangium subsphaericum mutanda, gonidia pro more 8–12, 5–6 μ diam., continente; cellula inferiore obconica, supra plana vel concava, contentu laete aeruginoso; membrana crassa, sublamellosa.

Cell solitary, clavate, about 8 μ diam. above the slightly larger basal disk, increasing in diameter upwards uniformly, or sometimes with a slight ring-like expansion near the base, to the rounded apex, about 20 μ diam.; height up to 75 μ. At maturity dividing into two cells,

the upper a subspherical gonidangium, containing gonidia, 5–6 μ diam., usually 8–12 in number; the lower cell obconical with flat or concave upper surface, contents bright blue-green; wall thick, somewhat lamellate.

On older parts of fronds of *Spermothamnion gorgoneum* and *Ceramothamnion Codii*, which grew on *Codium decorticatum*, in company with *Xenococcus Schousboei*, *Lyngbya Meneghiniana* and other small algae. The cells are always scattered, never forming cushion-like masses, as is the case with most species of *Dermocarpa*. The general appearance of the plant is not unlike that of some small species of *Codiolum*, except for the shade of color, and that the colorless stipe is shorter.

2. D. PRASINA (Reinsch) Bornet & Thuret, 1876, p. 75, Pl. XXVI; P. B.-A., No. 2051. *Sphaenosiphon prasinus* Reinsch, 1875, p. 73, Pl. XII. Not *D. prasina* P. B. A., No. 1, which is *D. Farlowii* Börgs. On *Catenella Opuntia* var. *pinnata* generally.

XENOCOCCUS Thuret.

X. SCHOUSBOEI Thuret in Bornet & Thuret, 1880, p. 74, Pl. XXVI, figs. 1–2; P. B.-A., No. 2052. On *Lyngbya confervoides*, in ditch back of Shelly Bay, Aug., Collins. Cells mostly separate and exactly spherical; but sometimes closely packed and compressed.

Var. PALLIDA Hansgirg, 1889, p. 5. On algae on roof of cave, Gravelly Bay, April, Collins. What may be a species of *Xenococcus* with minute cells was found on *Oedogonium* from Devonshire marshes, but could not be specifically identified.

FAMILY OSCILLATORIACEAE.

SPIRULINA Turpin.

1.	Trichome rose-color.	1. S. rosea.
1.	Trichome aeruginous.	2.
2.	Trichome less than 1 μ diam., spiral loose.	2. S. tenerrima.
2.	Trichome over 1 μ diam., spiral close.	3. S. subsalsa f. oceanica.

1. S. ROSEA Crouan ex Gomont, 1893, p. 273. Forming a pinkish film on *Amphiroa* between tide marks, North Shore, Sept., Collins.

*2. S. TENERRIMA Kützing ex Gomont, 1893, p. 272; Kützing,

1845–49, p. 25, Pl. XXXVII, fig. I; P. B.-A., No. 2054. Among other algae in a coating on rock between tide marks, North Shore, Sept., Collins.

3. S. SUBSALSA forma OCEANICA Gomont, 1893, p. 274; P. B.-A., No. 2053. Among other algae at various stations.

OSCILLATORIA Vaucher.

1. Filaments torulose.	2.
1. Filaments not torulose.	6.
2. Trichomes 18–36 μ diam., loosely spiral.	1. O. Bonnemaisonii.
2. Trichomes not spiral.	3.
3. Trichomes and stratum dull red.	2. O. miniata.
3. Trichomes and stratum not red.	4.
4. Limicolous; trichomes 17–29 μ diam.	3. O. margaritifera.
4. Trichomes 6–11 μ diam.	5.
5. Limicolous or saxicolous; black-olive.	4. O. nigro-viridis.
5. Epiphytic; aeruginous, light green or light brown.	5. O. Corallinae.
6. Trichomes not attenuate at tip.	7.
6. Trichomes attenuate at tip.	8.
7. Trichomes 4–10 μ diam.	6. O. tenuis.
7. Trichomes less than 3 μ diam.	7. O. amphibia.
8. Apical cell capitate.	8. O. amoena
8. Apical cell not capitate.	9.
9. Trichomes 3 μ diam. or more.	10.
9. Trichomes less than 3 μ diam.	11. O. longearticulata.
10. Distinctly marine.	9. O. laetevirens.
10. Plant of fresh water pools.	10. O. formosa.

1. O. BONNEMAISONII Crouan ex Gomont, 1893, p. 235, Pl. VI, figs. 17–18; P. B.-A., No. 2055. Forming floating masses in ditch in Pembroke Marsh, Aug., Collins.

2. O. MINIATA Hauck ex Gomont, 1893, p. 236; P. B.-A., No. 2156. Hungry Bay, April, May, Collins. Forming a deep red film on the bottom, also floating clots adhering to everything. The filaments are usually about 20 μ diam., but occasionally as high as 45 μ. The plant decays very quickly, and even when put on paper with a promptness ample for most Oscillatorias, the coloring matter stains the paper purple, and the filaments remain nearly colorless.

3. O. MARGARITIFERA Kützing ex Gomont, 1893, p. 236, Pl. VI, fig. 19. In brackish pool with other algae, April, Sept., Collins.

4. O. NIGRO-VIRIDIS Thwaites ex Gomont, 1893, p. 237, Pl. VI, fig. 20. On rocks wet by salt water, Jan., Farlow.

5. O. CORALLINAE Gomont, 1893, p. 238, Pl. VI, fig. 21. On *Codium tomentosum*, Cooper's Island, April, Collins.

*6. O. TENUIS Ag. var. TERGESTINA Rabenhorst ex Gomont, 1893, p. 241. Among other algae in a ditch in meadow by Shelly Bay, Aug., Collins.

*7. O. AMPHIBIA Gomont, 1893, p. 241, Pl. VII, figs. 4–5; P. B.-A., No. 1852. In brackish pool among other algae, April, Aug., Collins.

*8. O. AMOENA Gomont, 1893, p. 245, Pl. VII, fig. 9. Forming a thin coating on rock at Inlet, Aug., Collins.

*9. O. LAETEVIRENS Crouan ex Gomont, 1893, p. 246, Pl. VII, fig. 11. Among other algae, Tucker's Town, May, Collins.

*10. O. FORMOSA Bory ex Gomont, 1893, p. 250, Pl. VII, fig. 16. In a puddle of rain water in road, April, Collins.

11. O. LONGEARTICULATA Hansgirg ex Forti, 1907, p. 176. On *Codium*, near Causeway, April, Hervey. We have not seen an authentic specimen of this species, but our plant agrees with the original description, with no description in Gomont, and with none but this in Forti.

TRICHODESMIUM Ehrenberg.

T. THIEBAUTII Gomont, 1893, p. 217, Pl. VI, figs. 2–4; Wille, 1904, p. 57, Pl. I, figs. 17–22. Hamilton Harbor, Wille, l. c.[6]

PHORMIDIUM Kützing.

1. Trichomes strongly moniliform.	1. P. fragile.
1. Trichomes not moniliform.	2.
2. Stratum purple or pink.	2. P. luridum.
2. Stratum greenish or blackish.	3.
3. Trichomes 3 μ diam. or less.	3. P. valderianum.
3. Trichomes 4–12 μ diam.	4. P. Retzii.

1. P. FRAGILE Gomont, 1893, p. 183, Pl. IV, figs. 13–15. Among other algae in an incrustation in rock between tide marks, April, Collins.

*2. P. LURIDUM Gomont, 1893, p. 185, Pl. IV, figs. 17–18; P. B.-A.,

[6] *Catagnymene pelagica* Lemmermann var. *major* Wille, 1904, p. 51, pl. I, fig. 7, is reported by Tilden, 1910, p. 159, as occurring at Bermuda, but we are unable to obtain any confirmatory evidence. Wille, l. c., reports it from open sea, at several points. *Dermocarpa Leibleinii* (Reinsch) Bornet var. *pelagica* Wille, also appears in Tilden, 1910, p. 55, as from Bermuda, on authority of Wille, 1904, p. 50; but Wille's record is 39° 4′ N., Long. 57° 8′ W., "ungefahr in der Mitte zwischen den Bermuda-Inseln und New Foundland."

No. 2056. Forming a pinkish film over rocks between tide marks, North Shore, Aug., Collins.

*3. P. VALDERIANUM Gomont, 1893, p. 187, Pl. IV, fig. 20; P. B.-A., No. 2157. Among other algae in a blackish coating on rocks and on *Bostrychia*, Aug. In thick wrinkled sheets on brackish water, near old race course Dec. Collins.

*4. P. RETZII Gomont, 1893, p. 195, Pl. V, figs. 6–9; P. B.-A., No. 2057. Forming a light green, firm coating on rock between tide marks, North Shore, Sept., Collins.

LYNGBYA Agardh.

1. Filaments attached at the middle. 1. L. Meneghiniana.
1. Filaments attached at one end or free. 2.
2. Trichomes over 5 μ diam., usually over 7 μ. 3.
2. Trichomes 4 μ diam. or less, seldom over 3 μ. 5.
3. Trichomes 16–60 μ diam., dissepiments not granulate. 2. L. majuscula.
3. Dissepiments granulate. 4.
4. Trichomes 9–25 μ diam., apex not attenuate nor capitate. 3. L. confervoides.
4. Trichomes 5–12 μ diam., apex usually attenuate and capitate. 4. L. semiplena.
5. Trichomes 2.5–4 μ diam., straight or flexuous, not regularly spiral. 5. L. lutea.
5. Trichomes about 2 μ diam., more or less spiral. 6. L. Lagerheimii.

1. L. MENEGHINIANA Gomont, 1893, p. 145. Mangrove Creek, Farlow; on Codium, Cooper's Island, Collins; Gibbet Island, March, Hervey. The only representative here of the subgenus *Leibleinia*, the filaments bent hairpin-shape, attached in the middle, both ends free.

2. L. MAJUSCULA Harvey ex Gomont, 1893, p. 151, Pl. III, figs. 3–4; Harvey, 1858, p. 101, Pl. XLVII. A; P. B.-A., No. 2001. Rein; Moseley; Walsingham Grotto, March, Alden Fish pond, Dec., Hervey. Usually blackish green, occasionally reddish or violet.

3. L. CONFERVOIDES Agardh ex Gomont, 1893, p. 156, Pl. III, figs. 5–6; including forma *violacea* Collins, P. B.-A., No. 1853. Common in floating masses in quiet waters, as attached tufts in more exposed places, nearly everywhere. A brownish or yellowish green is the more usual color, but violet and reddish shades are not uncommon. These are in striking contrast to the normal color, but from our observations on the species of *Lyngbya* found at Bermuda, we are

of the opinion that there is no justification for keeping color forms distinct taxonomically. Both colors occur in nature, both in dried material; plants originally aeruginous may change to red, plants originally red fade to pale green. We have no suggestion to make as to the causes determining these changes, except the general principle in regard to filamentous Nostocaceae, that red forms generally occur where the plant is always under water, not left exposed at low tide.

4. L. SEMIPLENA J. G. Agardh ex Gomont, 1893, p. 158, Pl. III, figs. 7–11. Not uncommon among other small algae; rarely pure.

5. LYNGBYA LUTEA Gomont, 1893, p. 161, Pl. III, figs. 12 & 13. Among various small algae, not found pure; bright red form on *Codium*, Harris Bay, Dec., Hervey.

*6. L. LAGERHEIMII Gomont, 1893, p. 167, Pl. IV, figs. 6–7. On decaying *Sargassum*, near Shelly Bay, April, Collins.

SYMPLOCA Kützing.

1. Cells 1–2 diam. long, aeruginous. 1. S. muscorum.
1. Cells much shorter than their diam., violet. 2. S. violacea.

*1. S. MUSCORUM Gomont, 1893, p. 130, Pl. II, fig. 9. On rock by roadside, Aug., Collins.

2. S. VIOLACEA Hauck ex Forti, 1907, p. 311; Hauck, 1885, p. 507, fig. 224. On ground near margin of pool in woods by Walsingham, April, Collins. This appears to have been overlooked by Gomont in his monograph either as an accepted species or among "species inquirendae" or "species excludendae." Hauck's record is included by Forti in the Sylloge, and by the international rules, which fix Gomont's monograph as the point of departure for homeocysted filamentous Nostochineae, 1907 is the date of publication. The Bermuda plant agrees with Hauck's description and figure; the violet color and short cells distinguish it from all other marine species.

PLECTONEMA Thuret.

*P. NOSTOCORUM Bornet ex Gomont, 1893, p. 122, Pl. I, fig. 11. Common in gelatinous masses of algae of various kinds.

PORPHYROSIPHON Kützing.

*P. NOTARISII Kützing ex Gomont, 1893, p. 69, Pl. XII, figs. 1–2. On *Juniperus bermudiana*, Aug., Collins.

Microcoleus Desmazières.

1. Terrestrial. 3. M. vaginatus.
1. Marine. 2.
2. Trichomes 2.5–6 μ diam. 1. M. chthonoplastes.
2. Trichomes 1.5–2 μ diam. 2. M. tenerrimus.

1. M. CHTHONOPLASTES Thuret ex Gomont, 1893, p. 91, Pl. XIV, figs. 5–8; P. B.-A., No. 1854. Common among other small algae in incrustations on rocks, and on bottoms of shallow pools; occasionally nearly pure, as a thin, blackish coating; also in fresh water reservoir near Spanish Rock, Hervey.

2. M. TENERRIMUS Gomont, 1893, p. 93, Pl. XIV, figs. 9–11. Occasional filaments among *M. chthonoplastes*, less commonly among other small algae.

*3. M. VAGINATUS var. MONTICOLA Gomont, 1893, p. 94. On moist ground at roadside near Flatts Bridge, Dec., Hervey.

Hydrocoleum Kützing.

1. Trichomes 14–24 μ diam. 2.
1. Trichomes 8–14 μ diam., rarely to 16 μ; sheaths irregular, gelatinous, often quite diffluent. 2. H. lyngbyaceum.
2. Color of mass of violet shade; sheaths cylindrical, distinct. 1. H. comoides.
2. Color of mass dull green or yellowish; sheaths irregular, becoming shapeless and diffluent. 3. H. glutinosum.

1. H. COMOIDES Gomont, 1893, p. 73, Pl. XII, figs. 3–5. Farlow, fide Gomont, l. c.; on rocks, Hungry Bay, April, Collins.

2. H. LYNGBYACEUM Kützing ex Gomont, 1893, p. 75, Pl. XII, figs. 8–10; P. B.-A., No. 2058. Farlow, fide Gomont, l. c.; occasional in pools, Collins. The latter resembling var. *rupestre* Gomont, l. c.

3. H. GLUTINOSUM Gomont, 1893, p. 77. Rocks east of Elbow Bay, Dec., Collins, forming a thin, tubercular coating on rocks between tides.

Schizothrix Kützing.

1. Among algae in pools; trichomes 2–3 μ diam. 1. S. vaginata.
1. On damp walls; trichomes 1–1.7 μ diam. 2. S. calcicola.

*1. S. VAGINATA Gomont, 1893, p. 40, Pl. VII, figs. 1–4. In a gelatinous mass with other algae, North Shore, Sept., Collins; Harrington Sound, Nov., Hervey.

*2. S. CALCICOLA Rabenhorst ex Gomont, 1893, p. 45, Pl. VIII, figs. 1–3; P. B.-A., No. 2158. On shaded wall of house near South Road, Dec., Collins.

FAMILY NOSTOCHACEAE.

ANABAENA Bory.

1. Spores ovoid, not contiguous to heterocysts. 1. A. variabilis.
1. Spores subcylindrical, contiguous to heterocysts. 2. A. torulosa.

*1. A. VARIABILIS Kützing ex Bornet & Flahault, 1888, p. 226, P. B.-A., No. 2059. *Sphaerozyga Thwaitesii* Harvey, 1846–51, Pl. CXIII. B. Brackish pool, April, Collins; in reservoir near Spanish Rock, Jan., Hervey. In the material from the latter station the filaments were sometimes straight, but oftener curved as in *A. flos-aquae* Bréb.; the spores were those of *A. variabilis*.

2. A. TORULOSA Lagerheim ex Bornet & Flahault, 1888, p. 236. Among other algae, North Shore, Aug., Collins.

Sterile filaments of an *Anabaena* or *Cylindrospermum* were found on ground wet by rain, near Flatts Bridge, Aug., Collins. The cells were about 4 μ diam., spherical, or just after division discoid.

HORMOTHAMNION Grunow.

H. convolutum sp. nov. Trichomatibus pallide aerugineis, interdum rubescentibus, parallelis, elongatis, 3–5 μ diam.; cellulis 1–4 diam. longis, cylindricis, nodis leviter constrictis; heterocystis ovoideis vel sphaericis, 8–10 μ diam.; sporis ?; fasciculis tenuibus, inter utriculis hospitis penetrantibus, curvatis.

Trichomes pale aerugineous, sometimes with a shade of red, parallel, long, 3–5 μ diam.; cells 1–4 diam. long, cylindrical, slightly constricted at the nodes; heterocysts ovoid to spherical, 8–10 μ diam.; spores ?; fascicles slender, winding among the utricles of the host. On *Codium tomentosum*, Cooper's Island, Aug. 29, 1913, F. S. Collins. Type in Collins herb., No. 7239.

More slender than the other species of the genus, the cells relatively longer. The cluster of filaments winds about among the utricles of the host, the continued growth of the two plants causing the endophyte to turn and twist very sharply.

Nostoc Vaucher.

*N. COMMUNE Vaucher ex Bornet & Flahault, 1888, p. 203; P. B.-A., No. 1901; *N. ciniflonum* Bornet & Thuret, 1880, p. 102, Pl. XXVIII, fig. 13. Common everywhere, especially on sandy soil; thin brittle skins in dry weather, expanded thickish soft masses in wet weather. No spores seen. Native name, "Devil's Tobacco."

Family SCYTONEMACEAE Kützing.

Microchaete Thuret.

M. VITIENSIS Askenasy ex Bornet & Flahault, 1887, p. 85. Scattered filaments on *Wrangelia penicillata*, Harris Bay, Jan., Hervey.

Scytonema Agardh.

1.	Sheaths not lamellate.	2.
1.	Sheaths lamellate.	3.
2.	Trichomes 5–7 μ diam.	1. S. varium.
2.	Trichomes 6–14 μ diam.	2. S. ocellatum.
3.	Branches usually geminate, free and divergent.	4.
3.	Branches frequently solitary, adherent at base.	5. S. crustaceum.
4.	Filaments 15–21 μ diam.; sheath thin at apex.	3. S. figuratum.
4.	Filaments 18–36 μ diam.; sheath thick throughout.	4. S. myochrous.

*1. S. VARIUM Kützing ex Bornet & Flahault, 1887, p. 97; Kützing, 1850–52, p. 6, Pl. XXIII, fig. II. High up on walls of a cave at Walsingham; shore of pool near Walsingham, April, Collins.

*2. S. OCELLATUM Lyngbye ex Bornet & Flahault, 1887, p. 95; P. B.-A., No. 711, on dunes, Paget, Farlow.

*3. S. FIGURATUM Agardh ex Bornet & Flahault, 1887, p. 101; *S. thermale* Kützing, 1850–52, p. 5, Pl. XVIII, fig. III. High up on wall of cave near Walsingham, April, Collins.

Bornet, 1889a, p. 155, shows that *Conferva mirabilis* Dillwyn, 1807, Pl. XCVI, is identical with *Scytonema figuratum* of Agardh, and of earlier date, and therefore changes the name to *S. mirabile* (Dillw.) Bornet. But as the starting point for nomenclature of the heterocysted Nostochaceae is definitely fixed at the Bornet & Flahault monograph, it appears as if the later name by Bornet cannot be substituted.

*4. S. MYOCHROUS Agardh ex Bornet & Flahault, 1887, p. 104; Kützing, 1850–52, p. 7, Pl. XXV, fig. III; P. B.-A., No. 1902. On perpendicular cliff, Paget, Aug., Collins; and common in company with *Calothrix* species etc. on rocks between tides. This species has a very wide distribution as a plant of rocks etc., dripping with fresh water, but in Bermuda it is commonly found with distinctly marine species, in mats on flat rocks in the litoral zone.

*5. S. CRUSTACEUM Agardh ex Bornet & Flahault, 1887, p. 106. On sand near Mangrove Creek, Hamilton, Jan., Farlow.

TOLYPOTHRIX Kützing.

*T. TENUIS Kützing ex Bornet & Flahault, 1887, p. 122; Kützing, 1850–52, p. 9, Pl. XXXI, fig. II. Among *Oedogonium*, in ditch in Devonshire Marsh, April, Collins.

HASSALLIA Berkeley.

*H. BYSSOIDEA Hassall ex Bornet & Flahault, 1887, p. 116. On bark of *Juniperus bermudiana*, rather common.

FAMILY STIGONEMACEAE Hassall.

MASTIGOCOLEUS Lagerheim.

M. TESTARUM Lagerheim ex Bornet & Flahault, 1887, p. 54; 1889, p. CLXII, Pl. X, fig. 4. In dead shells of mollusks, with *Gomontia* etc.

HAPALOSIPHON Nägeli.

*H. INTRICATUS W. & G. S. West, 1895, p. 271, Pl. XV, figs. 16–28; P. B.-A., No. 1855. In ditch in Devonshire Marsh, April, Dec., Collins.

STIGONEMA Agardh.

*S. INFORME Kützing ex Bornet & Flahault, 1887, p. 75; Kützing, 1850–1852, p. 15, Pl. XXXVIII, fig. 3. Feb., H. Kennedy in Farlow herbarium.

FISCHERELLA Gomont.

*F. AMBIGUA Gomont, 1895, p. 49, Pl. III. On stone wall, Jan., Farlow.

Family RIVULARIACEAE.

Calothrix Agardh.

1. Heterocysts basal only.	2.
1. Heterocysts basal and intercalary.	6.
2. Trichomes violet.	1. C. fusco-violacea.
2. Trichomes olivaceous or aerugineous.	3.
3. More or less endophytic.	3. C. parasitica.
3. Not endophytic.	4.
4. Filaments in stellate tufts on other algae.	6. C. confervicola.
4. Filaments not in stellate tufts; saxicolous.	5.
5. Trichomes olivaceous.	2. C. scopulorum.
5. Trichomes aerugineous.	4. C. aeruginea.
6. Filaments attached at the middle.	7. C. pilosa.
6. Filaments attached at one end.	7.
7. Filaments 9–10 μ diam.	4. C. aeruginea.
7. Filaments 12–40 μ diam.	5. C. crustacea.

1. C. fusco-violacea Crouan ex Bornet & Flahault, 1886, p. 352; P. B.-A., No. 2060. On *Enteromorpha, Ectocarpus* etc., rock pool, South Shore, Jan., Hervey.

2. C. scopulorum Agardh ex Bornet & Flahault, 1886, p. 353; Bornet & Thuret, 1880, p. 159, Pl. XXXVIII; P. B.-A., No. 1856. On flat rocks between tides, Causeway, Shelly Bay, etc., common.

3. C. parasitica Thuret ex Bornet & Flahault, 1886, p. 357; Bornet & Thuret 1880, p. 157, Pl. XXXVII, figs. 7–10. In *Trichogloea Herveyi*, Cooper's Island, April, Collins; in gelatinous mass of various algae, in drip from Aquarium outlet, Aug., Collins. Occasionally found in various loose-tissued algae.

4. C. aeruginea Thuret ex Bornet & Flahault, 1886, p. 358; Bornet & Thuret, 1880, p. 157, Pl. XXXVII, figs. 1–6. On rocks, North Shore, mixed with *Schizothrix* etc., Nov., Hervey.

5. C. crustacea Thuret ex Bornet & Flahault, 1886, p. 359; Bornet & Thuret, 1876, p. 13, Pl. IV. Spanish Rock, April; on *Sargassum*, Gravelly Bay, Dec., Hervey.

6. C. confervicola Agardh ex Bornet & Flahault, 1886, p. 349; Bornet & Thuret, 1876, p. 8, Pl. III. On *Cladophora crystallina*, Harrington Sound, Collins.

7. C. pilosa Harvey ex Bornet & Flahault, 1886, p. 363; Harvey, 1858, p. 106, Pl. XLVIII. C. Common in shallow pools and on flat rocks between tides.

Dichothrix Zanardini.

1. On rocks; filaments 15–20 μ in branches of last order. 1. D. Baueriana.
1. Epiphytic; filaments 20–30 μ in branches of last order. 2. D. fucicola.

*1. D. Baueriana Bornet & Flahault, 1886, p. 376. On rocks between tides, North Shore, Oct., Nov., Hervey; Hamilton Harbor, Nov., Collins. Known heretofore only as a fresh water species, but the Bermuda plant is distinctly marine, though agreeing in characters with European and American specimens from fresh water stations.

2. D. fucicola Bornet & Flahault, 1886, p. 379; *Schizosiphon fucicola* Kützing, 1850–52, p. 18, Pl. LV, fig. II. On various algae forming a mat at the bottom of a pool, Gibbet Island, Hervey.

Polythrix Zanardini.

P. corymbosa Grunow ex Bornet & Flahault, 1886, p. 380; P. B.-A., No. 1903; *Microcoleus corymbosus* Harvey, 1858, p. 109, Pl. XLVIII. B. Common on rocks between tides in quiet water all around the islands.

Rivularia Roth.

R. polyotis Bornet & Flahault, 1886a, p. 360; P. B.-A., No. 1904; *R. hospita* Bornet & Thuret, 1880, p. 168, Pl. XLI. Rocks near high water, South Shore, Feb., April, Collins; grotto, Tucker's Town, Dec., Hervey.

Brachytrichia Zanardini.

B. maculans Gomont, 1901, p. 127, Pl. V, figs. 5–7; P. B.-A., No. 2159. Forming a thin film on roots etc. of mangroves between tides, in company with *Dichothrix* and *Calothrix* species, Fairyland, Dec., Collins.

Originally described from material collected in Siam, this species now makes its second appearance half way round the globe.

Family CRYPTOGLENACEAE.

Cryptoglena Ehrenberg.

C. americana B. M. Davis, 1894, p. 101, Pl. XI; P. B.-A., No. 1851. Among *Cladophora expansa* and other algae, in a brackish pool between Harrington Sound and the North Shore, April, Collins.

Class **CHLOROPHYCEAE.**

Family DESMIDIACEAE.

Closterium Nitzsch.

1. Apices subacute; median diam. 17–37 μ. 1. C. Leibleinii.
1. Apices obtuse; median diam. 33–50 μ. 2. C. moniliferum.

*1. C. Leibleinii Kützing ex Ralfs, 1848, p. 167, Pl. XXVIII, fig. 4; Wolle, 1884, p. 46, Pl. VII, figs. 13, 14, 20; G. S. West, 1904, p. 141, Pl. XVI, figs. 9–14; P. B.-A., No. 2061. In small quantity in an artificial reservoir for fresh water, near Spanish Rock, Dec., Hervey.

*2. C. moniliferum Ehrenberg ex Ralfs, 1848, p. 166, Pl. XXVIII, fig. 3; Wolle, 1884, p. 45, Pl. VII, fig. 15; G. S. West, 1904, p. 142, Pl. XVI, figs. 15–16; P. B.-A., No. 1961. Very abundant in an artificial reservoir for fresh water, near Spanish Rock, Dec., Hervey.

Cosmarium Corda.

1. Uniformly granulate; semi-cell ovate-pyramidal, 51–68 μ wide. 4. C. botrytis.
1. Smooth. 2.
2. Semi-cell semicircular to semielliptic; 34–36 μ broad. 1. C. Cucumis.
2. Semi-cell truncate-pyramidal, 19–30 μ broad. 2. C. granatum.
2. Semi-cell trapezoidal to truncate-pyramidal; about 33 μ broad. 3. C. pseudonitidulum.

*1. C. Cucumis Corda ex Ralfs, 1848, p. 93, Pl. XV, fig. 2; G. S. West, 1905, p. 152, Pl. LIX, figs. 18–20; P. B.-A., No. 1858. Among *Sphagnum* in a ditch, Devonshire Marsh, April, Collins. Distributed as *C. subcucumis* Schmidle, but agreeing better with *C. Cucumis*.

*2. C. granatum Brébisson in Ralfs, 1848, p. 96, Pl. XXXII, fig. 6; Wolle, 1884, p. 60, Pl. L, fig. 13; G. S. West, 1905, p. 186, Pl. LXIII, figs. 1–3. Rather scanty, among *Oedogonium Itzigsohnii*, ditch in Devonshire Marsh, April, Collins.

*3. C. pseudonitidulum Nordstedt, 1873, p. 16, Pl. I, fig. 4; Wolle, 1884, p. 62, Pl. XVIII, fig. 19; G. S. West, 1905, p. 195, Pl. LXIII, fig. 26; P. B.-A., No. 2063. Among various algae in a ditch in South Shore marshes, Sept., Collins.

*4. C. BOTRYTIS Meneghini ex Ralfs, 1848, p. 99, Pl. XVI, fig. 1; Wolle, 1884, p. 74, Pl. XIII, fig. 5; G. S. West, 1911, p. 1, Pl. XCVI, figs. 1, 2, 5–15; P. B.-A., No. 2062. In artificial reservoir for fresh water near Spanish Rock, Dec., Hervey.

MESOTAENIUM Nägeli.

*M. ENDLICHERIANUM Nägeli, 1849, p. 109, Pl. VI. B; G. S. West, 1904, p. 56, Pl. IV, figs. 20–21; P. B.-A., No. 1857. Among other algae in a ditch, fresh water or nearly so, Devonshire Marsh, April, Collins.

FAMILY ZYGNEMACEAE.

SPIROGYRA Link.

S. SUBMARINA (Collins) Transeau, 1915, p. 25; *S. decimina* var. *submarina* Collins, 1909, p. 110; 1912, p. 72. Ditch in South Shore marshes, Sept., Collins. This was first described as a variety of *S. decimina*, which it considerably resembles, and it was known from three widely separated stations in New England. The Bermuda material emphasizes the differences from *S. decimina;* the long cells, up to 8 diam., and the considerably swollen fertile cells; the material from the Elizabeth Islands, Collins, 1912, p. 72, has cells as small as 21 μ diam.

FAMILY VOLVOCACEAE.

A *Chlamydomonas* was found in abundance in the water of an old tank, near Trott's Pond, Aug., Collins, but we have not been able to determine the species.

FAMILY TETRASPORACEAE.

TETRASPORA Link.

*T. LUBRICA (Roth) Agardh, 1824, p. 188; Collins, 1909, p. 139, fig. 26; ¶ *Ulva lubrica* Roth, 1806, p. 168. On dead leaves in ditch in Devonshire Marsh, Dec., Collins.

Family PROTOCOCCACEAE.

Protococcus Agardh.

*P. viridis Agardh, 1824, p. 13; *Pleurococcus vulgaris* Nägeli, 1849, p. 65, Pl. IV. E, fig. 2; Collins, 1909, p. 304, fig. 106. On shady side of trees, walls etc., all over the island; it occurs in similar stations in all temperate regions, and possibly also in tropical. Wille, 1913, p. 3, Pl. I, fig. 1, has pointed out the confusion that has long existed in regard to this species and *Pleurococcus vulgaris* Meneghini, and by examination of type specimens, cleared up the matter.

Chlorocystis Reinhard.

C. Cohnii (Wright) Reinhard, 1885, p. 4, Pl. I; Moore, 1900, p. 100, Pl. X; Collins, 1909, p. 148, fig. 35; *Chlorochytrium Cohnii* Wright, 1877, p. 367, Pl. IV–V. In *Ulva Lactuca*, Hungry Bay, April, Collins. Spores, apparently the smaller kind, had been formed in some of the cells.

Family SCENEDESMACEAE.

Oocystis Nägeli.

*O. Borgei Snow, 1903, p. 379, Pl. II, fig. VII; Collins, 1909, p. 160. Among *Oedogonium Itzigsohnii*, in ditch in Devonshire Marsh.

Scenedesmus Meyen.

*S. bijuga (Turp.) Wittrock, Nordstedt & Lagerheim, Alg. Exsicc., No. 1567; Collins, 1909, p. 168; *Achnanthes bijuga* Turpin, 1828, p. 310, Pl. XIII, fig. 4. Among *Rhizoclonium hieroglyphicum* in an artificial reservoir near Spanish Rock, Dec., Hervey.

Family ULOTHRICHACEAE.

Geminella Turpin.

G. scalariformis forma **marina** G. S. West in litt.; P. B.-A., No. 2002. Forming a floating gelatinous mass in an upper tide pool,

at the entrance to Hungry Bay, April, Collins. The typical form of this species is a fresh water plant from Barbados, described and figured as *Hormospora scalariformis* by G. S. West, 1904a, p. 282, Pl. CCCCLXIV, figs. 6–7. In the Bermuda plant the cells are sometimes longer in proportion to the diameter, and the wall of the filament shows no differentiated portion about the individual cell. It is probable that *Hormotrichum bermudianum* Harvey is the same plant, but the specimens of the latter cannot be found. Rein, 1873, p. 153, gives this name as Harvey, sp. n. Dr. Möbius has kindly looked for it in the collection at Frankfort, and was unable to find it. Professor Dixon of the University of Dublin tells us that he cannot find it in the Harvey herbarium. The *nomen nudum* cannot of course stand against West's name, but it would be of interest to recover the material.

Stichococcus Nägeli.

*S. subtilis (Kütz.) Klercker, 1896, p. 103; Hazen, 1902, p. 162, Pl. XXI, figs. 10–13; Collins, 1909, p. 191; *Ulothrix subtilis* Kützing, 1845, p. 197. Among other algae, in a ditch in South Shore marshes, Aug., Collins. Straight filaments a few cells long, scattered among *Spirogyra, Rhizoclonium* etc.

Microspora Thuret.

1. Cells thick-walled, 20 μ or more diam. 1. M. Wittrockii.
1. Cells thin-walled, 11–14 μ diam. 2. M. Willeana.

*1. M. Wittrockii (Wille) Lagerheim, 1887, p. 417; Hazen, 1902, p. 172, Pl. XXIII, figs. 5–7; Collins, 1909, p. 193; P. B.-A., No. 2066; *Conferva Wittrockii* Wille, 1887, p. 461, Pl. XVII, figs. 35–41. Fresh water pool near Shark's Hole, Feb., Hervey.

*2. M. Willeana Lagerheim in De Toni, 1889, p. 228; Hazen, 1902, p. 175, Pl. XXIV, figs. 5–7; Collins, 1909, p. 194. Among *Oedogonium* etc. in ditch in Devonshire Marsh, April, Collins.

Family ULVACEAE.

Enteromorpha Link.

1. Cells not in longitudinal series except in the very youngest parts. 2.
1. Cells mostly in longitudinal series. 3.
2. Cells 10–20 μ diam. 6. E. intestinalis.

2. Cells 5–7 μ diam.	2. E. minima.
3. Fronds simple or with a few proliferations.	4.
3. Fronds more or less branched.	5.
4. Fronds inflated and flexuous.	5. E. flexuosa.
4. Fronds compressed-filiform.	3. E. marginata.
5. Branches largely monosiphonous.	1. E. plumosa.
5. Branches not monosiphonous, except occasional proliferations.	4. E. prolifera.

1. E. PLUMOSA Kützing, 1843, p. 300, Pl. XX, fig. 1; Collins, 1909, p. 198; Börgesen, 1913, p. 7; P. B.-A., No. 2065; *E. Hopkirkii* Vickers, 1908, Pl. V. Rein, as *E. percursa;* North Shore, Jan., Gibbet Island, Feb., March, Devonshire Bay, Feb., Harris Bay, March, Hervey; Tucker's Town, Harrington Sound, Shelly Bay, April, Hungry Bay, May, Inlet, Aug., Collins. The most frequent species of the genus here and quite distinct from our other forms, by the rather large, longitudinally seriate cells, and the many branches of a few series or a single series of cells. Sometimes long, subsimple branches occur, of two series of cells, much resembling *E. percursa* (Ag.) J. Ag, with which a plant of this kind was identified by Rein. It is the *E. plumosa* of Börgesen, the *E. Hopkirkii* of Vickers, as shown by authentic specimens; whether the plants passing under these names in the North Atlantic are identical with this and with each other may be questioned. If there should prove to be two species, an examination of original specimens would be needed to decide what names to use.

2. E. MINIMA Nägeli in Kützing, 1849, p. 482; 1856, p. 16, Pl. XLIII, fig. 3; Collins, 1909, p. 201; P. B.-A., No. 2005. Grasmere, March, Hervey; on old fish car, Hungry Bay, April, in drip from outlet of aquarium, Agar's Island, Aug., Collins.

3. E. MARGINATA J. G. Agardh, 1842, p. 16; Kützing, 1856, p. 15, Pl. XLI, fig. 1; Collins, 1909, p. 202. On old *Sargassum,* below Flatts Bridge, May, Collins.

4. E. PROLIFERA (Fl. Dan.) J. G. Agardh, 1882, p. 129, Pl. IV, figs. 103–104; Collins, 1909, p. 202; *Ulva prolifera* Flora Danica, Vol. V, p. 5, Pl. DCCLXIII, 1782. Rein, as *E. compressa.* Rein's specimen is the only one of the species that we have seen from Bermuda, but it may be not uncommon. Little branched forms might easily be mistaken for *E. minima* or *E. flexuosa,* until examined microscopically.

5. E. FLEXUOSA (Wulf.) J. G. Agardh, 1882, p. 126; Collins, 1909, p. 203; P. B.-A., No. 2004; *Conferva flexuosa* Wulfen, 1803, p. 15. Miss Peniston; Harrington Sound, Feb., Dec., Devonshire Bay, Feb.,

Inlet, March, Hervey; Harrington Sound, April, Collins. In some specimens cells may be found as large as 20 μ square, but in other parts of the same individual they are of normal dimensions, little over 12 μ.

Forma **submarina** f. nov.; P. B.-A., No. 2161. Natans: frondibus inflatis, contortis.

Floating; fronds inflated, contorted. In extensive floating mats in brackish water, near old race course, Dec., Collins.

6. E. INTESTINALIS (L.) Grev. forma TENUIS Collins, 1903, p. 23; 1909, p. 205; P. B.-A., No. 2003. In brackish water, South Shore marshes, Aug., Collins. The thickness of the frond, 20–30 μ, is greater than that of the plant on which this form was founded. The latter grew in fresh water, remote from the sea; the present form, growing in brackish water, may be considered as intermediate between the form from fresh water and the typical species growing in the sea. A specimen in the Kemp herb., marked *Ulva linza,* seems to be typical *E. intestinalis,* but it is not in good enough condition for certainty.

MONOSTROMA Thuret.

1. Frond 25 μ thick or less, cells more or less in twos and fours. 1. M. latissimum.
1. Frond 30 μ thick or more; cells not in twos or fours. 2. M. orbiculatum.

1. M. LATISSIMUM (Kütz.) Wittrock, 1866, p. 33, Pl. I, fig. 4; Collins, 1909, p. 211; P. B.-A., No. 1859; *Ulva latissima* Kützing, 1856, p. 7, Pl. XIV. On mangroves just below Flatts Bridge; on *Salicornia,* Hungry Bay, April, Collins. This plant made its first appearance at Flatts Bridge about the middle of April, 1912, and grew rapidly. None was to be seen at the same station from July to September, 1913, nor elsewhere during those months.

2. M. ORBICULATUM Thuret, 1854, p. 388; Wittrock, 1866, p. 37, Pl. II, fig. 6; Collins, 1909, p. 212; Alg. Am.-Bor. Exsicc., No. 173. The material collected and distributed by Farlow is all that is recorded for Bermuda.

ULVA Linnaeus.

1. Frond divided into linear lobes. 2. U. fasciata.
1. Frond rounded or of irregular outline. 1. U. Lactuca.

1. U. LACTUCA L. var. LATISSIMA (L.) De Candolle, 1805, p. 9; Collins, 1909, p. 215. Rein; Moseley; April, June, Kemp, as *U.*

latissima; in high pool near Tucker's Town, April, Collins; in quiet waters elsewhere, but less common than var. *rigida.*

Var. RIGIDA (Ag.) Le Jolis, 1863, p. 38; Collins, 1909, p. 215; P. B.-A., No. 2064; *U. rigida* Agardh, 1822, p. 410. Rein; Kemp, as *U. Lactuca;* Tobacco Bay, Grasmere, March, Harrington Sound, July, Hervey; Inlet, Aug., Collins. Rather common both in sheltered and exposed places; sometimes quite near to *U. fasciata.*

2. U. FASCIATA Delile, 1813, p. 153, Pl. LVIII, fig. 5; Collins, 1909, p. 216. Miss Wilkinson; Harrington Sound, March, Hervey. Apparently not common; not easy to distinguish from forms of *U. Lactuca var. rigida,* but generally of darker color, especially near the margin of the linear, dentate or crenate lobes; the frond is thicker than in most forms of *U. Lactuca,* and the cells more elongate vertically.

PROTODERMA Kützing.

P. MARINUM Reinke, 1889, p. 81; Collins, 1909, p. 217. On pebbles, North Shore near Inlet, Aug., Collins. Probably common everywhere but inconspicuous.

FAMILY CYLINDROCAPSACEAE.

CYLINDROCAPSA Reinsch.

*C. INVOLUTA Reinsch, 1867, p. 66, Pl. VI, fig. 1; P. B.-A., No. 2067; *C. geminella* Wolle, 1887, p. 104, Pl. XCI, figs. 1–17; Collins, 1909, p. 222; *C. geminella* var. *minor* Hansgirg, 1886, p. 224, fig. 122; *Hormospora geminella,* Wolle, 1877, p. 140. In artificial reservoir near Spanish Rock, among *Rhizoclonium hieroglyphicum* etc., Feb., Hervey. In explanation of the synonymy just given, we must go into a little detail. The genus *Cylindrocapsa* and the species *C. involuta* were founded by Reinsch on vegetative characters only; the fructification was discovered by Cienkowski, described and well figured by him, 1876, p. 560, Pl. IX, figs. 50–65. Wolle, 1877, p. 140, described *Hormospora geminella,* vegetative characters only; in 1887, p. 104, *Cylindrocapsa geminella* with description of fructification. Pl. XCI, figs. 1–17 is supposed to represent the latter, but is not very instructive. No reference is made to *Hormospora geminella.* Hansgirg, 1886,[7] p. 223,

[7] The date on the first title of the Prodromus is 1886; a second title, introducing a "Schlusswort" with separate paging, is dated 1888; under *C. geminella* there is a reference to the author's "Phyc. u. algol. Studien, 1887."

records for Bohemia "*C. geminella* Wolle (*Hormospora geminella* Wolle Bull. of the Tor. Bot. Club 1877)" and describes var. *minor*. The diameter of cells given for the typical *C. geminella*, 20–24 μ, does not agree with Wolle's figures, 16–21 μ for *Hormospora*, 14–16 μ for *Cylindrocapsa*, but are nearer *C. involuta* Reinsch, 23–30 μ. Hansgirg's var. *minor* is said to be 12–15 μ, diam., exceptionally 18–25 μ, in very young filaments 9–12 μ, which would certainly include Wolle's *C. geminella*. On comparing all the descriptions and figures, we can find no real distinction between *C. involuta*, *C. geminella* and *C. geminella* var. *minor;* and in the Bermuda material we can match practically every figure. We have therefore used the oldest name.

Family OEDOGONIACEAE.

Oedogonium Link.

1. Oogonium with a whorl of conical projections. 3. O. Itzigsohnii.
1. Oogonium without whorl of projections. 2.
2. Filaments 14–20 μ diam. 1. O. Pringsheimii.
2. Filaments seldom over 12 μ diam., usually in stellate clusters. 2. O. consociatum.

*1. O. Pringsheimii Cramer ex Hirn, 1900, p. 170, Pl. XXVII, fig. 155; Collins, 1909, p. 246; P. B.-A., No. 1861. In ditch in Devonshire Marsh, April, Collins.

*2. **O. consociatum** sp. nov. Plate I, figs. 1–4; P. B.-A., No. 2068. Diocum (?), macrandrium; oogonia solitaria, globosa vel depresso-globosa, operculata, rima mediana vel subsuperiore, angusta sed distincta; oospora globosa vel depresso-globosa, oogonium implente, membrana laevi; cellula basali depresso-globosa; cellulis vegetativis plus minusve distincte clavatis.

Dioecious (?), macrandrous; oogonia single, globose to depressed-globose, operculate, division median to superior, narrow but distinct; oospore globose to depressed globose, filling the oogonium, membrane smooth; basal cell depressed-globose; vegetative cells more or less distinctly clavate.

veg. cell, female,	6–12 (20) μ	diam.,	1–4 diam. long.
oog.	28 μ	"	26–28 μ "
oosp.	26 μ	"	24–26 μ "

In an artificial fresh water reservoir near Spanish Rock, Jan., Hervey, Aug., Collins. Type in herb. Collins, No. 7812.

The basal cell is depressed-globose, 20–24 μ diam., 12–16 μ high; the first cell above is 6–8 μ diam., 2–3 diam. long; the filament may continue of the same diameter, or may increase up to 12 μ, the cells 1–2 diam. long; occasionally the diam. reaches 20 μ, the cells about one diam. long and moniliform; at any point a larger filament may suddenly change to the smaller diameter, a cell of 8–10 μ following a cell of 12–20 μ. Oogonia were not uncommon, but were very generally abortive; in the few instances where they seemed normal they were regularly globose, and contained a globose oospore, quite filling the oogonium, of orange yellow color. The division of the oogonium was median or slightly higher; no antheridia were seen.

The study being made from formalin material, the development of the zoospores could not be followed, but they must have been produced in immense numbers. Cells of *Pithophora kewensis* were seen, completely covered with zoospores which had affixed themselves, but still retained the spherical form, and were 16–24 μ diam.; the appearance was much like that of a filament of *Lyngbya* covered with *Xenococcus,* as shown in Bornet & Thuret, 1880, Pl. XXVI, fig. 1. The zoospores seemed to secrete some adhesive substance from the cell wall, forming a sort of collar underneath the cell, extending beyond the diameter of the cell, so as to be visible from above as well as from the side. Something similar is seen in *Chantransia collopoda* Rosenvinge, 1898, fig. 10, A. As the densely packed zoospores germinate, the host soon becomes indistinguishable, the sporelings forming a bristly mass, to the filaments of which more zoospores attach themselves, adhering to the young *Oedogonium* filaments in the same way as to the *Pithophora.* It seems probable, however, that often the zoospores adhere to each other in a larger or smaller rounded mass; when they germinate the radiating filaments form an echinate body, which is different from anything we find recorded for the genus, except the figures of *O. pachyandrium* in Wolle, 1887, Pl. LXXIII, figs. 38 and 39.

These figures though rude and in no way showing the evolution of the cluster, give a fair idea of the appearance. These masses often contain hundreds, probably thousands of spores, and before germination has much progressed, look like bits of fish roe. In the material of No. 7812 the *Pithophora* appeared to be fairly smothered by the *Oedogonium,* many of the cells dead; the greater part of the spores were attached to *Oedogonium* filaments or to each other; in No. 7368

material the *Oedogonium* was less abundant, and except a few loose clusters was all on the *Pithophora,* which was still uninjured; *Rhizoclonium hieroglyphicum* was much more common in this material than *Pithophora,* but was quite free from the *Oedogonium.* The nearest relative would seem to be *O. inversum* Wittr., which has capitate cells of approximately the same size, and a broadened basal cell, but has cells uniformly 12–14 μ diam., and up to 8 diam. long; rather larger oospores, with quite low division; the basal cell is attached by the flat lower surface, while in *O. consociatum* the lower surface is convex, resting in the ring by which it is affixed to the host.

*3. O. Itzigsohnii De Bary ex Hirn, 1900, p. 177, Pl. XXVIII, fig. 167; Collins, 1912, p. 86; P. B.-A., No. 1860. In ditch, Devonshire Marsh, April, Collins.

Sterile filaments of at least two other species have been found in collections from a roadside pool near Old Ferry Road, Aug., and from a ditch in South Shore marshes, Sept., Collins.

Family CHAETOPHORACEAE.

Diplochaete Collins.

D. solitaria Collins, 1901, p. 242; 1909, p. 278, fig. 99. Occasional individuals on *Laurencia* and other algae, never in any abundance.

Blastophysa Reinke.

B. rhizopus Reinke, 1889a, p. 27, Pl. XXIII; Börgesen, 1911, p. 151, fig. 13; 1913, p. 8, fig. 2; Collins, 1912, p. 99, fig. 12; P. B.-A., No. 1905. South Shore, Jan., Hervey; marsh near racecourse, Aug., Collins. At the South Shore in the basal layer of a growth of *Sphacelaria tribuloides;* at the marsh on *Ruppia maritima,* among other small algae; in *Ulva Lactuca,* Harrington Sound, Aug., Collins.

Phaeophila Hauck.

P. floridearum Hauck, 1876, p. 57; 1885, p. 464, fig. 200. Harris Bay, Jan., Hervey. This minute plant occurred among various other algae from a pool, the whole forming a thin, crisp, light green incrustation of about the consistency of some thin, encrusting sponge. It

is probably not uncommon, but is easily overlooked, as it can be found only by microscopic examination. It has been found in small quantity in *Halymenia bermudensis,* Grasmere, March, Hervey.

Endoderma Lagerheim.

1. Cells mostly irregular. 1. E. viride.
1. Cells mostly cylindrical. 2. E. filiforme.

1. E. viride (Reinke) Lagerheim, 1883, p. 74; Collins, 1909, p. 279; P. B.-A., No. 2006; *Entocladia viridis* Reinke, 1879, p. 476, Pl. VI, In the cell wall of various algae, common.

2. **E. filiforme** sp. nov. Filamentis lateraliter vel dichotome ramosis, cellulis vegetativis cylindricis, prope apices circa 2 μ diam., longitudine diametrum pluries superante; inferne ad 6 μ diam., longitudine diametrum duplo superante, forma plus minusve irregulari; quavis cellula matura in sporangium mutata, circumscriptione circulari supra visa, 6–12 μ diam., depresso-hemisphaerica lateraliter visa, membrana crassa; prolongatione papilliformi per membranam plantae hopsitis protrusa, mox aperta ad exitum sporarum (?); sporis (?) 2 μ diam., in cellula paucis; setis, cellulae continuis, haud raro membranam hospitis penetrantibus, basi circa 4 μ diam., mox ad 2 μ attenuatis, neque bulbosis nec constrictis; chromatophora parietali, pyrenoideo unico, magno, munita.

Filaments branched laterally or dichotomously; vegetative cells cylindrical, near apex about 2 μ diam. and several diam. long, below up to 6 μ diam. and 2 diam long, more or less irregular; any cell of the older portion changing to a sporangium, circular in outline seen from above, 6–12 μ diam., depressed hemispherical in side view, with thick wall; a small papilla-like extension passing through the wall of the host, then opening to permit the exit of the spores (?); spores about 2 μ diam., few in a cell; bristles continuous with the cell also occasionally passing through the wall of the host, the base about 4 μ diam., quickly tapering to 2 μ, no constriction or bulb. In wall of *Lyngbya confervoides,* Bailey's Bay, Jan. 18, 1913, Hervey. Type in Collins herbarium, No. 7419a.

The older part is not unlike *E. viridis,* but the long, very slender, often quite straight filiform branches distinguish it from that as well as from other species; these branches seem usually to run lengthwise of the host, dividing mostly dichotomously; the older cells increase rapidly in width, and send off many branches at right angles, often

in secund series, passing around the host; in older plants the branching may be quite dense, with no regularity discernible. The wall is very thin in the younger cells, but becomes quite thick in the older; the chromatophore is dense, and nearly or quite covers the wall. Bristles appear to be rare, and those we saw were short, evidently broken off. In the oldest parts of the plant, most of the cells had become sporangia, many of them had emptied, and only one was seen containing spores; these appeared spherical, but no details could be made out from the formalin material. The host has thick, distinctly laminate walls, and the Endoderma seems to push apart the laminae without difficulty; in one case two plants were seen, one outside the other, separated by one of the laminae of the host. In another case a plant was seen quite on the outside of the host wall; in this the cells were quite small and spherical; it seems probable that the lamina of the host under which they grew had peeled off, and the cells took the unusual form on release of the pressure.

Pringsheimia Reinke.

P. scutata Reinke, 1889a, p. 33, Pl. XXV; Collins, 1909, p. 288, fig. 95. On *Wurdemannia*, Gibbet Island, Aug., Collins; on *Ulva*, Harrington Sound, Aug., Collins.

Microthamnion Nägeli.

*M. Kuetzingianum Nägeli in Kützing, 1849, p. 352; Hazen, 1902, p. 191, Pl. XXVI, fig. 1; Pl. XXVII, figs. 2–4; Collins, 1909, p. 294. Among *Tetraspora lubrica*, on dead leaves in ditch in Devonshire Marsh, Dec., Collins.

Urococcus Kützing.

*U. insignis (Hass.) Kützing, 1849, p. 207; Wolle, 1887, p. 201, Pl. CXXIII, figs. 11–12; Collins, 1909, p. 306; P. B.-A., No. 1862; *Haematococcus insignis* Hassall, 1845, p. 324, Pl. LXXX, fig. 6. Among *Sphagnum* in Devonshire Marsh, April, Collins.

Gloiococcus A. Braun.

*G. mucosus A. Braun, 1851, p. 170; Collins, 1909, p. 310, fig. 122. Among *Oedogonium* etc., in ditch in Devonshire Marsh, April, Collins.

Family TRENTEPOHLIACEAE.

Trentepohlia Martius.

*T. aurea (L.) Martius, 1817, p. 351; Collins, 1909, p. 316; *Byssus aureus* Linnaeus, 1753, p. 1168. Common on shaded cliffs all over the islands, forming little orange-colored tufts of soft filaments, sometimes confluent and covering considerable spaces.

Family CLADOPHORACEAE.

Chaetomorpha Kützing.

1. Filaments under 100 μ diam.	2.
1. Filaments over 100 μ diam.	3.
2. Filaments attached, not over 25 μ diam.	1. C. minima.
2. Filaments not attached, 40–70 μ diam.	2. C. gracilis.
3. Filaments 500 μ diam. or more.	5. C. crassa.
3. Filaments 400 μ diam. or less.	4.
4. Light green; filaments 200–250 μ diam.	4. C. Linum.
4. Dark green; filaments 125–175 μ diam.	3. C. brachygona.

1. **C. mimima** sp. nov.; Plate I, figs. 5–7; P. B.-A., No. 2007. Filamentis disco affixis, cylindricis vel plus minusve clavatis, 10–20 μ diam., ad nodos interdum constrictis; cellulis 2–4 diam. longis, membrana crassa distincte laminata; zoosporis (?) in quavis cellula formatis, per foramine laterale liberatis.

Filaments attached by a disk, cylindrical or more or less clavate, 10–20 μ diam., nodes sometimes constricted; cells 2–4 diam. long, wall distinctly laminate; zoospores (?) formed in any cell, escaping by a lateral opening in the wall. On fronds of *Codium, Cladophora* etc.

The smallest species yet known in this genus; *C. californica* Collins, P. B.-A., No. 664 was the smallest heretofore known in the attached state, and its filaments average about twice the diameter of the present species; as regards length, the contrast is even more striking, as in *C. californica* the fronds reach a length of a decimeter, while in *C. minima* 5 mm. is the longest observed. It was first found growing on the rounded ends of the utricles of *Codium tomentosum*, sometimes singly, sometimes many individuals close together. Being quite imper-

ceptible to the eye, it was noticed only in the examination of the *Codium* material preserved in formalin, so that nothing can be said as to the characters of the supposed zoospores; everything was however similar to the formation and emission of zoospores in the larger and better known species of *Chaetomorpha*. Emptied cells were common, sometimes every cell of a filament being fertile, even the basal cell; in one instance a filament consisted of a single cell, which had emptied itself through the small round lateral opening. In the form of the cells, thick laminate wall, dense chromatophore with many pyrenoids, the plant is a microscopic copy of forms like *C. Linum*. Rather curiously, it is the only attached form we find in the islands. The type is in the Collins herbarium.

2. C. GRACILIS Kützing, 1845, p. 203; 1853, p. 17, Pl. LII, fig. 1 P. B.-A., No. 2162. Hungry Bay, in dense masses, April, Collins.

3. C. BRACHYGONA Harvey, 1858, p. 87, Pl. XLVI. A; Collins, 1909, p. 325. Fish pond, Walsingham, Nov., Hervey, lying loose on the bottom of the pond.

4. C. LINUM (Fl. Dan.) Kützing, 1845, p. 204; *C. aerea* forma *Linum* Collins, 1909, p. 325; P. B.-A., No. 1863. *Conferva Linum* Flora Danica, Vol. V, p. 4, Pl. DCCLXXI, 1782; Harvey, 1846–51, Pl. CL. A; Moseley; Rein, as *C. geniculata;* Hungry Bay, Pool by Moore's calabash tree, April, Collins; Walsingham, Causeway, Nov., Tucker's Town, Dec., Hervey. Common and variable.

5. C. CRASSA (Ag.) Kützing, 1845, p. 204; 1853, p. 19, Pl. LIX, fig. 11; P. B.-A., No. 1864; *Conferva crassa* Agardh, 1824, p. 99. Kemp, as *Hormotrichum;* Pool near Walsingham, April, Lagoon near Fairyland, Aug., Collins. Not always easily distinguishable from *C. Linum;* study of the various forms in their natural condition if continued over a considerable time, might lead to considerable rearrangement.

RHIZOCLONIUM Kützing.

1. Cells rarely under 30 μ diam., wall thick, often lamellate. 2.
1. Cells rarely over 30 μ diam., usually 10–25 μ. 3.
2. Filaments 50–100 μ diam., usually with frequent short branches. 4. R. Hookeri.
2. Filaments 33–44 μ diam. branching from basal cell only. 5. R. crassipellitum.
3. In fresh or slightly brackish water. 2. R. hieroglyphicum.
3. In salt water. 4.
4. Cells 20–25 μ diam. 3. R. riparium.
4. Cells 10–15 μ diam. 1. R. Kerneri.

1. R. KERNERI Stockmayer, 1890, p. 582; Collins, 1909, p. 329. Forming a coating on mangroves, Hungry Bay, April, Collins.

*2. R. HIEROGLYPHICUM (Ag.) Kützing, 1845, p. 206; Collins, 1909, p. 329; P. B.-A., No. 2009; *Conferva hieroglyphica* Agardh, 1827, p. 636; Pool in rock by Old Ferry landing, Aug.; ditch in South Shore marshes, Sept., Collins; artificial reservoir near Spanish Rock, Feb., Hervey. Mostly the typical form, but with some var. *macromeres* Wittr.

3. R. RIPARIUM (Roth) Harvey, 1846–51, Pl. CCXXXVIII; Collins, 1909, p. 327; *Conferva riparia* Roth, 1806, p. 216; Hungry Bay, April, Collins; Causeway, Nov., Hervey. On mangroves and other objects between tide marks; apparently not very common; mostly the form known as var. *implexum* (Dillw.) Rosenvinge.

4. R. HOOKERI Kützing, 1849, p. 383; 1853, p. 21, Pl. LXVII, fig. III; Collins, 1909, p. 330. Shore of Harrington Sound, April; Hungry Bay, May, Collins; Walsingham, Jan., Hervey. A rather coarse species, varying in diameter of filaments from 50 to 100 μ; the same filament is not infrequently double the diameter in one part that it is in another. The branches are mostly short, but have dense chromatophores the same as in the cells of the filament. Beside the localities given, it occurs on the walls of caves along high water mark, and on shaded sides of quarries, and even in reservoirs of quite fresh water.

5. R. CRASSIPELLITUM W. & G. S. West, 1897, p. 35; Collins, 1909, p. 330. In small pools, Ely's harbor, April, Hervey.

CLADOPHORA Kützing.

1. Fresh water.	19. C. fracta.
1. Marine.	2.
2. With distinction of prostrate and erect filaments.	16. C. Howei.
2. No distinct prostrate filaments.	3.
3. Forming a low matted expansion.	4.
3. Erect.	5.
4. Filaments 100–150 μ diam. throughout.	17. C. repens.
4. Filaments 70–100 μ diam. below, 60–80 μ above.	18. C. frascatii.
5. Main filaments 150 μ diam. and upwards.	6.
5. Main filaments seldom reaching 150 μ.	10.
6. Lower cells 10 diam. long or more.	14. C. catenifera.
6. Lower cells less than 10 diam. long.	7.
7. Diam. of filaments about the same throughout.	15. C. fuliginosa.
7. Terminal divisions markedly smaller than main axes.	8.

8. Ramuli clustered. 10. C. fascicularis.
8. Ramuli not clustered. 9.
9. Ultimate ramuli very short, often of a single cell; cells in ramuli ovoid, 1–2 diam. long. 8. C. brachyclona.
9. Ultimate ramuli not extremely short, cylindrical or nearly so. 13. C. utriculosa.
10. Cells generally with a sharp constriction near base. 3. C. constricta.
10. Cells without regular constrictions. 11.
11. Fronds floating except at earliest stages. 12.
11. Fronds always attached during active growth. 13.
12. Main filaments 30–60 μ diam. 4. C. crispula.
12. Main filaments, 100–150 μ diam. 7. C. expansa.
13. Main filaments distinctly angled or flexuous. 14.
13. Main filaments straight or nearly so. 15.
14. Pale yellow-green; cells 6–8 diam. long. 2. C. luteola.
14. Light to bright green; cells 2–6 diam. long. 6. C. flexuosa.
15. Main filaments 60 μ diam. or less. 1. C. delicatula.
15. Main filaments 80 μ diam. or more. 16.
16. Some branches decumbent, attaching by rhizoids. 5. C. corallicola.
16. No decumbent branches. 17.
17. Color pale, glossy, substance soft. 9. C. crystallina.
17. Color darker, substance crisp. 18.
18. Cells 3–5 diam. long; ramuli scattered. 11. C. piscinae.
18. Cells mostly 1–2 diam. long; ramuli closer and seriate. 12. C. rigidula.

1. C. DELICATULA Montagne, 1850, p. 302; Kützing, 1856, p. 1, Pl. I, fig. 2; Collins, 1909, p. 337; P. B.-A., No. 2070. Ely's Harbor, April, Hervey. Some of the plants were young and vigorous, reaching a length of 10 cm.; others were evidently old, the main branches with laminate walls up to 15 μ thick, and covered with minute epiphytes; new proliferous growth was very abundant, with delicate, thin walls, and generally like the younger plants.

2. C. LUTEOLA Harvey, 1858, p. 81; Collins, 1909, p. 338. Rein; Merriman in Farlow herb. We have not collected this species, and only these two records exist for Bermuda.

3. C. CONSTRICTA Collins, 1909a, p. 19, Pl. LXXVIII, figs. 4–5; 1909, p. 339. Hungry Bay, Feb., Hervey. Not over 3 cm. high, while the original material from Jamaica reached a height of 10 cm. The Bermuda plant occasionally sends out a very long, slender rhizoid from one of the lower cells; this has not been seen in the Jamaica material.

4. C. CRISPULA Vickers, 1905, p. 56; 1908, p. 19, Pl. XVI; Collins,

1909, p. 339; Börgesen, 1913, p. 24, fig. 15. P. B.-A., No. 2011. Harrington Sound, March, Hervey. To this species we have referred, with some doubt, a form found in floating masses, which agrees in size and length of cells, and in manner of branching, with *C. crispula,* but does not form contorted, rope-like strands. It seems to us that these may be a later development, and that our plant represents an earlier stage. Similar conditions are well known in species of *Rhizoclonium* and *Chaetomorpha.*

5. C. CORALLICOLA Börgesen, 1913, p. 21, figs. 11–12; P. B.-A., No. 2010. Tucker's Town, Dec., Hervey. Growing matted among old fronds of Bryopsis; the slender rhizoids characteristic of the species are well developed, and occasionally branch.

6. C. FLEXUOSA (Griff.) Harvey, 1846–51, Pl. CCCLIII; Collins, 1909, p. 339; *Conferva flexuosa* Griffiths in Wyatt, Alg. Danm., No. 227. Gibbet Island, June, Howe; North Shore, Tucker's Town, April, Inlet, Aug., Collins. A delicate plant but often reaching a length of 2 dm. Late in its season it becomes unattached and may be found in large floating masses, in Castle Harbor and similar places.

7. C. EXPANSA (Mert.) Kützing, 1853, p. 27, Pl. XCIX, fig. 1; Collins, 1909, p. 340; *Conferva expansa* Mertens in Jürgens, Algae Aquaticae, Dec. V. Brackish pool between North Shore and Harrington Sound, April, Collins. Forming loose floating masses, sometimes pure, sometimes in company with *Lyngbya* and *Enteromorpha.* In the latter case the algae form a felted stratum on the surface of the water so firm that the shore birds may be seen in large flocks, walking on it as if it were land, while they pick the small animals living among it. Whether this plant is the same as *C. heteronema* Kütz., as described by Börgesen, 1913, p. 25, may be a question. *C. flavescens* Harvey, 1846–51, Pl. CCXCVIII, Collins, 1909, p. 339, is certainly distinct, but we have not found it here; it seems to be a more northern form. Reinbold, 1893, p. 196, considers *Conferva expansa* of Jürgens Alg. Aquat. as distinct from *Cladophora fracta* forma *marina,* and refers for details to Farlow, 1881, p. 56; but the *C. fracta* forma *marina* of Farlow is a plant of much smaller filaments than the Hauck plant of the same name. We have found a plant in Harrington Sound, that could, without violence, pass for a slender form of *C. fracta* forma *marina* of Hauck, but it seems to us to fit equally well, if not better, in *C. expansa,* as we understand it.

8. C. BRACHYCLONA Montagne in Kützing, 1849, p. 394; 1853, p. 27, Pl. XCVI, fig. II; Collins, 1909, p. 344. A single specimen from Miss Peniston, without definite locality, is the only American

record for this Mediterranean plant. The specimen is well developed and characteristic.

9. C. CRYSTALLINA (Roth) Kützing, 1845, p. 213; 1854, p. 4, Pl. XIX, fig. II; Collins, 1909, p. 342; P. B.-A., No. 1865; *Conferva crystallina* Roth, 1797, p. 196. Rein, as *C. glaucescens;* Gravelly Bay, Feb., Dec., Hervey; Hungry Bay, April, North Shore, Harrington Sound, May, Collins. A handsome plant, soft and silky, growing on rocks on somewhat exposed shores, more commonly and luxuriantly in quiet water, where it sometimes becomes detached and continues growing in the floating state.

10. C. FASCICULARIS (Mert.) Kützing, 1843, p. 268; Vickers, 1905, p. 56; 1908, p. 18, Pl. XIII; Collins, 1909, p. 345; P. B.-A. No. 2163; *Conferva fascicularis* Mertens in Agardh, 1824, p. 114. Harrington Sound, Feb., Hervey. A quite variable species, common from Florida to South America, but found only once in Bermuda.

11. **C. piscinae** sp. nov. P. B.-A., No. 2165. Filamentis primariis 100 μ diam.; ramulis ultimis 50 μ; cellularum longitudine diametrum 3–5-plo superante; nodis haud constrictis; cellula terminali rotundata vel truncata, longitudine cellulas ceteras non superante; ramificatione inferne per dichotomias patentes, distantes, aequales, cellula dichotomias gerente plerumque sed non semper ceteris breviore; ramis superne ramulos distantes, patentes, ferentibus; colore laeteviridi; chromatophora laxe reticulata; substantia subcrispa, nec fragili.

Main filaments 100 μ diam.; ultimate ramuli 50 μ; length of cells 3–5 diam., nodes not constricted; terminal cell rounded or truncate, not longer than other cells; branching below by wide, equal, distant forkings, the cell bearing the forking usually but not always shorter than the others; above with distant patent ramuli; color light green; chromatophore a loose network; substance somewhat crisp but not fragile. In an old fishpool at Godet's Island, Nov. 30, 1915. Type in Collins herbarium, No. 8427.

The water in this pool is quite still, the tide having access only by small openings in the wall. The plant formed a loose mass, over one meter in diameter, the lower part caught on coral; the appearance was quite that of a loose *Spirogyra.* Though crisp to the touch, the fronds collapsed immediately on being taken from the water; the living plant is of a light green color, but this becomes dark in drying. There is some similarity in the characters above to those of the description of *C. Macallana* Harv., but that is a stouter and stiffer plant, with different habit. *C. patens* Kütz. has cells 4–8 diam. long, larger main fila-

lents and smaller ramuli than *C. piscinae*. *C. crystallina*, the most nearly related Bermuda species, has larger main filaments, smaller and more closely set ramuli, longer cells, more fasciculate habit, softer substance, and does not become dark in drying.

12. **C. rigidula** sp. nov. Filamentis primariis circa 120 μ diam., secundi ordinis 100 μ, cellulis ultimis 80 μ; cellularum longitudine diametrum 1–2-plo superante; nodis haud constrictis; cellula terminali plerumque longiore, interdum ad 3 diam., rotundata vel subacuta; ramificatione prope basin per dichotomias patentes, primo approximatas, deinde distantes; ramis partis superioris frondis longis, rectis, ramulos gerentibus fere vel omnino sub angulo recto egredientes, distantes sparsosque inferne, in seriebus secundis prope apicem; colore viridi diluto obscuro; chromatophora subtiliter reticulata, pyrenoideos multos, minutos, nitidos monstrante; substantia firma crispaque.

Main filaments about 120 μ diam., secondary 100 μ, ultimate cells 80 μ; length of cells 1–2 diam., nodes not constricted; terminal cell usually longer, sometimes 3 diam., rounded or subacute; branching at base by broad forkings, at first frequent, later distant; branches in upper half of frond long, straight, with ramuli nearly or quite at right angles, distant and scattered below, near the tips in secund series; color rather dull light green; chromatophore a fine network with very many small bright pyrenoids; substance firm and crisp. In a stone tank above the bridge at Fairyland, Dec. 13, 1915. Type in Collins herbarium, No. 8513.

Though occurring in a station similar to that of *C. piscinae*, and in some points resembling the latter, it has seemed to us better to consider it a distinct species than to combine the two by too vague a description. *C. piscinae*, though crisp, promptly collapses when taken from the water, *C. rigidula* long keeps its shape and stiffness; the distinction is as marked as that between *Polysiphonia violacea* and *P. fastigiata*. In *C. piscinae* the cells are seldom under three or over five diam. long; in *C. rigidula* they are seldom over two diam., often only one diam. for a good part of the frond; the terminal cell is, however, often three diam. long. In both the ultimate ramuli are patent, often at a right angle; in *C. piscinae* they are scattered and usually distant, in C. rigidula closer and often in secund series. The differences can hardly be due to the station, as each grew in a stone tank, sea water going in and out with the tide, but with no active current, and no disturbance of the surface. On the other hand it has some resemblance to the plant from Harrington Sound which we distributed, P. B.-A., No. 2014, as *C. utriculosa*, but is still further

removed from the typical Mediterranean form. In the latter the cells below are 6–8 diam. long, 2–4 diam. above, while in the present species only the terminal cell is usually over 2 diam. long. It seems to us safer to treat it as a new species than to put it in a species whose typical form, at least, is so distinct.

13. C. UTRICULOSA Kützing, 1843, p. 269; 1853, p. 26, Pl. XCIV, fig. I; Collins, 1909, p. 346; P. B.-A., No. 2014. Harrington Sound, Wadsworth, March; same station, Oct., Hervey. A common Mediterranean and West India species. Wadsworth's plants are rather more slender than the typical, but otherwise quite the same. The material collected by us in October formed loosely floating masses. evidently a later condition; all branching was wide; the dichotomies in the lower part about 120°, the ramuli, usually quite short, about 90°.

14. C. CATENIFERA Kützing, 1849, p. 390; 1853, p. 24, Pl. LXXXIII, fig. I; Collins, 1909, p. 347; P. B.-A., No. 2069. Kemp in herb., as *Cladophora* sp.?; Howe; Red Bay, St. David's Island, June, cave at Gravelly Bay, Feb., April, Dingle Bay, March, Hervey. The most striking of our species of the genus, with stout stem and main branches, very long cells, firm lustrous cell wall. Bermuda plants are 10–20 cm. high; at Jamaica it sometimes reaches a height of 50 cm. In February only very small plants were found.

15. C. FULIGINOSA Kützing, 1849, p. 415; Collins, 1909, p. 348; P. B.-A., No. 2012. Kemp, St. George's, unnamed specimen in herb.; Harris Bay, Jan., Apr., Gravelly Bay, Dec., Inlet, Dec., Hervey; Gravelly Bay, Aug., Collins. A coarse species, generally distributed and common; always infested with the fungus *Blodgettia Borneti* Wright. The combination of the two forms the *Blodgettia confervoides* Harvey, 1858, p. 48, Pl. XLV. C.

16. C. HOWEI Collins, 1909a, p. 18, Pl. LXXVIII, fig. 1; 1909, p. 349. Tide pools, Gibbet Island, June, 1900, Howe. The short, subsimple filaments arise from a dense mass of prostrate filaments, a character found in no other of our species. Gibbet Island is the type, and so far as known, the only, station for the species; so for the present it may be considered as endemic.

17. C. REPENS (J. Ag.) Harvey, 1846–51, Pl. CCXXXVI; P. B.-A., No. 2071. *Conferva repens* J. G. Agardh, 1842, p. 13; *Aegagropila repens* Kützing, 1854, p. 15, Pl. LXX, fig. II. Gravelly Bay, Jan., Feb., Hervey. A low, densely matted plant of dark color, not however, with prostrate and erect filaments clearly differentiated. The plant from California distributed under this name as P. B.-A., No. 727 has since proved to be *C. trichotoma* (Ag.) Kütz.; the present record is therefore the first for America.

18. C. **frascatii** sp. nov.; P. B.-A., No. 2164. Humilis, 1–2 cm. alta; ramificatione irregulari, inferne plerumque dichotoma, dichotomiis patentibus; superne partim conformi, sed etiam laterali, patente, saepe rectangulari; ramulis ultimis 1–3-cellularibus, prope vel omnino rectangularibus, saepe secundis latere exteriore rami recurvati; cellulis inferne 70–100 μ diam., 2–5 diam. longis, cylindricis; ramulorum 60–80 μ diam., 2–3 diam. longis, leviter inflatis, nodis constrictis; cellula terminali obtusa.

Low, 1–2 cm. high, branching irregular, below mostly dichotomous, with wide forkings; above partly similar, partly lateral, patent, often at a right angle; ultimate ramuli 1–3-celled, nearly or quite at right angles, often secund on the outer side of a recurved branch. Cells below 70–100 μ diam., 2–5 diam. long, cylindrical; in the ramuli 60–80 μ diam., 2–3 diam. long, somewhat swollen with constricted nodes; terminal cell obtuse. In matted tufts in tide pools near Frascati Hotel, Jan. 11, 1914, A. B. Hervey. Type in Collins herb.

Growing in similar places to C. repens, and forming similar matted tufts, but distinct by the smaller dimensions and the lateral, secund, submoniliform ramuli.

*19. C. FRACTA (Fl. Dan.) Kützing, 1843, p. 263; 1854, p. 10, Pl. L; Collins, 1909, p. 353; P. B.-A., No. 2013. *Conferva fracta* Flora Danica, Vol. V., Pl. DCCCCXLVI, 1782. Artificial Reservoir of fresh water near Spanish Rock, Dec., Hervey. Some of the material is in a vigorously growing state; some in a hibernating state, cells with thick walls, dense contents, few branches.

CLADOPHOROPSIS Börgesen.

C. MEMBRANACEA (Ag.) Börgesen, 1905, p. 288, figs. 8–13; 1913, p. 47, fig. 33; Collins, 1909, p. 362; P. B.-A., No. 1866; *Conferva membranacea* Agardh, 1824, p. 120. North Shore, Jan., Tucker's Town, March, Harris Bay, Shelly Bay, April, Hervey; Inlet, May, Hungry Bay, July, Collins. A very common species, forming cushions on rocks, and on and under mangroves; in still pools it is sometimes also in floating masses.

PITHOPHORA Wittrock.

*P. KEWENSIS Wittrock, 1877, p. 52, Pl. I, fig. 8; Pl. II, figs. 1–12; Pl. III, figs. 1–9; Pl. IV, figs. 2–11; Pl. V, figs. 9–10; Collins, 1912, p. 98; P. B.-A., No. 2072. With *Rhizoclonium* etc. in reservoir of fresh water near Spanish Rock, Dec., Hervey.

Anadyomene Lamouroux.

A. stellata (Wulf.) Agardh, 1822, p. 400; Vickers, 1908, p. 21, Pl. XXI; P. B.-A., No. 1906; *A. flabellata* Harvey, 1858, p. 49, Pl. XLIV. A; Alg. Am.-Bor. Exsicc., No. 172; *Ulva stellata* Wulfen in Jacquin, 1786, p. 351. Common in shallow water everywhere about the islands, and dredged down to 18 m.; in quiet places as large, thin fronds, in exposed places masses of short, irregular, densely packed fronds. Apparently equally common at all times of the year. Aug. 11, 1913, in the cave at Agar's Island, young plants were found growing on the rocks between tides, forming a continuous coating, the individual plants not over 1 mm. high. In some individuals the lamina was beginning to form, but most of the plants resembled young *Cladophora*, except that the branching was in one plane. There was a distinct filiform stipe, attached at the base by slender coralloid projections.

Dictyosphaeria Decaisne.

D. favulosa (Ag.) Decaisne, 1842, p. 32; Börgesen, 1913, p. 33, figs. 20–22; Collins, 1909, p. 367, fig. 137; P. B.-A., No. 2015; *Valonia favulosa* Agardh, 1822, p. 432. Harrington Sound, Farlow; South Shore, Jan., Feb., Hervey; Hungry Bay, Tucker's Town, April, Reef, Ely's Harbor, Aug., Collins. Grows both in sheltered and in exposed stations, perhaps more generally in the latter.

Family GOMONTIACEAE.

Gomontia Bornet & Flahault.

G. polyrhiza (Lagerheim) Bornet & Flahault, 1888a, p. 164; 1889, p. CLVIII, Pl. VI–VII; Collins, 1909, p. 370, fig. 135; *Codiolum polyrhizum* Lagerheim, 1885, p. 22. Common in dead shells of mollusks along the shore, giving them a more or less deep grass-green color.

Family VALONIACEAE.

Valonia Ginnani.

1. Fronds bullate, unbranched. 1. V. ventricosa.
1. Fronds branched. 2.
2. Branches in whorls. 4. V. pachynema.

2. Branches not whorled.	3.
3. Cells spherical, ovoid or pyriform.	2. V. macrophysa.
3. Cells cylindrical to clavate.	3. V. utricularis.

1. V. VENTRICOSA J. G. Agardh, 1886, p. 96; Vickers, 1905, p. 56; 1908, p. 21, Pl. XXIII. A; Collins, 1909, p. 373; Börgesen, 1913, p. 27, fig. 16. July, Kemp; Gravelly Bay, Aug., Collins. At Gravelly Bay this plant was washed ashore; the plants were 1–3 cm. diam., smooth and glassy, spherical or slightly ovoid. Murray states that it is sometimes as large as a hen's egg.

2. V. MACROPHYSA Kützing, 1843, p. 307; 1856, p. 30, Pl. LXXXVII, fig. III; P. B.-A., No. 1867; *V. utricularis* Alg. Am.-Bor. Exsicc., No. 171, not of Agardh. Harrington Sound, Walsingham, Jan., Tucker's Town, Dec., Hervey; pool near Moore's calabash tree, Ducking Stool, April, Ely's Harbor, July, Gravelly Bay, Gibbet Island, Aug., Fairyland, Nov., Collins. Grows usually in dense masses sometimes as large as a man's head; the individual plants are only loosely attached, and are easily separable; under water it usually shows a very brilliant iridescence. The turgor in the living cell is considerable; when the cell is punctured by a dissecting needle, it sends out a fine stream which may reach a distance of a meter or more.

3. V. UTRICULARIS (Roth) Agardh, 1822, p. 431; Collins, 1909, p. 373; *Conferva utricularis* Roth, 1797, p. 160, Pl. I, fig. 1. Dredged in 18 meters, Hamilton Harbor, Dec., Collins.

Forma CRUSTACEA Kuckuck, 1907, p. 180; Börgesen, 1913, p. 30, figs. 17–18; P. B.-A., No. 2074. The typical *V. utricularis* is rather loosely branched, but in forma *crustacea* the cells form a dense mass, and might be mistaken for one of the solid-fronded species of *Dictyosphaeria*, but under the microscope it is easily distinguished by the different manner of attachment of the cells. It has some resemblance to *V. macrophysa*, but the cells are smaller, closely adherent and more elongate. It appears to be a form of shallow water, forming dense masses, as well in the quiet water at Grasmere as on the reefs, always awash, at Ely's Harbor.

4. V. PACHYNEMA (Martens) Weber, 1913, p. 61; *V. confervoides*[8] Harvey, Alg. Ceylon, No. 73; J. G. Agardh, 1886, p. 100; Collins, 1909, p. 373; *Bryopsis pachynema* Martens, 1866, p. 24, Pl. IV, fig. 2. Miss Wilkinson.

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8 Mme. Weber calls attention to the fact that *Valonia confervoides* was *nomen nudum* until 1886; hence *V. pachynema* has priority.

Ernodesmis Börgesen.

E. verticillata (Kütz.) Börgesen, 1912, p. 259, figs. 10–12; 1913, p. 66, figs. 51–54. P. B.-A., No. 1907; *Valonia verticillata* Kützing, 1849, p. 508; Collins, 1909, p. 373. Kemp, April, St. George's, unnamed specimen in herb.; Castle Harbor, Farlow; Harrington Sound, 3–10 dm., June, Howe; cave by Gravelly Bay, April, tidal stream, Hungry Bay, July, Collins. Generally grows in dense masses of crisp fronds, but easily separable.

Siphonocladus Schmitz.

1. Primary cell long, erect; substance soft. 1. S. tropicus.
1. Primary cell short; substance firm. 2. S. rigidus.

1. S. tropicus (Crouan) J. G. Agardh, 1886, p. 105; Börgesen, 1913, p. 61, figs. 44–51; Collins, 1909, p. 374; Vickers, 1908, p. 20, Pl. XVIII; *Apjohnia tropica* Crouan in Mazé & Schramm, 1870–77, p. 105. Harris Bay, in pools, a few individuals only, Feb., Hervey.

2. S. rigidus Howe, 1905, p. 244, Pl. XII, fig. 1; Pl. XIV; Collins, 1909, p. 374, fig. 139; P. B.-A., No. 2169. On flat rock at low water mark, Agar's Island, Dec., Collins.

Petrosiphon Howe.

P. adhaerens Howe, 1905, p. 248, Pl. XV; Collins, 1909, p. 375; P. B.-A., No. 2073. Forming a closely attached crust in pools at Harris Bay, March, Hervey.

Struvea Sonder.

S. ramosa Dickie, 1874a, p. 316; Murray & Boodle, 1888, p. 280, Pl. XVI, fig. 3; Collins, 1909, p. 377. This species was described from specimens collected by Moseley with the Challenger Expedition; there is no record of it since, either here or elsewhere.

Family DASYCLADACEAE.

Acetabularia Lamouroux.

A. CRENULATA Lamouroux, 1816, p. 249; Harvey, 1858, p. 40, Pl. XLII. A; Collins, 1909, p. 378, fig. 131; P. B.-A., No. 1908. St. George's, Kemp; Achilles Bay, June, Harrington Sound, Oct., Hervey; Fairyland, July, Harrington Sound, Aug., Collins. Common, at least during summer and autumn, on rocks and pebbles in shallow water, also brought up by dredge from about 5 meters off Spanish Point. Ripe aplanospores were found in plants from Fairyland, distributed as P. B.-A., No. 1908. At this station it covers the bottom in patches many meters square, just below the low water level.

Acicularia d'Archiac.

A. Schenckii (Möb.) Solms, 1895, p. 33, Pl. III, figs. 4, 9, 11, 12, 14, 15; Collins, 1909, p. 380; *Acetabularia Schenckii* Möbius, 1889, p. 318, Pl. X, figs. 8–12. Hungry Bay, in the tidal stream under the mangroves, June, Howe. Resembling *Acetabularia crenulata*, but with disk usually smaller, stipe shorter and stouter. It probably occurs in other stations, but has been overlooked on account of its resemblance to the more common plant.

Neomeris Lamouroux.

N. ANNULATA Dickie, 1874, p. 198; Howe, 1909, p. 87, Pl. I, fig. 2; Collins, 1909, p. 382, fig. 143; P. B.-A., No. 1909; Börgesen, 1913, p. 71, figs. 55–57; *N. Kelleri* Vickers, 1908, p. 28, Pl. XLVI. In shallow water on rock and especially on small stones, and dredged in 18 meters. Faxon; Miss Wilkinson; White Island, June, Howe; Ely's Harbor, July, Harrington Sound, Aug., Collins; Harrington Sound, Oct., Nov., Hervey. Probably to be found in quiet shallow water everywhere in the islands; other species of *Neomeris*, equally common in the West Indies, have not been noticed here.

Dasycladus Agardh.

D. CLAVAEFORMIS (Roth) Agardh, 1828, p. 16; Collins, 1909, p. 383; P. B.-A., No. 1868; *Conferva clavaeformis* Roth, 1806, p. 315. Cooper's

Island, April, Collins; Pink Bay, Spanish Point, March, Hervey. In habit much like *Batophora Oerstedi var. occidentalis*, but growing in more sheltered places.

Batophora J. G. Agardh.

B. Oerstedi J. G. Agardh. 1854, p. 108; Collins, 1909, p. 383, fig. 145; Börgesen, 1913, p. 73, fig. 58; P. B.-A., No. 1910. Fairyland, July, with ripe aplanospores, Collins.

Var. occidentalis (Harv.) Howe, 1905a, p. 579; Collins, 1909, p. 384; P. B.-A., No. 2016; *Dasycladus occidentalis* Harvey, 1858, p. 38, Pl. XLI. B. Rein; Spanish Point, June, Howe; Shelly Bay. Dec., Hervey. A condensed form, growing in more exposed localities.

Family CODIACEAE.

Codium Stackhouse.

1. Prostrate. 1. C. intertextum.
1. Erect. 2.
2. All divisions contracted at base, enlarging upwards. 4. C. isthmocladum.
2. No distinct contractions at base of divisions. 3.
3. Peripheral utricles 100–150 μ diam., exceptionally 200 μ. 2. C. tomentosum.
3. Peripheral utricles rarely under 300 μ. 3. C. decorticatum.

1. **C. intertextum** sp. nov.; P. B.-A., 2018. Fronde prostrata, tereti vel complanata, saxo arcte adhaerente, apicibus autem vulgo liberis; ramis brevibus, irregularibus, stratum subcontinuum formantibus, strato interiore siphonum dense implicatorum strato corticali cincto, utriculorum longorum, cylindricorum vel subclavatorum, apicibus truncatis, subrotundatisve, diam. 70–90 μ; colore atroviridi; substantia subfirma, nec maxime gelatinosa.

Frond prostrate, subterete or flattened, closely adherent to the rock, but with tips usually free; with short, irregular branches, forming an almost continuous coating. Interior layer of densely packed, slender tubes, surrounded by a cortical layer of long, cylindrical or somewhat clavate utricles, with truncate or somewhat rounded ends, 70–90 μ diam. Color dark green, substance rather firm, not specially gelatinous. Forming a continuous belt a few dm. wide on upright or

sloping rocks, at low water mark; Harrington Sound, Castle Harbor, etc.

In habit somewhat resembling *C. adhaerens and C. difforme,* but the frond in these is continuous, with margin entire or lobed; in *C. intertextum* the frond is narrow and branching, the branches being so densely set as to make an almost continuous coating, one branch often over another. The utricles are of much the same size and shape as in *C. adhaerens,* but the structure of the latter is dorsiventral, the utricles on the upper side only, the lower, adherent surface consisting of the slender tubes, which in *C. intertextum* form a central layer, surrounded on all sides by the utricles, rarely the middle part of the under surface without the utricles. *C. repens* Crouan, also a prostrate species, has utricles even larger than *C. tomentosum,* of the order of size of *C. decorticatum;* its branching is not as dense as that of *C. intertextum,* being more like that of *C. tomentosum,* but without the erect habit. The utricles vary somewhat in shape and size, as in all species of the genus, but the long, slender shape, the end either sharply truncate or slightly capitate, is distinct from the shape in all other American species except *C. adhaerens.* Type 7070 in Collins herbarium, from Tucker's Town, April 25, 1912. Also from Ely's Harbor, July, Gibbet Island, Sept., Collins; Gravelly Bay, Dec., Hervey. All records of *C. adhaerens* for Bermuda probably belong here.

2. C. TOMENTOSUM (Huds.) Stackhouse, 1795, p. 21, Pl. VII; Harvey, 1846–51, Pl. XCIII; Collins, 1909, p. 388; P. B.-A., No. 1869; *Conferva tomentosa* Hudson, 1762, p. 480. Tucker, No. 4, 1856; Tucker's Town, Farlow; Kemp in herb; Moseley; Buildings Bay, Harrington Sound, Shelly Bay, March, Hervey; Hungry Bay, April, Ely's Harbor, Aug., Collins. Rather common about the islands; sporangia found in May.

3. C. DECORTICATUM (Woodw.) Howe, 1911, p. 494; P. B.-A., No. 2017; *C. elongatum* Vickers, 1908, p. 22, Pl. XXVII; Collins, 1909, p. 388; *Ulva decorticata* Woodward, 1797, p. 55. Faxon; Miss Peniston; Harrington Sound, April, Aug., St. David's Island, April, Cooper's Island, Gibbet Island, Aug., Collins. Very variable in habit and size, but usually less densely branched than *C. tomentosum,* the branches often quite virgate; usually compressed more or less at or below the axils. But there are often cases when the two species are indistinguishable by external characters; the size of the utricles must then determine; in *C. tomentosum* 100–150 μ diam. rarely to 200 μ; in *C. decorticatum* 300–400 μ diam. rarely to 200 μ. There has

been some question as to whether the distinction between these two species should be based on the size of the utricles, or on the presence or absence of compression; the matter is fully discussed by Bornet, 1892, p. 216. We have adopted the former plan. It must be kept in mind that in actively growing plants or parts of plants, small and immature utricles occur among those of normal size. *C. decorticatum* sometimes grows to a large size; one plant which we found growing below low water mark in Harrington Sound was nearly a meter long and over 10 cm. wide in the expanded part; it was the largest alga we have seen in Bermuda, except possibly some *Sargassum*. It is unfortunate that the rather appropriate name of *elongatum* should have to be replaced by the quite inappropriate *decorticatum*, but as shown by Howe, it seems inevitable.

Var. **clavatum** var. nov. Fronde habitu formam cylindricam *C. decorticati* approximante, sed substantiae firmioris, vix gelatinosa, colore laete viridi; utriculis forma multo variantibus; aliis cylindricis vel leviter clavatis, 80 × 480 μ; aliis 500 μ longis, sursum dilatatis ad caput subsphaericum 145 μ diam.; aliorum inflatione terminali ad 200 μ diam., a parte subcylindrica minus distincta; aliis obcampanulatis, 650 μ longis, 350 μ diam., apice spatio brevi paullo latioribus; aliis turbinatis, 640 μ longis, apice 470 μ diam.; inter omnes, formis intermediis.

Habit that of a rather densely branched cylindrical *C. decorticatum*, but of quite firm substance, hardly gelatinous, color light green. Utricles very variable in form; some cyclindrical or slightly clavate, 80 × 480 μ; some 500 μ long, increasing in size upward to 112 μ, then with a subspherical head 145 μ diam.; in others the capitate swelling up to 200 μ diam., but less sharply marked off from the subcyclindrical part, 120 μ diam.; others inverted bell-shape, 650 μ long, 350 μ diam., somewhat wider for a short space at the truncate top; others turbinate, 640 μ long, 470 μ wide at top; with all intermediate gradations.

The largest utricle observed was 980 μ long, 480 μ diam. The plant is so firm in texture that it does not collapse when taken from the water; but when dried it is thin and papery. Sporangia ovoid, largest at the middle, obtuse at each end; sporangia apparently not mature, 160 × 64 μ, 275 × 105 μ, 280 × 100 μ; mature sporangia, packed with spherical spores about 12 μ diam., 190 × 100 μ, 240 × 120 μ. Type specimen, from stone wall at Inlet, by Frascati Hotel, Dec. 20, 1912, Hervey, No. 7322 in Collins herb. Also at Devonshire Bay, Gravelly Bay, Feb., Causeway, March, Hervey.

4. C. ISTHMOCLADUM Vickers, 1905, p. 57; 1908, p. 23, Pl. XXVIII; Collins, 1909, p. 388. Shelly and Gravelly Bays, March, Hervey. Probably not uncommon, resembling a condensed form of *C. tomentosum*, but with the divisions more or less contracted at the base, gradually increasing in diameter to the next forking. The utricles are larger than in *C. tomentosum*, approaching the size in *C. decorticatum*.

AVRAINVILLEA Decaisne.

1. Filaments distinctly moniliform. — 1. A. nigricans.
1. Filaments nearly or quite cylindrical. — 2. A. longicaulis.

1. A. NIGRICANS Decaisne, 1842, p. 96; Howe, 1907, p. 508, Pl. XXVIII, figs. 8–25; Collins, 1909, p. 390. Walsingham, Feb., Harris Bay, April, Hervey; Inlet, Cooper's Island, Aug., Collins. Very variable, from small, delicate plants to coarse, heavy and unsightly ones.

Var. FULVA Howe in P. B.-A., No. 1480; Collins, 1909, p. 390; P. B.-A., No. 2171. Stouter, coarser, with less difference between stipe and flabellum; color more yellowish than in the type.

2. A. LONGICAULIS (Kütz.) Murray & Boodle, 1889, p. 70, as to name only; Collins, 1909, p. 391; P. B.-A., No. 2170; *Rhipilia longicaulis* Kützing, 1858, p. 13, Pl. XXVIII, fig. 2. Walsingham, Feb., Mangrove Bay, Feb., Harrington Sound, Nov., Inlet, Dec., Hervey; Fairyland, Dec., Collins. Growing in company with *A. nigricans*, from which it is frequently indistinguishable, except that the filaments of the latter show distinctly moniliform on microscopic examination, while those of *A. longicaulis* are nearly or quite cylindrical. The name is a somewhat unfortunate result of following the rules of botanical nomenclature; the authors of the binomial used it for a different plant, *A. nigricans*. *Rhipilia longicaulis*, from which it derives its specific name, is according to the type specimen the present species, while the description and figure given by Kützing belong better to a third species, *A. sordida* Murray & Boodle. The arguments in favor of the name used here are found in Howe, 1907, p. 509; those in favor of preferring *A. Mazei* Murray & Boodle in Gepp, 1911, p. 27; a later summation will be found in Howe, 1911, p. 133.

PENICILLUS Lamarck.

1. Surface of stipe smooth. — 1. P. capitatus.
1. Surface of stipe rough. — 2. P. pyriformis.

1. P. CAPITATUS Lamarck, 1813, p. 299; Harvey, 1858, p. 45, Pl. XLIII. B; Collins, 1909, p. 392; P. B.-A., No. 1911. Kemp, specimen in herb.; Rein; Moseley; Wadsworth, No. 75; Tucker's Town, Farlow; Hungry Bay, June, Howe; Gravelly Bay, March, Mangrove Bay, Feb., Harris Bay, Oct., Nov., Inlet, Dec., Hervey; Cooper's Island, April, Jew's Bay, July, Ely's Harbor, Inlet, Hungry Bay, Aug., Collins. Common practically everywhere in shallow water and dredged down to 10 m.

Forma ELONGATUS (Dcne.) Gepp, 1911, p. 83, figs. 166–167; P. B.-A., No. 1912; *P. elongatus* Decaisne, 1842, p. 97 (reprint). Jew's Bay, July, Harrington Sound, Mangrove Lake, Aug., Collins. A form with long stipe, pyriform head, filaments stouter than in the typical form, in company with which it grows, the two shading into each other.

Forma LAXUS Börgesen, 1913, p. 98, fig. 80. Walsingham, Feb., Hervey. A form with long and slender stipe, head more or less irregular in form, filaments loose and slender. In the specimens which we identify with this form the branching of the stipe is not unusual, each division having a head of the normal shape for this form.

2. P. PYRIFORMIS Gepp, 1905, p. 1, Pl. CCCCLXVIII, fig. 1; Collins, 1909, p. 393; P. B.-A., No. 2075. June, Howe; Feb., Farlow; Harris Bay, Jan., Oct., Dec., Inlet, Dec., Hervey. Often growing with *P. capitatus*, but less common.

UDOTEA Lamouroux.

1. Whole flabellum with a stony coating. 2. U. flabellum.
1. Flabellum flexible, individual filaments encrusted. 1. U. conglutinata.

1. U. CONGLUTINATA (Soland.) Lamouroux, 1816, p. 312; Howe, 1909, p. 96, Pl. II, Pl. VIII, figs. 1–13; Collins, 1909, p. 395; P. B.-A., No. 1913; *Corallina conglutinata* Solander in Ellis & Solander, 1786, p. 125, Pl. XXV, fig. 7. Rein; Kemp; South Beach by Paget, Feb., Farlow; Harris Bay, Jan., Feb., March, Nov., Hervey. In tide pools, a small form only; dredged in 10 meters by the Challenger Expedition.

2. U. FLABELLUM (Ell. & Sol.) Howe, 1904, p. 94; Gepp, 1911, p. 131, Pl. III, figs. 26–28; Collins, 1909, p. 395; P. B.-A., No. 1914; *Corallina flabellum* Ellis & Solander, 1786, p. 124, Pl. XXIV. Rein; Kemp; Tucker, No. 23; Walsingham, Farlow; many stations, Hervey,

Collins. Grows practically everywhere in shallow water, varying much in size, texture, outline, etc. Some forms are rounded and entire, wider than broad; some plane, others folded longitudinally; some cuneate and much divided, some consisting of a few linear laciniae from the top of the stipe, the laciniae up to 3 dm. long and less than 1 cm. wide. All pass gradually into each other, so that varietal or form names are useless.

Halimeda Lamouroux.

1. All segments except those bearing branches cylindrical. 4. H. Monile.
1. Most segments ovoid or flattened, not cylindrical. 2.
2. Segments distinctly ribbed. 3. H. tridens.
2. Segments indistinctly or not at all ribbed. 3.
3. Segments strongly calcified, firm, thick. 2. H. simulans.
3. Segments lightly calcified, flexible, thin. 1. H. Tuna.

1. H. Tuna (Ell. & Sol.) Lamouroux, 1812, p. 186; Collins, 1909, p. 400; P. B.-A., No. 1918; *Corallina Tuna* Ellis & Solander, 1786, p. 111, Pl. XX, fig. e. Kemp; Moseley; Walsingham, Farlow; Howe; Harrington Sound, Jan., Inlet, Dec., Harris Bay, Dec., Hervey; cave, Agar's Island, Aug., Hamilton Harbor, dredged in 5 meters. Dec., Collins. Not uncommon, but less frequent than *H. tridens* and *H. Monile.* Our *H. Tuna* seems all to belong to forma *typica* Barton, 1901, p. 13, Pl. I, fig. 1.

2. H. simulans Howe, 1907, p. 503, Pl. XXIX; Collins, 1909, p. 401; P. B.-A., No. 1916. Tucker's Town, Dec., Hervey. Found only in this one locality and in small quantity. Its segments have the outline of those of *H. Tuna,* but are thicker and more calcified.

3. H. tridens (Ell. & Sol.) Lamouroux, 1812, p. 186; Harvey, 1858, p. 24, Pl. XLIV. C; Collins, 1909, p. 398; P. B.-A., No. 1917; *Corallina tridens* Ellis & Solander, 1786, p. 109, Pl. 20, fig. a. Rein; Moseley, as *H. incrassata;* Walsingham, Farlow; many stations, Collins and Hervey, dredged down to 18 meters. Common nearly everywhere and very variable. Of the various varieties and forms to which names have been given, we have

Forma typica (Barton) Collins, 1909, p. 398; *H. incrassata* forma *typica* Barton, 1901, p. 27, Pl. IV, fig. 39. A stout, stony form, with lower joints short, more or less adherent, upper joints three-ribbed or three-lobed.

Forma tripartita (Barton) Collins, 1909, p. 399; *H. incrassata* forma *tripartita* Barton, 1901, p. 27, Pl. IV, fig. 43. A more slender

form, less branched, the lower joints longer, the upper joints ending in three cylindrical lobes.

Forma GRACILIS Börgesen, 1913, p. 111, fig. 89. Joints small, subcircular in outline, not strongly calcified.

These forms all pass into each other. Börgesen considers *H. Monile* and *H. simulans* also as forms of this species, and it may be that he is right as to the former, but the differences between these two, and the three forms that we consider to belong to *H. tridens*, are greater than the differences among the latter. Gepp and Börgesen prefer the name *H. incrassata* to *H. tridens;* the case for the former is stated by Börgesen, 1911, p. 136, that for *H. tridens* by Howe, 1907, p. 501.

4. H. MONILE (Ell. & Sol.) Lamouroux, 1812, p. 186; Collins, 1909, p. 399; P. B.-A., No. 1915; *H. incrassata* forma *monilis* Barton, 1901, p. 27, Pl. IV, fig. 40; *Corallina monilis* Ellis & Solander, 1786, p. 110, Pl. XX, fig. c. Inlet, Jan., Oct., Dec., Bailey's Bay, Jan., Walsingham, Nov., Tucker's Town, Dec., Hervey; Hungry Bay, April, Collins. Rather common; the forms recognized by Börgesen both occur here.

Forma ROBUSTA Börgesen, 1913, p. 113, fig. 90. Densely branched, the upper joints cylindrical, the lower tripartite and sometimes resembling the upper joints of *H. tridens* forma *tripartita.*

Forma CYLINDRICA Börgesen, 1913, p. 113, fig. 91. Less branched, the joints nearly all cylindrical.

FAMILY BRYOPSIDACEAE.

BRYOPSIS Lamouroux.

1. Ramuli distichous. 2. B. pennata.
1. Ramuli not distichous. 2.
2. Main branches virgate, with very slender ramuli. 3. B. Duchassaingii.
2. Outline pyramidal, branching of several orders, no sharp distinction between branches and ramuli. 1. B. hypnoides.

1. B. HYPNOIDES Lamouroux, 1809, p. 333; 1809b, p. 135, Pl. I, fig. 2, a & b; Collins, 1909, p. 403. Harrington Sound, Jan., Feb., April, Walsingham, March, Hervey; Kemp, May, as *B. plumosa,* in part; cave by Gravelly Bay, April, Collins.

Forma PROLONGATA J. G. Agardh, 1886, p. 28; P. B.-A., No. 1870; *B. hypnoides* Harvey, 1846–51, Pl. CXIX. Harrington Sound, May, Dec., Collins; Old Ferry, April, Hervey.

2. B. DUCHASSAINGII J. G. Agardh, 1854, p. 107; Collins, 1909,

p. 403; *Trichosolen antillarum* Montagne, 1860, p. 171, Pl. XI. C. Kemp; Harrington Sound, March, Hervey.

Var. **filicina** var. nov. Frondis circumscriptione late vel anguste lanceolata; axi primario non diviso; axibus secundariis approximatis, aequidistantibus, saepe oppositis, a basi ramulis tenuissimis aequilongis dense obsitis.

Outline of frond broadly to narrowly lanceolate; main axis not divided; secondary axes closely and uniformly set, often opposite, densely beset from the base with very fine ramuli of equal length. Near Flatts bridge, Feb., Hervey. Type in Collins herb.

The habit of this variety is strikingly different from that of typical *B. Duchassaingii*, and the very regular pinnate branching makes it a beautiful object; but in a genus where there is so much variation within each species, it is hardly safe to consider this a distinct species.

3. B. PENNATA Lamouroux, 1809, p. 133; 1809b, p. 134, Pl. III, fig. 1; Collins, 1909, p. 405; P. B.-A., No. 1871. Rein, as *B. plumosa;* Kemp, as *B. plumosa*, in part, *B. hypnoides*, in part. In Collins, 1909, *B. pennata, B. Leprieurii* and *B. Harveyana* were kept distinct, chiefly on the judgment of Miss Vickers, who was familiar with them at Barbados. Since then we have examined some 200 specimens of *Bryopsis* of Miss Vickers' collecting, and some hundreds of specimens from Bermuda, and we have come to the conclusion that while typical examples of these three are quite distinct, intermediate forms are more common, and specific distinction is impracticable. So far we agree with Börgesen, 1911, p. 145, and 1913, p. 117, but we cannot agree with him in placing them all under *B. plumosa* (Huds.) Ag. The normal form of *B. pennata* seems to be a long, simple rachis, with short, distichous ramuli of uniform length, giving a linear outline to the frond. In *B. plumosa* the rachis bears lateral branches, increasing in length from the apex to the base, so as to give a triangular outline, usually broadly triangular, to the frond. Each of the branches has a similar triangular outline. There is much variation in luxuriance of branching, but in examining a considerable series of *B. plumosa* from northern Europe and America, to the Mediterranean on one side, to North Carolina on the other, we have seen nothing like the linear form. Among the abundant material from Barbados and Bermuda we have found no plants with repeated triangular outline of the frond and its divisions. We recognize the same varieties as Börgesen, but place them under *B. pennata*, the oldest name for the distinctly linear forms. The species and its varieties are to be found almost everywhere in the islands, but one must expect more intermediate than typical forms; moreover old plants become denuded, and present many puzzles.

Var. **secunda** (Harv.) comb. nov.; *B. plumosa* var. *secunda* Harvey, 1858, p. 31, Pl. XLV. A, figs. 1–3; *B. Harveyana* Collins, 1909, p. 405. This variety shows a certain dorsiventral arrangement, the ramuli on both edges of the rachis curving towards each other on one side.

Var. **Leprieurii** (Kütz.) comb. nov.; *B. Leprieurii* Kützing, 1849, p. 490; 1856, p. 27, Pl. LXXV, fig. 2; Collins, 1909, p. 404. In this variety the ramuli are in short secund series, separated by short vacant spaces.

Family DERBESIACEAE.

Derbesia Solier.

1. Filaments 100–600 μ diam. 3. D. Lamourouxii.
1. Filaments less than 100 μ diam. 2.
2. Filaments 40–50 μ diam., dichotomously branched. 1. D. vaucheriaeformis.
2. Filaments 50–70 μ diam., simple or with short lateral branches. 2. D. marina.

1. D. vaucheriaeformis (Harv.) J. G. Agardh, 1886, p. 34; Collins, 1909, p. 406; *D. tenuissima* Farlow, 1881, p. 60, Pl. IV, fig. 4; *Chlorodesmis vaucheriaeformis* Harvey, 1858, p. 30, Pl. XL. D. On *Dictyopteris Justii*, Gravelly Bay, Aug., Collins. With sporangia.

2. D. marina (Lyng.) Kjellman, 1883, p. 16; Collins, 1909, p. 407; *Vaucheria marina* Lyngbye, 1819, p. 79, Pl. XXII. On *Acanthophora spicifera*, Hungry Bay, May, Collins. With sporangia.

3. D. Lamourouxii (J. Ag.) Solier, 1847, p. 162, Pl. IX, figs. 18–30; Collins, 1909, p. 407; P. B.-A., No. 2168; *Bryopsis Balbisiana* var. *Lamourouxii* J. G. Agardh, 1842, p. 18. Castle Harbor, near landing at Tucker's Town, March, Hervey. The fronds are much stouter than in the two other species of the genus, sometimes simple, sometimes with a few irregular tufts of ramuli. Old and denuded plants of *Bryopsis* have some resemblance to it, but always show the scars of fallen ramuli.

Family CAULERPACEAE.

Caulerpa Lamouroux.

1. Stolon and fronds filiform, without distinct ramuli. 1. C. fastigiata.
1. Stolon and fronds different in character. 2.
2. Fronds very slender, ramuli whorled, near the summit. 3.
2. Fronds stouter, ramuli not in distinct whorls. 4.

3. Fronds not over 1 cm. high, stolon and base of frond hairy. 2. C. pusilla.
3. Fronds to 5 cm. high, hairs wanting or few. 3. C. verticillata.
4. Fronds flat or with ramuli in one plane. 5.
4. Ramuli not in one plane. 8.
5. Frond flat, entire or with proliferations. 4. C. prolifera.
5. Frond pinnate. 6.
6. Pinnules flat. 5. C. crassifolia.
6. Pinnules cylindrical or compressed. 7.
7. Pinnules narrowed at base and tapering to tip. 6. C. taxifolia.
7. Pinnules at base somewhat larger than at the curved and mucronate tip. 7. C. sertularioides.
8. Ramuli peltate. 8. C. peltata.
8. Ramuli not peltate. 9.
9. Ramuli varying from long-clavate to spherical-pedicellate. 9. C. racemosa.
9. Ramuli short, of various form, the lowest always rostriform. 10. C. cupressoides.

1. C. FASTIGIATA Montagne, 1838, p. 19, Pl. II, fig. 3; Collins, 1909, p. 411. Dingle Bay, March, Hervey; Hungry Bay, April, Collins. Fine, Vaucheria-like tufts or mats on mangroves and other objects near low water mark. The Hungry Bay material seems to be the floating form known as var. *confervoides* Crouan.

2. C. PUSILLA (Kütz.) J. G. Agardh, 1872, p. 6; Weber, 1898, p. 266, Pl. XX, fig. 6; Vickers, 1908, p. 25, Pl. XXXVIII; Collins, 1909, p. 412; P. B.-A., No. 2019. *Stephanocoelium pusillum* Kützing, 1847, p. 54. Tide pool, Harris Bay, Oct., Nov., Hervey. The branching stolon creeps over the loose sand etc., on the bottom of the pool, forming with other small algae a thin but firm turf, which has to be forcibly torn apart to show the character of the plant. The ramuli are in two or three whorls; in the Bermuda plants these whorls are more closely set than in the forms figured by Mme. Weber and Miss Vickers, and can often be distinguished only by dissection.

3. C. VERTICILLATA J. G. Agardh, 1848, p. 6; Weber, 1898, p. 267, Pl. XX, figs. 7–10; Collins, 1909, p. 412; Börgesen, 1907, p. 355, figs. 1–3; 1913, p. 121, figs. 95, 96. St. George's, April, Hervey.

4. C. PROLIFERA (Forsk.) Lamouroux, 1809, p. 332; Weber, 1898, p. 278, Pl. XXII, fig. 1; Collins, 1909, p. 413; P. B.-A., No. 1872; *Fucus proliferus* Forskäl, 1775, p. 163. Rein; Kemp; Walsingham, Farlow; Walsingham, April, Hervey; Pool by Moore's calabash tree, April, Somerset Bridge, July, Ely's reef, July, Collins. Typical form, passing into

Forma OBOVATA J. G. Agardh, 1872, p. 11; Börgesen, 1907, p. 359,

fig. 4; 1913, p. 127, fig. 100; Collins, 1909, p. 413; with broad, little proliferous fronds.

Forma ZOSTERIFOLIA Börgesen, 1907, p. 359, fig. 6; 1913, p. 127, fig. 101; Collins, 1909, p. 413; with narrow, proliferous fronds; Fairyland, Dec., Collins.

5. C. CRASSIFOLIA (Ag.) J. G. Agardh, 1872, p. 13. Typical *C. crassifolia* has not been found here; forma *laxior* is common, and is apparently a well marked endemic form, not having been reported elsewhere; forma *mexicana* is the common form of Florida and the West Indies, and though not rare in Bermuda is less common than forma *laxior*.

Forma LAXIOR (Weber) Collins, 1909, p. 413; P. B.-A., No. 1919; *C. pinnata* forma *laxior* Weber, 1898, p. 291; *C. crassifolia* var. *mexicana* Alg. Am. Bor. Exsicc., No. 170. Walsingham, April, Hervey; Hungry Bay, Tuckertown, Gravelly Bay, Pool by Moore's calabash tree, Cliff pool, April, Harrington Sound, May, Collins.

Forma MEXICANA (Sond.) J. G. Agardh, 1872, p. 13; Collins, 1909, p. 413; *C. mexicana* Sonder in Kützing, 1849, p. 496; Harvey, 1858, p. 16, Pl. XXXVII. A; Gibbet Island, Bailey's Bay, Jan., Hervey.

The form from Cliff Pool deserves special notice; Cliff Pool is a name we have used for a small but deep pool, near the SW. corner of Harrington Sound, between Tucker's Bay and Green Bay. It has a steep cliff on the side towards the sea; on the other side it is near the Sound, but separated from it by land considerably above its level. It evidently has underground connection with the Sound, the water rising and falling somewhat with the tide. On the surface of this pool, in April and May, 1912, was a floating mass of algae, chiefly *C. crassifolia, C. racemosa* and *C. sertularioides*. The stolons floated on the surface, the fronds extending beside them, the tapering rhizoids hanging straight down, sometimes reaching a length of 2 dm., reminding one of the roots of a *Lemna* or *Spirodela*, on a larger scale. Börgesen, 1907, p. 344, classifies the Caulerpas under three types. (1) The epiphytic or mud-collecting Cauperpas. (2) The sand and mud Caulerpas. (3) Rock and coral-reef Caulerpas. These three types are represented in Bermuda, and we can now add a fourth, the floating Caulerpas. Evidently this form can occur only at a station with considerable depth of water, not reached by surf, sheltered from winds, and with no current. Specimens collected here in May have been distributed as P. B.-A., Nos. 1873 and 2021. The station was revisited in August, 1913, but only a few bleached individuals were found; apparently the plants could not endure the intense heat of the midsummer sun.

6. C. TAXIFOLIA (Vahl) Agardh, 1822, p. 435; Weber, 1898, p. 292; Börgesen, 1907, p. 363, figs. 9–10; 1913, p. 131, figs. 104–105; Collins, 1909, p. 414; *Fucus taxifolius* Vahl, 1802, p. 36. Farlow; Walsingham, a single plant, Hervey. Apparently rare, but may have been mistaken for the commoner *C. crassifolia* or *C. sertularioides*, from both of which it can be distinguished by the opposite, sickle-shaped, narrow pinnules, with contracted base.

7. C. SERTULARIOIDES (Gmel.) Howe, 1905a, p. 576; Collins, 1909, p. 414; *Fucus sertularioides* Gmelin, 1768, p. 151, Pl. XV, fig. 4.

Forma LONGISETA (J. Ag.) Svedelius, 1906, p. 114, fig. 10; Collins, 1909, p. 415; P. B.-A., No. 1873; *C. plumaris* forma *longiseta* Weber, 1898, p. 295. Harrington Sound, Oct., Hervey; Cliff Pool, April, Collins.

Forma BREVIPES (J. Ag.) Svedelius, 1906, p. 114, fig. 7; Collins, 1909, p. 415; *C. plumaris* forma *brevipes* Weber, 1898, p. 294. Walsingham, March, Hervey; Ely's Harbor, July, Collins.

8. C. PELTATA (Turn.) Lamouroux, 1809, p. 332; 1809c, p. 145, Pl. III, fig. 2; Weber, 1898, p. 373, Pl. XXXI, figs. 9–11; Collins, 1909, p. 421; *Fucus chemnitzia* var. *peltatus* Turner, 1819, p. 8, Pl. CC. Faxon, a single quite typical specimen; Bethel's Island, Dec., Collins.

9. C. RACEMOSA (Forsk.) J. G. Agardh, 1872, p. 35; Weber, 1898, p. 357, Pl. XXXI, figs. 5–8; XXXII, figs. 1–7; Collins, 1909, p. 419; *Fucus racemosus* Forskäl, 1775, p. 191. A very variable species, with no acknowledged typical form, apart from the many forms and varieties into which it has been divided. It is uncertain to which of these should be referred the *C. clavifera* of Rein and Moseley.

Var. CLAVIFERA (Turn.) Weber, 1898, p. 361: Vickers, 1908, p. 28, Pl. XLV; Collins, 1909, p. 420; *Fucus clavifer* Turner, 1808, Pl. LXXVII. Harrington Sound, March, Wadsworth, No. 71; Hamilton, Farlow; these are the only records of the typical form of this variety, but forms between this and vars. *uvifera* and *laetevirens* are not uncommon.

Var. UVIFERA (Turn.) J. G. Agardh, 1872, p. 35; Weber, 1898, p. 363, Pl. XXXIII, figs. 6–7; Collins, 1909, p. 420; P. B.-A., No. 2022. *Fucus uvifer* Turner, 1819, Pl. CCXXX; Gravelly Bay, Feb., Hervey.

Var. OCCIDENTALIS (J. Ag.) Börgesen, 1907, p. 379, figs. 28–29; 1913, p. 152, fig. 124; Collins, 1909, p. 420; P. B.-A., No. 2021. *C. chemnitzia* var. *occidentalis* J. G. Agardh, 1872, p. 37; Walsingham, Jan., March, Tucker's Town, Feb., Dec., Hervey; Cliff Pool, Hungry Bay, April, Hamilton Harbor, dredged down to 18 meters, Dec., Collins. Agrees well with Börgesen's description and figures, and with

the plant distributed as W. N. & L., No. 1586. The Cliff Pool plants have mostly more distant ramuli, but some individuals are quite typical. At Hungry Bay a form was found in which the ramuli were produced on one side of the frond only; not secund in the usual sense, as they were not in a single series, but were placed, apparently irregularly, on one semi-cylinder of the axis, the other being naked.

Var. LAETEVIRENS (Mont.) Weber, 1898, p. 366, Pl. XXXIII, figs. 8, 16–22; Börgesen, 1907, p. 386, fig. 30; 1913, p. 154, fig. 125; Collins, 1909, p. 420; P. B.-A., No. 2020. *C. laetevirens* Montagne, 1842, p. 16. Kemp, in herb.; Wadsworth, No. 70; Walsingham, March, Hervey; Tucker's Town, April, Cooper's Island, Aug., Collins.

10. C. CUPRESSOIDES (Vahl) Agardh, 1822, p. 441; Weber, 1898, p. 323; Collins, 1909, p. 416; *Fucus cupressoides* Vahl, 1802, p. 29. A species containing many forms, all intergrading, once held to be distinct species.

Var. TYPICA Weber, 1898, p. 326; Börgesen, 1907, p. 368, figs. 14–16; 1913, p. 137, figs. 109–111. South Beach, Paget, Farlow.

Var. MAMILLOSA (Mont.) Weber, 1898, p. 332, Pl. XXXVIII, figs. 2–7; Collins, 1909, p. 417; Alg. Am.-Bor. Exsicc., No. 96; P. B.-A., No. 1920; *Caulerpa mamillosa* Montagne, 1842, p. 13. Outer reef, Ely's Harbor, July, Somerset Bridge, July, Gravelly Bay, Aug., Collins. At Gravelly Bay it grew exposed to the waves, the stolon adhering firmly to the rock and covered with sand, so that only the short fronds were visible, often only the tips.

Var. ERICIFOLIA (Turn.) Weber, 1898, p. 335; Collins, 1909, p. 417; *Fucus ericifolius* Turner, 1808, p. 124, Pl. LVI, "found at Bermuda Islands, Herb. Banks." Kemp, in herb. as *C. ericifolia;* Gravelly Bay, Aug., Collins. A few plants at Gravelly Bay, among var. *mamillosa,* distinguished by the cylindrical ramuli.

C. Ashmeadii Harvey, is recorded in Collins, 1909, p. 414, as occurring at Bermuda. We have not been able to confirm this record, and as we have not ourselves found this species, we do not include it in the present work.

FAMILY VAUCHERIACEAE.

VAUCHERIA DC.

*V. SPHAEROSPORA Nordstedt, 1878, p. 177, Pl. II, figs. 7–8; Collins, 1909, p. 429. In "Millbrook" Dec., Collins, with oogonia and antheridia. This species has been found in Greenland, Denmark,

Sweden and Great Britain, and also in Uruguay. The Bermuda plant is dioecious, agreeing in that respect with the South American form; in Europe the species is monoecious. Another *Vaucheria* was found at Hungry Bay, Collins, but being sterile could not be specifically determined.

Dichotomosiphon Ernst.

D. pusillus Collins, 1909, p. 431; P. B.-A., No. 2023. Bailey's Bay, Jan., Harrington Sound, March, Inlet, March, Hervey; Shelly Bay, Hungry Bay, April, Collins. Apparently common, forming dark green or almost black mats on rocks, Udotea etc., or loose floating felts. At Bailey's Bay it was found with filaments 50 μ diam.; the normal diam. does not exceed 30 μ. In the material from Harrington Sound, the contents of the filaments is often divided into sections, approximately as long as their diameter, separated by a narrow transparent space in a plane at right angles with the axis of the filament. This may be preliminary to the formation of spores of some sort, but no more advanced stage was seen.

Family CHARACEAE.

Chara Agardh.

*C. gymnopus var. Berteroi A. Braun, 1882, p. 195. Pembroke Marshes, Jan., Farlow. The specimen in the Farlow herbarium was characterized by Nordstedt, in litt., as "forma tenuior" which we understand to be merely descriptive, not a name.

Class **PHAEOPHYCEAE.**

Family ECTOCARPACEAE.

Pylaiella Bory.

P. FULVESCENS (Schousboe) Bornet, 1889, p. 5, Pl. I; P. B.-A., No. 2076; *Conferva fulvescens* Schousboe ms ex Bornet. On sand-covered rocks by lighthouse, St. David's Island, May, 1913, Hervey. The plant agrees fully with Bornet's figure as to form and dimension of horizontal filaments and sporangia; the erect filaments are in part simple, as figured by Bornet, in part like those figured by Sauvageau, 1896a, fig. 1, being recurved near the tips, and bearing numerous longer or shorter branches, mostly on the outer side of the curve. The unilocular sporangia are rare, but well developed. *P. Hooperi*, Barbados, Miss Vickers, seems hardly distinct. In comparing the description of *P. fulvescens* by Bornet with that of *Pylaiella* sp. (*Ectocarpus Hooperi* Crouan) on the following page, the chief distinctive character of the latter would seem to be the Rhizocloniumlike ramuli near the base; such ramuli were occasionally seen in the Bermuda plant, but were not at all abundant.

Ectocarpus Lyngbye.

1. Lower part of frond endophytic. 2.
1. Not endophytic. 3.
   2. Only slightly endophytic, in Dictyopteris Justii; largely free; plurilocular sporangia cylindrical. 8. E. luteolus.
   2. Mostly endophytic, in Halymenia; plurilocular sporangia ovoid. 9. E. parasiticus.
3. Erect filaments arising from prostrate, branching filaments. 4.
3. No distinct prostrate filaments. 5.
   4. Erect filaments with plurilocular sporangia near base, no other branching. 7. E. elachistaeformis.
   4. Erect filaments freely branched, bearing sporangia throughout. 9.
5. Plurilocular sporangia seriate on upper side of branches, near base. 6.
5. Plurilocular sporangia variously placed, not seriate. 8.
   6. Plurilocular sporangia cylindrical. 3. E. Mitchellae.
   6. Plurilocular sporangia ovoid to conical. 7.

7. Branching irregular, branches patent. 4. E. coniferus.
7. Branches subsecund, ramuli long, pectinate. 5. E. Sandrianus.
8. Plurilocular sporangia fusiform, unilocular unknown. 1. E. confervoides.
8. Plurilocular sporangia short-conical, unilocular ovoid or subspherical. 2. E. siliculosus forma arctus.
9. Plurilocular sporangia variable, always blunt or truncate. 6. E. Duchassaingianus.
9. Plurilocular sporangia acute. 10. E. Rallsiae.

1. E. CONFERVOIDES (Roth) Le Jolis, 1863, p. 75; Kuckuck, 1891, p. 19, fig. 3; *Ceramium confervoides* Roth, 1797, p. 151. Floating, Gibbet Island, March, Hervey. Somewhat variable, but mostly of the typical form.

2. E. SILICULOSUS (Dillw.) Lyng. forma ARCTUS (Kütz.) Kuckuck, 1891, p. 18; P. B.-A., No. 1922; *Ectocarpus arctus* Kützing, 1843, p. 289; *Corticularia arcta* Kützing, 1855, p. 23, Pl. LXXX, fig. II. On sand covered rocks, below low water mark, Gibbet Island, March, Harris Bay, April, Hervey; floating, Tucker's Town, April, Harrington Sound, May, Collins. *E. acanthoides* Vickers, Barbados, No. 95, seems to be the same plant. We have not found in Bermuda the typical form of *E. siliculosus*, which is common on both sides of the North Atlantic.

3. E. MITCHELLAE Harvey, 1852, p. 142, Pl. XII. G; P. B.-A., No. 1921; *E. virescens* Thuret in Sauvageau, 1896, p. 18 of reprint. Harris Bay, Heron Bay, Jan., St. David's Island, Feb., Harrington Sound, Shelly Bay, March, Hervey; Shelly Bay, Harrington Sound, Cooper's Island, April, Collins. A common species, growing on corals, larger algae, aquatic phanerogams, and on submerged twigs of live Tamarisk. Plurilocular fruit apparently always abundant, megasporangia and meiosporangia in about equal numbers. The former have not been recorded for the Atlantic coast of North America, where the species is common, but were found in California, and distributed as P. B.-A., No. 671. When growing on any hard substance, rhizoidal growth is usually insignificant; on *Castagnea, Helminthocladia* etc., the rhizoids are strongly developed, penetrating well into the tissue of the host.

4. E. CONIFERUS Börgesen, 1914, p. 164, figs. 131–132. Shelly Bay, April. Hervey, among *E. Mitchellae.* This species was quite recently described from the Danish West Indies, and its occurrence at Bermuda is of interest, indicating that it may be found at other stations in the Atlantic.

5. E. SANDRIANUS Zanardini, 1843, p. 41; 1865, p. 143, Pl. LXXIV. B; *E. elegans* Thuret in Le Jolis, 1863, p. 77, Pl. II, fig. 1–2; not of Menegh. Shelly Bay, Jan., St. David's Island, Feb., Hervey; with plurilocular sporangia. In both cases mixed with other species of *Ectocarpus;* this mixture of species of *Ectocarpus* is quite common and sometimes perplexing. It is the rule rather than the exception.

6. E. DUCHASSAINGIANUS Grunow, 1867, p. 45, Pl. IV, fig. 1; Vickers, 1905, p. 59; 1908, Pl. XXVII; Börgesen, 1914, p. 159, figs. 127–128; P. B.-A., No. 2077. Major's Bay, March, Hervey. On sticks and twigs, outlet of aquarium, Agar's Island, Aug., Collins. The Major's Bay plant agrees with Börgesen's description and figures, and with a specimen of Miss Vickers, Barbados, No. 89. The plant from the aquarium outlet differs in the absence of hairs, and in the greater variability of form of the plurilocular sporangia. These are often exactly like Börgesen's figures, but in other instances the cylindrical or clavate body of the sporangium has a shortly acuminate or subulate apex; the same occurs in Miss Vickers specimen. Unilocular sporangia were not seen. The cells were all very densely packed, and it was only in the youngest that the irregularly rounded disks of the chromatophores could be seen. Though there were no hairs, the branches often ended in a long simple filament, 10–14 μ diam., with longer cells than in the rest of the plant, but all were well supplied with chromatophores. The sporangia were sometimes sessile, oftener on a short pedicel, occasionally terminating a branch, as shown in Börgesen's fig. 128e. The cell bearing a sporangium was usually distinctly shorter than the adjacent cells, as in *E. indicus* Sonder, as noted by Mme. Weber, 1913, p. 129, fig. 34. We are inclined to agree with Börgesen that *E. Duchassiangus* may be merely a form of *E. indicus,* but for the present it seems better to retain the former name. The station where this plant occurred is a peculiar one; the salt water outlet of the aquarium is well up in the rock at the shore of the island; the water runs down into the sea, stalks of grass and other objects reached by it being covered by a dense coating of various kinds of algae, *Enteromorpha* predominating, but also other Chlorophyceae and several Myxophyceae; the variations of this material from the type may be due in some way to the exceptional conditions.

7. E. ELACHISTAEFORMIS Heydrich, 1892, p. 470, Pl. XXV, fig. 14; Börgesen, 1914, p. 174, fig. 137. On *Codium decorticatum,* Cooper's Island, Aug., on *Galaxaura squalida* & *Helminthodadia Calvadosii,* St. David's Island, April, Collins. The form reported by Börgesen

differs somewhat from the typical, but not enough to raise any question as to identity. Our form comes nearer to the type from New Guinea. The only marked difference is in the basal portion of the plant growing on *Codium*. When growing on *Sargassum* it formed a more or less definite basal layer, from which short rhizoids issued, entering the host. On the *Codium* there is no definite basal layer, but a compact bundle of irregular rhizoidal filaments, narrower than the assimilating filaments, with few chromatophores, and cells up to 10 diam. long. The lower ends of these rhizoids separate more or less, and spread among the utricles of the host. This difference is explainable by the difference in structure of the hosts. On the *Galaxaura* the rhizoids are less conspicuous. Plurilocular sporangia, similar to those figured by Heydrich, were abundant.

8. E. LUTEOLUS Sauvageau, 1892, p. 25, Pl. II, figs. 14–19. On *Dictyopteris Justii*, South Shore, Aug., Collins. The lower part of the frond inhabits the tissue of the host; the upper part forms a fine down on the surface.

9. E. PARASITICUS Sauvageau, 1892, p. 28, Pl. III, figs. 20–23; *Streblonema parasiticum* (Sauv.) De Toni, 1895, p. 575. In *Halymenia pseudofloresia*, Jan., Hervey. Mostly endophytic; the plants from Maine, distributed as P. B.-A., No. 1337, were chiefly external, the difference being probably due to the firmer tissue of the host in the latter case, *Cystoclonium purpurascens*.

10. E. RALLSIAE Vickers, 1905, p. 59; 1908, Pl. XXXII; Börgesen, 1914, p. 169, fig. 133; P. B.-A., No. 2172. On *Helminthocladia calvadosii*, Old Ferry, April, Hervey. The main filaments are occasionally stouter than in the Barbados and St. Thomas material, up to 40 μ diam., but usually not over 30 μ, in lesser divisions down to 20 μ, in hairs to 10 μ. There is a system of descending filaments, irregular and twisted, but otherwise like the erect filaments, extending for quite a distance in the tissues of the host; plurilocular sporangia agree in form, dimensions and position with Börgesen's figure.

STREBLONEMA Derbès & Solier.

S. SPHAERICUM Derbès & Solier in Castagne, 1851, p. 100; Sauvageau, 1897, p. 18, figs. 2–3 (of reprint); Kuckuck, 1899, p. 28, figs. 6–7. In *Castagnea Zosterae*, Cooper's Island, April, Collins. With uni- and plurilocular sporangia; generally in company with *Myriotrichia*, which it much resembles.

Ascocyclus Magnus.

A. orbicularis (J. Ag.) Magnus, 1874, p. 73; P. B.-A., No. 1878; *Myrionema orbiculare* J. G. Agardh, 1848, p. 48. On marine phanerogams in shallow water, Cooper's Island, April, Collins. Probably elsewhere, but easily overlooked.

Family SPHACELARIACEAE.

Sphacelaria Lyngbye.

1. Propagula with broad body. 2.
1. Propagula slender, branching. 3.
2. Filaments mostly 30–40 μ diam.; lateral cell of propagulum not divided. 3. S. tribuloides.
2. Filaments mostly 55–75 μ diam.; lateral cell of propagulum divided into two. 4. S. novae-hollandiae.
3. Propagulum with three rays from summit of pedicel. 2. S. fusca.
3. Propagulum with two rays from summit of pedicel. 1. S. furcigera.

1. S. furcigera Kützing, 1855, p. 27, Pl. CX; Sauvageau, 1901,[9] p. 145, fig. 35. On small spider crab, Hungry Bay, July, on floating *Turbinaria*, Dec., Collins; with propagula.

2. S. fusca (Huds.) Agardh, 1828, p. 28; Sauvageau, 1902, p. 206, fig. 43; *Conferva fusca* Hudson, 1798, p. 602. Spanish Rock, April, Hervey, with propagula.

3. S. tribuloides Meneghini, 1840, p. 2; Sauvageau, 1901, p. 123, figs. 28–29; P. B.-A., No. 1923. Not uncommon in shallow rock pools and on various submerged substances. In pools, South Shore, Farlow; Harris Bay, Feb., March, Dec., Gravelly Bay, Jan., Hervey; on *Galaxaura*, St. David's, April, Collins. Found once on twigs of Tamarisk that drooped into the water of Harrington Sound. Propagula common; no sporangia seen.

4. S. novae-hollandiae Sonder, 1845, p. 50; Sauvageau, 1901, p. 137, fig. 33. In small quantity, among *S. tribuloides*, Spanish Rock,

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[9] In references to this work, the page given is that of the completed and separate issue; the date, however, is that of the original publication in the Journal de Botanique.

Harris Bay, March, Hervey. The species is a native of Australia, but has been found at Martinique and at Barbados; in both these places it was in company with *S. tribuloides*, as at Bermuda. It is a stouter plant than the latter, and the technical difference, though not striking, seems to be constant.

Family ENCOELIACEAE.

Colpomenia Derbès & Solier.

C. sinuosa (Roth) Derbès & Solier, 1856, p. 11, Pl. XXII, figs. 18–20; Börgesen, 1914, p. 176, fig. 138; P. B.-A., No. 2024; *Ulva sinuosa* Roth, 1806, p. 327, Pl. XII, fig. 2. Rein; Moseley; Kemp, as *Asperococcus sinuosus;* Gibbet Island, Tucker's Town, Gravelly Bay, Harrington Sound, Feb., Hungry Bay, April, Hervey. Very common from Feb. to April, disappearing entirely in July and August, and at least the first part of September. On exposed shores it forms a nearly continuous coating, firmly adherent to the rock; in quiet water, such as the tidal stream at Hungry Bay, it takes the form of subspherical vesicles, up to 20 cm. diam.

Hydroclathrus Bory.

H. cancellatus Bory, 1825, p. 419; Vickers, 1908, Pl. XXIII; Börgesen, 1914, p. 177, fig. 139; P. B.-A., No. 2078. Spanish Rock, March, April, Hervey. Apparently not common.

Scytosiphon Agardh.

S. Lomentaria (Lyng.) J. G. Agardh, 1848, p. 126; P. B.-A., No. 2079; *Chorda Lomentaria* Lyngbye, 1819, p. 74, Pl. XVIII. E. Inlet, Feb., Dec., Bailey's Bay, Jan., Mangrove Bay, Feb., Hervey. Appears to be a plant of winter and early spring, varying in different years as to date of appearance, in some years not appearing at all at a station where it was plenty the year before. It is a rapid grower, and disappears soon after maturity.

Rosenvingia Börgesen.

R. intricata (J. Ag.) Börgesen, 1914, p. 182; P. B.-A., No. 2173; *Asperococcus intricatus* J. G. Agardh, 1847, p. 7; *Striaria intricata* Vickers, 1905, p. 59; 1908, p. 41, Pl. XXIV. Harris Bay, Feb., Hervey, with plurilocular sporangia.

Family MYRIOTRICHIACEAE.

Myriotrichia Harvey.

M. repens Hauck, 1879, p. 22; Kuckuck, 1899, p. 21, Pl. III (of reprint); P. B.-A., No. 2025; *Dichosporangium repens* Hauck, 1885, p. 339, fig. 141. In fronds of *Castagnea Zosterae*, Cooper's Island, April, Collins. The creeping filaments bear abundant unilocular sporangia; the erect filaments bear each a terminal cluster of plurilocular sporangia; no unilocular sporangia were seen on the erect filaments. *Streblonema sphaericum*, with both kinds of sporangia, accompanies the *Myriotrichia*. As pointed out by Kuckuck, it is practically impossible to distinguish the two species when both bear only unilocular sporangia, as is often the case; the presence of erect filaments in *Myriotrichia* and their absence in *Streblonema* is the only distinguishing character.

Family MESOGLOIACEAE.

Castagnea Derbès & Solier.

C. Zosterae (Mohr) Thuret, fide Börgesen, 1914, p. 184, figs. 144–145; *Castagnea mediterranea* P. B.-A., No. 1879. Kemp, as *Mesogloia vermicularis*, *M. Griffithsiana* and *M. Chordariae;* Castle Harbor, Bailey's Bay, March, Wadsworth; Shelly Bay, Jan., Castle Harbor, Feb., Hervey; Cooper's Island, April, Collins. As this plant seems to be the same as that from the Danish West Indies, we provisionally give the same name used by Börgesen. It was distributed by us as *C. mediterranea* (Kütz.) Bornet, but is not *Cladosiphon mediterraneus* Kützing, as shown by comparison with an authentic specimen of the latter, for which we are indebted to the kindness of

Dr. M. A. Howe. It is certainly not *C. Zosterae* Farlow, 1881, p. 86, Alg. Am.-Bor. Exsicc., No. 162, but resembles *C. virescens* Farlow, 1881, p. 85, *Eudesme virescens* P. B.-A., No. 33, which is the same as *Mesogloia virescens* Carmichael in Wyatt, Alg. Danm., No. 49. Though some writers speak of *C. virescens* as having a solid axis, *C. Zosterae* as hollow, for instance Bornet, 1892, p. 236, the statement is true of the former only in the earlier stages. "A section of the frond of a well-developed *C. virescens* shows a circle of roundish cells around a central cavity"; Farlow, l. c. The description and figure of *C. Zosterae* Börgesen, agree with the Bermuda plant.

In New England and northern Europe there are two species of *Castagnea,* which are well distinguished by Farlow as *C. virescens* and *C. Zosterae;* the former resembles the Bermuda plant; the latter, quite distinct, is the *Myriocladia Zosterae* Crouan, Alg. Mar. Finistère, No. 49, and the *Castagnea Zosterae* of Le Jolis, 1863, p. 85, fide spec. authent.; but it may be open to question whether it is the *Mesogloia virescens* var. *zostericola* Harvey, 1846–1851, Pl. LXXXII, of which Harvey says "only differs in being of smaller size, with less compound ramification; there is no microscopic character to distinguish it." And in the Nereis Bor.-Am., part 1, 1852, p. 127, where he recognizes two species as distinct, he questions the identity of his *Mesogloia Zosterae* with the species of Lyngbye and Areschoug. His plate X. B, *M. virescens,* is drawn from a specimen from Sand Key, Florida, to which we will refer later; we do not think it is the *M. virescens* of New England and northern Europe. Plate X. A, *M. Zosterae,* is incorrect and misleading, as pointed out by Farlow. If it should prove that *Rivularia Zosterae* Mohr, 1810, p. 367, was identical with *Mesogloia virescens* Carmichael, *Castagnea Zosterae* would be the proper name for the spring plant of New England and northern Europe, and a new name would be needed for the smaller summer plant now known by that name. As to the identity of *C. virescens* of New England and northern Europe with the Bermuda plant, we are not now prepared to point out distinctive characters. But the southern plant is usually stouter, less branched, and with a firmer gelatine. For the purpose of comparison we have examined a large number of specimens of *Castagnea* (or *Mesogloia*) *virescens* of northern Europe and New England, including specimens from Mrs. Griffiths, Mrs. Wyatt, Greville, Harvey, Le Jolis etc.; with very few exceptions they bore unilocular sporangia; none had plurilocular. Of *Castagnea* (or *Myriocladia*) *Zosterae* we have examined a considerable number, including specimens from Le Jolis and Crouan, and the No. 162 of Farlow, Anderson

& Eaton; with one exception, sterile, all had plurilocular sporangia, none unilocular. Of the Bermuda plant we have examined many specimens of different ages and from different stations; with the exception of a very few, very young or very old individuals, sterile, all bear both uni- and plurilocular sporangia on the same individual. To add to the confusion, the plant from Florida, distributed as *C. mediterranea*, P. B.-A., No. 481, when compared with the Bermuda plant now seems to be distinct both from that and from *Cladosiphon mediterraneus* Kütz. The peripheral filaments seem to be not so much laterally attached to the external longitudinal filaments as continuations of them or their branches; the basal cell, up to 25 μ diam., followed by several similar colorless cells rapidly diminishing to about 12 μ diam.; above this begins the peripheral filament proper, with colored cells about 7–9 μ diam.; this is several times dichotomous, the cells, except the few lower ones, spherical, increasing in size up to 15 μ, sometimes to 20 μ diam., the filaments strongly incurved; unilocular sporangia, 70–80 $\times$ 55–60 μ in the lower forkings. The frond does not exceed 10 cm. in height, and has few branches. Harvey's figure of *Mesogloia virescens*, 1852, Pl. X. B, was drawn from a plant from Sand Key, Florida, and we have examined two specimens collected by Harvey at that place at that time; they agree with P. B.-A., No. 481, except that they have no fruit. In Harvey's plate fig. 4 represents quite well the upper part of a peripheral filament of this plant, but is quite different from a filament of *C. virescens*. We have found only one European specimen agreeing with P. B.-A., No. 481; this is "No. 572, Société dauphinoise, 1882, *Cladosiphon mediterraneus* Kütz. (Vidit Bornet, 1882) Portofino (Ligurie orientale) sur les feuilles de *Posidonia Caulini*. Dr. A. Piccone, Mai, 1876." This specimen was received by one of us from Dr. Piccone. Sauvageau, 1897, p. 46, discusses *Castagnea*, assuming correctly enough that if *Castagnea* is maintained, *Cladosiphon* Kützing should be divided between *Castagnea*, *Nemacystus* etc. But the name *Cladosiphon* clearly antedates *Castagnea*, and under the international rules should be retained for *C. mediterraneus* and its congeners. *Eudesme* J. G. Agardh seems to have no claim to distinctness from *Cladosiphon*. We refrain from making any new combinations, in the hope that Kuckuck's work on the Phaeophyceae may soon appear, and bring order out of the present chaos.

Family STILOPHORACEAE.

Stilophora J. G. Agardh.

S. rhizodes (Ehrh.) J. G. Agardh, var. adriatica (Ag.) J. G. Agardh, 1848, p. 85; *Sporochnus adriaticus* Agardh, 1827, p. 646; 1828–35, Pl. XXX. Harrington Sound, April, Hervey, with plurilocular sporangia. More slender and delicate than the typical *S. rhizodes*, which is of a more northern range.

Family SPOROCHNACEAE.

Sporochnus Agardh.

S. Bolleanus Montagne in Kützing, 1859, p. 33, Pl. LXXXI, fig. II; P. B.-A., No. 2174. Dredged in 22 meters on coral rocks in June, Kemp, as *S. pedunculatus;* handsome plants with assimilative filaments well developed, Castle Island, Miss Wilkinson; a similar plant, Miss Peniston, no data; Gravelly Bay, old plants with mature fruit, washed ashore, Aug., Collins; dredged near Challenger Reef, in 60 meters, Aug., 1903, Bermuda Biological Station.

Family TILOPTERIDACEAE.

Heterospora Kuckuck.

H. Vidovichii (Meneg.) Kuckuck, 1895, p. 318, Pl. IV, figs. 1–20; *Haplospora Vidovichii* Bornet, 1891, p. 363, Pl. VIII, figs. 1–5; P. B.-A., No. 2026; *Ectocarpus Vidovichii* Meneghini in Kützing, 1845, p. 233; *E. crinitus* Hauck, 1885, p. 330, not of Carmichael. Forming rather dense tufts, up to 4 dm. long, on wall of inlet by the Frascati Hotel, March, Hervey, with monosporangia. The occurrence here of a representative of the family Tilopteridaceae is of much interest; barely half a dozen species are known, and all but this one inhabit the colder waters of the Atlantic. *H. Vidovichii* inhabits the Mediterranean, and this is its first recorded occurrence elsewhere.

Family FUCACEAE.

Ascophyllum Stackhouse.

A. NODOSUM (L.) Le Jolis, 1863, p. 96; *Fucus nodosus* Linnaeus, 1763, p. 1628; Harvey, 1846–51, Pl. CLVIII. Wadsworth, in Farlow herb.; Inlet, Jan., May, Gravelly Bay, Feb., Shelly Bay, March, Hervey; Gravelly Bay, April, Shelly Bay, Bethel's Island, Dec., Collins. This species is not uncommonly found among the floating algae left by the tide but it has never been found attached, and as it is a conspicuous plant, it is not likely that it has been overlooked. It is common on the American coast from New Jersey to the arctic regions, but rarely reaches to low water mark, and does not grow in places exposed to the full force of the waves. There is no reason to suppose that it grows here in deep water, or on the outer reefs awash with the waves, the only class of localities not well explored. Prof. Sauvageau, to whom we are much indebted for information as to its habits in Europe, writes us "Jamais je n'ai vu l'*Ascophyllum* dans les stations franchement exposées au choc des vagues, mais toujours dans les stations plus ou moins abritées, par exemple dans les anses rocheuses, dans les petits ports, sur les rochers qui émergent parmi la vase. C'est une plante de mi-marée." As regards the general question of brown algae washed ashore in places on the Bay of Biscay, where they do not grow, he says, "En résumé, l'*Ascophyllum*, rejeté, arrive en très bon état, fructifié ou non, selon la saison, mais on ne peut dire s'il a flotté très longtemps, puisqu'il vit sur les rochers à une trentaine de kilometres de là. *L'Himanthalia* est dans le même cas. Mais le *Cystoseira concatenata* et le *Sargassum vulgare* viennent surement de très loin, et cependant leurs organes reproducteurs sont aptes à la fecondation. Les algues brunes, normalment fixées, se conservent très bien à l'état flottant, beaucoup mieux qu'on le croit generalment. Donc, à mon avis, il n'est nullement nécessaire que l'*Ascophyllum* croisse aux Bermudes pour que vous l'y trouvez rejeté; il peut y arriver en très bon état, et même capable de produire des fécondations et des germinations, bien qu'il provienne d'un pays lointain et qu'il ait flotté longtemps." It seems to us quite unlikely that the plants found at Bermuda could have come from the American coast across the Gulf Stream. The chances are certainly greater for its European origin, and there is good reason to suppose that it forms a portion,

a relatively small portion, to be sure, of the living and floating brown algae of the North Atlantic, which have given a certain district of it the name of the "Sargasso Sea." Bouvier, 1907, p. 35, says "Ça et la, parmi les Sargasses, on rencontre quelques fragments de Fucus nodosus, arrachées certainement aux rivages des Canaries, de Madère ou des Açores." To be sure, Sauvageau, 1907, p. 1084, points out that the *Fucus* (*Ascophyllum*) has never been reported growing at the Canaries, Madeira or the Azores; but Bouvier's erroneous assumption does not invalidate his record of the occurrence of the plant as described. Börgesen, 1914a, p. 14, note, says "Professor Gran has most kindly communicated me that *Ascophyllum* was found in the northern part of the Sargasso Sea, and rather abundant." We think it may be concluded that *Ascophyllum*, the original derivation unknown, continues to live in a floating state among the *Sargassum* of the North Atlantic in active vegetation, and at least occasionally fruiting.

Fucus Linnaeus.

F. vesiculosus Linnaeus, 1763, p. 1636. A single battered but unmistakable fragment was found washed ashore, Hervey.

Turbinaria Lamouroux.

T. tricostata Barton, 1891, p. 218, Pl. LIV, fig. 3; P. B.-A., No. 1877. Gravelly Bay, Jan., Feb., March, April, Aug., Oct., Nov., Dec., Hervey; Hungry Bay, July, Collins. Except a few plants from near the entrance of Hungry Bay, the only locality we have observed is at Gravelly Bay, where it grows abundantly in pools at low water mark and sometimes higher up. *T. trialata* Kütz., the common species of the West Indies, we have not found, and though the two species have much in common, we have found no plants that would raise any doubt as to their distinctness. Quite young plants were found in August; in these neither alae nor costae had yet been formed. The mature plants, in December and January, are from 10 to 15 cm. high; the root is rather slender, much branched, 2–4 cm. long; as the plants grow close together, the roots are intermixed, but so loosely that individual plants can be separated without difficulty.

Sargassum Agardh.

The Sargassa abound everywhere in warmer water; there have been very many species described, and new ones are continually added to the list; undoubtedly there have been many cases where observers from distant regions have described the same species independently and in good faith; ultimately one of the names must give way to the other. On the other hand more conservative botanists have used the name of a well-known species for a form found at a station distant from the home of the species, and sooner or later the later named form will have to be segregated. Whether mistakes made by too radical or by too conservative treatment are more harmful, will probably remain an open question in botanical as in other matters. In our treatment of the Bermuda species, we find in some of them more or less noticeable differences from the species of the same name elsewhere, and we have given an account of the characters of each of the species we recognize, and have drawn these characters from Bermuda specimens, not from descriptions of others.

Key to the Species of Sargassum.

1. Always floating, without fruit or basal attachment. 2.
1. Attached, fruiting. 3.
2. Slender throughout, the leaves very narrow, with aculeate teeth. 1. S. natans.
2. Stouter; leaves lanceolate with triangular teeth. 2. S. fluitans.
3. Stem densely muriculate or with short proliferations. 4.
3. Stem not muriculate, or only slightly and occasionally so. 5.
4. Leaves ovate or broadly lanceolate. 4. S. lendigerum.
4. Leaves narrowly linear, simple or 1-several times forked. 3. S. linifolium.
5. Fructification long, slender, filiform, loosely branched. 6. S. Filipendula var. Montagnei.
5. Fructification not so slender or elongate. 6.
6. Receptacles with dentate wings. 8. S. platycarpum var. bermudense.
6. Receptacles wingless. 7.
7. Individual receptacles on slender pedicels. 3. S. linifolium.
7. Receptacles fertile throughout. 8.
8. Receptacles forming a dense glomerule. 7. S. Hystrix.
8. Receptacles repeatedly forked, branches separate. 5. S. vulgare.

1. S. natans (L.) J. Meyen, 1838, p. 185; Börgesen, 1914, p. 7; P. B.-A., No. 2180; *S. bacciferum* Agardh, 1821, p. 6; Harvey, 1852,

p. 54; *Fucus natans* Linnaeus, 1753, p. 1160; *Fucus bacciferus* Turner, 1808, p. 105, Pl. XLVII. Stem long, slender, smooth, with more or less distant similar branches; leaves long, slender, linear, with many sharp teeth, cryptostomata wanting or inconspicuous; vesicles numerous, on long slender pedicels, and usually with a filiform prolongation; fructification unknown; unattached, floating near the surface of the sea, forming loose floating patches, or strips in the line of the direction of the wind; in quiet water the tips of the leaves project above the water, like bristles; drifting ashore at all times, and in case of storms in immense quantities, and used as a fertilizer. It inhabits a large area in the North Atlantic, within a boundary formed by the Gulf Stream and its subsidiaries, reaching the coast of Europe, turning south and then west to its origin in the Gulf of Mexico. It has an active vegetative growth, the lower part of the stem decaying, increasing the number of individuals by fragmentation. It has never been found attached nor in fruit, and though in all probability originally derived from an attached form, it now appears to be so changed by its mode of life that it is unlikely that the attached species from which it was derived will ever be certainly determined.[10]

In several instances there have been reports of finding this species in fruit, but in each case when examined there are circumstances leading to the conclusion that the plant observed belonged to some other species.

2. S. FLUITANS Börgesen, 1914a, p. 222; P. B.-A., No. 2177; *S. Hystrix* var. *fluitans* Börgesen, 1914, p. 11, fig. 8. Stem rather stout, mostly smooth, occasionally with a few spines, much branched; leaves lanceolate to ovate-lanceolate, thickish, cryptostomata present but not conspicuous, teeth short and triangular; vesicles spherical, about 5 mm. diam., short-pedicelled, usually without prolongations; fructification unknown. Floating with *S. natans*, but less abundant; propagated by fragmentation only. It may be derived from *S. Hystrix* J. Ag., but if so the derivation is remote and the differentiation considerable. Both *S. natans* and *S. fluitans* are lighter in color than the attached species.

3. S. LINIFOLIUM (Turn.) Agardh, 1848, p. 18; P. B.-A., No. 2179; *Fucus linifolius* Turner, 1811, p. 64, Pl. CLXVIII. On rocks above and below Flatts bridge and at other points in Harrington Sound and in Hamilton Harbor, Hervey, Collins. From a common base but without any general trunk arise several axes with more or less frequent

10 For fuller discussion of floating Sargassum, see Collins, 1917.

branches, elongate, virgate, bearing leaves, fructification, and short branches; stems slender, terete, densely muriculate with short simple or forked papillae, which are occasionally more scattered on the older parts; leaves thickly set at the tips of the main branches and along short lateral branches, linear and attenuate to both ends, 1–2 mm. wide, up to 5 cm. long, simple or forked, margin irregularly dentate with small distant teeth, in young leaves larger and more frequent; midrib not specially conspicuous; cryptostomata rather large, a single series each side of the midrib, rather irregularly spaced; vesicles 3–6 mm. diam., smooth, or sometimes with cryptostomata, subspherical on a filiform pedicel of uniform diameter, or pyriform on a pedicel enlarged above; pedicel smooth, length one and one half to three times the diameter of the vesicle, usually unarmed, occasionally with a small mucro, rarely with a short filiform prolongation. Rachis of fructification usually short, sterile and filiform, or fertile and torulose, bearing several alternate, torulose, fertile branches, with subacute tip, one half to one cm. long; fructification mostly on the lower part of short branches of the second order with leaves about them on the branches.

The above description refers to the attached plant of quiet waters, but individuals more slender than the typical form can be found, in which the stem is almost entirely smooth and the rachis of fructification quite elongate. As with other species of *Sargassum*, individuals are to be found among the masses of *S. natans* floating after storms, and these show a certain resemblance to the latter, but their condition shows indications of their not persisting.

4. S. LENDIGERUM (L.) Agardh, 1820, p. 9; P. B.-A., No. 2178; *Fucus lendigerus* Linnaeus, 1763, p. 1628; Turner, 1808, p. 107, Pl. XLVIII. South shore, various points, Jan., Feb., Apr., Dec., Hervey; Little Agar's Island, Nov., Collins. Common on exposed rocks in shallow water all around the islands. A stout torulose trunk, 1–3 cm. high, divides into several main axes, often unbranched, occasionally rather freely branching; axes and branches terete, usually thickly set with short, simple or forked proliferations, rarely over 1 mm. long; leaves ovate or broadly lanceolate, margin irregularly undulate or slightly dentate; occasionally forked, usually much crisped, midrib distinct, cryptostomata small, scattered; vesicles spherical, smooth, usually about 3 mm. diam., occasionally 5 mm., on filiform pedicels usually shorter than the diameter of the vesicle, rarely with short tips. Fructification of filiform branching receptacles, the main rachis usually distinct, stouter than the radial branches, which may reach a length of 2 cm. in the looser forms, but usually do not reach a length of 1 cm.;

branching more or less dense, when dense often apparently dichotomous, tips acute; sometimes fertile throughout, sometimes rachis or even branches sterile. Fructification mostly on the upper part of the axes, often occupying these to the exclusion of leaves and vesicles, but also sometimes on short branches on the lower part of the axes. Specially a plant of exposed shores.

5. S. VULGARE Agardh var. FOLIOSISSIMUM (Lamour.) J. G. Agardh, 1889, p. 108; *Fucus foliosissimus* Lamouroux, 1813, p. 36, Pl. VII, fig. 1. Cooper's Island, April, Hervey. From a very short trunk arise several main axes, mostly smooth, sometimes slightly muriculate, bearing more or less numerous similar branches; leaves lanceolate to oblong, the margins finely and closely dentate; midrib distinct, cryptostomata abundant and without definite order on the younger leaves, often obsolete on the older and thicker leaves; vesicles spherical, 3–5 mm. diam., without prolongation, on a pedicel equal to the diameter or longer; receptacles axillary, branching, fertile throughout, verrucose, shorter than the leaves.

At Spanish Point, March, Hervey, was found a form probably belonging here, but without fruit; the leaves are narrower and nearly entire; it may be *S. vulgare*, typical; *S. vulgare* varies much in the size and form of the leaves.

6. S. FILIPENDULA Ag., var. **Montagnei** (Bailey) comb. nov.; *S. Montagnei* Bailey in Harvey, 1852, p. 58, Pl. I. A; *S. vulgare* var. *Montagnei* Farlow, 1881, p. 103; *S. Filipendula* forma *subedentata* J. G. Agardh, 1889, p. 120. Kemp; near Wistowe, floating, Aug., Collins. Stem long, slender, filiform, smooth except for a few minute, scattered papillae on the younger parts, loosely branched; leaves linear, usually 3–6 mm. wide, up to 15 cm. long, often one or more times forked, the divisions sometimes equal and symmetrical, oftener subpinnate and alternate; leaves tapering gradually or abruptly to the subacute tip; midrib distinct throughout leaves and their divisions; cryptostomata few, small, scattered, rarely showing a linear arrangement; margin even or slightly undulate or indistinctly dentate; vesicles spherical to subpyriform, 2–3 mm. diam., tipped generally with a mucro, often with a leaf; pedicel in length one and one half to three times the diameter of the vesicle, sometimes filiform, often compressed, or with midrib and margin. Rachis of fructification filiform, smooth, sterile, elongate, bearing rather distant lateral branches at first with sterile base, later fertile throughout, sometimes with a second series of similar branches, all branches at right angles, of uniform diameter, torulose; ultimate divisions up to 3 cm. long.

Generally characterized by the slenderness and delicacy of all the parts; typical *S. Filipendula*, stouter and shorter, with broader and more dentate leaves and more condensed fructification, has not been found here.

7. S. HYSTRIX J. G. Agardh, 1847, p. 7; 1889, p. 91, Pl. VI. Stem terete, smooth; leaves thickish, lanceolate or ovate-lanceolate, entire or obscurely dentate, 3–6 cm. long, 4–8 mm. wide, midrib rather indistinct, no cryptostomata; vesicles spherical, up to 7 mm. diam., pedicel short, sometimes imperceptible; fructification in dense glomerules of short, verrucose branches; receptacles, vesicles and leaves densely packed along the little branched axis. Harris Bay, Dec., attached, Hervey; washed ashore on Agar's and Bethel's Islands after a storm, Dec., Collins. Apparently recently torn from its attachment.

While our plant appears to agree in all other respects with *S. Hystrix*, the receptacles, though quite verrucose, show no spines or teeth. We should hardly have ventured to give it this name, but for what is said by Reinbold in Weber, 1913, as to sexual dimorphism in *Sargassum*, with presence or absence of spines on the receptacles according to sex. We suspect that another instance of dimorphism may be found in *S. platycarpum* Montagne and *S. vulgare* Agardh, at least the plant distributed under the latter name as P. B.-A., No. 178. We have seen a large number of plants from Florida, some with smooth, some with spiny receptacles, otherwise indistinguishable.

8. S. PLATYCARPUM Montagne var. BERMUDENSE Grunow, 1915, p. 389. We have not seen this, and include it only on the authority of Grunow.

FAMILY DICTYOTACEAE.

SPATOGLOSSUM Kützing.

S. SCHROEDERI (Mert.) J. G. Agardh, 1880, p. 113, in part; 1894, p. 38; P. B.-A., No. 2027; *S. Areschougii* Vickers. 1905, p. 58; 1908, part II, p. 38, Pl. XI; *Ulva Schroederi* Mertens in Martius, 1826, p. 21; 1827, Pl. II, fig. 3; *Taonia Schroederi* Farlow in Alg. Am.-Bor. Exsicc., No. 159. Gravelly Bay, Feb., March, Hervey; Gravelly Bay, April, Aug., Cooper's Island, Aug., Collins. Observed only at these two stations, and apparently not common. In the water it shows a brilliant iridescence. Tetraspores, much like those of *Dictyota*, were found on a few plants; there does not seem to have been any previous

record of them. Tufts of hairs were common; the cells in a definite rectangular region divide, four cells from an original cortical cell, and each of these cells grows out into a hair; the hairs are contracted at base, lower cells about as long as their diameter, moniliform, with rich contents; upper cells 5–6 diam. long, cylindrical, nearly empty. It does not seem to us that the distinction made by J. G. Agardh between *S. Schroederi* and *S. Areschougii* can be maintained. Bermuda specimens show the forms of frond and characters of dentation characteristic of both species, as well as intermediate gradations.

Zonaria Draparnaud.

1. Frond rounded, little divided; mostly dorsiventral and prostrate. 1. Z. variegata.
1. Frond erect, with many deep and narrow divisions. 2. Z. lobata.

1. Z. VARIEGATA (Lamour.) Mertens in Martius, 1826, p. 21; 1827, p. 6, Pl. II, fig. 2; Vickers, 1905, p. 58; 1908, Pl. VI. B; Börgesen, 1914, p. 197, figs. 151–152; *Dictyota variegata* Lamouroux, 1813, p. 57, Pl. V, figs. 7–9. Kemp, including some specimens marked *Z. lobata;* Wadsworth, No. 6; Moseley, from shallow water down to 31 fathoms; Hamilton Harbor, Agar's Cave, Jan., Walsingham, Feb., Farlow; Gravelly Bay, Jan., Harrington Sound, Feb., Harris Bay, Jan., Nov.; Inlet, Dec., Hervey; Ely's Harbor, Aug., Collins. Common nearly everywhere. It is sometimes found with one side of the lamina quite firmly attached; sometimes the frond is quite free, with little difference between the two sides; these differences do not seem to depend on the depth of water. Dickie, 1874, p. 311, notes that the plants dredged in 31 fathoms were mostly bluish green in color.

2. Z. LOBATA Agardh, 1824, p. 265; Harvey, 1852, p. 105, Pl. VII. C; Vickers, 1905, p. 58; 1908, Pl. VI; Börgesen, 1914, p. 199; P. B.-A., No. 1876. Kemp; Tucker, No. 5; South Beach, near Paget, Farlow; Wadsworth, No. 11; Inlet, Jan., Dec., Gravelly Bay, Feb., March, Dec., Hervey; Gravelly Bay, July, Aug., Ely's Harbor, Hungry Bay, July, Cooper's Island, Aug., Collins. Young plants are common in Dec.; by the last of Jan. good sized plants are common, and the plants continue in good condition till May; after that, only old, battered fronds are to be found. It is common in quiet water as well as on exposed shores. The best locality we observed was at Gravelly Bay, where it grew in great tufts in pools and on rocks at low water mark. The color varies from light to dark brown, the substance from

thin and membranaceous to coarse and leathery; the dark, zonate lines are distinct in the thin, light colored form, imperceptible on the old, coarse and dark fronds. It differs much in the extent of division of the fronds, from broad-cuneate and little parted, to fronds consisting of innumerable narrow divisions, sometimes broad below, narrow above, always more or less cuneate with apex truncate. Under water it shows a very brilliant iridescence of peacock blue and green.

Padina Adanson.

1. Epidermis persistent as an indusium over the spores. 2.
1. No indusium; spore band in middle of each second zone between bands of hairs. 4. P. gymnospora.
2. Frond dark and thickish, not much calcified; in middle part 2–3 cells thick; bands of spores alternating with bands of hairs. 3. P. variegata.
2. Lighter colored and thinner; distinctly calcified. 3.
3. Band of spores above each second band of hairs; frond normally 2 cells thick. 1. P. sanctae-crucis.
3. One band of spores above and one below each second band of hairs; frond normally 3 cells thick. 2. P. Pavonia.

1. P. sanctae-crucis Börgesen, 1914, p. 201, figs. 153–154; P. B.-A., No. 2082. Harris Bay, Jan., Nov., Hervey; Shelly Bay, April, Jew's Bay, Ely's Harbor, Hungry Bay, July, Gravelly Bay, Aug., Collins. A rather thin, delicate species, growing mostly in shallow, quiet water. The color is usually a quite light yellowish brown on the upper side, the under side being usually covered with a continuous but quite thin calcareous coating, white or bluish in color. The dried plant is papyraceous and brittle. Only tetrasporic fruit has been found, which was on plants collected in July and August. The indusium consists of the epidermis, which is pushed up by the spores as they grow, and finally ruptured; being very thin and transparent it is not always easy to make out, but it often happens that when it is pushed away from the frond, it retains the markings outlining the layer of cells beneath; in such case a fine network corresponding to the cells can be seen with the microscope by careful focusing, on a level with the top of the spores. This form of indusium has been noted in *Zonaria variegata* by Sauvageau, 1905, p. 11 (of reprint.)

2. P. Pavonia (L.) Gaillon, 1828, p. 371; Harvey, 1846–51, Pl. XCI; P. B.-A., No. 2081; *Fucus pavonius* Linnaeus, 1763, p. 1630.

Gates Bay, March, Gibbet Island, April, Hervey. In the Bermuda material identified with this species the frond is smaller throughout and generally more delicate than in *P. variegata*, averaging much the size and consistency of *P. sanctae-crucis*, and with a similar calcareous coating. Tetrasporic fruit was well developed on the material from both stations noted above. Sterile plants resembling the two species just mentioned abound in warm shallow water, but can be distinguished only by sectioning and counting the layers of cells. In *P. Pavonia* the sexual plant, which we have not found here, is monoecious; in *P. variegata* it is dioecious, in both it is rare. While all American forms of *Padina* were formerly placed under *P. Pavonia*, this seems to be the first occurrence of the species on this side of the Atlantic. The material from Florida distributed as *P. Pavonia*, P. B.-A., No. 1442a, and that distributed as *P. Durvillaei*, P. B.-A., No. 580b, should be referred to *P. variegata;* 1442b to *P. gymnospora.* The plant distributed as *P. Durvillaei*, 580a, closely resembles *P. gymnospora*, but in the specimens now accessible the frond is uniformly two cells thick, which would bring it under *P. australis* Hauck; but Mme. Weber, 1913, p. 180, suggests that the latter may be only a form of *P. gymnospora.* The true *P. Durvillaei* Mont., appears to be found only in the Pacific.

3. P. VARIEGATA (Lamour.) Hauck, 1887, p. 42; P. B.-A., No. 2083; Börgesen, 1914, p. 205, figs. 157–161; *Dictyota variegata* Lamouroux, 1809, p. 331. Kemp, May, June, July, as *P. Pavonia;* Shelly Bay, Harris Bay, Jan., Gibbet Island, Jan., Nov., Dec., Hervey; Inlet, July, Aug., Collins. Very variable in form, from orbicular and undivided up to 15 cm. diam., to fronds split into innumerable strips, or with many rounded proliferations; in texture from thin and papery to thick and tough. It is however always darker than the two preceding species, and with less conspicuous calcification, and it is more than two cells in thickness, except at the growing edge, and may be six layers in the older parts. Tetrasporic fruit is rather common, oogonia infrequent; antheridia are known in this species, but we have not found them here.

4. P. GYMNOSPORA (Kütz.) Vickers, 1905, p. 58; 1908, Pl. VII; Börgesen, 1914, p. 202, figs. 155–156; *Zonaria gymnospora* Kützing, 1859, p. 29, Pl. LXXI, fig. 11. Farlow, 1881, without exact station. Observed once only, but in good condition and fruit. Characterized among our species by the absence of indusium, the frond with one layer of small cells and one layer of large in cross section, the larger cells sometimes dividing so as to give a section of three cells; the spore bands in the center of every second space between hair bands.

Dictyopteris Lamouroux.

1. Frond thick, wide, Fucus-like. 2. D. Justii.
1. Frond thin, delicate. 2.
2. Diagonal veins from midrib to margin. 3. D. plagiogramma.
2. No lateral veins. 1. D. delicatula.

1. D. DELICATULA Lamouroux, 1809, p. 332, Pl. VI, fig. 2 B; Vickers, 1905, p. 58; 1908, part 2, Pl. III; Börgesen, 1914, p. 216, fig. 166; P. B.-A., No. 1924. Castle Harbor, Jan., Farlow; Cave, Gravelly Bay, Oct., Harris Bay, Heron Bay, Dec., Hervey. Not uncommon, but mostly small plants, not over 10 cm. high.

2. D. JUSTII Lamouroux, 1809, p. 330, Pl. VI, fig. 2 A; Vickers, 1905, p. 58; 1908, part 2, Pl. V; P. B.-A., No. 1925. Rein, as *Haliseris polypodioides;* Mosely, dredged in 31 fathoms; Wadsworth, March, No. 9; St. David's Island, April, Kemp, as *Fucus ceranoides;* Faxon; Gravelly Bay, Jan., Feb., Oct., Dec., Hervey; Gravelly Bay, April, July, Aug., Tucker's Town, April, Outer Reef, Ely's Harbor, Hungry Bay, July, Cooper's Island, Aug., Collins. Occasionally found growing just below low water mark, but mostly floating, coming from deeper water. Old and battered plants came in abundantly in August; only young plants were found in February. It may grow to a length of 40 cm. Most reports of species of *Fucus* from Florida and the West Indies are based on large specimens of this species. Tetraspores were found in abundance on plants collected in August; they occur on both sides of the frond, the sori originally circular, about 1 mm. diam., or elongate, about 1 mm. wide. They increase in size, often become confluent, forming irregular patches, more than 1 cm. across. The sporangia are broadly pyriform, about 45 μ high, 25–35 μ diam. seen from above, and closely packed.

3. D. PLAGIOGRAMMA (Mont.) Vickers, 1905, p. 58; 1908, part 2, Pl. IV; *Haliseris plagiogramma* Montagne, 1837, p. 356. Kemp, May, as *Haliseris polypodioides;* this single specimen, large and in fine condition, is the only Bermuda record.

Dictyota Lamouroux.

1. Margin with small sharp teeth. 3. D. ciliata.
1. Margin even or uneven, without teeth. 2.
2. Frond rather broad, with more or less distinct rachis, bearing alternate divisions; tips not tapering, either blunt or with two points. 8. D. dentata.

2. Frond dichotomously branched, with or without lateral proliferations. 3.
3. Frond usually rather broad, very regularly dichotomous, axils usually wide, tips rounded, proliferations on old plants only. 1. D. dichotoma.
3. Not with above combination. 4.
4. Frond very narrow, almost filiform throughout. 5.
4. Frond of varying width, not appearing filiform throughout. 6.
5. Regularly dichotomous, few or no proliferations except in very old plants. 2. D. linearis.
5. Dichotomous in younger parts, elsewhere with many proliferations, often much entangled. 6. D. divaricata.
6. Fronds narrow, dichotomous, few or no proliferations. 7.
6. Fronds broad or narrow, divisions of dichotomies often unequal, sometimes appearing subpinnate, proliferations frequent. 5. D. Bartayresii.
7. Dichotomies distant, regular, divisions equal. 3. D. indica.
7. Dichotomies close, some divisions long, some short, patent, acute. 4. D. cervicornis.

1. D. DICHOTOMA (Huds.) Lamouroux, 1809, p. 331; Harvey, 1846–51, Pl. CIII; P. B.-A., No. 2175; *Ulva dichotoma* Hudson, 1798, p. 476. Rein; Hamilton, Kemp; up to 31 fathom depth, Moseley; Tucker, No. 11; Cave near Ducking Stool, Farlow; Faxon; Buildings Bay, Inlet, Dec., Hervey. This species, the common one of Europe and the most widely distributed of the genus, seems to be rather uncommon in Bermuda; we have found it of only moderate size, not at all like the large plants from North Carolina distributed as P. B.-A., No. CXX. Antheridia have once been observed, but no other form of fruit. There is little indication of rhizoidal filaments in the Bermuda plants.

2. D. LINEARIS (Ag.) Greville, 1830, p. XLIII; Kützing, 1859, p. 9, Pl. XXI, fig. II; P. B.-A., No. 2031; *Zonaria linearis* Agardh, 1820, p. 134. Jew's Bay, July, Collins. In loose floating masses, antheridia fairly frequent, no other fruit observed. The frond is very narrow, seldom over 1 mm.; the forkings are rather distant, axils narrow. The lower part of the frond was old and dry, but showed no proliferations; no rhizoidal filaments were seen.

3. D. INDICA Sonder in Kützing, 1859, p. 8, Pl. XVII, fig. 1; Vickers, 1905, p. 59; 1908, part 2, Pl. XVIII; P. B.-A., No. 2030. Kemp, as *D. fasciola*, in part; Ely's Harbor, Aug., Collins. Our plants agree with the narrower form distributed by Miss Vickers under No. 78; the width of the frond from 1–2 mm. remaining practically the same throughout in each individual. The divisions are quite

regularly dichotomous throughout, the axils rather wide and rounded, the divisions immediately incurving and often becoming parallel, the apices rounded. Antheridia of the usual form were found on these plants; also, on the same plants, scattered or in twos, tetrasporangia; none of these were found showing the regular division into fours, but in many the contents had divided into many small squarish cells, the sporangium enlarging to two or three times its former dimensions, and developing a point of growth at the tip. This closely parallels the development in *D. dichotoma,* described and figured by Reinke, 1878, p. 8, Pl. I, figs. 31–35. The occurrence on the same frond with antheridia is, however, noteworthy. We hardly see how *D. volubilis* Vickers, Algues de la Barbade, No. 78a, can be distinguished from the present species, apart from the spiral twisting of the frond. A plant in the Kemp herbarium, marked *D. fasciola,* is intermediate between *D. indica* and *D. volubilis* of the Algues de la Barbade.

4. D. CERVICORNIS Kützing, 1859, p. 11, Pl. XXIV, fig. II; *D. fasciola* Harvey, 1852, p. 108, Pl. VIII. B., not of Lamouroux. Rein, as *D. fasciola.* The true *D. fasciola* has slender fronds, regularly but not very closely dichotomous, the divisions all developing equally and ending at nearly the same level. In *D. cervicornis* one division is frequently short, acute and erect, giving quite a different habit, which is well characterized by the specific name.

5. D. BARTAYRESII [11] Lamouroux, 1809, p. 331; *D. Bartayresiana,* Harvey, 1852, p. 110, Pl. VIII. C.; P. B.-A., No. 1874. Kemp, as *D. fasciola,* in part; in shallow water, Moseley; St. David's Island, from half tide down, April, Shelly Bay, May, Gravelly Bay, Hungry Bay, July, Cooper's Island, Aug., Collins; Gibbet Island, Jan., Oct., Dec., Hervey. This seems to be the species of *Dictyota* occurring most frequently in Bermuda. It is quite variable, and narrow forms certainly show similarity to *D. divaricata.* On comparing the accounts given of the species by different authors, and the specimens from different localities distributed under this name, one is led to suspect that more than one species is really in question. As originally described, stress was laid on the acute apices, but later authors include forms with distinctly blunt apices. Both forms occur among the Bermuda material we have studied. It is probable that all species of the genus

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11 This species is generally known as *D. Bartayresiana,* but in the original publication by Lamouroux the specific name is *Bartayresii.* Few authors refer to this rare and neglected paper, almost all starting from a later publication of the same year, 1809a, p. 43, in which the author, without stating any reason, substitutes the name *Bartayresiana.*

are subject to much variation with age and environment, and much study of living plants is needed before we can get a clear idea of specific lines. What we consider as the normal form of the species in Bermuda closely resembles No. 72 of Miss Vickers Algues de la Barbade; in this some apices are acute, some rounded, on the same individual. The branching seems intermediate between *D. dichotoma* and *D. dentata*, with a suggestion of lateral branching not found in the former, but not the distinctive character as in the latter. Antheridia were common in material collected at all seasons; tetraspores occurred occasionally on the same individual with antheridia, in July and August. No rhizoidal filaments were seen. Mme. Weber, 1913, p. 182, states that the type of *D. Bartayresii* cannot be found; she speaks of Harvey's figure as excellent, and we have taken it for our standard.

6. D. DIVARICATA Lamouroux, 1809, p. 331, not of Kützing, 1859, p. 10, Pl. XXIII, fig. 1; *D. acutiloba* Kützing, 1859, p. 13, Pl. XXIX, fig. 1, not of J. Ag. Inlet, Gravelly Bay, Dec., Hervey. Fronds as narrow as in *D. linearis*, but the dichotomous habit, distinct in young growing branches, is quite obscured in the older parts by the abundant, mostly short, proliferous branches. By these the fronds are often so densely matted that it is not easy to disentangle any individual plant. Antheridia are abundant in this material, but no other form of fruit was observed. The fronds seem to attach themselves by interlaced proliferous branches, with a few short, monosiphonous rhizoidal filaments close to the tip.

7. D. CILIATA J. G. Agardh,[12] 1841, p. 5; Harvey, 1852, p. 110, Pl. VIII. A.; *D. crenulata* P. B.-A., No. 1875, an J. Ag. ?. Rein; Kemp, May, June; South Shore near Paget, Feb., Castle Harbor, Feb., Farlow; Gravelly Bay, Jan., Feb., Harris Bay, Dec., Hervey; Causeway, April, Shelly Bay, May, Hungry Bay, July, Collins. There is considerable variation in the material which we now include under *D. ciliata*, but after a re-examination of the form that we distributed as *D. crenulata*, we do not feel justified in keeping it distinct. It seems to us also that *D. crenulata* from Barbados, Vickers, No. 75,

12 The first use of the combination *Dictyota ciliata* is by Lamouroux, 1809, p. 331, where a synonym is given, *Fucus pseudociliatus* Lamouroux, 1805, p. 41; a description is given of the latter and figure, Pl. XXX, fig. 2; the locality is the Mediterranean. It is now generally acknowledged to be *Taonia atomaria* (Good. & Woodw.) J. Ag. Being a name proposed for a plant recognized by Lamouroux as already named, *Dictyota ciliata* Lamouroux never had any standing, and cannot interfere with the subsequent *D. ciliata* J. Ag.

of which we have examined several specimens, belongs under *D. ciliata*. Agardh, 1848, p. 94, says of *D. crenulata* "margine tenui dentibus brevissimis late triangularibus initio fere serrato, demum dentato aut crenato." Harvey, 1852, says "The margin is undulated, and closely eroso-denticulate, or jagged with unequal, deltoid or subulate, tooth-like processes." In the Bermuda plants the margin is quite even, and the teeth are of uniform size and never very closely set. We have, however, seen a specimen of *D. crenulata* from the Suhr herbarium "West Indien," that fully agrees with Agardh's and Harvey's descriptions. In the Bermuda material of this species confervoid rhizoidal filaments arise from the lower part of the main axis of the frond, often forming a dense, continuous mass for several cm.; proliferations are few and insignificant. Antheridia and oogonia were found on specimens collected in February, tetrasporangia on specimens collected in July.

8. D. DENTATA Lamouroux, 1809, p. 331; Kützing, 1859, p. 15, Pl. XXXV, fig. I; *D. Mertensii* (Mart.) Kützing, 1859, p. 15, Pl. XXXVI, fig. I; *Ulva Mertensii* Martius, 1826, p. 21; 1827, Pl. I; P. B.-A., No. 1926; *D. Brongniartii* J. G. Agardh, 1841, p. 5; Kützing, 1859, p. 15, Pl. XXXV, fig. II; *D. subdentata* Kützing, 1859, p. 14, Pl. XXXIII, fig. II. Kemp, as *D. crenulata*, in part; Gravelly Bay, Jan., Hervey, Aug., Collins; Hungry Bay, July, Collins. J. G. Agardh, 1880, p. 98, gives *D. Mertensii* as a synonym of *D. Brongniartii*, mentioning *D. subdentata* without expressing an opinion as to whether it should be referred to *D. dentata* or *D. Brongniartii;* later, 1894, p. 70, he recognizes *D. dentata, D. Mertensii* and *D. Brongniartii* as distinct species. Hauck, 1888, p. 466, unites all four under the oldest name, *D. dentata*, as it seems to us rightly. The distinctive characters are found in the greater or less distinctness of the axis and branches, and in the character of the terminal segments. In the abundant material we found in Bermuda, there were individuals with the primary axis narrower and firmer than the lateral segments, and others, apparently mostly younger individuals, in which all was uniformly membranaceous. Typical *D. dentata* has segments ending in acute, spinous tips; typical *D. Mertensii* has segments short-cuneate, with truncate or emarginate tips. It is not uncommon to find both these types on the same individual. In comparing the vegetative structure of *D. dentata* with that of *D. dichotoma*, as described by Reinke, 1878, several points are to be noted. The main axis is thick, and somewhat flattened, but can hardly be described as a "rundtrieb." In old plants, there grow from this, for a distance of

three or four cm. from the base, descending, terete, branching filaments, of an average diam. of one half mm., forming a loose felt. A cross section shows a densely cellular structure, the cells much smaller than in the median layer of the frond, the superficial cells much like those of the frond. From the superficial cells issue, not continuously but in groups, monosiphonous filaments, 20–25 μ diam., the cells 2–4 diam. long, nodes somewhat constricted; these filaments are mostly simple, occasionally with short branches; when a filament reaches the substratum the terminal cell forms a coralloid expansion as an organ of attachment. Other species of *Dictyota, D. ciliata* for instance, are attached by rhizoidal filaments of a similar character, but arising directly from the frond; *D. dentata* is the only Bermuda species in which they arise from descending cellular branches. In older plants prolifications are common from the surface of the frond, sometimes papillose to clavate, sometimes flattened with rounded outline. None were observed over 1 mm. in length; the papillose-clavate form seemed to be of a similar character to the descending filaments developed near the base. Antheridia were common in material collected in Jan., July and Aug.; no other fruit was observed.

Dilophus J. G. Agardh.

D. guineensis (Kütz.) J. G. Agardh, 1880, p. 108; Vickers, 1905, p. 59; 1908, part 2, p. 37, Pl. IX; Börgesen, 1914, p. 214, figs. 164–165; P. B.-A., No. 2080; *Spatoglossum guineense* Kützing, 1843, p. 339; 1859, Pl. XLVI, fig. I. South Shore near Paget, Farlow; Gravelly Bay, March, Hervey.

Class **RHODOPHYCEAE.**

Family BANGIACEAE.

Bangia Lyngbye.

B. fuscopurpurea (Dillw.) Lyngbye, 1819, p. 83, Pl. XXIV. C; P. B.-A., No. 2084; *Conferva fuscopurpurea* Dillwyn, 1809, p. 54, Pl. XCII. On exposed rock, North Shore near Shelly Bay, April, Fairyland, Dec., Collins; in tufts on wall by Palmetto Vale, Harrington Sound, March, Hervey. In the North Shore and Fairyland stations there were scattered filaments only, imperceptible except on microscopic examination. At the Sound station the tufts were several cm. long. In all cases it was a slender form, mostly monosiphonous, rarely over four cells to a segment.

Porphyra Agardh.

P. atropurpurea (Olivi) De Toni, 1897, p. 17; P. B.-A., No. 2085; *P. leucosticta* P. B.-A., No. 1927; *Ulva atropurpurea* Olivi, 1791, p. 153, Pl. I–III. Kemp, May, as *P. laciniata*; "Spitall Lake Ferry" May, Kemp, unnamed specimen in herb.; on mangroves below Flatts Bridge, April, May, Collins; Ely's Harbor, May, Hervey. At Flatts Bridge the *Porphyra* began to be visible about April 20, 1912, growing on mangroves in company with *Monostroma latissimum;* both minute when first observed, but growing rapidly up to May 3, when we left Bermuda. When next at this place, from July to Sept., 1913, the *Porphyra* was not to be found. The Ely's Harbor plant is of moderate size, up to 6 cm. long; the specimens in the Kemp herbarium reach 10 cm. in length. *P. vulgaris* of Moseley is undoubtedly this species.

Erythrotrichia Areschoug.

E. carnea (Dillw.) J. G. Agardh, 1882, p. 15, Pl. I, figs. 8–10; P. B.-A., No. 2032; *E. ceramicola* Farlow, 1881, p. 113; *Conferva carnea* Dillwyn, 1809, p. 54, Pl. LXXXIV. Common on various algae, Jan., Feb., Hervey; April, May, July, Aug., Nov., Dec., Collins; on submerged tamarisk branches, Harrington Sound, May, Collins.

Erythrocladia Rosenvinge.

E. subintegra Rosenvinge, 1909, p. 73, figs. 13–14; Börgesen, 1915, p. 7, figs. 3–4; P. B.-A., No. 2086. On *Bryopsis pennata*, Tucker's Town, April; on *Caulerpa crassifolia*, Hungry Bay, May, Collins; on *Cladophora catenifera*, Gravelly Bay, Feb., Hervey. Probably common, but perceptible only on microscopic examination when it appears in the form of minute orbicular disks, of closely set radiating filaments, dichotomously branched, united laterally except at the edge, closely adherent to the host. At Gibbet Island it grew in company with *Pringsheimia scutata*, the fronds of which have much the same structure; their bright green color contrasts strongly with the red of the *Erythrocladia*.

Goniotrichum Kützing.

1. Filaments one or at most two cells wide. 1. G. elegans.
2. Main filaments many cells wide. 2. G. Humphreyi.

1. G. elegans (Chauv.) Le Jolis, 1863, p. 103; Rosenvinge, 1909, p. 75, fig. 15; Börgesen, 1915, p. 4, fig. 2. *Bangia elegans* Chauvin, 1842, p. 33. On many species of algae, especially on *Codium* and its epiphytes, very frequently met with as isolated individuals, rarely in large quantity. The filaments are often simple; when branched, the branching approaches lateral rather then dichotomous; the cells are 10–15 μ diam., spherical or slightly compressed or elongate; they are smallest at the base of the filament, largest near the apex, while the filament is largest at the base, up to 25 μ, tapering slightly towards the apex. Lateral division of cells by an oblique wall is not uncommon. It is quite distinct from the duplication by displacement described by Rosenvinge, 1909, p. 75, and seems to be a normal process.

2. G. Humphreyi Collins, 1901, p. 251; P. B.-A., No. 421; *Bangiopsis subsimplex* Börgesen, 1915, p. 10, figs. 5 and 6, not *Compsopogon subsimplex* Mont. Among other algae, *Ectocarpus Mitchellae*, *Calothrix fusco-violacea*, *Enteromorpha* species, etc., forming a dense growth on the bottom of a rock pool near Gravelly Bay, Jan., Hervey. The fronds are more freely branched than in the material from Jamaica, but the main stems are not as stout; otherwise they are identical.

Family HELMINTHOCLADIACEAE.

Acrochaetium Nägeli.

A conservative course has been followed by us in regard to the plants belonging to this genus. No such richness of new forms has been found here as by Börgesen in the Danish West Indies, but we cannot claim to have made as thorough a study as he has, and it is very unlikely that all the Bermuda forms have been discovered and listed. We include under *Acrochaetium* the marine species formerly passing under *Chantransia*, many of which have recently been juggled back and forth, only too often.

1. Original spore remaining manifest at base of filament.	2.
1. Original spore not distinguishable.	5.
2. Basal cell with descending endophytic and erect free filaments.	3.
2. No descending endophytic filaments.	4.
3. Cells 8–10 μ diam., 4–5 diam. long.	3. A. corymbiferum.
3. Cells 12–14 μ diam., 2–3 diam. long.	4. A. barbadense.
4. Cells short, subspherical.	2. A. crassipes.
4. Cells long, cylindrical.	1. A. Dufourii.
5. Frond arising from a disk.	8. A. Thuretii.
5. Frond not arising from a disk.	6.
6. Horizontal filaments on surface of host.	7.
6. Horizontal filaments endophytic only.	9. A. Hypnae.
7. Horizontal filaments producing endophytic branches.	7. A. Nemalionis.
7. Horizontal filaments without endophytic branches.	8.
8. Erect filaments 6–12 μ diam.	6. A. Sagraeanum.
8. Erect filaments 4–5 μ diam.	5. A. leptonema.

1. A. Dufourii Collins, P. B.-A., No. 1594; *Chantransia Dufourii* Collins, 1911, p. 187; P. B.-A., No. 2087. On *Dictyota ciliata*, Hungry Bay, Dec., Hervey. Forming a dense fringe on the edge of the host. The basal cell (original spore) remains distinct, attached to the host by a circular disk, of diameter larger than that of the cell. This development is of the same character as that in *Chantransia collopoda* Rosenvinge, 1909, p. 81, but on a smaller scale; it is found also in another Bermuda species, *A. crassipes*.

2. A. crassipes Börgesen, 1915, p. 20, fig. 11; *Chantransia crassipes* Börgesen, 1909, p. 1, fig. 1; P. B.-A., No. 2033. On *Ceramium clavulatum* and *Polysiphonia ferulacea*, St. David's Island, Feb., and on *Callithamnion Hookeri*, Gravelly Bay, April, Hervey.

3. **A. corymbiferum** (Thuret) comb. nov.; *Chantransia corymbifera* Thuret in Le Jolis, 1863, p. 107; Bornet & Thuret, 1876, Pl. V, fig. 3; P. B.-A., No. 1880. On *Dudresnaya crassa*, Salt Kettle, Feb., Spanish Point, March, Buildings Bay, April, Hervey; Shelly Bay, May, Collins. In Europe and California this species occurs on *Helminthocladia calvadosii;* although the latter is common in Bermuda, the *Acrochaetium* has not been observed on it, but seems to occur generally on the *Dudresnaya*. Its filaments have some resemblance to those of the host, and the resemblance might puzzle one unfamiliar with both. But usually antheridia or cystocarps can be found.

4. A. BARBADENSE (Vickers) Börgesen, 1915, p. 45; *Chantransia barbadensis*, Vickers, 1905, p. 60. On *Liagora elongata*, Buildings Bay, March, Hervey. This plant resembles *A. corymbiferum*, but is kept distinct by Bornet, 1904, p. XX, as well as by Miss Vickers, the distinctive characters being the stouter and shorter cells, and the less developed basal portion. We have compared our plant with an authentic specimen from Miss Vickers, also on *Liagora elongata*, and find them to agree, except that while in the Bermuda plant most of the filaments are composed of cells agreeing in dimensions with Miss Vickers plant and description, in others the dimensions approach those of *A. corymbiferum*. It is possible that future observations may show that the difference is not specific.

5. A. LEPTONEMA (Rosenv.) Börgesen, 1915, p. 31; *Chantransia leptonema* Rosenvinge, 1909, p. 118, figs. 47–48. On *Dictyopteris Justii*, Gravelly Bay, Aug., Collins. Our smallest species of the genus.

6. A. SAGRAEANUM Bornet, 1904, p. XXI; P. B.-A., No. 2181; *Cladophora Sagraeana* Montagne, 1838, p. 459. On *Zonaria lobata*, Gravelly Bay, Aug., Collins; On *Dictyopteris Justii*, Buildings Bay, July, Hervey. The Buildings Bay plant almost entirely covers the *Dictyopteris* with a dense coating, the individual plants up to 5 mm. high, main filaments about 12 μ diam., branches seldom under 7 μ. These dimensions are greater than those given by Bornet in his description, but as all other characters agree, it must be considered a luxuriant form of this species. Monospores, 18–22 $\times$ 8–10 μ were observed, on unicellular pedicels in a series on the inner side of a branch near the base. On other individuals were observed tetraspores, not before known for the species. They were arranged similarly to the monospores, but were larger and relatively broader, 28–34 $\times$ 17–27 μ. The division is in the form indicated by Rosenvinge, 1909, p. 85, as characteristic of the genus, cruciate with the first division horizontal;

sometimes the division proceeds no farther, but usually a vertical division occurs in one of the halves, often in both, but in the latter case the divisions of the two are seldom in the same plane.

7. A. NEMALIONIS (De Not.) Börgesen, 1915, p. 55; *Chantransia Nemalionis* Rosenvinge, 1909, p. 126, figs. 53–54; *Callithamnion Nemalionis* De Notaris in Erb. Critt. Ital., No. 952. Harrington Sound, April, Collins, growing on Tamarisk branches which had bent down until submerged. As in *A. Sagraeanum* the erect filaments arise from a plexus of irregular horizontal filaments, but in *A. Nemalionis* the latter emit descending filaments which penetrate the host. In the Bermuda plant these are less developed than in the European plant growing on *Nemalion,* probably on account of the more resisting character of the substratum of Tamarisk, as compared with *Nemalion.*

8. **A. Thuretii** (Bornet) comb. nov.; *Chantransia Thuretii* Kylin, 1907, p. 119, fig. 28; *C. efflorescens* forma *Thuretii* Bornet, 1904, p. XVI. On *Codium decorticatum,* Cooper's Island, Aug., Collins. With monospores.

9. A. HYPNEAE Börgesen, 1915, p. 51, fig. 54; *Chantransia Hypneae* Börgesen, 1909, p. 2, fig. 2. On *Ceramium clavulatum,* in company with *A. crassipes,* St. David's Island, Feb., Hervey. With monospores.

TRICHOGLOEA Kützing.

T. HERVEYI Setchell ms.; P. B.-A., No. 2034. In tide pools, Gravelly Bay, March, April, Hervey; from low water mark to two meters depth, near Cooper's Island, April, May, Collins. Extremely gelatinous, not calcified. Appearing in March, but not found after midsummer.

HELMINTHOCLADIA J. G. Agardh.

H. CALVADOSII (Lamour.) Setchell in P. B.-A., No. 2035; *Dumontia calvadosii* Lamouroux in Duby, 1830, p. 941; *Nemalion purpureum* Harvey, 1846–51, Pl. CLXI; *Helminthocladia purpurea* J. G. Agardh, 1851, p. 414. Bailey's Bay, Feb., Castle Harbor, March, Wadsworth; Dingle Bay, March, North Shore, April, Old Ferry Road, April, Hervey; Tucker's Town, St. David's Island, Long Bird Island, April, Collins. Specimens in Kemp herbarium, marked *Helminthora divaricata* and *Helminthocladia divaricata* both belong here. On stones from half tide down, not uncommon in quiet water; antheridia and

cystocarps in April. Prof. Setchell has called our attention to Lamouroux's name which considerably antedates the Harveyan name in general use.

LIAGORA Lamouroux.

1. Not calcified. 4. L. pectinata.
1. Calcified. 2.
2. Very soft and gelatinous. 3. L. pulverulenta.
2. Firmer. 3.
3. Calcareous coating continuous and smooth. 1. L. valida.
3. Calcareous coating loose, penetrated by assimilative filaments. 2. L. elongata.

1. L. VALIDA Harvey, 1853, p. 138, Pl. XXXI. A; Börgesen, 1915, p. 70, figs. 71–75; P. B.-A., No. 1929. Rein; Kemp; St. David's Island, Feb., April, Buildings Bay, April, Hervey; Cooper's Island, April, Aug., Collins. The most common of the Bermuda species of *Liagora*, and generally easily recognized by the continuous calcareous coating and firm, little gelatinous consistency. It occurs in its best condition just below low water mark, but may extend up nearly to high water mark. In many places it forms a continuous zone between tide marks, the individual plants short and stunted, mostly chalky white. When growing in more favorable conditions a pinkish shade shows through the coating more or less.

2. L. ELONGATA Zanardini, 1851, p. 35; 1858, p. 274, Pl. VI, fig. 1; Börgesen, 1915, p. 67, figs. 67–70; P. B.-A., No. 2088; *L. corymbosa* J. G. Agardh, 1896, p. 104. Kemp, July, unnamed specimen in herb.; Miss Wilkinson; Gates Bay, Buildings Bay, March, St. David's Island, May, Hervey; Cooper's Island, Aug., Collins. Cystocarps in March. Not as variable as other species of the genus, and usually recognized easily by the light purple-brown color, the light and loose calcification, and the long, rather distantly dichotomous fronds, of nearly uniform diameter. *L. corymbosa*, according to J. G. Agardh, 1896, p. 104, "Hab. ad littora Floridae et insulas Bermudas." Specimens agreeing fairly well with Agardh's description were collected at Castle Harbor by Wadsworth, March, 1890; at Tobacco Bay, March 11, 1914, Hervey; but it is impossible to separate them from *L. elongata*. As to characters derived from internal structure used by Agardh in his treatment of the genus, l. c., we have not been able to apply them, as we find them inconstant. He divides *Liagora* into two subgenera, *Euliagora* and *Goralia*, the former with an inner layer

of longitudinal filaments, subdistant, large and small intermixed, the outer usually small, the fascicles of the cortical layer free from each other except as united by the general gelatinous coating. In *Goralia* the larger filaments of the inner layer are densely packed, the smaller being on the surface only, the fascicles of the cortical layer adherent and confluent. *L. pulverulenta* is placed in *Euliagora, L. valida* in *Goralia;* but in both species as they occur in Bermuda we have found large central filaments branching and producing smaller filaments, with no definite position in the central strand; generally the cortical fascicles are borne on the smaller filaments of the central strand, but not infrequently on the larger ones. The density of the cortical fascicles and their mutual adhesion or freedom seem to depend largely on age or activity of growth; they often vary much in the same individual.

3. L. PULVERULENTA Agardh, 1822, p. 396; Börgesen, 1915, p. 80, figs. 87–92; P. B.-A., No. 1928. Miss Peniston; Castle Harbor, Harrington Sound, Cooper's Island, March, Wadsworth; St. David's Island, Feb., May, Tobacco Bay, March, Hervey; Cooper's Island, Shelly Bay, April, Collins. Very soft and gelatinous, collapsing into a shapeless jelly when taken from the water, but not difficult to arrange in natural form on paper if dried without pressure or with very slight pressure.

L. pectinata sp. nov. Fronde submolli, ecalcarea, rubro-purpurea, ad 20 cm. alta; ramis primariis inferne nudis vel ramulis paucis brevibus munitis, superne ramos gerentibus frequentes breves, alternantes vel secundatos, ramulos similes gerentes; ramis et ramulis omnibus, primariis exceptis, plus minusve sinuosis et curvatis, ultimis patentibus, in- vel recurvatis, saepe pectinato-secundatis; apicibus abrupte acutis. Strato axili, circa 150 μ diam., filamentis dense compactis; cellulis circa 20 μ diam., 4–8 diam. longis; fasciculis filamentorum assimilatorium 600–800 μ longis, densis, aequilongis, superficiem aequalem continuam frondis formantibus; filamentis repetite dichotomis, cellulis inferioribus 5–7 μ diam., 5–8 diam. longis, subcyclindricis; superioribus brevioribus, crassioribus, ovoideis; terminalibus 8–10 μ diam., 2–3 diam. longis, interdum pilos breves, circa 4 μ diam., ferentibus. Fructificatione ignota.

Frond rather soft, without incrustation, dull red-purple, up to 20 cm. high; main branches naked below or with a few short ramuli, above with numerous alternate or secund branches, bearing similar ramuli, all but the main branches more or less sinuous and curved, the lesser divisions patent, in- or recurved, often pectinately secund; all tapering

suddenly to an acute point. Central strand about 150 μ diam., of closely packed filaments, cells about 20 μ diam., 4–8 diam. long; fascicles of assimilative filaments 600–800 μ long, dense, even-topped, making a continuous smooth surface to the frond; filaments many times dichotomous, lower cells 5–7 μ diam., 5–8 diam. long, subcylindrical; upper cells shorter, stouter, more ovoid; end cells 8–10 μ diam., 2–3 diam. long, occasionally with a short hair, about 4 μ diam. Fructification unknown. Cooper's Island, April, Hervey.

The peripheral filaments do not arise directly from the cells of the central strand; at the summit of one of these cells a short conical or ovoid cell is formed, from which radiate the basal filaments of several peripheral fascicles; these filaments are usually straight and unbranched for 200–400 μ, then dichotomous. The substance is softer than in *L. valida*, not as soft as in *L. pulverulenta*. The reference to the genus *Liagora* is from the structural characters; we have found no fruit. As is well known, the amount of calcification varies much in the different species, but there is only one species recorded practically free from lime, *L. dubia* (Bory) Bornet in De Toni, 1905, p. 1628; *Cladostephus dubius* Bory, 1832, p. 331, Pl. XXXVIIbis, fig. 6. Little is known of this species beyond Bory's plate and description, but it seems to be quite distinct from the present species.

Family CHAETANGIACEAE.

Scinaia Bivona.

S. COMPLANATA (Collins) Cotton, 1907, p. 260; Setchell, 1914, p. 100, Pl. XI, figs. 19–22; *S. furcellata* var. *complanata* Collins, P. B.-A., No. 836; 1906, p. 110. Farlow. A single specimen in the Farlow herbarium is the only representative of the species and genus that we have seen from Bermuda; as the segregation of the forms till recently included under *S. furcellata* has only just been made, it is impossible to locate the *S. furcellata* recorded by Moseley, "a single specimen dredged."

Galaxaura Lamouroux.

Representatives of this genus are common all around the islands, but the distinguishing of species is very difficult. We note below five species in regard to which we feel some confidence, but we have many

collections that cannot be placed under any of them, and to which we do not venture to give names. Kjellman, 1900, gives full descriptions of many species founded by him on material in Scandinavian herbaria, but without descriptions of older species, and with little indication of the distinguishing characteristics between the latter and his new species. Howe, 1917, shows that in one case what Kjellman considers as two sections of the genus are really sexual and asexual forms of the same species. Beside the five species listed below, we can only say that we have also forms resembling *G. fasciculata* Kjellm., *G. ramulosa* Kjellm., and *G. fruticulosa* Kjellm. Moseley reports *G. rugosa* and *G. lapidescens*, from both of which species, as formerly understood, Kjellman segregated new species. Rein reports *G. fastigiata*, but we have not been able to see a specimen.

G. FLAGELLIFORMIS Kjellman, 1900, p. 47, Pl. III, figs. 2–11; Pl. XX, fig. 16; Börgesen, 1916, p. 93, figs. 99–101. Castle Island, Feb., Hervey.

G. SQUALIDA Kjellman, 1900, p. 55, Pl. VI, figs. 1–12; Pl. XX, fig. 9; Börgesen, 1916, p. 102, figs. 108–111; P. B.-A., No. 1882. Harris Bay and other points on the South Shore, at all seasons. In pools from half tide to low water, in dense tufts or often a much branched individual plant, about 10 cm. high, varying much in smoothness, firmness, and in density of branching; a favorite host for many species of small algae.

G. CYLINDRICA (Ell. & Sol.) Lamouroux, 1821, p. 22, Pl. XXII, fig. 4; Kjellman, 1900, p. 64, Pl. VIII, figs. 34–42; Pl. XX, fig. 53; Börgesen, 1916, p. 106; *Corallina cylindrica* Ellis & Solander, 1786, p. 114, Pl. XXII, fig. 4. Miss Wilkinson, a single specimen, without exact locality.

G. MARGINATA (Ell. & Sol.) Lamouroux, 1816, p. 264; Kjellman, 1900, p. 77, Pl. XX, fig. 44; Börgesen, 1916, p. 106, figs. 115–117; *Corallina marginata* Ellis & Solander, 1786, p. 115, Pl. XX, fig. 6; *Brachycladia marginata* P. B.-A., No. 1930. Near low water mark, Gravelly Bay, Jan., Hervey; at and below low water mark, Cooper's Island, Aug., Collins.

G. OBTUSATA (Ell. & Sol.) Lamouroux, 1816, p. 262; Kjellman, 1900, p. 88; P. B.-A., No. 1881; *Corallina obtusata* Ellis & Solander, 1876, p. 113, Pl. XXII, fig. 2. Faxon; Tucker's Town, Feb., Dec.; Walsingham, April, Hervey. Varies much in amount of calcification, which sometimes is entirely lacking. Usually there is not a gradual diminution of the amount of calcification, often the lower part of a frond is thickly calcified, this part sharply marked off from the upper part, quite uncalcified.

Family GELIDIACEAE.

Wrangelia Agardh.

W. penicillata Agardh, 1828, p. 138; Harvey, 1853, p. 143, Pl. XXXIV. B; Börgesen, 1916, p. 120, figs. 131–132; P. B-A., No. 1883. Rein; Kemp; Merriman, No. 5; Harris Bay, Jan., Castle Harbor, March, Tucker's Town, May, Harrington Sound near Flatts Bridge, Dec., Hervey; Shelly Bay, washed ashore, Hungry Bay, Nov., young plants only; dredged in 18 m. Nov., Collins. Abundant and luxuriant near Flatts Bridge from Dec. to Feb., seldom seen during the summer months.

Naccaria Endlicher.

N. corymbosa J. G. Agardh, 1899, p. 109; P. B.-A., No. 2036. Cooper's Island, Feb., Farlow; Buildings Bay, April, Hervey. Bornet, 1892, p. 266, incidentally refers to Farlow's specimens as *N. Wigghii;* comparison with the type specimen of *N. corymbosa* from Key West, in Agardh's herbarium, shows that the Bermuda plant is the same. Whether the differences between the American and the European plant are specific may require further study.

Gelidium Lamouroux.

1. Basal layer well developed; erect shoots seldom over 2 cm. high. 4. G. pusillum.
1. Basal layer scanty or wanting; erect shoots 5–50 cm. high. 2.
2. Frond compressed or flat throughout, pinnate. 1. G. corneum.
2. Frond terete, at least in the lower part. 3.
3. Fruit in ovate terminal expansions. 2. G. crinale.
3. Fruit in terminal expansions of irregular form, the edges dentate or ciliate. 3. G. spathulatum.

1. G. corneum (Huds.) Lamouroux, 1813, p. 41; *Fucus corneus* Hudson, 1798, p. 585; Turner, 1819, p. 146, Pl. CCLVII, fig. a. Kemp, June, July. Two specimens in the Kemp herbarium resemble ordinary European forms; one is marked "var. k, *abnorme* Harvey" but is hardly like the figure in Turner for that variety. We have not ourselves found anything we should refer to this species.

2. G. crinale (Turn.) Lamouroux, 1825, p. 191; P. B.-A., No.

2089; *Fucus crinalis* Turner, 1819, p. 4, Pl. CXCVIII. North Village, Dingle Bay, Jan., Hervey. A slender, irregularly branching form; the erect filaments are more flattened than in the common northern forms, and the branching is scanty, but there seems to be no better place for it than here.

3. G. SPATHULATUM (Kütz.) Bornet, 1892, p. 268; *G. crinale* var. *spathulatum* Hauck, 1885, p. 193, fig. 84; *Acrocarpus spathulatus* Kützing, 1868, p. 13, Pl. XXXVI, d–g. Harrington Sound, Feb., Hervey. Resembles *G. crinale*, but the upright fronds are terete except at the summit, where they are suddenly flattened; in the fruiting specimens numerous short branches arise here, making a tubercular mass, but always showing a distinct flattening.

4. G. PUSILLUM (Stack.) Le Jolis, 1863, p. 139; P. B.-A., No. 2182; *Fucus pusillus* Stackhouse, 1795, p. 16, Pl. VI. North Shore, Jan., Nov., Tucker's Town, Feb., Hervey; above and below Flatts Bridge, April, May, Aug., Collins. Tetraspores in March, April, Nov. Very common on pebbles, shells and flat rock bottom in shallow quiet water all about the islands, forming a dense mat, usually not over one cm. in thickness, the creeping basal part and the lower part of the upright growth terete, the upper part flat. As we understand this species, it includes *G. pulvinatum* (Kütz.) Thuret, and *G. repens* Kütz. Forms corresponding to Kützing's plates of both of these, as well as to typical *G. pusillum*, are found in Bermuda material, with all intermediate forms.

Var. CONCHICOLA Piccone & Grunow in Piccone, 1884, p. 316, P. B.-A., No. 2183, is a reduced form, common on small shells in shallow water; the upright fronds seldom reach 5 mm. high; they are mostly flat for their entire length, and only sparingly branched. But the same form occurs also on stones, and every intermediate can be found up to plants with erect fronds, 2 cm. high. Forms which we refer to *G. pusillum* occasionally occur in which the terete stipe expands into a flat frond, up to 5 cm. long and 3–5 mm. wide. This is very different in appearance from the usual form, but it intergrades so that it and var. *conchicola* must be regarded as extreme forms of a very variable species.

WURDEMANNIA Harvey.

W. SETACEA Harvey, 1853, p. 246; P. B.-A., No. 1887. A very common plant in quiet shallow water, all about the islands and dredged down to 18 m. It is quite variable in size, amount of rami-

fication etc. It often forms dense mats, attached to the substratum by frequent rhizoids; at other times only the bases of the filaments are attached, the upper part forming loose tufts. Cystocarps and antheridia are unknown, tetraspores seldom occur, but were found in plants collected at Smith's Bay, Nov., Hervey. Short much branched forms might be mistaken for *Gelidium*, but on sectioning, the absence of the fine descending rhizoidal filaments of the internal layer is a sufficient distinction. *Gelidiopsis gracilis* Vickers, Algues de la Barbade, No. 126, seems to be this species; we have compared her specimen with an authentic specimen of *W. setacea* from the Harvey herbarium, and both with Bermuda material, and can find no differences.

Family GIGARTINACEAE.

Gigartina Stackhouse.

G. ACICULARIS (Wulf.) Lamouroux, 1813, p. 48; Harvey, 1846–51, Pl. CIV; P. B.-A., No. 1884; *Fucus acicularis* Wulfen, 1803, p. 63. Kemp, June, as *G. Tecdii;* Burchell's Cove, Feb., Gravelly Bay, April, Tucker's Town, March, May, Dec., Hervey; pool near Moore's calabash tree, April, Collins. Forming a somewhat matted coating on floors of caves or on bottoms of pools.

Kallymenia J. G. Agardh.

K. PERFORATA J. G. Agardh, 1871, p. 9; 1876, p. 219. Washed ashore, Cooper's Island, Feb., Farlow. There is much variability as to the amount of perforation; some fronds 6–7 cm. diam. are quite imperforate, while others, no larger, are little more than a network.

Family RHODOPHYLLIDACEAE.

Catenella Greville.

C. OPUNTIA (Good. & Woodw.) Grev. var. PINNATA (Harv.) J. G. Agardh, 1876, p. 588; Alg. Am.-Bor. Exsicc., No. 149; P. B.-A., No. 1885; *C. pinnata* Harvey, 1853, p. 201, Pl. XXIX. B. Common between tide marks in quiet waters all about the islands, on ground,

rocks and mangroves, usually in company with *Caloglossa Leprieurii*, species of *Bostrychia, Cladophoropsis membranacea* and the like. Cystocarps were found on plants collected near Flatts Bridge in August, Collins. The pinnate branching is usually quite manifest, but occasionally plants are found where it is not at all conspicuous; these are quite close to the typical *C. Opuntia* of Europe.

Meristotheca J. G. Agardh.

M. Duchassaingii J. G. Agardh, 1871, p. 36; 1879, Pl. XXXI, figs. 1–3. A single specimen among other algae collected March 4, 1911, Hervey, without exact locality. Evidently not common in Bermuda, as this one specimen, about 2 cm. high, is all that is recorded. It grows to a considerable size along the coast from Florida to North Carolina, specimens from Beaufort, N. C., reaching a length of 4 dm. It is usually very rough with short, stiff proliferations on the surface and margin, but occasionally it occurs quite smooth, when it is not so easily recognized. The difference is not one of maturity, as large smooth plants are found as often as small ones.

Eucheuma J. G. Agardh.

1. Fronds flattened.	1. E. Gelidium.
1. Fronds stout, subterete, very spinous.	2. E. denticulatum.

1. E. Gelidium J. G. Agardh, 1851, p. 627; 1876, p. 602; P. B.-A., No. 2184; *Sphaerococcus Gelidium* Kützing, 1869, Pl. XX. St. David's Island, Feb., Hervey, a few small plants only; South Shore, April, Collins.

2. **E. denticulatum** (Burm. f.) comb. nov.; *E. spinosum* J. G. Agardh, 1847, p. 16; *E. isiforme* Harvey, 1853, p. 118, Pl. XXIV; P. B.-A., No. 1886; *Fucus denticulatus* N. L. Burman, 1768, p. 28; *F. spinosus* Linnaeus, 1771, p. 313; Turner, 1808, Pl. XVIII. Rein; Moseley; April, May, June, Kemp; March, Wadsworth; Tucker, No. 14; Castle Harbor, Jan., Farlow; Bailey's Bay, Mrs. Hastings in Farlow herb.; Bailey's Bay, Jan., Gibbet Island, Jan., Cooper's Island, April, Devonshire Bay, Harris Bay, Dec., Hervey; Gravelly Bay, Tucker's Town, April, Aug., Collins. As may be inferred from the list of stations and collectors, this plant is plentiful and attractive. The living plant is of a dull red, and if prepared without exposure to

sun or air, the color darkens, sometimes becoming nearly black. But if the plant has grown where it is exposed to the full sunshine or if it has been exposed long to the air, the red becomes lighter and clearer, and later takes on a yellow shade. Exposure to the air for several days, if not in full sunshine, gives handsome color without disintegrating or decomposing the plant, if quite fresh when collected. It occurs in all sizes from 5 to 50 cm. high, and varies much in diameter of frond, frequency and regularity of branches, and especially as to the frequency, position and form of the conical or spinous ramuli. In the typical form these ramuli are arranged in whorls, distinctly separated, but forms occur, especially in old and large individuals, in which this whorled arrangement is hardly perceptible. The same differences occur in this species as found on the Florida coast, where it is common. At some stations in Bermuda a form occurs which we have not seen elsewhere; the frond is not over 10 cm. high, is relatively slender, but is so densely and so repeatedly branched that no trace of regularity is seen. This form was collected by Wadsworth in 1890, and has been found by us each year we have collected here. The American plant was described by Agardh, 1822, p. 271, as *Sphaerococcus isiformis;* J. G. Agardh, 1847, p. 16, proposed the new genus *Eucheuma,* including this and other species of *Sphaerococcus,* and the name has been continued since that time. Comparing the original description of *Sphaerococcus isiformis* with the species following, *S. spinosus,* the only distinctions of importance are, first that the former is described as "cartilagineo-gelatinosa" the latter as "gelatinoso-cartilaginea"; second, the former "papillulis ramorum verticillatis," the latter "papillulis solitariis, vel binis ternisve." The question of the distinctness of the two species was raised by Sonder, 1871, p. 60; under *E. spinosum* he notes that he found it with long, naked branches, also beset with papillae, either scattered or whorled. This alga is sold as an article of food in eastern countries, and most of the specimens that had then reached Europe were coarse forms obtained in the markets. J. G. Agardh, 1876, p. 601, referring to Sonder's criticism, says "Quae potissimum conveniunt, *E. spinosum* atque *E. isiforme,* stadio fructifero omnino diversae obvenerunt." But we find on *E. isiforme* fruit of the character attributed by him to *E. spinosum,* as well as that attributed to *E. isiforme.* Later, 1892, p. 12, in a revision of the genus, he uses vegetative characters, giving as the reason that the cystocarps were unknown to him on many of the species. Under *E. spinosum* he says "Icon Turneri tab. 18 pro suo tempore egregia." *E. isiforme* he considers as represented by Harvey's

plate, 1853, Pl. XXIV, and the specimens distributed as Alg. Am.-Bor. Exsicc., No. 12. Turner's plate of *Fucus spinosus* was drawn from the specimen in the Linnean herbarium, and represents the type of the species. It has papillae partly whorled, partly scattered; there would be no trouble in matching it from Bermuda material, while Harvey's plate is quite typical of the ordinary, well developed plant. We think we are justified in discontinuing the name *E. isiforme*. But on referring to the original description of *Fucus spinosus*, Linnaeus, 1771, p. 313, we find that he gives as synonym "*F. denticulatus* Burm. prodr. 28".[13] Referring to that page we find the description "Caule compresso ramoso ramis dentato-geniculatis ramulosis subdichotomis." This, with the reference by Linnaeus, necessitates the new binomial we have used.

We have examined specimens from the Cape of Good Hope, Singapore and the Sunda Islands, quite indistinguishable from the American plant.

Family SPHAEROCOCCACEAE.

Gelidiopsis Schmitz.

G. rigida (Vahl) Weber, 1904, p. 9; P. B.-A., No. 2090; *Gelidium rigidum* var. *radicans* Alg. Am.-Bor. Exsicc., No. 142; *Fucus rigidus* Vahl, 1802, p. 46. Forms dense mats at and below low water mark, generally coarse and unattractive.

Gracilaria Greville.

1. Fronds stout, prostrate, attached to the substratum. 8. G. horizontalis.
1. Frond erect. 2.
2. Frond plane. 3.
2. Frond terete or compressed. 4.
3. Frond membranaceous, dichotomous, axils wide and rounded, apices obtuse. 7. G. dichotomo-flabellata.
3. Frond cartilaginous, axils acute, divisions tapering, acute. 6. G. multipartita.
4. Branches long, filiform, slender. 1. G. confervoides.
4. Branches not filiform. 5.

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[13] There is an error in the paging of this work; the pages run 1–28, then 25, 26, 27, 28, and thereafter correctly; the present reference is to the second p. 28.

5. Frond coarse, stout, branches mostly short and blunt. 5. G. Wrightii.
5. Frond less stout; many short, acute branches. 6.
6. Branching corymbose; short acute branches near summit. 4. G. damaecornis.
6. Short acute branches throughout. 7.
7. Frond pyramidal, branchlets dense, erect. 2. G. ferox.
7. Frond irregular, delicate, branches scattered, patent. 3. G. divaricata.

1. G. CONFERVOIDES (L.) Greville, 1830, p. 121; Harvey, 1846–51, Pl. LXV; *Fucus confervoides* Linnaeus, 1763, p. 1629. Kemp, a single plant of typical character; another specimen, marked *G. compressa,* is probably also *G. confervoides.*

2. G. FEROX J. G. Agardh, 1851, p. 592; 1876, p. 414; P. B.-A., No. 1932. Faxon; In shallow water, Moseley; Kemp; Rein, as *G. armata;* Dingle Bay, Inlet, Heron Bay, Jan., Grasmere, March, Hervey; Grasmere, Aug., Collins. Several species of the general appearance of *G. ferox* have been described, and it is by no means easy to separate them. There is a good deal of variety in the Bermuda forms we have included under this name, but they seem to agree in the terete but apparently distichously branched frond, with short acute branches, subsecundly placed. We have found it quite common in warm shallow water, such as the lagoons near Grasmere and Fairyland.

3. G. DIVARICATA Harvey, 1853, p. 109. Mrs. S. A. Boggs; Bailey's Bay, Feb., Wadsworth; reported by Kemp, but no specimen found in his herbarium. The two specimens we have seen agree well with Harvey's description, and there seems no other place for them. The habit is much like that of *Ochtodes filiformis* J. Ag., and the latter species, from Jamaica, was erroneously distributed as *G. divaricata* in P. B.-A., No. 789. The *Ochtodes* has an articulated filamentous axis which is not found in *Gracilaria.*

4. G. DAMAECORNIS J. G. Agardh, 1851, p. 597; 1876, p. 415. In shallow water, Grasmere, Aug., Collins; Miss Wilkinson. As we understand this species, it is stouter than *G. ferox,* drying very hard and firm; the branching is more regularly dichotomous, the ramuli short and subulate, near the ends of the branches. We have found it once only, when it grew among *G. ferox,* but could be distinguished from the latter by its appearance, even as seen from the boat.

5. G. WRIGHTII (Turn.) J. G. Agardh, 1851, p. 599; *Fucus Wrightii* Turner, 1811, Pl. CXLVIII; including *G. Poitei* J. G. Agardh, 1851, p. 596 and *G. cornea* J. G. Agardh, 1851, p. 598. Castle Harbor, Feb., Farlow; Elbow Bay, Dec., Collins. We have carefully examined

a large amount of material from the Florida-West India region, including specimens determined by J. G. Agardh, and can find no line of demarcation between the three species mentioned. *Fucus Poitei* Lamouroux, 1805, Pl. XXX, figs. 2–3, antedates *F. Wrightii*, but now proves to be a *Laurencia*, and the next oldest name is Turner's which we adopt. It includes most of the coarse, fleshy or cartilaginous Gracilarias of the warmer Atlantic; probably always terete when alive, but often appearing compressed in herbarium material. It is not common at Bermuda.

6. G. MULTIPARTITA (Clem.) Harvey, 1846–51, Pl. XV; *Fucus multipartitus* Clementi, 1804, p. 311. Kemp, July, two specimens in herb.; Building's Bay, Feb., one small frond, Hervey.

7. G. DICHOTOMO-FLABELLATA Crouan in Mazé & Schramm, 1870–77, p. 218. Mrs. Boggs, 1895; St. David's Island, Feb., May, South Shore, April, Hervey; tetraspores in May. This species varies considerably in color and texture, from thin membranaceous and clear red to subcartilaginous and brownish. In the former case the shape and subdivision of the frond are indicated by the specific name; in the latter the division is more irregular. The Bermuda plant as a rule has a thinner frond and narrower segments than the Florida material distributed as P. B.-A., No. 334. We were at first inclined to identify this plant with *G. Textorii* (Suringar) Hariot, 1891, p. 223, *Sphaerococcus Textorii* Suringar, 1870, p. 36, Pl. XXIII, and a specimen from Province Boshu, Japan, for which we are indebted to the kindness of Dr. K. Yendo, has much resemblance to the Bermuda plant. But the plant figured by Okamura, 1901, p. 65, Pl. XXIII, and distributed in his Algae Japonicae Exsiccatae No. 13, differs considerably, having a habit more like the common little divided forms of *Rhodymenia palmata*. Our plant agrees with Crouan's species, as represented by an authentic specimen in the Museum d'Histoire Naturelle, at Paris, and it has seemed to us better on the whole to retain for the present Crouan's name, under which the plant had already been distributed in P. B.-A. J. G. Agardh, 1889, p. 25, refers to *G. dichotomo-flabellata* as a possible synonym of *Chrysymenia halymenioides* Harvey, mentioning *Chrysymenia dichotomo-flabellata* Crouan as perhaps the same; the latter has been distributed as P. B.-A., No. 385; it is probable that it is, as suggested by J. G. Agardh, a form of *Chrysymenia halymenioides*, but the plant distributed as P. B.-A., Nos. 334 & 1931 is certainly a *Gracilaria*. The following short diagnosis, in connection with the material distributed as P. B.-A., Nos. 334, 1931, will probably give a sufficient idea of the species.

Gracilaria dichotomo-flabellata Crouan in Mazé & Schramm, Algues de la Guadeloupe, p. 218, without description. A disco parvo, stipite brevi subtereti vel compresso, mox in frondem planam regulariter dichotomam abeunte, segmentis linearibus 5 mm. ad 2 cm. latis, apicibus obtusis vel truncatis; axillis latis, rotundatis; substantia membranacea, juniore tenuiore, adultiore crassiore et firmiore; colore laete- vel fusco-rubro; tetrasporangiis sparsis; cystocarpiis magnis, ad superficiem utrinque sparsis.

8. **G. horizontalis** sp. nov. Fronde a disco centrali irregulari horizontaliter expansa, ramis quoquoversum exeuntibus, subteretis, crassis, ramos ferentibus densissimos, minime attenuatos; cellulis interioribus magnis, corticem versus minoribus, cortice submonostromatico, cellularum minutarum coloratarum. Fructificatione ignota.

Frond expanding horizontally from a central irregular disk, emitting on all sides very densely set branches, tapering very little; interior cells large, becoming smaller towards the submonostromatic cortex, which is formed of small colored cells. Fructification unknown.

The habit is unique in the genus; the plant seems to creep over the bottom of the pool in which it grows, much in the same way as do the haptera of a *Laminaria;* the tips of the branches, or short projections on the margins or lower surface, adhering to the substratum quite firmly. If a young but vigorous frond of *Laminaria* were cut off at the base of the stipe, just at the level of the upper haptera, the remaining basal part would give a good idea of the appearance of this species. Plants growing together are almost inextricably entangled, and even when a plant is not in contact with others, it is difficult to detach it. The substance is tough and cartilaginous, the color of the more or less wrinkled surface is dull yellowish brown, but the lower part, not exposed to the light, is of the clear purplish red found in other species of Gracilaria. It was found in rock pools at low water mark at Gravelly Bay, Aug. 27, 1913, Collins. Type in Collins herb., No. 7818. Since found at the same station in Feb. and April, at Harris Bay, April, Hervey.

Hypnea Lamouroux.

1. Branches long, virgate, often with hooked tips. 1. H. musciformis.
1. Branches not virgate, no hooked tips. 2.
2. Forming a low, dense, matted expansion. 3. H. spinella.
2. Erect fronds from a matted base, slender, with patent ramuli. 2. H. cervicornis.

1. H. MUSCIFORMIS (Wulf.) Lamouroux, 1813, p. 43; Hauck, 1885, p. 188, fig. 81; P. B.-A., No. 2185; *Fucus musciformis* Wulfen in Jacquin, 1789, p. 154, Pl. XIV, fig. 3. Rein; Kemp; Miss Peniston; Dingle Bay, Bailey's Bay, Jan., St. David's Island, Feb., Grasmere, March, Buildings Bay, Heron Bay, April, Hervey; Hungry Bay, April, Cooper's Island, Aug., Collins. Generally distributed; the well developed plants with long, virgate branches, beset with short ramuli, and with tips hooked, are not to be mistaken for anything else, but young and stunted forms are hard to distinguish from other species of the genus.

Wulfen's type was from Trieste, where he found the plant growing on crabs for sale in the fish market. His plate is excellent, and shows a slender form with filiform ramuli, often with constricted bases. We have seen similar plants from the Mediterranean and the Adriatic, and on the American shore from Cape Cod to Florida and the West Indies. A form different in appearance has been distributed by Bornet, collected at Biarritz; it is stouter, the ramuli shorter and more patent, and mostly with distinctly wider base, in dried specimens often like rose thorns; hooked tips are very rare in this form, common in the other. This form we have seen from various parts of the Atlantic coast of France, and on the American coast from Beaufort, N. C., to Florida and the West Indies. The two extreme forms are distinct in appearance, though less characteristic forms can be found. Sterile plants can be found in both, but as far as we have observed, cystocarpic plants usually have all the ramuli of the thorn-like type, always some ramuli of this form; while tetrasporic plants have the filiform ramuli with base ultimately constricted. The appearance of the two types is so different that in Agardh's treatment of the genus, 1851, p. 441, the former would come under Sect. I, Virgatae, "ramulis adultioribus basi constrictis," the other, p. 446, Sect. Spinuligerae, "ramulis subulatis, a basi latiore acuminatis." Both forms occur in Bermuda.

2. H. CERVICORNIS J. G. Agardh, 1851, p. 451; 1876, p. 564. Miss Peniston; Old Ferry, April, Hervey. This lacks the hooked apices of *H. musciformis*, and is a more slender and more densely branched plant; but the line between the two species is by no means clear.

3. H. SPINELLA (Ag.) J. G. Agardh, 1847, p. 14; *Sphaerococcus spinellus* Agardh, 1822, p. 323. Cave by Gravelly Bay, Apr., Hervey. Forming a dense, inextricable mat on rocks, usually 1–2 cm. thick.

There is probably no genus of red algae of this region the species of which are so poorly defined, and the plants so little characteristic, as

Hypnea. Well developed plants of *H. musciformis* are easily recognized, but practically everything else is vague and doubtful, and our determinations of other species are only tentative. In regard to the smaller forms, it seems as if no two authors used the same name for the same plant, and even the best authors are often inconsistent with themselves. For instance, J. G. Agardh, 1876, p. 564, under *H. cervicornis,* refers to *H. spinella* Kützing, 1868, Pl. XXVI, as a synonym; under *H. spinella* (Ag.) J. Ag., on the next page, he refers to the same plate. We have collections of *Hypnea* from several stations to which we do not feel willing to give specific names. *H. cornuta* reported by Moseley proves to be *Chondria polyrhiza* Collins & Hervey.

Family RHODYMENIACEAE.

Cordylecladia J. G. Agardh.

C. rigens (Ag.) comb. nov.; P. B.-A., No. 2186; *C.? irregularis* Harvey, 1853, p. 156; *Sphaerococcus rigens* Agardh, 1822, p. 332; *Chylocladia rigens* J. G. Agardh, 1851, p. 362. In dense matted tufts between tide marks, Harrington Sound, Feb., Farlow; Fairyland, Dec., Collins. Comparison with authentic specimen of *Chylocladia rigens* shows the identity with Harvey's species, and the fructification, see Collins, 1901, p. 255, is that of *Cordylecladia.*

Chrysymenia J. G. Agardh.

1. Frond with solid terete stipe and vesicular ramuli. 2.
1. Frond without solid stipe. 3.
2. Branches long, virgate, with spherical or ovoid ramuli. 4. C. uvaria.
2. Branches short, stout, with larger, pyriform ramuli. 5. C. pyriformis.
3. Frond tubular, branches proliferous with constricted base. 3. C. Enteromorpha.
3. Frond compressed, dichotomous or irregularly cleft. 4.
4. Frond slender, divisions linear. 2. C. halymenioides.
4. Frond broader, divisions lanceolate or ovate. 1. C. Agardhii.

1. C. Agardhii Harvey, 1853, p. 189, Pl. XXX. A. Cooper's Island, Feb., Farlow; shallow water, Moseley. Apparently rare, as

neither of us has found it. In Kemp's list mention is made of *Chylocladia rosea*. No specimen with that name is to be found in his herbarium; the species is northern in its range, and not likely to occur here; some forms of *Chrysymenia Agardhii* have habitual resemblance to *Chylocladia*, and may have been the basis for this record.

2. C. HALYMENIOIDES Harvey, 1853, p. 188, Pl. XX. A. One very small plant, Moseley.

3. C. ENTEROMORPHA Harvey, 1853, p. 187. Dredged in 60 meters on Challenger Bank, Aug., 1903, Berm. Biol. Sta.

4. C. UVARIA (L.) J. G. Agardh, 1842, p. 106; Harvey, 1853, p. 191, Pl. XX. B; P. B.-A., No. 1933; *Fucus uvarius* Linnaeus, 1767, p. 714. Rein; Kemp; Moseley; Faxon; Walsingham, Jan., March, Hervey, April, Collins. Appears to grow chiefly in sheltered places among rocks, and may be more common than would appear from the single locality in which we have found it.

5. C. PYRIFORMIS Börgesen, 1910, p. 187, figs. 8–9. A single, well-developed plant, on the perpendicular wall of a "chasm" near Tucker's Town, below low water mark, April, Collins.

COELARTHRUM Börgesen.

C. ALBERTISII (Piccone) Börgesen, 1910, p. 189, figs. 11–12; P. B.-A., No. 2091; *Chylocladia Albertisii* Piccone, 1884a, p. 37, figs. 3–5. Attached to Corallines, Ducking Stool, Jan., Farlow; floating off Cooper's Island, Feb., Farlow; Miss Wilkinson; Shore of Gibbet Island, Jan., Feb., North Shore, March, washed ashore, Buildings Bay, Feb., Hervey; dredged in 18 m., Nov., Collins. This species was founded on a single specimen collected at the Canaries, 1882; a single specimen with the ms. name *Chrysymenia Lomentaria* Crouan is in the Thuret herbarium at Paris; it was dredged once, in about 30 meters, in March, in the Danish West Indies; these are the only records outside of Bermuda. In January and February small plants are found among the roots of *Sargassum*, seldom over 1 cm. high; the larger plants are found washed ashore, probably from deep water. These plants were packed together in crisp masses, with rounded surfaces, like the masses of *Valonia macrophysa*, but on a smaller scale. No fruit was found on the specimens of our collecting, but there were cystocarps on those collected by Farlow in February, tetraspores on those collected by Börgesen in March; both are figured by Börgesen.

Lomentaria Gaillon.

L. uncinata Meneghini in Zanardini, 1840, p. 21; Farlow, 1881, p. 154. Miss Wilkinson; Walsingham, Jan., Hervey. Rather small plants.

Var. filiformis (Harv.) Farlow, 1881, p. 155; *Chylocladia Baileyana* var. *filiformis* Harvey, 1853, p. 185, Pl. XX. C, fig. 2. Very small plants among *Polysiphonia macrocarpa*, on mangroves, Hungry Bay, May, Collins.

Champia Desvaux.

C. parvula (Ag.) Harvey, 1853, p. 76; P. B.-A., No. 1934; *Chondria parvula* Agardh, 1824, p. 207; *Chylocladia parvula* Harvey, 1846–51, Pl. CCX. Gibbet Island, Jan., Heron Bay, April, Hervey; Gibbet Island, Sept., Fairyland, Dec., Collins. On *Sargassum*, *Coelarthrum* and other algae; mostly with tetraspores; small plants, seldom over 3 cm. high.

Family DELESSERIACEAE.

Nitophyllum Greville.

N. Wilkinsoniae sp. nov.; P. B.-A., No. 2037. Frondes usque ad 10 cm. altae, dense di- polychotomae, divisionibus linearibus cuneatisve, latitudine centimetrum raro superantibus; marginibus dentes minutas ciliiformes plus minusve approximatas ferentibus; venis nullis; fronde monostromatica, juniore 15 μ crassa, adultiore usque ad 60 μ; cellulis in superficiem visis irregulariter polygonis, 30–80 μ diam.; in sectione transversali junioribus elongatis, adultioribus subquadratis. Tetrasporangiis tripartitis, ad 60 μ diam., soris rotundatis vel elongatis per totam frondem sparsis, utrinque prominulis; cystocarpiis ignotis; substantia tenuissima; fronde viva, colore malvacea; emersa cito in aurantiacam mutata; siccata rosea. Plate I, fig. 8, Plate II, fig. 9, Plate V, figs. 32–33.

Fronds up to 10 cm. high, densely tufted, di- polychotomously divided, divisions linear or cuneate, seldom over one cm. wide, margin more or less densely set with small ciliform teeth; no veins; monostromatic, 15 μ thick in the younger part, up to 60 μ in older parts; cells regularly polygonal in superficial view, 30–80 μ diam., in cross

section, elongate in younger, squarish in older parts. Tetraspores tripartite, up to 60 μ diam., densely packed in small roundish or oval sori, generally distributed over the frond, slightly projecting on both surfaces; cystocarps unknown. W. Faxon; Miss Wilkinson; Harrington Sound, Ducking Stool, Feb., Farlow; Dingle Bay, April, caves at Tucker's Town, May, Collins. On rocks below low water mark; forming dense masses, crisp when first taken from the water, but soon softening into a shapeless mass. The branching is so dense and the substance so tender that it is difficult to disentangle individual plants. When growing the color is mauve, on exposure changing almost instantaneously to orange; when mounted on paper lake or rosy red. In habit like *N. marginatum* Harvey, Ceylon Algae No. 26, but that species lacks the ciliiform teeth, and has somewhat smaller cells but larger tetraspores, which are in less dense sori, and tend to form a confluent marginal band. A specimen of *N. venulosum* Zan., from Trieste, leg. Hauck, also resembles *N. Wilkinsoniae*, but has more slender segments, less densely branched and tufted, and distinct though microscopic veins.

Hypoglossum Kützing.

H. hypoglossoides (Stack.) comb. nov.; *H. Woodwardi* Kützing, 1843, p. 444, Pl. LXV, fig. 1; *Delesseria Hypoglossum* Harvey, 1846–51, Pl. II; *Fucus hypoglossoides* Stackhouse, 1795, p. 76, Pl. XIII. Jan., 1912, a single specimen, without exact locality, Hervey. The rather unfortunate combination we now use for the first time, appears to be required by the international rules.

Caloglossa J. G. Agardh.

C. Leprieurii (Mont.) J. G. Agardh, 1876, p. 499; P. B.-A., No. 2038; *Delesseria Leprieurii* Montagne, 1840a, p. 196, Pl. V, fig. 1; Harvey, 1853, p. 98, Pl. XXII. C. Among other algae on mangroves and other objects between tide marks, less commonly pure or nearly so. Farlow; Burchell's Cove, Feb., Ely's Harbor, Dingle Bay, April, Hervey; Hungry Bay, May, Collins. Tetraspores in April. The Bermuda material corresponds to *C. mnioides* J. G. Agardh, 1876, p. 500,[14] the segments being ovate, sometimes quite broadly so, and the

[14] Later, 1898, p. 235, J. G. Agardh intimates that most of the described species of the genus may be only forms, depending on locality. This appears to be his latest expression of opinion on the subject.

cells in the membrane narrowly rectangular, in quite distinct series to the margin. Compared with the very narrow form from brackish water at West Point, New York, the distinctness of species seems justified, but intermediate forms occur, some from Florida having as wide segments as the Bermuda plant, but with polygonal or rhomboidal cells in indistinct series. The variation can hardly be due to climate, as a specimen of Miss Vickers, Algues de la Barbade, No. 144, has fronds as narrow as in the plant of Long Island Sound and Hudson River.

Taenioma J. G. Agardh.

T. perpusillum J. G. Agardh, 1863, p. 1257; *T. macrourum* Thuret in Bornet & Thuret, 1876, p. 69, Pl. XXV; P. B.-A., No. 1935; *Polysiphonia perpusilla* J. G. Agardh, 1847, p. 16. In a gelatinous mass among small algae, Gibbet Island, April, Hervey. Tetraspores were common in this material; a single mature cystocarp was found, but unfortunately was lost before notes and figures could be made.

Family BONNEMAISONIACEAE.

Asparagopsis Montagne.

A. taxiformis (Delile) comb. nov.; *A. Delilei* Montagne, 1840, p. XIV; *Dasya Delilei* Montagne, 1840, p. 166, Pl. VIII, fig. 6; *Fucus taxiformis* Delile, 1813, p. 151, Pl. LVII, fig. 2. Merriman; Cooper's Island, Feb., Farlow. Apparently rare, as we have not met with it, nor have we found it in any other collections than as above. As Montagne refers to *Fucus taxiformis* Delile, but changes the specific name to do more honor to the author, the original name must be restored according to the international rules.

Family RHODOMELACEAE.

Laurencia Lamouroux.

1.	Ultimate ramuli short, often tubercle-like.	2.
1.	Ultimate ramuli longer.	3.
2.	Ultimate ramuli distant, simple.	2. L. Poitei.
2.	Ultimate ramuli densely set, mostly lobed.	3. L. papillosa.

3. Frond decumbent, rooting, densely matted. 1. L. perforata.
3. Frond erect. 4.
4. Outline of frond and of main divisions narrowly pyramidal. 5.
4. Outline broader. 6.
5. Slender, 3 or 4 cm. high. 5. L. obtusa var. gelatinosa.
5. Stout, 1–2 dm. high. 6. L. paniculata.
6. Branching mostly opposite or whorled. 5. L. obtusa.
6. Branching subdichotomous, corymbose. 4. L. cervicornis.

1. L. PERFORATA Montagne, 1860, p. 155; Kützing, 1865, p. 18, Pl. XLIX, figs. c–g; P. B.-A., No. 1889. Bailey's Bay, Jan., Harris Bay, Jan., Nov., Gravelly Bay, Oct., Hervey; Tucker's Town, May, South Shore, Aug., Collins. This species occurs not uncommonly in caves and potholes, where it forms dense matted masses, the filaments adhering to the rock and to each other by numerous holdfasts. The surface of the mass sometimes has an iridescence of remarkable brilliancy, chiefly in metallic blues and greens. The iridescence is on the upper surface only, and persists for a short time after the plant is taken from the water.

2. L. POITEI (Lamour.) M. A. Howe, 1905, p. 583; *L. tuberculosa* J. G. Agardh, 1852, p. 760; P. B.-A., No. 1937. *L. gemmifera* Harvey, 1853, p. 72, Pl. XVIII. B.; *Fucus Poitei* Lamouroux, 1805, p. 63, Pl. XXXI, figs. 2–3. Harrington Sound, Farlow; Cooper's Island, a slender form, Wadsworth; Heron Bay, April, Hervey; Fairyland, July, Collins. In warm shallow water, where it forms loose-lying masses in warm weather. *L. tuberculosa* has been described by J. G. Agardh as "fronde compressa distiche decomposito-pinnata," but it may well be that the compression and distichous branching in Agardh's plant are due to the manner of preparation; the Bermuda plant has no such characters.

3. L. PAPILLOSA (Forsk.) Greville, 1830, p. LII; P. B.-A., No. 1936; *Fucus papillosus* Forskäl, 1775, p. 190. Castle Harbor, Farlow; Harris Bay, Jan., Heron Bay, April, Hervey; Jew's Bay, July, Cooper's Island, Harrington Sound, Aug., Collins. Quite common and usually easily recognizable.

4. L. CERVICORNIS Harvey, 1853, p. 73, Pl. XVIII. C; P. B.-A., No. 2187. Wadsworth, No. 19; Miss Wilkinson; Cooper's Island, April, Aug.; dredged in 4 m., Dec., Collins; Buildings Bay, April, St. David's Island, May, Hervey. This species appears to be little known to European botanists; De Toni, 1903, p. 781, gives it as a synonym under *L. implicata*, but it is certainly not the *L. implicata* of Harvey, 1853, p. 72, Pl. XVIII. D., fide authentic specimens. *L.*

cervicornis has a frond of rounded outline, branching subdichotomous, distant below, increasingly close upward; all branches, long or short, are of about the same diameter, about that of the main axis of a frond of *L. obtusa*, medium size. Proliferous ramuli, very short, may be abundant or nearly or quite wanting. It is found in rather sheltered stations, the color a somewhat deep and translucent red in the living plant, growing darker in the mounted specimen. It usually adheres fairly well to paper.

5. L. OBTUSA (Huds.) Lamouroux, 1813, p. 42; Harvey, 1846–51, Pl. CXLVIII; P. B.-A., No. 2092; *Fucus obtusus* Hudson, 1798, p. 586. A very common and variable species, occurring nearly everywhere in quiet water, and often in somewhat exposed places, and dredged to a depth of 18 m. The genus *Laurencia* is very puzzling; though typical forms can be found of all the species, intermediate forms are equally common, and it is very difficult to draw any sharp lines. Of what may be considered the typical form of *L. obtusa* there are two varieties, differing sharply in color, but not otherwise; one is reddish or yellowish brown, lighter where exposed to sunshine, darker below; the other a light, glaucous blue-green. They grow in similar stations; often, as in the lower part of Harrington Sound, both are found together, but as separate individuals or tufts; we have seen no intermediate forms under these conditions.[15] Beside the typical form, two varieties may be noted.

Var. GRACILIS Kützing, 1865, p. 20, Pl. LIV, figs. c and d; *L. dasyphylla* Kemp, in herb. A delicate, soft and slender form.

Var. GELATINOSA (Desf.) J. G. Agardh, 1852, p. 751; P. B.-A., No. 1888; *Fucus gelatinosus* Desfontaines, 1798, p. 427. Mrs. Hastings; Spanish Rock, Jan., Gravelly Bay, March, Dec., Hervey. Tetraspores in Jan. A low and slender form of exposed rocky shores; in spite of its name it is firmer and less adherent to paper than *L. obtusa*, typical. In connection with *L. obtusa* we have found forms near to *L. setacea* Kützing, 1848, p. 854; *L. intricata* Kützing, 1865, Pl. LXI, figs. a-c,[16] but they shade into the typical *L. obtusa* so plainly, and in no

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15 It is of interest to note that practically the same forms occur at Naples; see Falkenberg, 1901, p. 247. "Um Neapel, wo die Pflanze das ganze Jahr hindurch zu den gemeinsten Formen gehört, kommt sie in zwei Varietäten vor, welche, im übrigen gleich, durch ihre Färbung sich wesentlich unterscheiden, die eine ist gelbrothlich, die andere grünlich. Beide Formen treten gesondert in unregelmässig durch einander gewirrten Rasen an den gleichen Standorten auf."

16 *L. intricata* Lamouroux, 1813, p. 43, Pl. IX, figs. 8–9, is nomen nudum, hence Kützing's name of 1848 has priority.

case are they quite typical *L. setacea*, that it seems best to consider them merely forms of the common and variable *L. obtusa*. A specimen in the Farlow herbarium, collected by G. Tucker, No. 10, is near *L. implicata* J. G. Agardh, 1852, p. 745, and a similar form was found on the outer reef, Ely's Harbor, July, Collins, and this also we have considered as a local form of *L. obtusa*. This form is found rather commonly when dredging.

6. L. PANICULATA (Ag.) J. G. Agardh, 1852, p. 755; *Chondria obtusa* var. *paniculata* Agardh, 1822, p. 343. Faxon; Dingle Bay, Jan., Buildings Bay, Mangrove Bay, Feb., Hervey. Connected by intermediate forms with *L. obtusa*, but in its typical form quite distinct by the firmer, little adhesive substance, the narrowly pyramidal form of the frond and of its principal divisions, the main axis distinctly projecting.

CHONDRIA Agardh.

1. Rhizoids frequent; tetraspores in specialized branches. 4. C. polyrhiza.
1. No rhizoids except at extreme base; tetraspores in normal branches. 2.
2. Ends of pericentral cells showing as a wavy line across the frond. 1. C. curvilineata.
2. Pericentral cells not showing externally. 3.
3. Ramuli acute or subacute. 3. C. atropurpurea.
3. Ramuli blunt or truncate. 2. C. dasyphylla.

1. **C. curvilineata** sp. nov.; P. B.-A., No. 2039. Fronde tenui, axibus principalibus diametro ½ mm. raro superantibus, ramos paullo minores paucos pluresve alternantes ferentibus, ordinum duorum, raro plures, cylindricos vel ad basin et apicem paullo contractos; puncto vegetationis ad fundo foveae apicalis, folia brevia ferente; foliis similibus secundum ramos sparsis; segmentis diam. duplo longioribus; cellulis corticalibus diam. duplo longioribus; apicibus cellularum centralium per corticem manifestis ut lineis curvis, latere convexo apicem versus; cystocarpiis sessilibus; substantia submolli; colore rubro obscuro. Plate II, figs. 10–11.

Frond slender, main axes seldom reaching ½ mm. diam., with more or less numerous alternate branches of two orders, seldom more, of only slightly less diam., cylindrical or slightly contracted at base and apex; growing point at bottom of an apical pit, with a tuft of short leaves, similar leaves occurring also at scattered points on branches; segments about 2 diam. long; cortical cells about twice as long as broad; swollen apices of pericentral cells showing through the cortication as

rounded lines, the convex side towards the apex of the branch; cystocarps sessile on the branches; no other organ of fructification observed; color dull red; substance rather soft. Type specimen in Collins herbarium, No. 7509, Heron Bay, April 19, 1913, Hervey; also at St. David's Island, Feb., near Wistowe, Dec., Hervey.

This plant belongs to the subgenus *Coelochondria* Falkenberg, but is distinct from all but one of the species of the subgenus by the peculiar transformation of the upper ends of the pericentral cells, which show even under a slight magnification as curved lines, two or three showing in the width of the branch. This same character is found in *C. succulenta* (J. Ag.) Falkenberg, 1901, Pl. XXII, figs. 22–23, an Australian species, but that is a large and fleshy plant. In some specimens of *C. curvilineata* this character is less conspicuous than in others, but it is always quite distinct at the base of a branch, where the cortication is thin.

2. C. DASYPHYLLA (Woodw.) Agardh, 1822, p. 350; *Fucus dasyphyllus* Woodward, 1794, p. 239, Pl. XXIII, figs. 1–3; *Laurencia dasyphylla* Harvey, 1846–51, Pl. CLII. St. David's Island, May, Hervey. A single plant, well developed and typical.

3. C. ATROPURPUREA Harvey, 1853, p. 22, Pl. XVIII. E. Heron Bay, March, Hervey. A single, quite typical plant.

4. **C. polyrhiza**, sp. nov.; P. B.-A., No. 2040. Fronde tenui, axi principali diametrum $\frac{1}{2}$ mm. raro attinente, ramos paullo minores paucos pluresve alternantes ferente, ramulis secundi vel tertii ordinis minoribus brevioribusque, ad basin plus minusve contractis, prope apices conicos foliis brevibus deciduis armatis; ramis ordinum omnium plus minusve flexuosis; cellulis corticalibus linearibus, longitudine latitudinem 3–4-plo superante; tetrasporis in ramulis ultimis, partis fertilis margine subdentato, apice breviacuto; basi a parte inferiori sterili ramuli evidenter distincto, parte fertili diametro partem sterilem duplo superante; segmentis per corticem tantum in parte extrema juvenili manifestis; rhizoideis brevibus unicellularibus in fasciculis densis ex partibus omnibus frondis exeuntibus; substantia subfirma; colore rubro pallido. Plate II, fig. 12.

Frond slender, main axis seldom reaching $\frac{1}{2}$ mm. diam., with more or less numerous, alternate patent branches of slightly less size, with one or two orders of smaller and shorter branches with more or less contracted bases, and with tufts of short, fugacious leaves near the tapering apices; branches of all orders more or less flexuous; cortical cells linear, 3–4 times as long as wide; tetraspores in ultimate ramuli, the fertile portion showing a subdentate outline, the apex short-

pointed, the base sharply distinct from the lower sterile part of the ramulus, which is usually about half the diam. of the fertile part; segments of pericentral cells showing indistinctly through the cortication in the youngest portions only; dense fascicles of short, unicellular rhizoids issuing from all portions of the plant; color pale red; substance rather firm. Type in Collins herbarium, No. 8007, Shelly Bay, Jan. 10, 1913, Hervey; also at North Shore near Wistowe, Jan., Feb., Hervey; dredged in 18 meters, Dec., Collins.

The cylindrical fronds and the absence of apical pits place this plant in the subgenus *Euchondria* Falk.; the abundant rhizoids are of the same type as in the genus *Herpochondria*, but there is neither the dorsiventral structure nor the lateral adherence of the latter. The rhizoids may occur in short cylindrical fascicles, or may form a dense mass along the frond for a distance equal to several diameters; they may occur on branches of any order, even on the stichidia with mature tetraspores.

Acanthophora Lamouroux.

A. spicifera (Vahl) Börgesen, 1910, p. 204, figs. 18–19; P. B.-A., No. 1938; *A. Thierii* Harvey, 1853, p. 17, Pl. XIV. A; *Fucus spicifer* Vahl, 1802, p. 44. Aug., Kemp; Rein; Tucker, No. 13; Walsingham, Farlow; common in quiet waters generally, Jan., March, Oct., Hervey; April, May, July, Aug., Collins. In July and August lying loose on the bottom, but continuing to grow. On submerged tips of live Tamarisk branches, Harrington Sound, Aug., Collins.

Falkenbergia Schmitz.

F. Hillebrandi (Born.) Falkenberg, 1901, p. 689; Börgesen, 1910, p. 199, fig. 17; P. B.-A., No. 2043; *Polysiphonia Hillebrandi* Bornet in Ardissone, 1883, p. 376. Growing in matted tufts on various algae; Miss Peniston; cave by Ducking Stool, April, cave, Gravelly Bay, Aug., Dec., Gibbet Island, Aug., Bethel's Island, Dec., Collins; Harrington Sound, Oct., Nov., Dec., cave, Gravelly Bay, Dec., Hervey. In the plants collected at Gravelly Bay in December, were found tetraspores, which have not before been recorded for the species; they are tripartitely divided, and formed from one of the pericentral cells of a ramulus, quite as in *Polysiphonia*, but occurred singly, not in series.

Polysiphonia Greville.

1. Pericentral cells 4. 2.
1. Pericentral cells more than 4. 4.
2. Forming low, dense, more or less even-topped tufts or mats. 2. P. macrocarpa.
2. Taller, more open in growth. 3.
3. Segments seldom over 1 diam. long; tetraspores in densely forking, divaricate ramuli. 4. P. ferulacea.
3. Segments in main axis usually over 1 diam. long; tetraspores near tips of normal branches. 1. P. havanensis.
4. Pericentral cells 8–13; soft and dense. 3. P. foetidissima.
4. Pericentral cells 20–24 in main axis; firmer. 5. P. opaca.

1. P. HAVANENSIS Montagne forma MUCOSA J. G. Agardh, 1863, p. 960; P. B.-A., No. 1941; *P. havanensis* Harvey, 1853, p. 34. Spanish Rock, April, floating by Causeway, Oct., Inlet, Oct., St. George's Bay, Dec., Hervey. On *Penicillus, Halimeda, Sargassum* etc.; cystocarps in April. Fairyland, Dec., Collins. The fine soft filaments and rich red-brown color are characteristic of this form; the segments vary from one to four diam. long in the same plant. The cystocarps are globose below, broadly urceolate above. The leaves are long and much branched; normal branches are formed in their axils.

2. P. MACROCARPA Harvey in Mackay, 1836, part 2, p. 206; P. B.-A., No. 2093; *P. pulvinata* Harvey, 1846–51, Pl. CII. B, not of J. Ag. On mangroves, with *Dichotomosiphon pusillus* etc., Hungry Bay, May, Collins. Forming a close and rather dense coating. The filaments resemble *P. subtilissima* Mont., but are more slender, and the habit is quite different. An account of the distinction between this plant and the original *P. pulvinata* (Roth) J. Ag. will be found in Bornet, 1892, p. 306. Our plant is more slender than the European but otherwise the same.

3. P. FOETIDISSIMA Cocks in Bornet, 1892, p. 314; British Seaweeds, No. 29; P. B.-A., No. 1890. On timbers by sea wall at Hamilton, Jan., on stones on beach at St. George's, April, Hervey; cystocarps and tetraspores in Jan. An apparently little known species, but quite well marked. The filaments have 8–10, rarely to 13 pericentral cells, are creeping at the base, then erect, much branched, reaching a height of 15 cm. The substance is soft, the color deep purplish red. It decays promptly when taken from the water, and then thoroughly justifies its specific name.

4. P. FERULACEA Suhr in J. G. Agardh, 1863, p. 980; P. B.-A., No. 1940; *P. breviarticulata* Harvey, 1853, p. 36, Pl. XVI. B, not of J. Ag. Rein, as *P. nigrescens* in part; Moseley, as *P. subtilissima;* Spanish Point, Harrington Sound, Jan., Gravelly Bay, Feb., April, Tucker's Town, Feb., Dec., Hervey. A rather common and generally distributed species. Harvey's figure represents the plant quite accurately, except as to the quadrangular section of the filaments, which was probably due to the use of dried material; the Bermuda material shows the usual circular section. Rhizoids are well developed on the lower, prostrate part, arising each from a pericentral cell, often one from each segment. Where the creeping filament is near to a firm substratum, the rhizoids are short and stout; where there is no such stratum near, the rhizoids may be much elongated, up to 3 mm. long, becoming very slender. In the actively growing tips, the segments may have a length of only one fifth their diameter; in older parts the segments may be slightly longer than their diameter; the usual length is about one half a diam. Leaves are abundant, branches being produced from their axils.

At Heron Bay we found a plant agreeing quite closely with *P. fracta* Harvey, 1853, p. 38, and with an authentic specimen in the Farlow herbarium; it seems to us, however, to be only an old and battered form of *P. ferulacea.* Authentic specimens of the latter, in the Farlow herbarium, confirm this view.

5. P. OPACA (Ag.) Zanardini, 1842, p. 165; P. B.-A., No. 1891; *Hutchinsia opaca* Agardh, 1824, p. 148. Kemp, as *P. fibrillosa;* Rein, as *P. nigrescens,* in part; On rocks, Heron Bay, Jan., March, Ely's Harbor, April, Hervey; in grotto, Tucker's Town, April, Fairyland, Dec., Collins. We have included under this name all the many-tubed Polysiphonias that we have found in Bermuda. Some specimens agree well with the European form, others, specially those from Fairyland, considerably resemble *P. simulans* Harvey, but we have not been able to draw any line between these and the more typical forms. Tetraspores were found in April. Branches arise in the axils of the leaves.

DIGENEA Agardh.

D. SIMPLEX (Wulfen) Agardh, 1822, p. 389; Harvey, 1853, p. 29, Pl. XIII. D; P. B.-A., No. 1939; *Conferva simplex* Wulfen, 1803, p. 7. Castle Harbor, Farlow; Gravelly Bay, Feb., Mangrove Bay, Feb., Harris Bay, April, Dec., Hervey; St. David's Island, April, Collins. Fairly common at various places, but plants usually small compared with ordinary forms of Florida and the Mediterranean.

Wrightiella Schmitz.

1. Main axes virgate, except in the older parts beset with short, subequal ramuli. 1. W. Blodgettii.
1. Branches of successive orders diminishing in size; ramuli of varying length. 2. W. Tumanowiczi.

1. W. Blodgettii (Harv.) Schmitz, 1893, p. 222; P. B.-A., No. 1942; *Alsidium Blodgettii* Harvey, 1853, p. 16, Pl. XV. B. Kemp, specimen in herb. as *Dasya mucronata*, also unnamed specimen; Shelly Bay, Feb., Harris Bay, Walsingham, April, Hervey; in pot-hole, Gravelly Bay, April, Bethel's Island, Dec., Collins; tetraspores in Jan. and April.

2. W. Tumanowiczi (Gatty) Schmitz, 1893, p. 222; P. B.-A., No. 2095. *Dasya Tumanowiczi* Gatty in Harvey, 1853, p. 64. Moseley; Buildings Bay, April, with cystocarps, Hervey. In this collecting a single plant was found, dense and bushy and over 7 dm. high; over 30 good mounted specimens were made from it, but it was throughout more slender than much smaller individuals of *W. Blodgettii*. In appearance the two species are quite different, the stout spinous branches of the latter are quite visible to the naked eye, and set all over the plant; in *W. Tumanowiczi* they are hardly visible without a lens. Technically, it is hard to find distinguishing characters; tetraspores and cystocarps are quite alike, and as suggested by Falkenberg, 1901, p. 559, they are certainly closely related.

Murrayella Schmitz.

M. periclados (Ag.) Schmitz, 1893, p. 227; P. B.-A., No. 2096; *Hutchinsia periclados* Agardh, 1828, p. 101; *Bostrychia Tuomeyi* Harvey, 1853, p. 58, Pl. XIV. E. Among *Bostrychia* species, on mangroves and rocks, Tucker's Town, Hungry Bay etc., Common as scattered individuals among other species, rarely pure or constituting the greater part of the growth.

Herposiphonia Nägeli.

1. Branches recurved. 3. H. pecten-veneris.
1. Branches straight. 2.
2. Determinate branches about the same size as the axis. 1. H. secunda.
2. Determinate branches about half the size of the axis. 2. H. tenella.

1. H. SECUNDA (Ag.) Falkenberg, 1901, p. 307, Pl. III, figs. 10–12; P. B.-A., No. 2041; *Hutchinsia secunda* Agardh, 1824, p. 149; *Polysiphonia pecten-veneris* Var. β Harvey, 1853, p. 46, Pl. XVI. D. On reef, Ely's Harbor, Aug., Collins. In this material the erect branches are often abortive, and the regularity of position of branches characteristic of the species is obscured.

2. H. TENELLA (Ag.) Nägeli, 1846, Pl. VII, fig. 2; P. B.-A., No. 1943; *Hutchinsia tenella* Agardh, 1828, p. 105. On rocks, corallines and other algae, Harrington Sound, Bailey's Bay, Gibbet Island, Jan., Smith's Bay, Feb., Nov., Harris Bay, April, Tucker's Town, Dec., Hervey.

3. H. PECTEN-VENERIS (Harv.) Falkenberg, 1901, p. 315; *Polysiphonia pecten-veneris* Harvey, 1853, p. 46, Pl. XVI. C. Among *Gelidiopsis*, Harris Bay, April, Hervey. A delicate and attractive species; the graceful recurving of the branches easily distinguishes it.

LOPHOSIPHONIA Falkenberg.

1. Pericentral cells 10–16. 3. L. obscura.
1. Pericentral cells 4. 2.
2. Basal filament attached to substratum by filiform rhizoids, with or without disks. 1. L. bermudensis.
2. Basal filaments penetrating the host by rhizoids much inflated below. 2. L. Saccorhiza.

1. **L. bermudensis** sp. nov.; Cellulis pericentralibus 4, interdum 5 aut 6; filamentis prostratis 100–110 μ diam., cellulis 1–2 diam. longis; filamentis erectis numerosis, ad 60 segmentis longis, 60–80 μ diam. a basi ad prope apicem; cellulis 1½–2 diam. longis, interdum solummodo ½ diam.; ramis plus minusve ramosis, aliquando densissime; ramis brevibus. Antheridiis conicocylindricis, 160–200 μ × 40–50 μ, ad apicibus ramorum aggregatis; cystocarpiis subglobosis, lateraliter sessilibus, vel ad pedicellum perbreve, circa 250 μ diam.; tetrasporangiis circa 80 μ diam., 2–5 in seriem rectilineam, in ramulis subincrassatis, saepe curvis. Plate III, figs. 18–21.

Pericentral cells 4, occasionally 5 or 6; prostrate filaments 100–110 μ diam., cells 1–2 diam. long; erect filaments numerous, up to 60 cells long, 60–80 μ diam. from base to near apex, cells 1½–2 diam. long, occasionally only ½ diam.; more or less branched, sometimes quite densely, branches short. Antheridia conical-cylindric, 160–200 × 40–50 μ, clustered at apices of branches; cystocarps subglobose,

sessile or lateral on very short pedicels, about 250 μ diam.; tetrasporangia about 80 μ diam., 2–5 in a straight series, in somewhat swollen, often curved ramuli. Rhizoids filiform, varying in size but usually slender, attached to the substratum by a terminal disk. Type in Collins herbarium. Gravelly Bay, Feb., Hervey, Fairyland, Cave at Agar's Island, Aug., and dredged in 6 m., Collins. A rather delicate plant, usually on *Sargassum* or *Zonaria*, but also on limpet shells. The variation in number of pericentral cells is something exceptional in a plant of normally four. The increased number does not seem to be limited to any part of the plant, but may occur in horizontal or erect filaments, younger or older. It has some resemblance to *L. subadunca* (Kütz.) Falk., but that has uniformly six pericentral cells.

2. **L. Saccorhiza** sp. nov.; P. B.-A., No. 2042. Cellulis pericentralibus 4; filamentis prostratis 50–70 μ diam., segmentis 1–2 diam. longis; filamentis erectis numerosis, ad 2 mm. longis, 25–45 μ diam., ad basin abrupte, apicem versus longissime attenuatis, prope apicem folia bene evoluta sed fugacissima gerentibus; segmentis 2–3 diam. longis, ad apicem diametro brevioribus; filamento prostrato ad plantem hospitem rhizoideis numerosis affixo a parte inferiore filamenti ortis, primo cylindraceis vel ortu complanatis axis filamenti sensu, mox in saccos ovoideos expansis, ad 800 μ longis, 160 μ diam., inter utriculos plantae hospitis penetrantes. Tetrasporangiis uniseriatis in parte superiore filamenti erecti sitis, diametrum filamenti ad duplo superantibus; cystocarpiis subsphaericis, circa 100 μ diam., apicibus ramorum proximis, segmentis proxime inferioribus saepe ramulos breves solitarios vel paucos gerentibus. Antheridiis foliorum evolutione ortis, conico-ovoideis. Colore roseo; substantia molli. Plate II, figs. 13–14, Plate III, figs.15–17.

Pericentral cells 4; prostrate filaments 50–70 μ diam., segments 1–2 diam. long, erect filaments numerous, up to 2 mm. long, 25–45 μ diam., contracted abruptly at base, gradually towards apex, segments 2–3 diam. long, at growing tip shorter than the diam.; well developed but very fugacious leaves formed on the upper part; prostrate filaments attached to the host by numerous rhizoids issuing from the lower pericentral cells of the prostrate filament, one or more from a segment, at first cyclindrical in section, or flattened in a line with the axis of the filament, below expanding into an ovoid sac, up to 800 μ long, 160 μ wide, penetrating between the utricles of the host. Tetrasporangia in a single series in the upper part of a filament, up to twice the diameter of the filament. Cystocarps subspherical, about 100 μ diam., near end of erect filament, one or more short branches issuing

from the segments next below. Antheridia developed from leaves, conical-ovoid. Color rosy red; substance soft.

From the few 4-tubed species of *Lophosiphonia* this is distinguished by branching characters, but specially by the great development of the rhizoids, which show a remarkable adaptation to its habitat, the fronds of *Codium*. The rhizoids take the shape of utricles, of much the same shape and size as those of the host, but in reversed position. At first a relatively slender cell, cyclindrical, or occasionally flattened in a line with the axis of the filament, as soon as the rhizoid has penetrated between the stouter parts of the *Codium* utricles it expands, and wedges itself in tightly among the latter. As seen under the microscope, there is a striking contrast between the rosy color of one set of utricles, and the green of the other. Type in Collins herbarium, No. 7456, Gibbet Island, March, 1913, Hervey; also from Gibbet Island, Jan., Smith's Bay, March, Hervey; Tucker's Town, April, Cave near Ducking Stool, Hungry Bay, May, Collins.

3. L. OBSCURA (Ag.) Falkenberg, 1901, p. 500; P. B.-A., No. 1892; *Hutchinsia obscura* Agardh, 1828, p. 108; *Polysiphonia obscura* Harvey, 1846–51, Pl. CII. A. Moseley, as *Polysiphonia exilis;* Smith's Bay, Spanish Rock, Jan., Gibbet Island, March, Harrington Sound, Dec., Hervey; North and South Shores, April, May, July, Aug., Collins. Common everywhere on rocks between tide marks, and in caves, where in well sheltered places it reaches even above ordinary tides. It varies considerably in size and in luxuriance of branching, but is not likely to be mistaken for any other species. Young plants bear long hairs (leaves) in dense branching tufts.

BOSTRYCHIA Montagne.

1. Main axis ecorticate.	1. B. rivularis.
1. Main axis corticate.	2.
2. Long monosiphonous ramuli present.	2. B. tenella.
2. Only a few terminal segments monosiphonous.	3.
3. Tips of branches incurved; rather coarse.	4. B. Montagnei.
3. Branches straight; slender.	3. B. sertularia.

1. B. RIVULARIS Harvey, 1853, p. 57, Pl. XIV. D. Walsingham, April, Hervey. This species, the only one occurring as far north as New England, has been found only once in Bermuda, and then in a quite small form, not over 2 cm. high. It was sparingly scattered among *B. Montagnei.*

2. B. TENELLA (Vahl) J. G. Agardh, 1863, p. 869; P. B.-A., No. 1894; Alg. Amer.-Bor. Exsicc., No. 137, as *B. calamistrata; Fucus tenellus* Vahl, 1802, p. 45. Common on roofs and walls of caves, flat rocks, under mangroves, etc., at all seasons; tetraspores in Nov. The most common species of the genus; the species of *Bostrychia* usually grow intermixed with each other, and with *Caloglossa* and *Catenella;* it is exceptional to find any one species pure, while the combination of two or more, in varying proportions, is to be found everywhere in the stations noted for this species. *B. tenella* is quite variable, and the extreme forms seem quite distinct. Forma *tenuior* J. G. Agardh, 1863, p. 869; *B. calamistrata* Harvey, 1853, p. 56, Pl. XIV. C, and forma *densa* J. G. Agardh, 1863, p. 869; *Rhodomela calamistrata* Montagne, 1846, p. 36, Pl. IV, fig. 1, both occur, often in the same collecting, connected by intermediate forms.

3. B. SERTULARIA Montagne, 1859, p. 176; P. B.-A., No. 2094; Alg. Am.-Bor. Exsicc., No. 138. Grotto, Tucker's Town, Dec., Hervey; Gravelly Bay, April, Collins. The tetraspores of this species, of which there seems to have been no record, were found in material from the cave at Gravelly Bay, and are also in material distributed by Farlow, in Alg. Am.-Bor. Exsicc. A stichidium is formed in the limited branch of a main axis, usually occupying only a small part of its length, in the majority of cases below the middle, the unchanged branch extending both above and below the stichidium, bearing both above and below ramuli of normal construction; this appears to be an exception to the usual formation in this genus. *B. sertularia* has been considered by some as a synonym of *B. tenella*, e. g., De Toni, 1903, p. 1162, but the two seem quite distinct. *B. tenella* is a plant of softer substance, with long monosiphonous ramuli, and long-lanceolate or linear-lanceolate stichidia; *B. sertularia* is firmer, only a few of the extreme segments of a ramulus being monosiphonous; the branching is strictly distichous, and the stichidium occupies the middle part of the otherwise unchanged ramulus of the penultimate or ultimate order.

4. B. MONTAGNEI Harvey, 1853, p. 55, Pl. XIV. B; P. B.-A., No. 1893; Alg. Am.-Bor. Exsicc., No. 136. H. Kennedy, Feb. in Farlow herb.; July, Kemp, as *B. scorpioides;* Hungry Bay, April, May, Collins; Causeway, Nov., with cystocarps, Hervey. The largest and coarsest species. The cystocarps are large, depressed-globose, and terminal on rather long ultimate ramuli.

Dasya Agardh.

1. Divisions few, subsimple, ramelli very dense at tips. 1. D. ocellata.
1. More branched; ramelli less dense at tips. 2.
2. Ramelli all unbranched or forkings narrow. 3.
2. Ramelli divaricately or squarrosely branched, at least near base. 5.
3. Ramelli deciduous, leaving short, acute, spinous branches. 3. D. spinuligera.
3. Ramelli more persistent; no spinous branches. 4.
4. Ramelli very slender, short-celled, generally distributed on all but the oldest parts. 2. D. pedicellata.
4. Ramelli larger, longer-celled, in more or less distinct whorls. 4. D. punicea.
5. Ramelli stout near their base, diminishing at each forking, very slender at apex. 6.
5. Ramelli nearly uniform in size throughout. 5. D. arbuscula.
6. Ramelli forming a very dense coating, especially near tips of branches. 6. D. ramosissima.
6. Ramelli in minute, subcorymbose clusters, not denser near apices. 7. D. corymbifera.

1. D. ocellata (Grat.) Harvey in Hooker, 1833, p. 335; 1846–51, Pl. XL; *Ceramium ocellatum* Grateloup, 1807, p. 34. Cooper's Island, Feb., Farlow; on *Sargassum*, Gibbet Island, Jan., Gravelly Bay, Feb., Hervey; tetraspores in Jan.

2. D. pedicellata Agardh, 1824, p. 211; *D. elegans* Harvey, 1853, p. 60; Kützing, 1864, p. 21, Pl. LIX. Kemp, as *D. pediculata;* Merriman; Miss Peniston; Miss Wilkinson; Shelly Bay, April, Collins; Buildings Bay, March, Hervey. The common *Dasya* of the Atlantic coast from Cape Cod to Florida, but evidently not common here. Though the name *D. elegans* has been long familiar, it will have to be given up for *D. pedicellata*, the priority of which is unquestionable.

3. **D. spinuligera** sp. nov.; P. B.-A., No. 2188. Cellulis pericentralibus 5, corticatis, cortice glabro, continuo, cellularum minorum, elongatarum; ramis paucis, elongatis, ramulos breves, patentes, acutos, gerentibus; apice ramuli junioris fasciculum densum ramellorum ferente, adultioris nudo; ramellis densissimis, deciduis, monosiphoniis, dichotomis, rectis nec divaricatis, cellulis 2–3 diam. longis, superne 1 diam. modo, diametro ubique aequali; stichidiis conicis vel cylindro-conicis, prope basin fasciculi ramellorum ortis; tetrasporangiis 2–4 in verticillo; frondis substantia firma; colore rubro obscuro. Plate IV, figs. 24–25.

Pericentral cells 5, corticate, cortex smooth, even, of small elongate

cells; with few elongate branches, bearing patent, acute ramuli, the younger with a dense fascicle of ramelli at the tip, the older naked; ramelli very dense, deciduous, monosiphonous, dichotomous, straight, not divaricate; cells 2–3 diam. long, above only 1 diam.; diameter the same throughout; stichidia conical or cyclindric-conical, arising near the base of a fascicle of ramuli; tetrasporangia 2–4 in a whorl. Substance of the frond firm; color dark red. Type in Collins herbarium, No. 7243; collected at Shelly Bay, May 4, 1912, Collins. When ramelli are abundant, this plant somewhat resembles *D. punicea*, but the ramelli show no tendency to a verticillate arrangement, and fall off more easily. The surface of the frond after the ramelli have fallen is smooth and even, not knotted and irregular as in *D. punicea;* the cells are small and regular, not large and irregular as in that species.

4. D. PUNICEA Meneghini in Zanardini, 1842, p. 171; 1865, Pl. LII. Dingle Bay, March, Hervey; Bethel's Island, Dec., Collins; both with tetraspores. In habit somewhat resembling *D. pedicellata*, but the ramelli are larger, of longer cells, and with a distinct tendency to issue in whorls.

5. D. ARBUSCULA (Dillw.) Agardh, 1828, p. 121; Harvey, 1846–51, Pl. CCXXIV; P. B.-A., No. 1944; *Conferva arbuscula* Dillwyn, 1809, Pl. G. Shelly Bay, Jan., Smith's Bay, March, Harris Bay, April, Hervey; Hungry Bay, April, in dense floating masses and attached to mangroves, Collins.

6. D. RAMOSISSIMA Harvey, 1853, p. 61; Kützing, 1864, Pl. LXIX, figs. d–e; P. B.-A., No. 1945. On vertical rock between tides, Pink Beach, Jan., Feb., Smith's Bay, March, Gibbet Island, Dec., Hervey. In habit not unlike *D. corymbifera*, but the divisions of the ramelli are incurved.

7. D. CORYMBIFERA J. G. Agardh, 1841, p. 31; *D. venusta* Harvey, 1846–51, Pl. CCXXV; *D. arbuscula* P. B.-A., No. 1097b, not 1097a; *D. arbuscula* forma *subarticulata* P. B.-A., No. 493. Washed ashore from deep water, Buildings Bay, Feb., Hervey; dredged in 4 m., Nov., Collins. Sometimes confused with *D. arbuscula* which it resembles in habit; both have a dense coating of divaricately branching ramelli, but in *D. corymbifera* the tips of the ramelli are much more slender than their bases.

HETEROSIPHONIA Montagne.

H. WURDEMANNI (Bailey) Falkenberg, 1901, p. 638, Pl. XVI, fig. 11; P. B.-A., No. 2097; *Dasya Wurdemanni* Bailey in Harvey, 1853, p. 64, Pl. XV. C. Cooper's Island, Feb., Farlow; Harrington Sound, Jan.,

March, Gibbet Island, Dec., Hervey; Hungry Bay, April, Cooper's Island, Aug., Little Agar's Island, Nov., Collins. On *Gelidium* and other algae, but most frequently on *Sargassum;* a careful search would probably discover it in any lot of old *Sargassum,* but it is seldom found in large quantity.

Family CERAMIACEAE.

Spermothamnion Areschoug.

1. Cells 5–20 diam. long; tetraspores usually in corymbose clusters. 3. S. macromeres.
1. Cells 2–7 diam. long; tetraspores solitary. 2.
2. Filaments 15–20 μ diam. 1. S. investiens.
2. Filaments 40–50 μ diam. 2. S. gorgoneum.

1. S. investiens (Crouan) Vickers, 1905, p. 64; *Callithamnion investiens* Crouan in Mazé & Schramm, 1870–1877, p. 141. On *Galaxaura squalida,* Gravelly Bay, April, St. David's Island, April, Collins; Harris Bay, Dec., Hervey. The dimensions of the Bermuda plant agree with those given by Miss Vickers for the Barbados plant; Börgesen, 1909, p. 17, fig. 10, describes and figures var. *cidaricola* from the Danish West Indies; the dimensions are considerably larger than in the typical form, but the habit and the tetraspores are the same as in the Bermuda plant.

2. S. gorgoneum (Mont.) Bornet in Vickers, 1905, p. 64; *Callithamnion gorgoneum* Montagne, 1857, p. 289. Common on fronds of species of *Codium.* Tetraspores with tripartite division were found in Bermuda material, borne on an upcurved pedicel.

3. **S. macromeres** sp. nov.; P. B.-A., No. 2044. Filamentis prostratis circa 65 μ diam., cellulis 3–5 diam. longis, rhizoideis magnum discum terminalem ferentibus, affixis; filamentis erectis 5–8 mm. longis, basi circa 50 μ diam., sensim diminutis, in ramis ultimis circa 30 μ; cellulis 5–20 diam. longis, cylindricis vel leviter clavatis, cellulis ramiferis valide clavatis; ramificatione distante, apparenter dichotoma, axi ramoque subaequalibus, minime divergentibus; tetrasporangiis in ramo laterali evolutis, ramum vegetativum referente, vel in ramis brevibus oppositis; ramis tetrasporangiferis raro simplicibus, vulgo di- trichotome ad cellulam quamque repetite divisis, cellulis brevibus, clavatis; tetrasporangiis terminalibus, tripartitis, 50–55 μ diam., globosis vel paullo elongatis, membrana crassa; antheridio

latere interiore rami evoluto, loco rami vegetativi, ovoideo-cylindrico, 125–130 × 50–60 μ; cystocarpio cellula brevi clavata suffulto, loco rami vegetativi evoluta.

Prostrate filaments about 65 μ diam., cells 3–5 diam. long, attached by rhizoids with a large terminal disk; erect filaments 5–8 mm. long, about 50 μ diam. at base, gradually diminishing to about 30 μ in ultimate divisions, cells 5–20 diam. long, cylindrical or somewhat clavate, branch-bearing cells strongly clavate; branching usually distant, apparently dichotomous, the axis and branch nearly equal in size and diverging very slightly; tetrasporangia produced on a short branch arising like a vegetative branch, or on two short branches opposite on the axis; tetrasporic branches rarely simple, usually di- or trichotomously divided, the divisions each of a short, clavate cell; tetraspores borne on the ultimate divisions, tripartite, 50–55 μ diam., globose or slightly elongate, with wide pellucid wall; antheridium on the inner side of a branch, occupying the place of a vegetative branch, ovoid-cylindrical, 125–150 × 50–60 μ; cystocarp borne on a short, clavate cell, taking the place of a vegetative branch. Type in Collins herbarium, Smith's Bay, Jan. 18, 1913, Hervey. Also at the same place, Feb., March, Nov., Dec., Hervey.

The extremely long cells in this species, 20 diameters long being not uncommon, distinguish it from other species of the genus. The erect filaments are usually very sparingly branched, though in the upper half there may sometimes be a branch from every cell; in other cases the erect filament branches only two or three times in its whole length; the branch is hardly distinguishable from the axis, either by size or direction. The tetrasporangium may be terminal on a relatively short cell, 2–3 diam. long, arising from the axis; or this cell may divide one to several times, in the latter case twenty to thirty tetrasporangia being borne at the apices of the divisions, forming a dense, corymb-like cluster. The antheridia appear sessile, as they take the place of normal branches on the inner side of a secondary axis, the unmodified cells of which are shorter than the normal, though not as short as in the tetrasporic clusters; occasionally both branches of a forking are transformed into antheridia. Cystocarps are formed in the same position as antheridia, but the lower cell of the transformed branch remains unchanged. Antheridia were plentiful in material collected in January, tetraspores at all seasons; cystocarps were found in January material only, scarce and somewhat immature. The prostrate filaments are affixed by numerous short, stout rhizoids with much expanded terminal disks; occasionally a more slender rhizoid is pro-

duced by the lowest cell of an erect filament. The plant grew on the top of sand-covered rocks, covered at high tide; the coral sand sifted in among the alga, forming a dense fibrous mass.

Ceramothamnion Richards.

C. Codii Richards, 1901, p. 264, Pl. XXI; P. B.-A., No. 1899; Plate III, fig. 22; plate IV, fig. 23. Common on *Codium tomentosum* and other species of *Codium* all about the islands, at all times of the year, almost always in abundant fruit. It was once found on *Laurencia cervicornis*. A few notes can be added to the quite full description of Richards. He observed only a single ripe tetrasporangium at a node; we have found not uncommonly two, rarely three, in one instance four, of apparently equal age, side by side; branches occasionally occur independently of the polyspores; we have found organs quite agreeing with his figures of the latter, but also similar organs, larger, up to 160 μ diam., spherical, containing up to 45 spores, and in appearance quite indistinguishable from cystocarps of *Ceramium*.[17] Against the identification of these organs as cystocarps must be reckoned our failure to discover anything like procarps, and the question must be left open. The rhizoids offer some interesting peculiarities, doubtless due to adaptation to their position, between the closely-packed utricles of the host; at first terete, they soon become flattened, and often two or more unite laterally, in a membranous expansion, which may be as much as 10 cells wide. In one case three rhizoids from one individual united with two from another to form one membrane. The cross walls in these rhizoidal membranes are often much oblique, and the arrangement of the cells reminds one somewhat of that in the leaf of a moss. See Figures 22 and 23. The material from which this species was described was collected in Bermuda in 1898 and 1899; the only other record of its occurrence is at Barbados, Vickers, 1905, p. 65.

Griffithsia Agardh.

1. Vegetative cells cylindrical throughout.	1. G. tenuis.
1. Lower cells subcylindrical, upper ovoid.	2. G. Schousboei.
1. All cells subspherical.	3. G. monilis.

[17] Schiller, 1913, has made extensive observations on organs of this character in genera allied to *Ceramothamnion*, and he reports that in every case they were accompanied by tetraspores of normal character on the same individual. This is not the case with this species.

1. G. TENUIS Agardh, 1828, p. 131; P. B.-A., No. 1895; Plate VI, figs. 38–39; *G. thyrsigera* Askenasy, 1888, p. 36, Pl. IX, figs. 1 & 4; Vickers, 1905, p. 64; *Callithamnion tenue*, Harvey, 1858, p. 130. Inlet, above and below Flatts Bridge, Jan., Feb., March, April, Dec., Heron Bay, Jan., Hervey. Common at these stations in late winter and early spring; cystocarps, antheridia and tetraspores all produced from January to March. The similarity between *Griffithsia tenuis* Ag. and *Callithamnion thyrsigera* Thwaites has been noticed more than once. Harvey, 1858, p. 130, kept up the distinction with some doubt. Grunow, 1874, p. 8, considers the latter merely a robust form of the former. Harvey had compared the plant from Beesley's Point, New Jersey, with an authentic Mediterranean specimen; we have compared with a Beesley's Point specimen of the original collecting specimens from Atlantic City, N. J. (S. R. Morse), Nantucket (L. L. Dame), Falmouth, Massachusetts (Collins), and *G. thyrsigera*, Vickers, Algues de la Barbade, No. 182. All agree in essential details with each other, and with the figures and text of Askenasy. The Bermuda material seems to be more luxuriant, especially the tetrasporic; it is not uncommon to find 15 tetrasporangia in a whorl, five whorls of tetrasporangia, mature or nearly mature, and two whorls of immature, at once on an axis. Antheridia are borne on a pedicel of one to three cells; Askenasy reports one-celled pedicels only. The cystocarps were unknown until found on our Bermuda material; they are characteristic of *Griffithsia*, and the generic position of the species may now be regarded settled. Rhizoids were frequent on the older plants, of the usual form, unicellular, longer or shorter as required to reach the substratum, where an expanded disk was formed. They have thicker walls than the filament cells, and contain nearly as deeply colored chromatophores.

2. G. SCHOUSBOEI Montagne in Webb, 1839, p. 11, Pl. X. Washed ashore, St. George's, Feb., sand covered rock, Pink Bay, March, Hervey. Agrees with the European plant in vegetative characters, but in the absence of fruit the identification is only provisional.

3. G. MONILIS Harvey, 1855, p. 559; in Hooker & Harvey, 1855–1860, p. 332, Pl. CXCV. B. In cave, Gravelly Bay, Dec., Jan., March, on sand-covered rocks, Smith's Bay, March, Hervey; Bethel's Island, Dec., Collins. Tetraspores in Jan. *G. monilis* is an Australian species, and its occurrence here is of interest. Agardh calls attention to its similarity to *G. Schousboei*, but while what we take for that species occurs in Bermuda, it has most of the cells cylindrical, a few ovoid, while in *G. monilis* the cells are strictly globose, or a little elongated or depressed.

CALLITHAMNION Lyngbye.

1. Branching distichous, pinnate. 2.
1. Branching radial or dichotomous. 3.
2. Little cortication, cells long, ultimate ramuli long, slender. 4. C. roseum.
2. Much cortication, cells short, pinnae decompound, ultimate ramuli, short, stout. 5. C. Hookeri.
3. Branching alternate throughout. 1. C. byssoideum.
3. Branching at least in part dichotomous. 4.
4. Ultimate divisions long, slender. 6. C. cordatum.
4. Ultimate divisions shorter and stouter. 5.
5. Alternate branching usually confined to axis and branches of first order, otherwise dichotomous. 3. C. Halliae.
5. Only smaller divisions dichotomous; distance very short between forkings. 2. C. corymbosum.

1. C. BYSSOIDEUM Arnott var. JAMAICENSE Collins, 1901, p. 258; P. B.-A., No. 2045. Gravelly Bay, Jan., Feb., March, Oct., Hervey; April, Aug., Collins. Growing in dense patches, not over 3 cm. high, just below low water mark, in a small cave. In the water it shows a peculiar bluish iridescence, like the bloom on a plum.

2. C. CORYMBOSUM (Eng. Bot.) Lyngbye, 1819, p. 125, Pl. XXXVIII. C.; Harvey, 1846–51, Pl. CCLXXII; *Conferva corymbosa* Eng. Bot., 1811, Pl. MMCCCLII. Washed ashore, Cooper's Island, Feb., Farlow; on *Wrightiella Blodgettii*, Harris Bay, April, Collins. In both cases with abundant tetraspores.

3. C. HALLIAE Collins in P. B.-A., No. 698; 1906, p. 111; P. B.-A., No. 1896. Outlet of Harrington Sound, Jan., Feb., March., Hervey, large and handsome plants; tetraspores in Jan., no other fruit; Burchell's Cove, Feb., large rich purple patches on bottom in shallow water, Hervey; shore of Agar's Island, Dec., Collins.

4. C. ROSEUM (Roth) Harvey in Hooker, 1833, p. 341; Harvey, 1846–51, Pl. CCXXX; *Ceramium roseum* Roth, 1798, p. 46. On *Codium*, near Causeway, Feb., Hervey, with tetraspores. The plants are attached to the *Codium* by a dense mass of slender filaments with red protoplasts, penetrating deeply the tissue of the host. They are continuations of the descending growths from the bases of the branches, which cover the lower part of the axis, as a cortex.

5. C. HOOKERI (Dillw.) Agardh, 1828, p. 178; Harvey, 1846–51, Pl. CCLXXIX; P. B.-A., No. 2046; *Conferva Hookeri* Dillwyn, 1809, Pl. CVI. Kemp, as *C. spongiosum*. Pink Beach, Jan., Feb.,

March, Gravelly Bay, Feb., March, April, Hervey. At Pink Beach this plant grew buried in fine sand, on an exposed rock; at Gravelly Bay in the cave with *C. byssoideum* var. *jamaicense*, not as large nor as well fruiting as at Pink Beach. At that station it bore tetraspores along the upper edge of the ramuli, as figured by Harvey; antheridia in rounded tufts at the same points; cystocarps large, spherical to ovoid, on opposite sides of a branch; the three on separate individuals. Paraspores were often found at the ends of the ramuli, ovoid, of varying size, up to 50 × 35 μ including the rather thick wall. Tetraspores were occasionally found on the individuals producing the paraspores, but no other organ of fructification. We saw no seriate paraspores, such as are found in *Seirospora Griffithsiana* Harv., but sometimes two were side by side, touching each other, at the end of an ordinary cell. Kylin, 1907, p. 152, figures and describes paraspores of *C. Hookeri*, but of quite a different type; they take each the place of a tetrasporangium, dividing to produce an indefinite number of spores, "polyspores" of most authors. De Toni, 1903, p. 1317, describes *C. Hookeri* with tetraspores and cystocarps, and vegetative characters quite as above, and adds "Cautissime haec a *Seirospora? Gaillonii*, quacum characteribus plurimis congruit, dignoscatur." The latter species is described by him, p. 1352, by vegetative characters and tetraspores only. There is practically no distinction as regards these characters between the descriptions of the two species. The final note under *S. Gaillonii* is "Seirosporae et cystocarpia (sec. Crouan) presentia." De Toni includes under *Seirospora*, with or without a ?, a number of species which do not seem to us to belong to that genus, and without any statement of his reasons for so assigning them; among them *Callithamnion byssoideum*, with var. *jamaicense* and three other varieties.

C. CORDATUM Börgesen, 1909, p. 10, figs. 5–6; P. B.-A., No. 2189. Washed ashore, Buildings Bay, Feb., Hervey. Abundant, but entirely sterile, so that the determination must remain doubtful, although the vegetative characters agree with Börgesen's description and figures.

GYMNOTHAMNION J. G. Agardh.

Plumaria Schmitz, not Stackhouse. The genus *Plumaria* was founded by Stackhouse, 1809, p. 58, *P. pectinata* type, with synonym *Fucus plumosus* Linnaeus. C. A. Agardh, apparently not knowing of this publication, proposed, 1817, p. XIX, the genus *Ptilota*, founded

on the same *Fucus plumosus* L.; Agardh's genus has been generally accepted, and many recent species have been included in it. Ruprecht, however, 1856, p. 335, calls attention to the priority of Stackhouse's name, and makes the combination *Plumaria asplenioides*, and also uses the *P. pectinata* of Stackhouse. Otto Kunze, 1891, p. 911, takes the same position, and makes new combinations for 16 species of Ptilota, some of which, however, are unnecessary, as the species had already been properly transferred to *Euptilota* Kütz. Schmitz, 1889, p. 450, retains *Ptilota* for most of the species, including Stackhouse's type for *Plumaria*, but revivies *Plumaria* for *Ptilota elegans*, Bonnemaison, a species unknown to Stackhouse; and in 1896, p. 7, transfers to *Plumaria, Ptilota Schousboei* Bornet in Bornet & Thuret, 1876, p. 34, *Callithamnion elegans* Schousboei in Agardh, 1828, p. 162. Under the international rules of nomenclature, and probably under any rule, the name *Plumaria* must be retained for Stackhouse's type, *P. plumosa* and its congeners; *Ptilota* founded on the same species, has no standing, and the only name we find available for the species placed under *Plumaria* by Schmitz is *Gymnothamnion* J. G. Agardh, 1892, p. 27, type *Callithamnion elegans* Schousboe. Accepting this in place of *Plumaria* Schmitz, not Stackhouse, it will include *Gymnothamnion elegans* (Schousboe) J. G. Agardh, 1892, p. 27; *Callithamnion elegans* Schousboe in Agardh, 1828, p. 162; Bornet & Thuret, 1876, p. 32, Pl. X; *Ptilota Schousboei* Bornet in Bornet & Thuret, 1876, p. 34; *Plumaria Schousboei* Schmitz, 1896, p. 7. **G. sericeum** (Harvey) comb. nov.; *Ptilota sericea* Harvey,[18] 1846–1851, Pl. CXCI; *P. elegans* Bonnemaison 1828, p. 70; *Plumaria elegans* Schmitz, 1889, p. 450. **G. Harveyi** (Hooker) comb. nov.; *Ptilota Harveyi* Hooker, 1845, p. 271; *Plumaria Harveyi* Schmitz, 1896, p. 7. **G. pellucidum** (Harvey) comb. nov.; *Ptilota pellucida* Harvey in Hooker & Harvey, 1853–1855, p. 257; *Plumaria pellucida* Schmitz, 1896, p. 7; also a new species, described below.

The taxonomy is somewhat complicated; of the five species credited to this genus, two were published in 1828, *Ptilota elegans* and *Callithamnion elegans;* in 1876 Bornet transferred the latter to *Ptilota,* but as the specific name *elegans* was preoccupied, changed it to *P. Schousboei.* In 1896 Schmitz transferred both to *Plumaria* with specific names unchanged, but in 1892 J. G. Agardh had used *Callithamnion elegans* as the type of his new genus *Gymnothamnion,* hence

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18 *Fucus sericeus* Gmelin, 1768, p. 149, Pl. XV, fig. 3, from Kamtschatka, can hardly be a *Gymnothamnion.* See Ruprecht, 1856, p. 337.

in transferring to the latter the other species of Schmitz's *Plumaria*, a new specific name is needed for *Ptilota elegans*, and we have taken Harvey's name as the next in order.

G. bipinnatum sp. nov.; filamentis basalibus circa 20–25 μ diam., ramificatione opposita, cellulis diam. 4–5, raro 6–7 longis, membrana crassa, nodis subconstrictis; axibus erectis basi 20–25 μ diam. superne attenuatis, ad apicem circa 12 μ, cellulis cylindricis vel subclavatis, inferioribus circa 3 diam. longis, apicem prope 1–1½ diam.; ramis oppositis apice cellulae singulae exeuntibus, parallelis, angula 50°–60°, rectis vel leviter recurvatis, axi referentibus sed minoribus, raro 15 μ diam. superantibus; ramorum aliis simplicibus, aliis et pluribus ramulos secundatos latere superiore ferentibus; ramulis 1–2-cellularibus, perraro magis; circumscriptione frondis ovata vel lanceolata; cellulis terminalibus rotundatis. Filamentis prostratis ramulos rhizoideos descendentes ferentibus, axibus erectis oppositis, cellula terminali ad substratum disco affixa. Tetrasporangiis in ramis et ramulis terminalibus, sphaericis vel subovoideis, 30–35 μ diam., tripartitis. Plate IV, fig. 26.

Basal filaments about 20–25 μ diam., with opposite branching, cells 4–5 diam. long, rarely 6–7, wall thick, nodes somewhat constricted; erect axes of about the same size near the base as the prostrate filaments, diminishing to 12 μ at apex; cells about 3 diam. long at base, near apex 1–1½ diam., cylindrical or slightly clavate, each bearing at the upper end a pair of opposite branches, forming an angle of 50–60° with the axis, straight or slightly recurved, similar to the axis, but averaging smaller, seldom over 15 μ diam.; these branches either simple or more commonly bearing on the upper side, on part or all of the cells, a second series of branches, 1–2 cells long, rarely more, 8–10 μ diam.; outline of frond ovate or lanceolate; terminal cells all rounded. Basal filaments producing, opposite to the erect axes, rhizoids of one or many cells, the end cell forming a disk of attachment when it reaches the substratum. The end of a basal filament sometimes becoming erect and developing into a frond similar to the erect axes; the erect axis sometimes extending beyond the pinnation, and after an indefinite number of unbranched cells, developing a second series of branches; or the prolonged naked axis descending and forming a prostrate filament bearing erect axes and rhizoids. Tetrasporangia terminal on the branches of the first and second orders, spherical or slightly ovoid, 30–35 μ diam., tripartite. Cystocarps? Antheridia? On wall of cave, Gravelly Bay, April, Hervey, type in Collins herbarium; on *Wurdemannia*, Harrington

Sound, Jan., cave, Agar's Island, July, Aug., shore of Gibbet Island, Aug., cave, Ducking Stool, Dec., Collins. Tetraspores in April, Aug. and Dec.

Growing on walls and roofs of caves, or in smaller cavities in rocks, usually among other algae with a creeping base, such as *Rhodochorton* and *Spermothamnion*. We have found this quite a puzzling form, as there are three European species, in different genera, of similar size and habit, and with tetraspores similarly placed. Two of these, *Ptilothamnion pluma* Bornet in LeJolis, 1863, p. 118 and *Plumaria Schousboei* (Bornet) Schmitz, 1896, p. 7, while differing in cystocarps and antheridia, are almost identical otherwise, but a comparison of the plates, Bornet & Thuret, 1876, p. 32, Pl. X, and Bornet & Thuret, 1880, p. 179, Pl. XLVI, shows that the *Plumaria* has shorter cells throughout, and that the branches arise at the upper edge of the cells of the axis, while in the *Ptilothamnion* they are distinctly lower. The Bermuda plant agrees exactly with *Plumaria Schousboei* in form and proportions of cells, and place of insertion of branches; on that account we have placed it in the genus Gymnothamnion, recognizing, however, that when the sexual fruit is discovered, a different disposition may be necessary. The uniformly opposite character of the branching is quite noticeable; even in the prostrate filaments any other branching is rare and evidently abnormal, though in most species with opposite branching in the erect parts, the basal part is apt to vary from this. Moreover, every rhizoid that we have observed is opposite to an erect axis. Bornet and Thuret, describing *P. Schousboei*, say "ils adherent par des crampons semblables a ceux des Spermothamnion et des Polysiphonia"; but an examination of Pl. X, fig. 1, shows all the rhizoids opposite to erect axes, while this is not the case in *Spermothamnion flabellatum* shown in Pl. VIII, fig. 1. We are led to keep the Bermuda plant separate from *P. Schousboei* principally from the fact that all well developed fronds bear erect branches of a second order, in luxuriant individuals one such branch from every cell of a branch of the first order, always on the upper side of the latter. If these branches were in pairs, the distinction would be less important, and might mean merely a repetition of the normal branching in luxuriant individuals, but we have never seen an outgrowth from the under side of a branch of the first order. Curiously enough, this mode of branching is identical with that of *Antithamnion pteroton* (Schousb.) Bornet, 1892, p. 331, Pl. III, figs. 8–9, in regard to which the author says, "Cette élégante petite Algue ressemble beaucoup aux *Callithamnion pluma* et *elegans* mais elle est plus délicate,

d'une couleur plus rose. Elle s'en distingue surtout, parce que ses pinnules, lorsqu'elles sont bien developpées, portent des pinnules de second ordre sur leur bord superieur et que les tétraspores sont divisés en croix." The tetraspores in the Bermuda plant are distinctly tripartite. As a secondary distinction we would note that a prostrate axis can become erect and an erect axis prolong itself and either develop a new branch system at some distance from the old, or be transformed into a prostrate axis.

The type specimen of the species is No. 7521 in the Collins herbarium; from the cave at Gravelly Bay, collected by Hervey in April, 1913.

Antithamnion Nägeli.

A. cruciatum (Ag.) Nägeli, 1847, p. 200; P. B.-A., No. 2191 *Callithamnion cruciatum* Agardh, 1827, p. 637; Harvey, 1846–51, Pl. CLXIV. Abundant and luxuriant on an old wreck, Castle Harbor, St. George's, April, on rock, Spanish Point, March, May, small form in cave, Gravelly Bay, Dec., Hervey.

Var. **radicans** (J. Ag.) comb. nov.; [19] P. B.-A., No. 2047; *A. cruciatum F. radicans* Hauck, 1885, p. 71; *Callithamnion cruciatum* var. *radicans* J. G. Agardh, 1841, p. 44. Creeping on perpendicular or overhanging rocks between tides, North Shore opposite Gibbet Island, Aug., Collins; Dec., Hervey. The main axis is prostrate, about 40 μ diam., the cells cylindrical, 2–5 diam. long; near the upper end of each cell is a pair of opposite branches; whorled branches were not seen. Successive pairs of branches are not in the same plane, but are more or less exactly decussate. The lower cell of each branch is short, no longer than broad, more or less rounded; the following cells are 2–4 diam. long, growing shorter upward; the diam. at the base of the branch, 20–25 μ. The short basal cell often bears a long, simple, rhizoidal branch, the cells up to 10 diam. long, about 15 μ diam., of paler color than cells elsewhere in the plant; the terminal cell of this rhizoid may form a discoid expansion, attaching itself to the substratum. All normal branches, whether issuing from the upper or the lower surface of the main filament, turn upwards; their branching is always alternate, a ramulus from each cell, all nearly or quite

[19] This combination occurs in Collins, 1900, p. 48, attributed by error to J. G. Agardh. No synonymy being given, it can hardly be considered a publication. The difference from the typical *A. cruciatum* seems too great to consider it as a form, as was done by Hauck.

in the same plane; these branches are of 2 or 3 orders, the ultimate about 12 μ diam., the cells about 2 diam. long, nodes more or less constricted; the end cell is distinctly acuminate or subulate. "Drusenzellen" are abundant, borne usually on the inner side of the lower cell of an ultimate branch, in the same way as a tetrasporangium; they are spherical, about 20 μ diam., or slightly elongate, 18 $\times$ 24 μ, with rather thin wall, strongly refringent, yellowish or pale aeruginous contents. Occasionally the cells of a branch or of a system of branches assume a spherical form, as if becoming seirospores, but the contents do not seem to become darker or denser; the end cell rounds the lower end, but remains pointed above. No fructification was observed. The plant is very small, the axis seldom over 1 cm. long, the branches hardly 1 mm.; it is possible that this is not the variety *radicans* of J. G. Agardh, of which we have not seen type specimens. Descriptions as far as we know have been short and imperfect, which has led us to describe the Bermuda plant in rather full detail.

Crouania J. G. Agardh.

C. attenuata (Bonnem.) J. G. Agardh, 1842, p. 83; Harvey, 1853, p. 226, Pl. XXXI. D; P. B.-A., No. 2048; *Batrachospermum attenuatum* Bonnemaison in Agardh, 1824, p. 51, as synonym under *Mesogloia attenuata*. Very young plants on *Caulerpa*, Harris Bay, Jan., Nov., plants up to 1 dm. high, washed ashore, Buildings Bay, Feb., March, Hervey.

Spyridia Harvey.

1. Branching mostly distichous.	3. S. complanata.
1. Branching radial.	2.
2. Recurved prickles at ends of ramuli.	2. S. aculeata.
2. No recurved prickles.	1. S. filamentosa.

1. S. filamentosa (Wulf.) Harvey in Hooker, 1833, p. 337; Harvey, 1846–51, Pl. XLVI; P. B.-A., No. 1897; *Fucus filamentosus* Wulfen, 1803, p. 64. Kemp; Tucker's Town, Feb., Harrington Sound, Jan., Feb., Nov., Hervey. Abundant, probably everywhere about the islands. Occasionally handsome plants can be found, but they are mostly matted and unattractive. The three species of *Spyridia* are much alike in habit; but generally easily distinguished on microscopic examination.

2. S. aculeata (Schimper) Kützing, 1843, p. 327; 1862, Pl. LI;

Ceramium aculeatum Schimper in Decaisne, 1841, p. 179. Kemp; Merriman; Harris Bay, Nov., Harrington Sound, Aug., Hervey. Tetraspores in Nov.

Var. BERKELEYANA (Mont.) J. G. Agardh, 1876, p. 272; *S. Berkeleyana* Montagne, 1846, p. 141, Pl. XV, fig. 8. Dense tufts on exposed flat rocks at low water, Gravelly Bay, April, Collins, with tetraspores. In this variety the recurved prickles characteristic of the species are usually present, but may sometimes be lacking, in which case it approaches *S. filamentosa.*

Var. HYPNEOIDES J. G. Agardh, 1876, p. 272; P. B.-A., No. 1946. Castle Harbor, near Walsingham House, April, Harris Bay, March, April, Hervey; tetraspores in collections of both months. The hooked tips of some of the branches, similar to those of *Hypnea musciformis,* characterize this form. The specimen marked *C. aculeata* in the Kemp herbarium belongs to this variety.

3. S. COMPLANATA J. G. Agardh, 1851, p. 343; 1876, p. 271; P. B.-A., No. 1947. Harris Bay, Jan., Feb., April, Pink Bay, March, Hervey; Hungry Bay, Nov., Elbow Bay, Dec., Collins. Growing in dense tufts on flat rocks near low water.

CERAMIUM Agardh.

1. Cortication continuous.	2.
1. Cortication at nodes only.	3.
2. Corticating cells in longitudinal series.	5. C. clavulatum.
2. Corticating cells not in series.	4. C. nitens.
3. Main axis creeping, attached by rhizoids.	4.
3. Main axis erect.	1. C. tenuissimum.
4. Tetraspores cruciate.	2. C. cruciatum.
4. Tetraspores tripartite.	3. C. transversale.

1. C. TENUISSIMUM (Lyng.) J. G. Agardh, 1851, p. 120; 1876, p. 94; P. B.-A., No. 1898. *C. diaphanum* var. *tenuissimum* Lyngbye, 1819, p. 120, Pl. XXXVII. B, fig. 4; *C. nodosum* Harvey, 1846–51, Pl. XC. Miss Peniston; Harrington Sound, March, Wadsworth; Harris Bay, Jan., Heron Bay, March, Harrington Sound, April, Hervey; Hungry Bay, May, Fairyland, Dec., floating, Collins. This is the plant that passes by this name on the New England coast, and also Miss Vickers Algues de la Barbade, No. 199; it does not have the reniform cells considered characteristic of *C. tenuissimum* by Petersen, 1908, p. 54, Pl. III; but in the present uncertainty of specific limitations in *Ceramium,* it had better retain the present name. No fruit of any kind has been observed by us.

Var. PATENTISSIMUM (Harv.) Farlow, 1881, p. 138; *C. arachnoideum* var. *patentissimum* Harvey, 1853, p. 217, Pl. XXXIII. B. Heron Bay, Jan., Hervey. The frequent wide forkings give a habit quite different from the typical form, but there is agreement in essentials.

Var. ARACHNOIDEUM (Ag.) J. G. Agardh, 1851, p. 117; 1876, p. 94; P. B.-A., No. 2098. *C. arachnoideum* Harvey, 1853, p. 217; *C. diaphanum* var. *arachnoideum* Agardh, 1824, p. 134. On *Cymodocea* and various algae, Grasmere, Feb., Harvey. A very slender and delicate form, but otherwise like the typical form.

Var. PYGMAEUM (Kütz.) Hauck, 1888, p. 460; P. B.-A., No. 2193; *Hormoceras pygmaeum* Kützing, 1862, p. 23, Pl. LXXV. On *Codium decorticatum*, Cooper's Island, Aug., Collins. With tetraspores.

2. **C. cruciatum** sp. nov.; P. B.-A., No. 2192. Minuta, ad algas alias repens; filamentis prostratis circa 200 μ diam., cylindricis vel ad nodos leviter constrictis, rhizoidis unicellularibus incoloratis affixis; filamentis erectis passim ad nodos evolutis; apice filamenti prostrati assurgente, in filamentum erectum transformato; cellulis inferne circa 3 diam. longis, superne brevioribus, prope apicem diametro brevioribus; ramulis penultimis 80–100 μ diam.; ramis repetite dichotomis, cellulis cylindricis vel plus minusve ad nodos constrictis; apicibus forcipatis; corticatione cellulis sensu filamenti elongatis constante, irregulariter positis, zonam arctam formante margine inaequali. Protoplasma cellularum inferiorum subcylindricum, superiorum subsphaericum, fasciis tenuissimis longitudinalibus notata, raro anastomosantibus, nec longitudinem cellulae aequantibus, plerumque spatio latitudinem fasciae aequali separatis. Tetrasporangiis ovoideis, circa 50 $\times$ 35 μ, membrana 6 μ crassa non inclusa, 1–4 ad nodum, cruciatis, modo regulariter, modo decussate; aut singulis ad nodum, seriem externalem longitudinalem formantibus, aut pluribus nodum circumdantibus; dimidio sporangii extra corticem emergente. Plate IV, figs. 27–28.

Minute, creeping on other algae; prostrate filaments of about 200 μ diam., cylindrical or slightly constricted at nodes, attached by unicellular, colorless rhizoids, issuing from the nodes; erect filaments occasionally arising at nodes; apex of prostrate filament becoming erect and assuming the character of an erect filament; cells about 3 diam. long below, diminishing towards the apex, to less than one diam.; penultimate branches 80–100 μ diam.; branches repeatedly forking, cells cylindrical or with nodes more or less constricted; apices forcipate; cortication consisting of cells elongate in the direction of the filament, in no definite order, band narrow, edge uneven.

Protoplast subcylindrical in the lower cells, subspherical in the upper, marked with a pattern of delicate, longitudinal bands, seldom anastomosing or extending the length of the cell, usually separated by spaces of about their own width. Tetrasporangia ovoid, about $50 \times 35\ \mu$, excluding wall about $6\ \mu$ thick, 1–4 at a node, cruciate, sometimes regularly, sometimes decussately; when singly at a node they form an external longitudinal series; when more than one, they are irregularly placed about the node; about half of the sporangium projecting beyond the cortication. On *Padina variegata*, Gibbet Island, Jan. 16, 1913, Hervey, type in Collins herbarium, No. 7418a; also on *Galaxaura*, Gravelly Bay, April, on various algae, Hamilton Harbor, Dec., Collins.

In habit like the following species, *C. transversale*, but a larger plant, and distinct by the division and position of the tetraspores, and the character of the cortication. Only tripartite tetraspores have been recorded for any of the numerous species of *Ceramium*, but as other characters agree, it does not seem desirable to remove it from the genus.

3. **C. transversale** sp. nov.; P. B.-A., No. 2049. Minuta, ad alias algas saxaque repens; filamento prostrato 60–90 μ diam., cellulis sesqui-8 diam. longis, cylindricis vel ad nodos leviter contractis, rhizoidis unicellularibus, incoloratis affixis, ad nodos singulis pluribusve ortis; filamentis erectis passim ad nodos evolutis; filamenti prostrati apice assurgente, in filamentum erectum transformato; ramulis penultimis circa $60\ \mu$ diam.; filamentorum erectorum cellulis ad 2 diam. longis, non amplius; prope apicem diametrum non aequantibus; filamentis erectis repetite dichotomis; cellulis inferioribus cylindricis, superioribus adparenter brevissime clavatis, causa corticationis ad apicem; corticatione a parte corticata distinctissima, super seriem cellularum transverse elongatarum series 2 vel 3 cellularum rotundo-angulatarum irregulariter positarum gerente. Protoplasma uniformiter granulosum vel striis tenuibus, parallelis, longitudinalibus notatum per totam longitudinem cellulae; in cellulis inferioribus cylindrica, in superioribus subsphaerica. Cystocarpio evoluto ad apicem segmenti 2–5-cellularis, cellulis supra incrassatis, cellula summa cellulam imam duplo plusve majore, nonnullos ramos paucicellulares involucrales, cystocarpios 1–2 includentes gerente; cystocarpiis adparenter terminalibus, atque axi plerumque ultra cystocarpios et involucrem protenso, ex cellulas paucas constante, cellula basali 2–3 diam. longa, ceteris, ut cellulis involucri, vix 1 diam. Tetrasporangiis tripartitis, ad $60\ \mu$ diam., membrana $8\ \mu$ crassa non

inclusa; uno, raro duobus ad nodum, corticatione fere liberis, secundum ramum longitudinaliter seriatis. Plate V, figs. 29–31.

Minute, creeping over other algae or rocks; prostrate filaments 60–90 μ diam., cells $1\frac{1}{2}$–8 diam. long, cylindrical or slightly constricted at nodes, attached by colorless, unicellular rhizoids issuing one or more at a node; an erect branch occasionally issuing at a node; apex of prostrate filament becoming erect and similar to an erect branch; penultimate branches about 60 μ diam.; cells in erect part not over 2 diam. long, near the apex less than one diam.; repeatedly forking; lower cells cylindrical, upper apparently very shortly clavate by the growth of cortication at the upper end; cortication sharply marked off from uncorticated portion, the lower portion of each band showing a series of transversely elongate cells passing around the central cell; the upper part of 2–3 series of irregularly placed roundish-angular cells. Protoplast uniformly granular, or with slender, parallel, longitudinal striations the whole length of the cell; the protoplast cylindrical in the lower cells, subspherical in the upper. Cystocarp borne at the end of a segment of 2–5 cells, which increase in size upward, the upper cell being twice the diam. of the lower or even more; on this are borne several wide-spread, few-celled involucral branches with one or two cystocarps between them, the cystocarps appearing terminal, but with usually an axis extended beyond them and the involucre, of few cells, the basal cell 2–3 diam. long, the others, as all the cells in the involucre, hardly 1 diam. long. Tetrasporangia tripartite, up to 60 μ diam. not including the wall 8 μ thick; one, occasionally two at a node, in longitudinal series, nearly free from the cortication.

On *Galaxaura*, Spanish Rock, April 10, 1914, Hervey, type in Collins herbarium, No. 8107. Also occurring on *Zonaria variegata*, Harrington Sound, May, on *Padina variegata*, Agar's Island, Nov., on *Thalassia*, Fairyland, Dec., Collins; on *Ascothamnion*, Tucker's Town, July, Howe.

The peculiar form of cortication, from which we have taken the specific name, does not seem to occur in any other species. *C. miniatum* Suhr, resembling it in some respects, has distichous branching, and small tetrasporangia sessile on both sides of the branches. Specially characteristic of *C. transversale* are the serrate outlines near the apices, due to the sharp limitation of the cortical growth there, and the tetraspores unusually large in proportion to the size of the frond. When two tetrasporangia are formed at a node, they are set side by side, the line made by the series of single sporangia passing between them. The

cystocarps appear as if terminal, as the short prolongation of the axis is liable to be mistaken for an involucral branch. In younger parts the cells of the basal layer are seldom over 2 diam. long; in older parts these cells may be up to 8 diam.; the corticating band does not increase in width, but is as narrow and sharply limited in the longest cells as in the others.

4. C. NITENS (Ag.) J. G. Agardh, 1851, p. 130; P. B.-A., No. 1949; *C. rubrum* var. *nitens* Agardh, 1824, p. 136. Harrington Sound, Jan., Dec., Hervey; Inlet, Aug., Agar's Island, Fairyland, Nov., Dec., and dredged down to 18 m., Dec., Collins.

5. C. CLAVULATUM Agardh in Kunth, 1822, p. 2; P. B.-A., No. 1948; *Centroceras clavulatum* Harvey, 1853, p. 211, Pl. XXXIII. C. Rein; Kemp; Wadsworth, Harrington Sound, No. 18. As this plant is abundant practically everywhere, we give no detail of stations of our own collecting. It is very variable, and many species have been proposed in the past, only to be found unworkable; it may be that some time a successful segregation will be made, but it can hardly be done with habit characters, which are very inconstant. Tetraspores were found in Nov. & Dec., but no other fructification has been observed by us. In the Kemp herbarium are specimens marked respectively *C. rubrum* and *C. fastigiatum*, which belong to this species. *C. cryptacanthum* reported by Moseley is a synonym.

RHODOCHORTON Nägeli.

1. Saxicolous; prostrate filaments bearing erect filaments. 1. R. speluncarum.
1. Endozoic; in tubes of bryozoans etc. 2. R. membranaceum.

1. **R. speluncarum** sp. nov. Filamentis prostratis 30–40 μ diam., membrana 4–5 μ crassa, cellulis 2–3 diam. longis; rhizoideis brevibus affixis, a parte media cellulae exeuntibus, in discum majorem minoremve desinentibus. Filamentis erectis cylindricis vel minime diminutis apicem versus, e superficie superiore filamenti prostrati exeuntibus, prope mediam partem cellulae, saepius rhizoideis oppositis, 24–30 μ diam., membrana 2–3 μ crassa, cellula inferiore 2–2$\frac{1}{2}$ diam. longa, cellulis ceteris 3–4 diam. longis, cellula terminali rotundata; filamentis erectis aut simplicibus aut ramis paucis alternatis vel secundis prope apicem munitis. Fructificatio ignota.

Prostrate filaments 30–40 μ diam., wall 4–5 μ thick, cells 2–3 diam. long, attached by short rhizoidal branches issuing from the middle part

of a cell, ending below in a larger or smaller disk. Erect filaments cylindrical or very slightly tapering, issuing from the upper surface of the prostrate filament, near the middle of a cell, usually opposite a rhizoid, 24–30 μ diam., walls 2–3 μ thick, lower cell 2–2½ diam. long, other cells 3–4 diam. long, terminal cell rounded; erect filaments sometimes unbranched, sometimes with a few alternate or secund branches near the apex. Fructification unknown. On rocks between tides, cave, Agar's Island, Aug., Nov., Collins.

This plant forms a plush on flat rocks a little above low water mark, as does *R. Rothii* (Turton) Näg. in similar stations on the shores of the North Atlantic, and its manner of branching resembles that of the latter species but its dimensions are about double. We have examined many specimens of *R. Rothii*, from both coasts of North America as well as from Europe, and find very little variation in size among them. In *R. speluncarum* the chromatophores are numerous small granules, usually densely packed, occasionally looser and showing something like a network. Type in Collins herbarium, No. 8401, Nov. 23, 1915.

2. R. MEMBRANACEUM (Magnus) Hauck, 1885, p. 69; *Callithamnion membranaceum* Magnus, 1874, p. 67, Pl. II, figs. 7–15. In bryozoans, Bethel's Island, Dec., Collins.

FAMILY GRATELOUPIACEAE.

HALYMENIA Agardh.

1. Frond many times dichotomous, digitate, cylindrical. 4. H. Agardhii.
1. Frond plane, simple or proliferous. 2.
2. Thin, not gelatinous. 1. H. bermudensis.
2. Thicker, gelatinous. 3.
3. Large echinate cells in subcortex. 2. H. echinophysa.
3. Few or no echinate cells in subcortex. 3. H. pseudofloresia.

1. H. BERMUDENSIS Collins & Howe, 1916, p. 169; P. B.-A., No. 2050; Plate V, fig. 34, plate VI, fig. 37. In shallow water in clefts of rocks and among roots of mangroves, often in loose, unattached masses. Kemp. Aug., as *Rhodymenia palmata;* Walsingham, Feb., Farlow; Oct., Miss Peniston; near Hamilton, June, Tucker's Town, July, Howe; Green Bay, March, Wadsworth; Harrington Sound, Jan., Tucker's Town, Feb., Dec., Dingle Bay, March, Grasmere,

March, Old Ferry, April, Hervey; Castle Harbor, April, Tucker's Town, May, Collins.

2. H. ECHINOPHYSA Collins & Howe, 1916, p. 180. Dredged in 31 fathoms off Bermuda by members of the Challenger Expedition, 1873, and reported, Moseley, 1884, p. 117, as *Kallymenia reniformis* J. Ag. Type and only specimen in herbarium of Royal Botanic Garden, Kew, England.

3. H. PSEUDOFLORESIA Collins & Howe, 1916, p. 177; P. B.-A., No. 2099; Plate V, fig. 35, plate VI, fig. 36. Faxon; Feb., Farlow; Green Bay, Feb., Shark's Hole, March, Wadsworth; Castle Harbor near Tucker's Town, April, Collins; Walsingham, Jan., Hervey; Aug., H. A. Cross. At Castle Harbor in narrow shaded clefts of rocks, well below low water mark; at Walsingham loose and unattached, the older parts darker and coarser than the young growth.

The three preceding species show some superficial resemblance in habit, but we consider them distinct. Full details will be found in Collins & Howe, 1916.

4. H. AGARDHII De Toni, 1905, p. 1543; *H. decipiens* of American authors, not of J. Ag. Oct., Miss Peniston; W. Faxon; Castle Harbor, in 2–3 meters water, July, Howe; at low water mark, under overhanging rocks, shore near Gibbet Island, Aug., Collins.

CRYPTONEMIA J. G. Agardh.

1. Midrib distinct. 2. C. luxurians.
1. No midrib. 1. C. crenulata.

1. C. CRENULATA J. G. Agardh, 1847, p. 11; Kützing, 1869, Pl. XXXI; P. B.-A., No. 2100. Kemp; Gravelly Bay, April, Collins, Dec., Hervey. In somewhat matted masses in the cave at this station, on a sand-covered rock; a smaller form than that commonly found in Florida.

2. C. LUXURIANS (Ag.) J. G. Agardh, 1851, p. 228; *Sphaerococcus Lactuca* var. *luxurians* Agardh, 1822, p. 232; *Euhymenia luxurians* Kützing, 1869, Pl. XXXII. Kemp, as *Botryoglossum platycarpum;* Cooper's Island, Miss Wilkinson; Buildings Bay, Jan., Hervey. Apparently not common.

Family DUMONTIACEAE.

Dudresnaya Bonnemaison.

1.	Peripheral filaments cylindrical or nearly so.	1. D. crassa.
1.	Peripheral filaments distinctly moniliform.	2.
2.	Auxiliary cell terminating the auxiliary branch.	3. D. caribaea.
2.	Auxiliary cell in middle of auxiliary branch.	2. D. bermudensis.

1. D. crassa Howe, 1905, p. 572, Pl. XXVIII, XXIX, figs. 12–26; P. B.-A., Nos. 1900, 2196. Castle Harbor, Spanish Point, July, Howe; Castle Harbor, A. E. Wight in Farlow herb.; Salt Kettle, Feb., Buildings Bay, March, Spanish Point, March, Hervey; Shelly Bay, April, Collins. The plants from Buildings Bay, Spanish Point and Shelly Bay were washed ashore; at Salt Kettle, Paget, it grew just below low water mark; at the type station in Castle Harbor it grew at 3 m. depth at low water. It varies much in habit, from the form with short, stout branches, figured by Howe, to forms with slender, acute branches; from generally rounded outline to loosely pyramidal; from forms so dense that when spread out on paper they cover it continuously, without interstices between the branches, to quite open specimens, all branches distinct. The largest plant noted was about 25 cm. high and 15 cm. broad. Howe had only cystocarpic plants when describing the species, but we have found antheridia equally abundant, always on separate individuals. The antheridia are formed near the ends of the peripheral filaments, which here bear short, erect lateral branches, usually covered with minute densely branched ramuli of a few cells each, the terminal cell becoming the antheridium. According to the length of the axis and the amount of branching in the ramulus, the antheridia may be cylindrical, conical or ovoid. Sometimes the antheridia are so abundant on the peripheral filaments as to form a dense continuous mass, through which it is difficult to see the filaments, except the tips, which project beyond the antheridia. Both antheridial and cystocarpic plants were distributed as P. B.-A., No. 1900. Some forms are habitually not unlike *D. caribaea* and *D. bermudensis*, but are easily distinguished microscopically by the character of the peripheral filaments. It is often overgrown with *Acrochaetium corymbiferum*, and when both have abundant antheridia, it may be perplexing to one unfamiliar with the species.

2. D. bermudensis Setchell, 1912, p. 244, Pl. XXVII, fig. 8; P. B.-A., No. 2195. Cooper's Island, Feb., Farlow, washed ashore in abundance; St. George's, washed ashore, March, Hervey.

3. D. CARIBAEA (J. Ag.) Setchell, 1912, p. 241, Pl. XXVI; *Calosiphonia caribaea* J. G. Agardh, 1899, p. 84. Cooper's Island, Feb., Farlow; washed ashore in abundance. This species and the preceding are very much alike in habit, and can be distinguished with certainty only by microscopic examination of plants in fruit.

These three species of *Dudresnaya* illustrate the possibilities of algae collecting. *D. bermudensis* is known only from Bermuda, from the material collected by Farlow on a single day in 1881 at Cooper's Island, and from a single collecting at St. George's in 1916 by Hervey; the Bermudian material of *D. caribaea* was all collected on the same day in 1881, and only one other station, Tortugas, Florida, is known; *Calosiphonia verticillifera* was collected at the same day and place, and is known elsewhere from the Tortugas station only. Material of all three species was abundant that day, but there is no record of any one of the species since, except the single collecting of *D. bermudensis*, though we have both been on the watch for them for the past five years, and have made visits to Cooper's Island at the same time of year as Farlow's collecting and at other times, to search for them. On the other hand we have found *D. crassa*, not known until 1905, in abundance at distant stations.

FAMILY NEMASTOMACEAE.

CALOSIPHONIA Crouan.

C. VERTICILLIFERA (J. Ag.) Setchell, 1912, p. 247, Pl. XXVIII; *Helminthiopsis verticillifera* J. G. Agardh, 1899, p. 98. Cooper's Island, Feb., Farlow. As noted under *Dudresnaya*, this is one of the three species of handsome red fleshy algae, found in abundance on the same day in 1881, at Cooper's Island, and not observed since. In habit it is not unlike *Dudresnaya*, but is distinguished on microscopic examination by the shorter and stouter peripheral branches, forming a definite cortical layer.

PLATOMA Schmitz.

P. CYCLOCOLPA (Mont.) Schmitz, 1889, p. 453; *Halymenia cyclocolpa* Montagne, 1840, p. 163; 1846, p. 116, Pl. XI, fig. b; *Nemastoma cervicornis* J. G. Agardh, 1879, Pl. IV, figs. 1–4. Cooper's

Island, Feb., Farlow, washed ashore; Castle Harbor, Gravelly Bay, April, Collins; Gravelly Bay, Dec., Hervey. Two large plants were collected in a narrow "chasm" in the rocky shore between Tucker's Town and Walsingham House, growing in company with *Halymenia bermudensis*, but while the latter grew plentifully at low water mark, the *Platoma* began about 5 dm. below, and seemed to extend down. Farlow's plants and ours from the cave at Gravelly Bay are smaller and of firmer substance; the Castle Harbor plants larger and looser, probably on account of being more developed.

Genus incertae sedis.

PORPHYRIDIUM Nägeli.

P. CRUENTUM (Eng. Bot.) Nägeli, 1849, pp. 71 & 139, Pl. IV. H; *Tremella cruenta* Eng., Bot., 1807, Pl. 1800. Roadside, Jan., Farlow. Forms a bright red film on the ground; is widely distributed and in northern countries is common in hothouses. It has been placed by different authors among green, blue-green and red algae respectively, but the latest investigations incline to the last. See Brand, 1908, p. 413.

SUMMARY.

Class.	Genera.	Species, marine.	Species, fresh water.
Myxophyceae	43	48	40
Chlorophyceae	56	95	28
Phaeophyceae	24	56	
Rhodophyceae	62	143	
Total	185	342	68
Total species		410	

List of Works to which Reference is Made.

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1824. Systema Algarum. Lund.

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1848. Species Algarum, Vol. I.

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1852. Species Algarum, Vol. II, pars III. 1.

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20 Though really only one edition was published of the Species Algarum of C. A. Agardh, copies are found with title pages of varying dates. As to actual dates of publication, see O. Nordstedt, The date of C. Agardh's Species Algarum, Bot. Notiser, 1914, p. 144.

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EXPLANATION OF PLATES.

PLATE I.

Oedogonium consociatum Collins & Hervey.

FIGURE 1. Large cluster of young filaments. 255 × 1.
FIGURE 2. Smaller cluster of same. 255 × 1.
FIGURE 3. Single filament with attached basal cell. 550 × 1.
FIGURE 4. Filament with oogonium (immature). 550 × 1.

Chaetomorpha minima Collins & Hervey.

FIGURE 5. Filament of two cells. 800 × 1.
FIGURE 6. Filament of five cells. 550 × 1.
FIGURE 7. Filament of five emptied cells. 550 × 1.

Nitophyllum Wilkinsoniae Collins & Hervey.

FIGURE 8. Whole plant. $\frac{4}{5}$ nat. size.

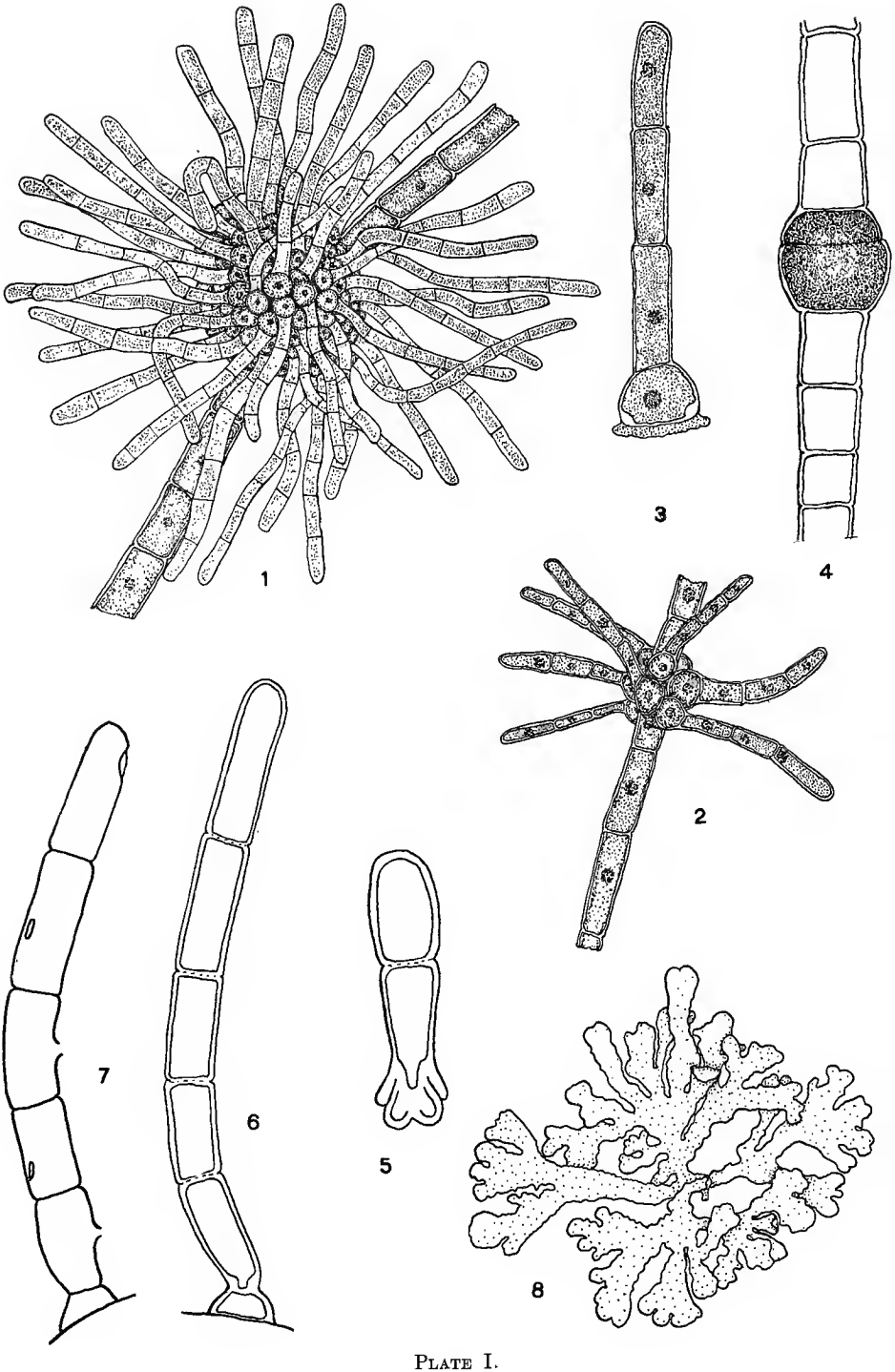

PLATE I.

PLATE II.

Nitophyllum Wilkinsoniae Collins & Hervey.

FIGURE 9. Margin of frond. 120 × 1.

Chondria curvilineata Collins & Hervey.

FIGURE 10. Portion of branch with ramulus and terminal leaves. 255 × 1.
FIGURE 11. Optical section of branch. 255 × 1.

Chondria polyrhiza Collins & Hervey.

FIGURE 12. Branch with rhizoids and tetraspores. 240 × 1.

Lophosiphonia Saccorhiza Collins & Hervey.

FIGURE 13. Tip of erect axis. 600 × 1.
FIGURE 14. Ramulus with tetraspores. 600 × 1.

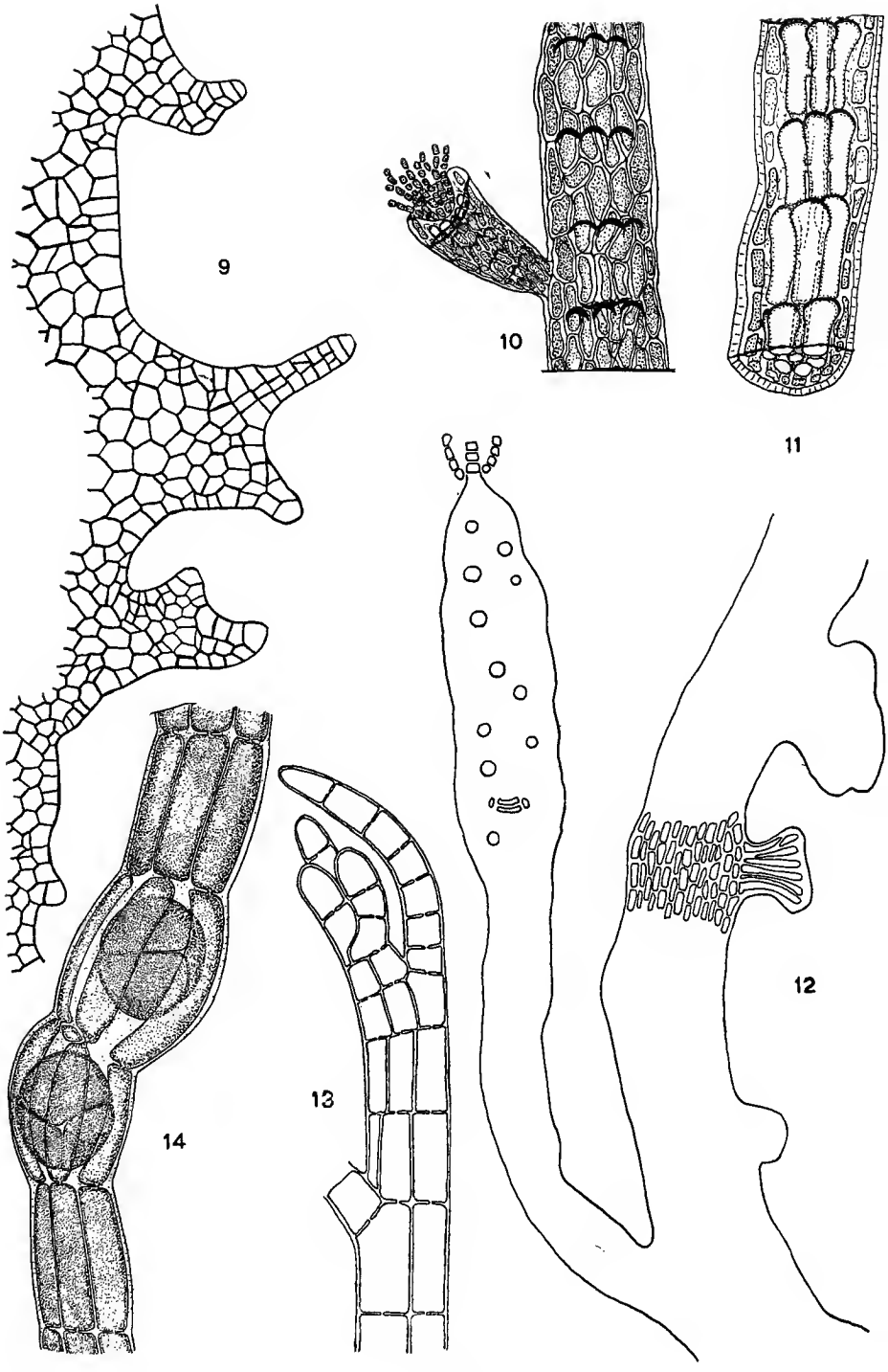

PLATE II.

PLATE III.

Lophosiphonia Saccorhiza Collins & Hervey.

FIGURE 15. Tip of erect axis with antheridium and leaves. 330 × 1.
FIGURE 16. Cystocarp. 330 × 1.
FIGURE 17. Prostrate filament with rhizoids. 120 × 1.

Lophosiphonia bermudensis Collins & Hervey.

FIGURE 18. Prostrate filament with rhizoids and erect branches. 160 × 1.
FIGURE 19. Antheridia. 160 × 1.
FIGURE 20. Cystocarp. 160 × 1.
FIGURE 21. Tetrasporangia. 160 × 1.

Ceramothamnion Codii H. M. Richards.

FIGURE 22. Lateral union of two rhizoids from same node. 310 × 1.

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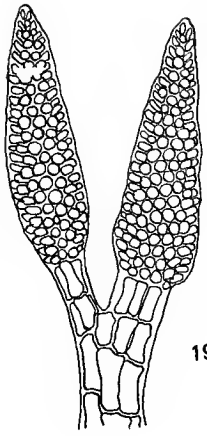

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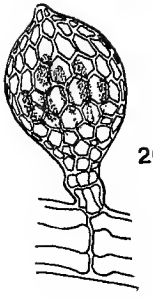

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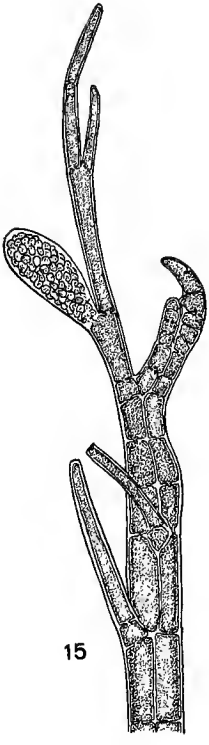

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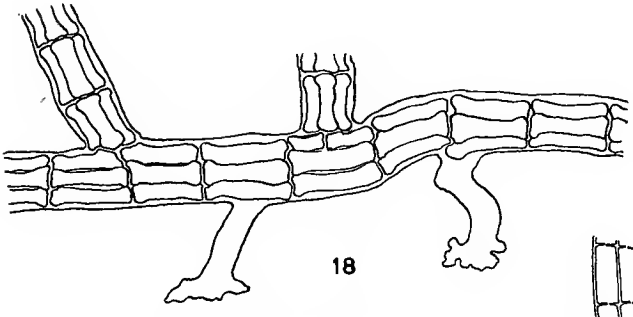

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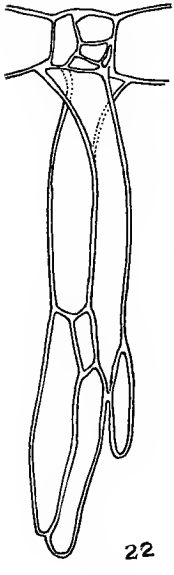

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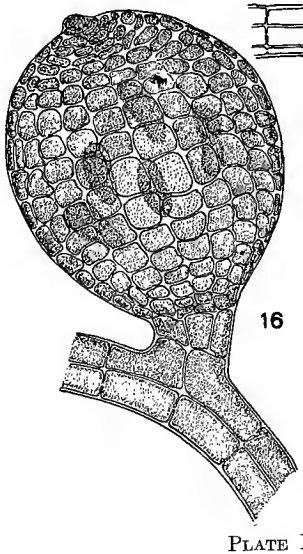

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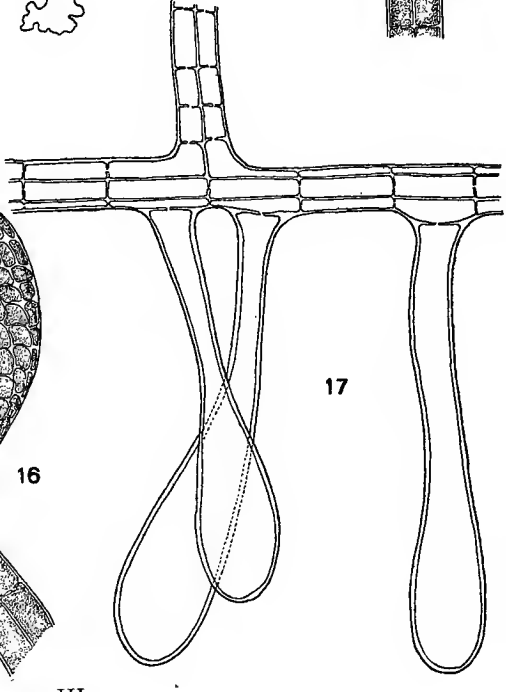

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PLATE III.

PLATE IV.

Ceramothamnion Codii H. M. Richards.

FIGURE 23. Union of three rhizoids from different nodes. 310 × 1.

Dasya spinuligera Collins & Hervey.

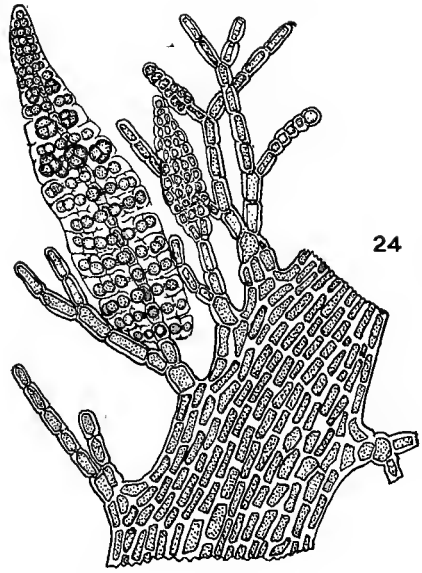
FIGURE 24. Branch with ramelli and young and mature stichidia. 120 × 1.
FIGURE 25. Cross section of branch. 160 × 1.

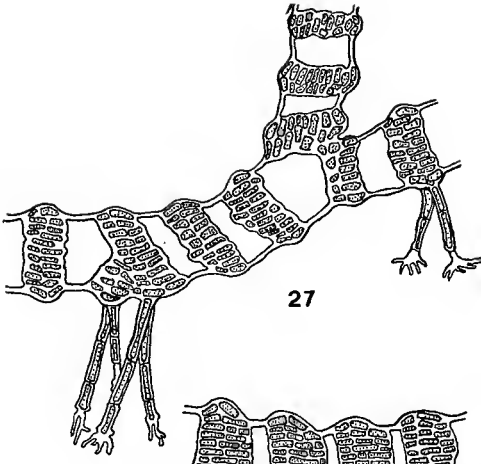
Gymnothamnion bipinnatum Collins & Hervey.

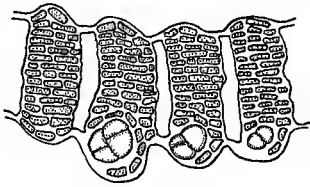
FIGURE 26. Prostrate filament with two erect and two descending axes. 300 × 1.

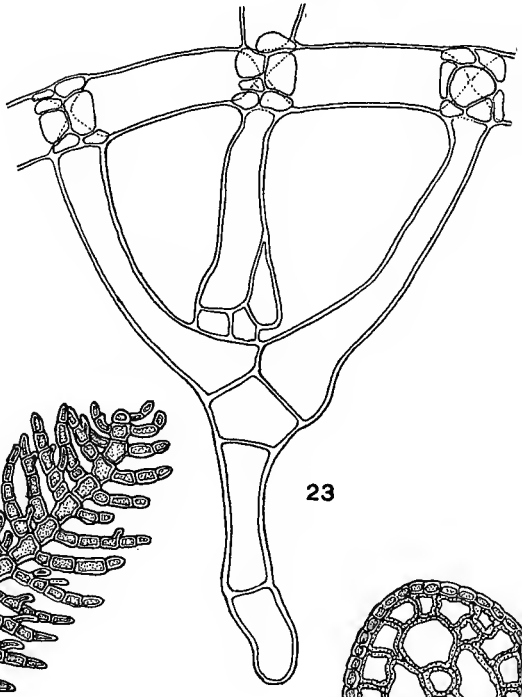
Ceramium cruciatum Collins & Hervey.

FIGURE 27. Prostrate filament with rhizoids and base of erect filament. 65 × 1.
FIGURE 28. Branch with tetraspores. 120 × 1.









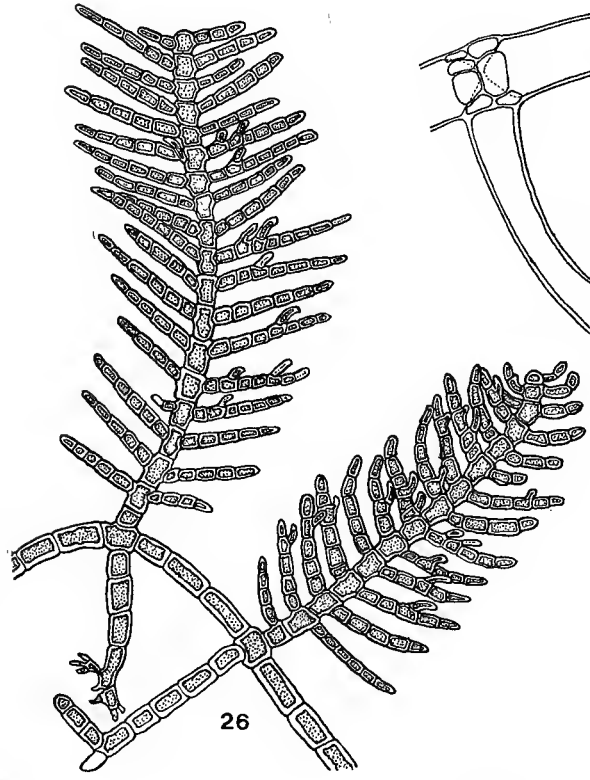


PLATE IV.

PLATE V.

Ceramium transversale Collins & Hervey.

FIGURE 29. Prostrate filament with erect filament and rhizoids. 120 × 1.
FIGURE 30. Erect filament with branch. 255 × 1.
FIGURE 31. Branch with tetraspores. 160 × 1.

Nitophyllum Wilkinsoniae Collins & Hervey.

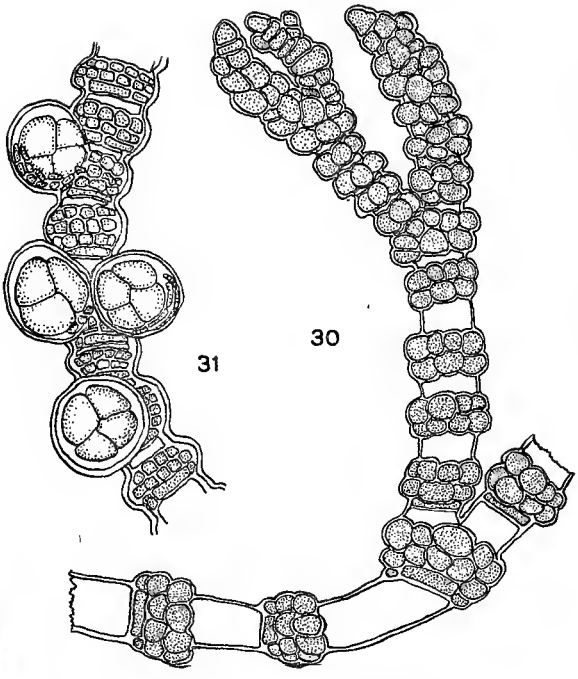
FIGURE 32. Section of frond through a sorus. 160 × 1.
FIGURE 33. Superficial view of a sorus. 160 × 1.

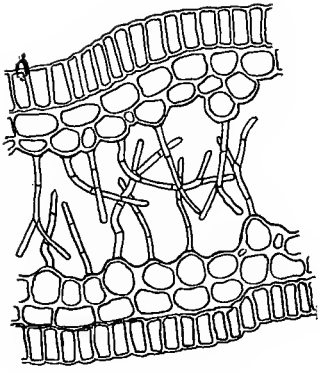
Halymenia bermudensis Collins & Howe.

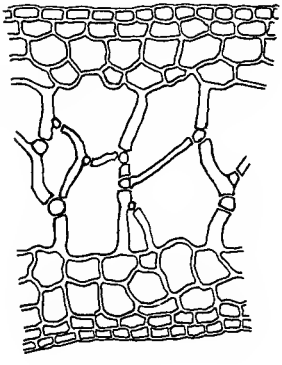
FIGURE 34. Cross section. 255 × 1.

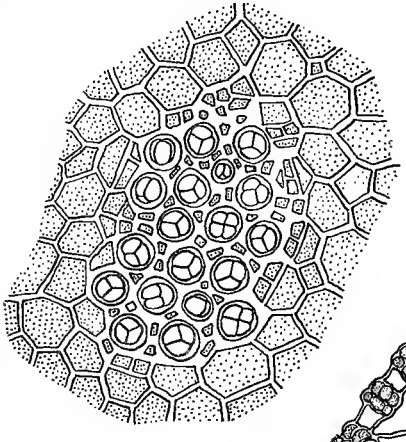
Halymenia pseudofloresia Collins & Howe.

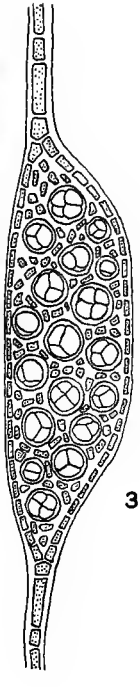
FIGURE 35. Cross section. 130 × 1.











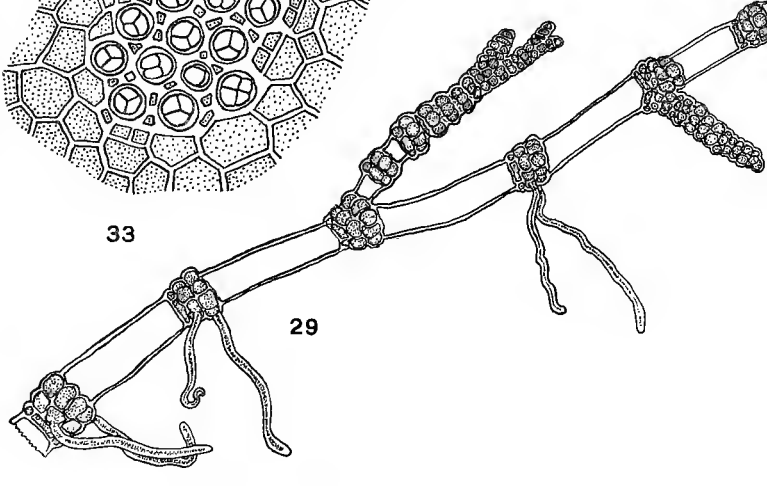


PLATE V.

PLATE VI.

Halymenia pseudofloresia Collins & Howe.

FIGURE 36. Whole frond, $\frac{2}{3}$ nat. size.

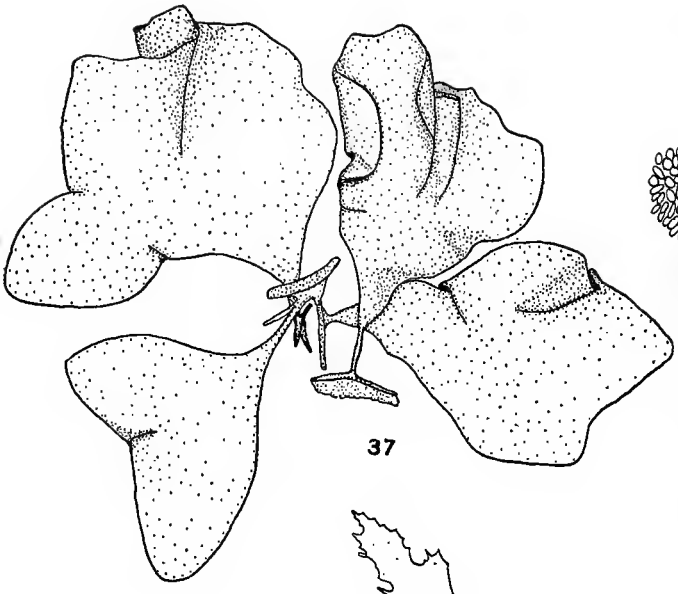
Halymenia bermudensis Collins & Howe.

FIGURE 37. Whole frond. $1\frac{3}{5} \times 1$.

Griffithsia tenuis Agardh.

FIGURE 38. Tip of tetrasporic branch. 160×1.
FIGURE 39. Node with antheridia. 300×1.

Habit figures were drawn from herbarium specimens, all others by camera lucida. Figures 5, 6, 7, 9, 12, 13, 14, 15, 16, 17, 22, and 23 are by F. D. Lambert; the others by A. C. Walton.



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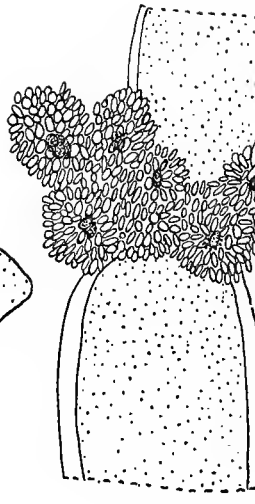

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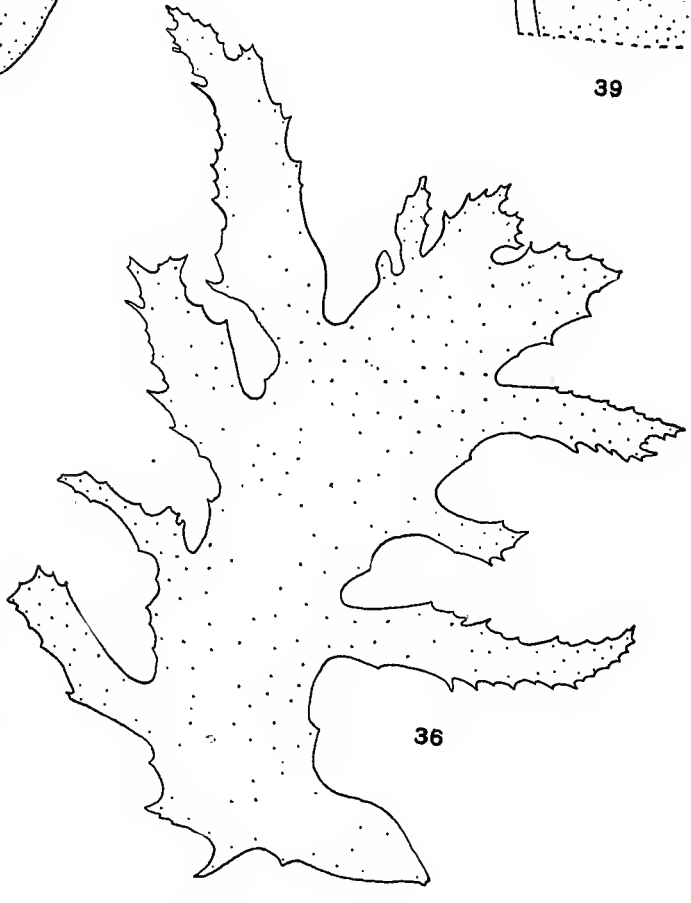

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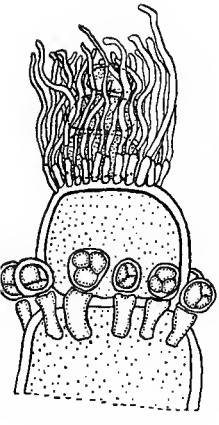

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PLATE VI.

INDEX.

Synonyms are printed in *italics*, also names of species, etc., not found in Bermuda, but which are incidentally mentioned. **Full-face type** indicates the principal reference for a species.

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